



ARCHITECTS CLIENT FOCUSED. PASSION DRIVEN.

May 12, 2016

TO : All Bidders
FROM : James P. DiCamillo
PROJECT : Rowland High School Additions/Renovations
Project 1310700.41
SUBJECT : Addendum 5
DSA : 03-115771 / 19-H54

The following changes, omissions, and/or additions to the Project Manual and/or Drawings shall apply to proposals made for and to the execution of the various parts of the work affected thereby, and all other conditions shall remain the same.

Careful note of the Addendum shall be taken by all parties of interest so that the proper allowances may be made in strict accordance with the Addendum, and that all trades shall be fully advised in the performance of the work which will be required of them.

Bidder shall acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject Bidder to disqualification.

In case of conflict between Drawings, Project Manual, and this Addendum, this Addendum shall govern.

5. GENERAL CLARIFICATION

5.1 All Architectural Roof Plans

- A. Architectural roof plans do not show every single item required by the mechanical, plumbing and electrical disciplines. Refer to the respective disciplines for detailed and complete information.
- B. Wall Legend: When discrepancies occur between architectural and structural requirement, the more restrictive requirement shall govern.

PROJECT MANUAL

5.2 FRONT END DOCUMENT

- A. Refer to attached additional information/clarification by Ledesma & Meyer Construction Co., Inc. dated May 9, 2016.

5.3 TABLE OF CONTENTS

- A. Replace Table of Contents in its entirety with the revised attached Table of Contents.

5.4 SECTION 06 10 00 - ROUGH CARPENTRY

- A. Add the attached Section 06 10 00 in its entirety.

5.5 SECTION 06 41 16 - PLASTIC LAMINATE CLAD ARCHITECTURAL CABINETS

- A. Item 2.3.A.2 - Core Material: Replace Medium Density Fiberboard (MDF) with Combination Core, Purebond Classic Core, www.columbiaforestproducts.com).

5.6 SECTION 07 42 43 - BUILDING CLADDING SYSTEM

- A. Item 2.01.A Composite Panels:
 - 1. Replace Item 2.01.A.2 with the following: VITRABOND, Fairview Architectural LLC (860) 242 2711.
 - 2. Add Item 2.01.A.3: Substitution per Section 01 25 13.

5.7 SECTION 07 52 00 - MODIFIED BITUMINOUS MEMBRANE ROOFING

- A. Part 2 Products: Add MB Technology (800) 621-9281 Ext. 116 as an acceptable equal product.

5.8 SECTION 07 72 33 - ROOF HATCHES

- A. Item 2.1: Add Leading Edge Safety, LLC - (888) 990-2990 as an acceptable manufacturer.

5.9 SECTION 08 14 00 - WOOD DOORS

- A. Add the attached Section 08 14 00 in its entirety.

5.10 SECTION 09 24 00 - CEMENT PLASTERING

- A. Item 2.1.E: Clarification: When underlayment is applied over gypsum sheathing board, only one layer is required. For other application, use two layers.

5.11 SECTION 09 30 00 - QUARRY TILE FLOOR FINISH

- A. Add the attached Section 09 30 00 in its entirety.

5 .12 SECTION 11 61 33 - STAGE RIGGING AND CURTAIN SYSTEMS

- A. Item 3.5: Add the following as an approved rigging contractor.

JR Clancy
7041 Interstate Island Road
Syracuse, New York 13209
(315) 451-3440

5 .13 SECTION 12 61 00 - FIXED SEATING

- A. Item 2.4.E: Add the following alternatives in seat pan perforation requirements: As alternatives, the following perforation configurations are acceptable: (54) 1/4" diameter holes or (54) 3/16" diameter holes.

5 .14 SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

- A. Add the attached Section 27 05 26 in its entirety.

5 .15 SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

- A. Add the attached Section 27 05 28 in its entirety.

5 .16 SECTION 27 05 44 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

- A. Add the attached Section 27 05 44 in its entirety.

5 .17 SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

- A. Add the attached Section 27 11 00 in its entirety.

5 .18 SECTION 27 13 00 - COMMUNICATIONS BACKBONE CABLING

- A. Add the attached Section 27 13 00 in its entirety.

5 .19 SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

- A. Add the attached Section 27 15 00 in its entirety.

5 .20 SECTION 27 41 33 - MASTER ANTENNA TELEVISION SYSTEM

- A. Add the attached Section 27 41 33 in its entirety.

5 .21 SECTION 27 51 16 - PUBLIC ADDRESS SYSTEMS

- A. Add the attached Section 27 51 16 in its entirety.

5 .22 SECTION 27 51 19 - SOUND MASKING SYSTEMS

A. Add the attached Section 27 51 19 in its entirety.

5 .23 SECTION 27 51 23 - INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

A. Add the attached Section 27 51 23 in its entirety.

5 .24 SECTION 27 51 23.50 - EDUCATIONAL INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

A. Add the attached Section 27 51 23.50 in its entirety.

5 .25 SECTION 27 53 13 - CLOCK SYSTEMS

A. Add the attached Section 27 53 13 in its entirety.

5 .26 SECTION 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

A. Add the attached Section 28 05 13 in its entirety.

5 .27 SECTION 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

A. Add the attached Section 28 05 26 in its entirety.

5 .28 SECTION 28 05 28 - PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY

A. Add the attached Section 28 05 28 in its entirety.

5 .29 SECTION 28 16 00 - INTRUSION DETECTION

A. Add the attached Section 28 16 00 in its entirety.

5 .30 SECTION 28 16 43 - PERIMETER SECURITY SYSTEMS

A. Add the attached Section 28 16 43 in its entirety.

DRAWINGS

Architectural

5 .31 DRAWING A0.4 - SITE CODE ANALYSIS

A. Clarification: Building area analysis does not dictate the scope of work. For example, fire sprinkler may be required by the Fire Marshal in a certain building to compensate for limited site fire access.

5 .32 DRAWING A1.2 - DEMO SITE PLAN

- A. Clarification: AC paving patching shall be 3" thick over 90% compacted native or base.

5 .33 DRAWING AA2.2 - ADMINISTRATION BUILDING 2ND FLOOR PLAN

- A. Replace drawing with the attached revised Drawing AA2.2 marked with Delta 5 attached.

5 .34 DRAWING AA7.4 - ADMINISTRATION / LIBRARY BUILDING A CASEWORK PLANS AND ELEVATIONS

- A. Detail 5 - Circulation Counter: Delete Reference Note 0503. Provide low 4" metal stud wall with plastic laminate finish over ½" core material at each side of the knee spaces to provide bracing support.
- B. Detail 5 - Circulation Counter: Refer to Detail 12/6.1(sim) for section at knee space.
- C. Detail 5 - Circulation Counter: Refer to Detail 13/6.1(sim) for section at counter top without raised section.
- D. Detail 5 - Circulation Counter: Refer to Details 9 and 10/6.1 for end conditions

5 .35 DRAWING AT6.1 - THEATER / CAFÉ/ MPR BUILDING T ENLARGED PLANS

- A. Detail 16: Provide one mirror (Reference Note 1007) at each lavatory; a total of seven mirrors.
- B. Detail 23: Clarification: Full height mirror in Rooms 142 and 144 are to be limited from the top of the counter to the height of 7'-0" AFF.

5 .36 DRAWING AT8.1 - THEATER/ CAFÉ/ MPR BUILDING T DOOR LEGEND AND SCHEDULE

- A. Door Schedule: Revise roll-up Door DT154B materials and finishes to match Door DT152B and per specification. Fire rating remains non-rated.

5 .37 DRAWING 5.2 - GATE DETAILS

- A. Detail 16: Revise panic hardware specification with the following:
 - Panic hardware: Von Duprin 98 NL/OP
 - Accessible Pull: Ives VR 910NL
 - Cylinder: Schlage 20-057

5 .38 9.1 - FLOOR, WALL AND ROOF DETAILS

- A. Detail 17: Revise wall finish material inside the mechanical well to roofing membrane to match Detail 9/9.1. Flashing and finishing around the drain opening per manufacturer instruction.

5 .39 DRAWING 9.4 - MISCELLANEOUS DETAILS

- A. Detail 4: Add the following information

Product: Radians by Ceiling Plus or equal
Contact: Joe Mercolino (323) 724-8166
Finish: Custom Paint color to be selected by Architect
Module: 24" x 72" or as required.

For panels elevations and configuration refer to Reflected Ceiling Plan and Building Section. Panel radius to be 43'-0".

Acoustical backing to be laminated to back of panel. Support grid to be designed and engineered by the manufacturer. Trims as shown in detail - finish to match.

Civil

5 .40 DRAWING C4.03 - UTILITY PLAN

- A. Replace drawing with the attached revised Drawing C4.03 marked with Delta 5.

Structural

5 .41 DRAWING S1.4 - TYPICAL DETAILS

- A. Replace drawing with the attached revised Drawing S1.4 marked with Delta 5.

5 .42 DRAWING S8.3 - DETAILS

- A. Replace drawing with the attached revised Drawing S8.3 marked with Delta 5.

Plumbing

5 .43 DRAWING PT2.1 - PLUMBING THEATER BUILDING FIRST FLOOR PLAN AREA B

- A. Replace drawing with the attached revised Drawing PT2.1 marked with Delta 5.

5 .44 DRAWING P3.3 - ENLARGED PLUMBING PLANS

- A. Replace drawing with the attached revised Drawing P3.3 marked with Delta 5.

Electrical

- 5 .45 E0.1 - SYMBOL LIST & NOTES
 - A. Replace drawing with the attached revised Drawing E0.1 marked with Delta 5.
- 5 .46 E0.2 - LIGHTING FIXTURE SCHEDULE AND NOTES
 - A. Replace drawing with the attached revised Drawing E0.2 marked with Delta 5.
- 5 .47 E1.1 - SITE POWER PLAN
 - A. Replace drawing with the attached revised Drawing E1.1 marked with Delta 5.
- 5 .48 E1.2 - SITE SIGNAL (LV) PLAN
 - A. Replace drawing with the attached revised Drawing E1.2 marked with Delta 5.
- 5 .49 E1.2D - DEMO SITE SIGNAL PLAN
 - A. Replace drawing with the attached revised Drawing E1.2D marked with Delta 5.
- 5 .50 E5.4 - PANEL SCHEDULES ADMIN BUILDING
 - A. Replace drawing with the attached revised Drawing E5.4 marked with Delta 5.
- 5 .51 E5.7 - PANEL SCHEDULES THEATER, ASB AND SPECIAL ED BUILDING
 - A. Replace drawing with the attached revised Drawing E5.7 marked with Delta 5.
- 5 .52 E5.8 - PANEL SCHEDULES KITCHEN BUILDING
 - A. Replace drawing with the attached revised Drawing E5.8 marked with Delta 5.
- 5 .53 EA2.2 - ADMINISTRATION BUILDING SECOND FLOOR POWER PLAN
 - A. Replace drawing with the attached revised Drawing EA2.2 marked with Delta 5.
- 5 .54 EA2.4 - ADMINISTRATION BUILDING SECOND FLOOR SIGNAL PLAN
 - A. Replace drawing with the attached revised Drawing EA2.4 marked with Delta 5.
- 5 .55 EA3.2 - ADMINISTRATION BUILDING SECOND FLOOR LIGHTING PLAN
 - A. Replace drawing with the attached revised Drawing EA3.2 marked with Delta 5.
- 5 .56 EA4.1 - ADMINISTRATION BUILDING ROOF ELECTRICAL PLAN
 - A. Replace drawing with the attached revised Drawing EA4.1 marked with Delta 5.

5 .57 EC4.1 - CLASSROOM BUILDING ROOF ELECTRICAL PLAN

- A. Replace drawing with the attached revised Drawing EC4.1 marked with Delta 5.

5 .58 ES3.1 - ASB & SPECIAL ED BUILDINGS LIGHTING PLANS

- A. Replace drawing with the attached revised Drawing ES3.1 marked with Delta 5.

5 .59 ES4.1 - ASB & SPECIAL ED BUILDINGS ROOF ELECTRICAL PLANS

- A. Replace drawing with the attached revised Drawing ES4.1 marked with Delta 5.

5 .60 ET2.3 - THEATER BUILDING SECOND FLOOR POWER PLAN

- A. Replace drawing with the attached revised Drawing ET2.3 marked with Delta 5.

5 .61 ET2.7 - THEATER BUILDING ENLARGED KITCHEN ELECTRICAL PLAN

- A. Replace drawing with the attached revised Drawing ET2.7 marked with Delta 5.

5 .62 ET4.2- THEATER BUILDING ROOF PARTIAL ELECTRICAL PLAN

- A. Replace drawing with the attached revised Drawing ET4.2 marked with Delta 5.

Addendum 5
Rowland High School Additions/Renovations
Project 1310700.41
DSA 03-115771 / 19-H54
May 12, 2016
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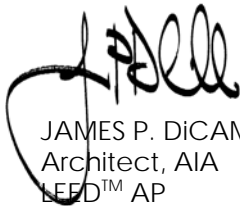
Food Service

5 .63 DRAWING FS-100 - SYMBOLS, NOTES AND INDEX

- A. Clarification: Where the abbreviation "NIFSEC (Not in Food Service Equipment Contract)" is used, the associated item is to be provided by the General Contractor, not by the Food Service Contractor.

END OF ADDENDUM 5

Submitted by,



JAMES P. DICAMILLO
Architect, AIA
LEED™ AP
President, Principal



JPD:SA:hb:/P41310700x5-add

Attachment: Ledesma & Meyer Construction Co., Inc. Front End Document
Table of Contents
Section 06 10 00 - Rough Carpentry
Section 08 14 00 - Wood Doors
Section 09 30 00 - Quarry Tile Floor Finish
Section 27 05 26 - Grounding and Bonding for Communications Systems
Section 27 05 28 - Pathways for Communications Systems
Section 27 05 44 - Sleeves and Sleeve Seals for Communications Pathways and Cabling
Section 27 11 00 - Communications Equipment Room Fittings
Section 27 13 00 - Communications Backbone Cabling
Section 27 15 00 - Communications Horizontal Cabling
Section 27 41 33 - Master Antenna Television System
Section 27 51 16 - Public Address Systems
Section 27 51 19 - Sound Masking Systems
Section 27 51 23 - Intercommunications and Program Systems
Section 27 51 23.50 - Educational Intercommunications and Program Systems
Section 27 53 13 - Clock Systems
Section 28 05 13 - Conductors and Cables for Electronic Safety and Security
Section 28 05 26 - Grounding and Bonding for Electronic Safety and Security
Section 28 05 28 - Pathways for Electronic Safety and Security
Section 28 16 00 - Intrusion Detection
Section 28 16 43 - Perimeter Security Systems
Drawing AA2.2, C4.03, S1.4, S8.3, PT2.1, P3.3, E0.1, E0.2, E1.1, E1.2, E1.2D, E5.4, E5.7, E5.8, EA2.2, EA2.4, EA3.2, EA4.1, EC4.1, ES3.1, ES4.1, ET2.3, ET2.7, ET4.2

May 9, 2016

ADDENDUM NO. 5

Item 1

Contractor shall include a **\$2,330,000.00** Cash Allowance into the base bid. Cash allowances shall be "NET" cost amounts. The contractor shall include all cost associated with the processing of items that may be charged against the designated allowance amount including estimating, project management, supervision, withholding of retention, overhead, profit and bond costs in their base bid. The only allowable markup shall be at 10% overhead and profit fee by any subcontractor that may perform work (labor) submitted under the General Contractor. The General Contractor shall receive no additional markups. If any allowance amount (in whole or part) is deleted by change order at any given point of the project, the General Contractor shall credit back the full or unused portion of the allowance amount stipulated. The general contractor shall not be entitled to withhold any monies for overhead or profit or be obligated to return any overhead or profit included in the base bid. The use of any allowances is at the sole discretion of the Construction Manager.

Item 2

Furnish and install **all** temporary erosion control and site drainage measures and **continually maintain same** during the duration of the project. Measures to be per Storm Water Pollution Prevention Plan (SWPPP) provided by Everest Environmental, dated April 28, 2016. **This is not an option of the contractor, this work must be in place at the start of the project.** Removal of all temporary measures upon the completion of the project. Costs for the installation, maintenance and removal shall be included in the Contractors bid.

Item 3

Clarification. The attached 131 page, Division 0 Front End Documents shall be utilized for this project.

ATTACHMENTS:

- Storm Water Pollution Prevention Plan (SWPPP) – Everest Environmental, dated April 28, 2016.
- Division 0 Front End Documents

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DOCUMENT NO.	DESCRIPTION
00 11 13	Notice Calling for Bids
00 21 13	Instructions for Bidders
00 41 00	Bid Proposal
00 42 13	Alternate Bid Items Proposal Form
00 43 24	Pre-Bid Inquiry Form
00 43 36	Subcontractors List
00 45 19	Non-Collusion Declaration
00 45 26	Certificate of Workers Compensation
00 45 27	Drug-Free Workplace Certification
00 45 28	DVBE Participation Goal
00 45 30	Iran Contracting Act Certification/Exemption
00 45 46	Fingerprint Certification
00 50 10	Roof Project Financial Disclosure Certificate
00 52 00	Agreement
00 61 10	Bid Bond
00 61 13	Performance Bond
00 61 14	Labor and Material Payment Bond
00 65 36	Guarantee Form
00 72 00	General Conditions
00 73 00	Special Conditions

NOTICE CALLING FOR BIDS

DISTRICT	ROWLAND UNIFIED SCHOOL DISTRICT
PROJECT DESCRIPTION	ROWLAND HIGH SCHOOL ADDITIONS
LATEST TIME/DATE FOR SUBMISSION OF BID PROPOSALS	2:00 P.M. Tuesday, May 17, 2016
LOCATION FOR SUBMISSION OF BID PROPOSALS	ROWLAND UNIFIED SCHOOL DISTRICT PURCHASING OFFICE 1830 S. NOGALES STREET ROWLAND HEIGHTS, CA 91748
LOCATION FOR OBTAINING BID AND CONTRACT DOCUMENTS	C2 Reprographics Planwell Department (866) 522-8475 Bid Questions and Information: Ledesma & Meyer Construction Co., Inc. (909) 476-0590

NOTICE IS HEREBY GIVEN that the **ROWLAND UNIFIED SCHOOL DISTRICT** (District), acting by and through its Board of Education, will receive up to, but not later than the above-stated date and time, sealed Bid Proposals for the Contract for the Work generally described as **Rowland High School Additions, BID NO. 2015/16:7R**.

1. Submittal of Bid Proposals. All Bid Proposals must be submitted on forms furnished by the District prior to the last time for submission of Bid Proposals and the District’s public opening and reading of Bid Proposals.
2. Bid and Contract Documents. The Bid and Contract Documents are available at the location stated above. The Project Manual, Specifications and Contract Drawings will be furnished in a CD only. Bidder shall be responsible, and at their expense, for printing of the documents.
3. Project Planholder List. The District’s Project Planholder List will be compiled exclusively from the sign-in sheet at the Mandatory Job Walk. Any Bidder failing to sign-in at the Mandatory Job Walk will be excluded from Project Planholder List and their Bid Proposal will be rejected by the District as being non-responsive. All Project Planholders will receive e-mails from the District advising of any and all Project Addenda issued by the District. Bidders bear sole responsibility for downloading the Project Addenda from the District’s website, C2 Reprographics or alternatively, purchasing the Project Addenda from ARC. The District will not fax Project Addenda to Planholders.
4. Pre-Qualification. Pre-Qualification packets must be returned to the District Purchasing Office before 3:00 PM on Tuesday, May 03, 2016. Contact the Purchasing Office for an application packet or from the District website <http://rowlandschools.org/OurDistrict>.
 - Local-Funded Contracts. Contractors must be pre-qualified prior to bidding District projects.
 - State-Funded Contracts Over \$1,000,000. All general contractors and/or electrical, mechanical and/or plumbing subcontractors must be pre-qualified prior to bidding District projects in compliance with Public Contract Code § 20111.6.

5. Documents Accompanying Bid Proposal. Each Bid Proposal shall be submitted with the following documents. All information or responses of a Bidder in its Bid Proposal and other documents accompanying the Bid Proposal shall be complete, accurate and true; incomplete, inaccurate or untrue responses or information provided therein by a Bidder shall be grounds for the District to reject such Bidder's Bid Proposal for non-responsiveness.

Bid Security	Iran Contracting Act Certification/Exemption
Subcontractors List	
Non-Collusion Affidavit	

6. Prevailing Wage Rates. Pursuant to California Labor Code §1773, the Director of the Department of Industrial Relations of the State of California has determined the generally prevailing rates of wages in the locality in which the Work is to be performed. Copies of these determinations, entitled "PREVAILING WAGE SCALE" are available for review on the internet at http://www.dir.ca.gov/dlsr/statistics_research.html. The Contractor awarded the Contract for the Work shall post a copy of all applicable prevailing wage rates for the Work at conspicuous locations at the Site of the Work. The Contractor and all Subcontractors performing any portion of the Work shall pay not less than the applicable prevailing wage rate for the classification of labor provide by their respective workers in prosecution and execution of the Work. During the Work and pursuant to Labor Code §1771.4(a)(4), the Department of Industrial Relations shall monitor compliance with prevailing wage rate requirements and enforce the Contractor's prevailing wage rate obligations.
7. Contractors' License Classification. Bidders must possess the following classification(s) of California Contractors License at the time that the Bid Proposal is submitted and at time the Contract for the Work is awarded: **B - General Building**. The Bid Proposal of a Bidder who does not possess a valid and in good standing Contractors' License in the classification(s) set forth above will be rejected for non-responsiveness. Any Bidder not duly and properly licensed is subject to all penalties imposed by law. No payment shall be made for the Work unless and until the Registrar of Contractors verifies to the District that the Bidder awarded the Contract is properly and duly licensed for the Work.
8. Bidder and Subcontractors DIR Registered Contractor Status. Each Bidder must be a DIR Registered Contractor when submitting a Bid Proposal. The Bid Proposal of a Bidder who is not a DIR Registered Contractor when the Bid Proposal is submitted will be rejected for non-responsiveness. All Subcontractors identified in a Bidder's Subcontractors' List must be DIR Registered contractors at the time the Bid Proposal is submitted. The foregoing notwithstanding, a Bid Proposal is not subject to rejection for non-responsiveness for listing Subcontractor the Subcontractors List who is/are not DIR Registered contractors if such Subcontractor(s) complete DIR Registration pursuant to Labor Code §1771.1(c)(1) or (2). Further, a Bid Proposal is not subject to rejection if the Bidder submitting the Bid Proposal listed any Subcontractor(s) who is/are not DIR Registered contractors and such Subcontractor(s) do not become DIR Registered pursuant to Labor Code §1771.1(c)(1) or (2), but the Bidder, if awarded the Contract, must request consent of the District to substitute a DIR Registered Subcontractor for the non-DIR Registered Subcontractor pursuant to Labor Code §1771.1(c)(3), without adjustment of the Contract Price or the Contract Time.
9. Contract Time. Substantial Completion of the Work shall be achieved within the time set forth in Contract Documents after the date for commencement of the Work established in the Notice to Proceed issued by the District. Failure to achieve Substantial Completion within the Contract Time will result in the assessment of Liquidated Damages as set forth in the Contract.

10. Disabled Veteran Business Enterprises ("DVBE") Participation Goal. Pursuant to Military & Veterans Code §999.2, the District has established a Participation Goal for DVBEs of three percent (3%) of the value of the Work. The District's DVBE Participation Goal and requirements are set forth in the Contract Documents.
11. Bid Security. Each Bid Proposal shall be accompanied by Bid Security in an amount equal to TEN PERCENT (10%) of the maximum amount of the Bid Proposal, inclusive of any additive Alternate Bid Item(s). Failure of any Bid Proposal to be accompanied by Bid Security in the form and in the amount required shall render such Bid Proposal to be non-responsive and rejected by the District.
12. Payment Bond; Performance Bond. Prior to commencement of the Work, the Bidder awarded the Contract shall deliver to the District a Payment Bond and a Performance Bond issued by a California Admitted Surety in the form and content included in the Contract Documents each of which shall be in a penal sum equal to One Hundred Percent (100%) of the Contract Price.
13. Pre-Bid Inquiries. Bidders may submit pre-bid inquiries or clarification requests. Bidders are solely and exclusively responsible for submitting such inquiries or clarification requests not less than **SEVEN (7)** calendar days prior to the scheduled closing date for the receipt of Bid Proposals. The District will not respond to any bidder inquiries or clarification requests, unless such inquiries or clarification requests are submitted timely to: Ledesma & Meyer Construction Co., Inc.
14. No Withdrawal of Bid Proposals. Bid Proposals shall not be withdrawn by any Bidder for a period of **ninety (90) days** after the opening of Bid Proposals. During this time, all Bidders shall guarantee prices quoted in their respective Bid Proposals.
15. Job-Walk. The District will conduct an Informational/Non-Mandatory Job Walk on **Thursday, April 14, 2016** and a **Mandatory** Job Walk on **Thursday, April 21, 2016**, both beginning at 9:00 AM. Bidders are to meet at Rowland High School Main Parking Lot for conduct of the Job Walk. If the Job Walk is mandatory, the Bid Proposal submitted by a Bidder whose representative(s) did not attend the entirety of the Mandatory Job Walk will be rejected by the District as being non-responsive.
16. Substitute Security. In accordance with the provisions of California Public Contract Code §22300, substitution of eligible and equivalent securities for any monies withheld by the District to ensure the Contractor's performance under the Contract will be permitted at the request and expense of the Contractor and in conformity with California Public Contract Code §22300. The foregoing notwithstanding, the Bidder to whom the Contract is awarded shall request consent of the District to substitute securities for retention not later than the time of submitting the first Application for Progress Payment. The failure to request consent of the District in accordance with the foregoing be deemed a waiver of the Bidder's rights under California Public Contract Code §22300.
17. Waiver of Irregularities. The District reserves the right to reject any or all Bid Proposals or to waive any irregularities or informalities in any Bid Proposal or in the bidding.
18. Award of Contract. The Contract for the Work, if awarded, will be by action of the District's Board of Education to the responsible Bidder submitting the lowest priced responsive Bid Proposal. If Alternate Bid Items are included in the bidding, the lowest Bid Proposal Amount will be determined on the basis of the Base Bid Proposal or on the Base Bid Proposal and the combination of Alternate Bid Items selected in accordance with the applicable provisions of the Instructions for Bidders. The District anticipates that action to award this Contract will be taken at the meeting of the District's Board of Education scheduled on Tuesday, June 14, 2016.

19. Essential Bid Requirements. Bidder has completed within the last five (5) years one (1) or more Division of State Architects (DSA) approved K-12 Modernization Projects with:

- ✓ a combined total at least fifteen (15) modernized individual Classrooms and Bidder has identified the qualifying project(s) in its Prequalification Application.
- a combined total at least eight (8) modernized intermediate school and/or high school level science classrooms and Bidder has identified the qualifying project(s) in its Prequalification Application.

20. Budgeted Amount: \$35,000,000.00

/s/ ROWLAND UNIFIED SCHOOL DISTRICT

Advertisement publication dates: Monday, April 11, 2016 and Monday, April 18, 2016.

[END OF SECTION]

INSTRUCTIONS FOR BIDDERS

1. Preparation and Submittal of Bid Proposal.
 - 1.1. Bid Proposal Preparation. All information required by the bid forms must be completely and accurately provided. Numbers shall be stated in both words and figures where so indicated in the bid forms; conflicts between a number stated in words and in figures are governed by the words, except where the figures represent an express, correctly calculated sum. Partially completed Bid Proposals or Bid Proposals submitted on other than the bid forms included herein are non-responsive and will be rejected. Bid Proposals not conforming to these Instructions for Bidders and the Notice to Contractors Calling for Bids ("Call for Bids") may be deemed non-responsive and rejected.
 - 1.2. Bid Proposal Submittal. Bid Proposals shall be submitted at the place designated in the Call for Bids in sealed envelopes bearing on the outside the Bidder's name and address along with an identification of the Work for which the Bid Proposal is submitted. Bidders are solely responsible for timely submission of Bid Proposals to the District at the place designated in the Call for Bids.
 - 1.3. Date and Time of Bid Proposal Submittal. A Bid Proposal is submitted only if the outer envelope containing the Bid Proposal is marked with the Project title and is received by a District Purchasing Department representative for logging-in at (or before) the latest date and time for submittal of Bid Proposals. The official U.S. time-clock website: <http://www.time.gov/timezone.cgi?Pacific/d/-8/java> is controlling and determinative as to the time of the Bidder's submittal of the Bid Proposal. The foregoing notwithstanding, whether or not Bid Proposals are opened exactly at the time fixed in the Call for Bids, no Bid Proposals shall be received or considered by the District after it has commenced the public opening and reading of Bid Proposals; Bid Proposals submitted after such time are non-responsive and will be returned to the Bidder unopened.
2. Bid Security. Each Bid Proposal shall be accompanied by Bid Security in the form of: (i) cash, (ii) a certified or cashier's check made payable to the District or (iii) a Bid Bond, in the form and content attached hereto, in favor of the District executed by the Bidder as a principal and a Surety as surety (the "Bid Security") in an amount equal to Ten Percent (10%) of the Bid Proposal amount, inclusive of the price(s) proposed for additive Alternate Bid Items, if any. A Bid Proposal submitted without the required Bid Security is non-responsive and will be rejected. If the Bid Security is in the form of a Bid Bond, the Bidder's Bid Proposal shall be deemed responsive only if the Bid Bond is in the form and content included herein, duly completed and executed (with notary acknowledgements) on behalf of the Bidder and Surety, and the Surety is an Admitted Surety Insurer under Code of Civil Procedure §995.120.
3. Documents Accompanying Bid Proposal; Signatures. Documents which must be submitted with each Bid Proposal are identified in the Call for Bids. Any document submitted with a Bid Proposal which is not complete, accurate and executed, as required by each document, will result in the Bid Proposal being deemed non-responsive.
4. Bidder Modifications; Withdrawal or Modification of Submitted Bid Proposal.
 - 4.1. Bidder Modifications to Bid Forms Prohibited. Modifications by a Bidder to the bid forms which are not specifically called for or permitted may result in the Bidder's Bid Proposal being deemed non-responsive and rejected.
 - 4.2. Erasures; Inconsistent or Illegible Bid Proposals. Bid Proposals must not contain any erasures, interlineations or other corrections unless the same are suitably authenticated by affixing in the margin immediately opposite such erasure, interlineations or correction the surname(s) of the person(s) signing the Bid Proposal. Any Bid Proposal not conforming to the foregoing may be deemed by the District to be non-responsive. If any Bid Proposal or portions thereof, is determined by the District to be illegible, ambiguous or inconsistent, whether by virtue of any

erasures, interlineations, corrections or otherwise, the District may reject such a Bid Proposal as being non-responsive.

- 4.3. Withdrawal or Modification of Submitted Bid Proposal. A Bidder may not withdraw or modify a Bid Proposal submitted to the District except in strict conformity to the following. Bid Proposals may be withdrawn or modified only if: (i) the Bidder submitting the Bid Proposal submits a request for withdrawal or modification in writing to the District; and (ii) the written withdrawal or modification request is actually received by the District prior to the latest date/time for submittal of Bid Proposals. Requests for withdrawal of a Bid Proposal after the public opening of Bid Proposals pursuant to Public Contract Code §5100, et seq. will be considered only if in strict conformity with requirements of Public Contract Code §5100, et seq.
5. Examination of Site and Contract Documents. Each Bidder shall, at its sole cost and expense, inspect the Site and to become fully acquainted with the Contract Documents and conditions affecting the Work. Failure of a Bidder to receive or examine any of the Contract Documents or to inspect the Site shall not relieve such Bidder from any obligation with respect to the Bid Proposal, or the Work required under the Contract Documents. The District assumes no responsibility or liability to any Bidder for, nor shall the District be bound by, any understandings, representations or agreements of the District's agents, employees or officers concerning the Contract Documents or the Work made prior to execution of the Contract which are not in the form of Bid Addenda duly issued by the District. The submission of a Bid Proposal shall be deemed prima facie evidence of the Bidder's full compliance with the requirements of this section.
6. Agreement and Bonds Upon Award of Contract. If the Bidder submitting this Bid Proposal is awarded the Contract, the undersigned will execute and deliver to the District the Contract in the form attached hereto **within five (5) calendar days after notification of award of the Contract.** Concurrently with delivery of the executed Agreement to the District, the Bidder awarded the Contract shall deliver to the District: (a) Certificates of Insurance evidencing all insurance coverage required under the Contract Documents; (b) the Performance Bond; (c) the Labor and Material Payment Bond; (d) the Certificate of Workers' Compensation Insurance; (e) the Drug-Free Workplace Certificate; (f) Fingerprint Certificates; (g) DVBE Certification; and (h) Roof Project Financial Disclosure Certificates, if required. Failure of the Bidder awarded the Contract to strictly comply with the preceding may result in the District's rescission of the award of the Contract and/or forfeiture of the Bidder's Bid Security. In such event, the District may, in its sole and exclusive discretion elect to award the Contract to the responsible Bidder submitting the next lowest Bid Proposal, or to reject all Bid Proposals. The required number of executed copies of the Agreement and the form and content of the Performance Bond and the Payment Bond and other documents or instruments required at the time of execution of the Agreement are specified in the Contract Documents.
7. Pre-Bid Questions; Contract Document Interpretation and Modifications.
- 7.1. Bidder Pre-Bid Questions. Any Bidder in doubt as to the true meaning of any part of the Contract Documents; finds discrepancies, errors or omissions therein; or finds variances in any of the Contract Documents with the Laws ("Pre-Bid Questions"), shall submit a request for an clarification, interpretation or correction thereof using the form of Pre-Bid Inquiry included with the Contract Documents. Bidders are solely and exclusively responsible for submitting Pre-Bid Questions no later than the time/date designated in the Call for Bids. Responses to Pre-Bid Questions will be by written addendum issued by, or on behalf of, the District. A copy of any such addendum will be mailed or otherwise delivered to each Bidder receiving a set of the Contract Documents. Failure to request interpretation or clarification of any portion of the Contract Documents pursuant to the foregoing is a waiver of any discrepancy, defect or conflict therein.
- 7.2. No Oral Interpretations. No person is authorized to: (i) render an oral interpretation or correction of any portion of the Contract Documents; or (ii) provide oral responses to Pre-Bid Questions.

No Bidder is authorized to rely on any such oral interpretation, correction or response.

8. District's Right to Modify Contract Documents. Before the public opening and reading of Bid Proposals, the District may modify the Work, the Contract Documents, or any portion(s) thereof by the issuance of written addenda disseminated to all Bidders who have obtained a copy of the Specifications, Drawings and Contract Documents pursuant to the Call for Bids. If the District issues any addenda during the bidding, the failure of any Bidder to acknowledge such addenda in its Bid Proposal will render the Bid Proposal non-responsive and rejected.
9. Bidder's Assumptions. The District is not responsible for any assumptions made or used by the Bidder in calculating its Bid Proposal Amount including, without limitation, assumptions regarding costs of labor, materials, equipment or substitutions/alternatives for any material, equipment, product, item or system incorporated into or forming a part of the Work which have not been previously expressly approved and accepted by the District. The successful Bidder, upon award of the Contract by the District, if any, will be required to complete the Work for the amount bid in the Bid Proposal within the Contract Time and in accordance with the Contract Documents.
10. Bidders Interested in More Than One Bid Proposal; Non-Collusion Affidavit. No person, firm, corporation or other entity shall submit or be interested in more than one Bid Proposal for the same Work; provided, however, that a person, firm or corporation that has submitted a sub-proposal to a Bidder or who has quoted prices for materials to a Bidder is not disqualified from submitting a sub-proposal, quoting prices to other Bidders or submitting a Bid Proposal for the proposed Work to the District. The form of Non-Collusion Affidavit included in the Contract Documents must be completed and duly executed on behalf of the Bidder; failure of a Bidder to submit a completed and executed Non-Collusion Affidavit with its Bid Proposal will render the Bid Proposal non-responsive.
11. Award of Contract.
- 11.1. Waiver of Irregularities or Informalities. The District reserves the right to reject any and all Bid Proposals or to waive any irregularities or informalities in any Bid Proposal or in the bidding.
- 11.2. Award to Lowest Responsive Responsible Bidder. The award of the Contract, if any, will be made by the District through action of its Board of Education and will be to the responsible Bidder submitting the lowest priced responsive Bid Proposal on the basis specified in this article.
- 11.3. Alternate Bid Items Proposal. If the bidding includes Alternate Bid Items, the price(s) proposed by a Bidder for each Alternate Bid Item shall be set forth in the form of Alternate Bid Items Proposal, included as Attachment A to the form of Bid Proposal. Each Bidder shall submit its completed and executed form of Alternate Bid Items Proposal concurrently with submission of the Bidder's Bid Proposal, provided that the page(s) forming the Alternate Bid Items Proposal shall be submitted by each Bidder in a separate sealed envelope, prominently marked "ALTERNATE BID ITEMS PROPOSAL." **The Bid Proposal of a Bidder will be rejected for non-responsiveness if the Bidder fails to: (i) propose prices for each Alternate Bid Item on the form Alternate Bid Items Proposal; and/or (ii) submit the completed/executed form of Alternate Bid Items Proposal concurrently with submission of the Bid Proposal.**
- 11.4. Determination of Lowest Responsive Bid. The lowest responsive bid for the Work shall be determined as follows:
- ✓ *The lowest bid shall be the lowest bid price on the base contract without consideration of the prices on the additive or deductive alternate items.*
 - *The lowest bid shall be the lowest total of the bid prices on the base contract and those additive or deductive alternate items that are specifically identified herein as being used for the purpose of determining the lowest bid price and include Alternates:*

- _____.
- The lowest bid shall be the lowest total of the bid prices on the base contract and those additive or deductive alternate items that when taken in order from the following specifically identified list of those items, and added to, or subtracted from, the base contract, are less than, or equal to, a funding amount in the sum of _____ Dollars (\$_____):*

Alternates: _____.

- The selection of Alternate Bid Items for inclusion in the scope of the Work of the Contract to be awarded and for determination of the lowest Bid Proposal based upon the Base Bid Proposal and the combination of Alternate Bid Items selected for inclusion in the Contract to be awarded will be by a blind-bidder process. After opening timely submitted Bid Proposals and before the public reading of the Bid Proposals, District staff who will not be engaged in the selection of Bid Alternates (“Clerical Staff”) will assign each Bidder an alphabetical letter for identification purposes. The Clerical Staff will mask all portions of the Bid Proposal and other documents submitted with Bid Proposals so that the identity of each Bidder and each listed subcontractor is not revealed. The Clerical Staff will maintain a list (“Bidders List”) which identifies each Bidder’s name and a corresponding alphabetical letter assigned to each Bidder. After completing the Bidders List, the Clerical Staff will publicly read the Bid Proposal amounts of each Bidder for the Base Bid as well as each Bid Alternate. In this public reading, Bidders will not be identified by name, only by alphabetical letter assigned to each Bidder. After the public reading of Bid Proposals, the Clerical Staff will provide the Project Manager and District staff responsible for selection of Bid Alternates (“Review Team”) copies of the Bid Proposals with the identities of Bidders and listed subcontractors masked. Bid Proposals reviewed by the Review Team will identify Bidders only by alphabetical letters. At such time as the Review Team has completed its review of the Bid Proposals, has selected Bid Alternates and has determined which Bidder (by the alphabetical letter designation assigned by Clerical Staff) has submitted the lowest Bid Proposal based upon the Base Bid and any combination of the Bid Alternates as determined by the Review Team, the Clerical Staff will make available to the Review Team the Bidders List so that the identity of the Bidder to be awarded the Contract can be identified. Until such time as the Review Team has completed review of Bid Proposals and determination of which Bidder has submitted the lowest responsive Bid Proposal, there will be no communication between members of the Clerical Staff and members of the Review Team regarding the identities of Bidders or listed subcontractors or any disclosure of any portion of the Bidders List.*

11.5. Responsive Bid Proposal. A responsive Bid Proposal shall mean a Bid Proposal which conforms to and complies with requirements of the Bid and Contract Documents. A Bid Proposal that does not conform to material bidding requirements, as reasonably determined by the District, is subject to rejection for non-responsiveness.

11.6. Responsible Bidder. A responsible bidder means a bidder who has demonstrated quality, fitness, capacity, trustworthiness and experience to satisfactorily perform public works contracts.

12. Subcontractors.

12.1. Designation of Subcontractors; Subcontractors List. In accordance with Public Contract Code §4104, the Subletting and Subcontracting Fair Practices Act (California Public Contract Code §§4100 et seq.), each Bidder shall submit, on the form of Subcontractors List included with the Contract Documents, a list of its proposed Subcontractors for the proposed Work, including any Alternate Bid Items, who will perform/provide portions of the Work valued at or more than one-half (1/2) of one percent (1%) of the amount proposed by the Bidder for the Work. The Subcontractors List consists of five (5) columns, each of which requires the Bidder’s

disclosure of information relating to each listed Subcontractor as follows:

Column A Name of Subcontractor
 Column B Subcontractor's Address
 Column C Subcontractor's Portion of the Work
 Column D Subcontractor's California Contractors' License

Columns A, B, C and D of the Subcontractors List must be completed by the Bidder for each Subcontractor identified by the Bidder in its Subcontractors List submitted concurrently with the Bidder's Bid Proposal.

- 12.2. Work of Subcontractors. All Bidders are referred to the Contract Documents and the notation therein that all Contract Documents are intended to be complementary and that the organization or arrangements of the Specifications and Drawings shall not limit the extent of the Work of the Contract Documents. Accordingly, all Bidders are encouraged to disseminate all of the Specifications, Drawings and other Contract Documents to all persons or entities submitting sub-bids to the Bidder. The omission of any portion or item of Work from the Bid Proposal or from the sub-bidders' sub-bids which is/are necessary to produce the intended results and/or which are reasonably inerrable from the Contract Documents is not a basis for adjustment of the Contract Price or the Contract Time. Dissemination of the Contract Documents to sub-bidders and dissemination of addenda issued during the bidding process is solely the responsibility of each Bidder.
- 12.3. Subcontractor Bonds. Pursuant to California Public Contract Code §4108, if a Bidder requires a bond or bonds of its Subcontractor(s), whether the expense of procuring such bond or bonds are to be borne by the Bidder or the Subcontractor(s), such requirements shall be specified in the Bidder's written or published request for sub-bids. Failure of the Bidder to comply with these requirements shall preclude the Bidder from imposing bonding requirements upon its Subcontractor(s) or rejection of a Subcontractor's bid under California Public Contract Code §4108(b).
13. Department of Justice. Except when there are no pupils present at the Site, no employee or independent contractor to the Contractor, nor any employee or independent contractor to any Subcontractor, of any tier, shall be permitted access to the Site nor to perform any Work at the Site until: (a) such person has submitted her/his fingerprints to the California Department of Justice ("DOJ") pursuant to Education Code § 45125.1; (b) the DOJ has ascertained, based upon the submitted fingerprints, that the individual has not been convicted of a felony defined in Education Code § 45122.1 and has no criminal felony proceedings (as defined in Education Code § 45122.1) pending against her/him; (c) the Contractor or Subcontractor engaging the individual for the Work has received written or electronic verification from the DOJ of the absence of felony convictions and pending felony criminal proceedings; and (d) the Contractor or Subcontractor engaging such individual as an employee or independent contractor has submitted a Fingerprint Certification to the District specifically identifying such individual as having been verified by the DOJ as not having been convicted of a felony and not having pending criminal felony proceeding pending against her/him.
14. Iran Contracting Act Certification/Exemption. Pursuant to Public Contract Code §§ 2202-2208, each Bidder shall submit with its Bid Proposal a Certificate or Exemption which is included within the Contract Documents to either: a) certify it is not on the current list of persons engaged in investment activities in Iran created by the California Department of General Services ("DGS") pursuant to Public Contract Code §2203(b) and is not a financial institution extending twenty million dollars (\$20,000,000) or more in credit to another person, for 45 days or more, if that other person will use the credit to provide goods or services in the energy sector in Iran and is identified on the current list of persons engaged in investment activities in Iran created by DGS; or b) demonstrate it has been exempted from the certification requirement for that solicitation or contract pursuant to Public Contract Code §2203(c) or (d). The Certificate or Exemption must be completed with the Bidder's

name and Federal ID number, if applicable. Any Bid Proposal not accompanied by the completed Certificate or Exemption bearing the signature of the Bidder's duly authorized representative will render the Bid Proposal non-responsive and rejected. In addition, California law establishes penalties for providing false certifications, including civil penalties equal to the greater of \$250,000 or twice the amount of the contract for which the false certification was made; contract termination; and three-year ineligibility to bid on contracts. See Public Contract Code §2205.

15. Workers' Compensation Insurance. Pursuant to California Labor Code § 3700, the successful Bidder shall secure Workers' Compensation Insurance for its employees engaged in the Work of the Contract. The successful Bidder shall execute and deliver to the District the form of Workers Compensation Certification included in the Contract Documents concurrently with such Bidder's delivery of the executed Agreement to the District.
16. Bid Security Return. The Bid Security of the Bidders submitting the three lowest priced Bid Proposals, the number being solely at the discretion of the District, will be held by the District for ten (10) days after the period for which Bid Proposals must be held open (which is set forth in the Call for Bids) or until posting by the successful Bidder(s) of the bonds, certificates of insurance required and return of executed copies of the Agreement, whichever first occurs, at which time the Bid Security of such other Bidders will be returned to them.
17. Forfeiture of Bid Security. If the Bidder awarded the Contract fails or refuses to execute the Agreement within Five (5) calendar days from the date of receiving notification that it is the Bidder to whom the Contract has been awarded, the District may declare the Bidder's Bid Security forfeited as damages caused by the failure of the Bidder to enter into the Contract and may thereupon award the Contract for the Work to the responsible Bidder submitting the next lowest Bid Proposal or may call for new bids, in its sole and exclusive discretion.
18. Contractors' License. No Bid Proposal will be considered from a Bidder who, at the time Bid Proposals are opened, is not licensed to perform the Work of the Contract Documents, in accordance with the Contractors' License Law, California Business & Professions Code §§7000 et seq. This requirement is not a mere formality and will not be waived by the District or its Board of Education. The required California Contractors' License classification(s) for the Work is set forth in the Call for Bids.
19. Non-Discriminatory Employment Practices. It is the policy of the District that there be no discrimination against any prospective or active employee engaged in the Work because of race, color, ancestry, national origin, religious creed, sex, age, marital status or other legally protected classification. All Bidders agree to comply with the District's non-discrimination policy and all applicable Federal and California anti-discrimination laws including but not limited to the California Fair Employment & Housing Act beginning with California Government Code §§ 12940 et seq. and California Labor Code § 1735. In addition, all Bidders agree to require like compliance by any Subcontractor employed by them on the Work of the Contract.
20. Sexual Harassment. It is the policy of the District to ensure that everyone complies with Education Code, Government Code, Title V of the Administrative Code, and all other related statutes related to the prevention of Sexual Harassment. All Bidders agree to comply with the District's Sexual Harassment Prevention Program and all applicable Federal and California laws including but not limited to the California Fair Employment & Housing Act commencing with California Government Code §12950, et seq. In addition, all Bidders agree to require like compliance by any Subcontractor employed by them on the Work of the Contract.
21. Job-Walk.
 - 21.1. Mandatory and Non-Mandatory Job Walk. The District will conduct a Job-Walk at the

time(s) and place(s) designated in the Call for Bids. If attendance at the Job Walk is indicated in the Call for Bids as being mandatory, the failure of any Bidder to have its authorized representative present at the entirety of the Job-Walk will render the Bid Proposal of such Bidder to be non-responsive. The attendance by representatives of the Bidder's Subcontractors at a Mandatory Job Walk without attendance by a representative of the Bidder shall not be sufficient to meet the Bidder's obligations hereunder and will render the Bid Proposal of such Bidder to be non-responsive. If a Job Walk is indicated in the Call for Bids as being Non-Mandatory, the Bid Proposal of a Bidder who does not attend the Non-Mandatory Job Walk will not be rejected for non-responsiveness. Notwithstanding the non-compulsory attendance of Bidders at a Non-Mandatory Job Walk, all Bidders are encouraged to attend Non-Mandatory Job Walks.

21.2. District Additional Job Walk. The District may, in its sole and exclusive discretion, elect to conduct one or more Job-Walk(s) in addition to that set forth in the Call for Bids, in which event the District shall notify all Bidders who have theretofore obtained the Contract Documents pursuant to the Call for Bids of any such additional Job-Walk. If the District elects to conduct any Job-Walk in addition to that set forth in the Call for Bids, the District shall, in its notice of any such additional Job-Walk(s), indicate whether Bidders' attendance at such additional Job-Walk(s) is/are mandatory.

21.3. Bidder Requested Additional Job Walk. Any Bidder who has obtained the Bid Documents pursuant to the Call for Bids may, by written request to the District, request an additional Job Walk if the District has designated a Job Walk in the Call for Bids or a Job Walk if the District has not designated a Job Walk in the Call for Bids. The District may, in its sole and exclusive discretion, conduct such requested Job-Walk taking into consideration factors such as the time remaining prior to the scheduled opening of Bid Proposals. Any such requested Job Walk will be conducted only upon the requesting Bidder's agreement to reimburse the District for the actual and/or reasonable costs for the District's staff and its agents and representatives in arranging for and conducting such additional Job-Walk.

22. Public Records. Bid Proposals and other documents responding to the Call for Bids become the exclusive property of the District upon submittal to the District. All Bid Proposals and other documents submitted in response to the Call for Bids are a matter of public record, except for information contained in such Bid Proposals deemed to be Trade Secrets (as defined in California Civil Code §3426.1). Financial documents submitted and information provided in support of a Bidder's Statement of Qualifications will not be disclosed by the District nor become a matter of public record pursuant to California Government Code §6255. However, a Bidder that indiscriminately marks all or most of its Bid Proposal as exempt from disclosure as a public record, whether by the notations of "Trade Secret," "Confidential," "Proprietary," or otherwise, may render the Bid Proposal non-responsive and rejected. The District is not liable or responsible for the disclosure of such records, including those exempt from disclosure if disclosure is deemed required by law, by an order of Court, or which occurs through inadvertence, mistake or negligence on the part of the District or its officers, employees or agents.

23. Drug Free Workplace Certificate. In accordance with California Government Code §§ 8350 et seq., the Drug Free Workplace Act of 1990, the successful Bidder will be required to execute a Drug Free Workplace Certificate concurrently with execution of the Agreement. The successful Bidder will be required to implement and take the affirmative measures outlined in the Drug Free Workplace Certificate and in California Government Code §§8350 et seq. Failure of the successful Bidder to comply with the measures outlined in the Drug Free Workplace Certificate and in California Government Code §§ 8350 et seq. may result in penalties, including without limitation, the termination of the Agreement, the suspension of any payment of the Contract Price otherwise due under the Contract Documents and/or debarment of the successful Bidder.

24. Roof Projects Certification Re Financial Relationships Disclosure. In accordance with Public Contract Code § 3006, upon award of contract, Contractor and/or any of its Subcontractors and Materialmen involved in bid or proposal for a roof project shall disclose financial relationships by completing and signing the District the Certification Re Financial Relationships Disclosure. Any person who knowingly provides false information or fails to disclose a financial relationship shall be subject to civil liability and penalties as set forth in Public Contract Code § 3006.
25. Notice of Intent to Award Contract. Following the public opening and reading of Bid Proposals, the District will issue a Notice of Intent to Award the Contract, identifying the Bidder to whom the District intends to award the Contract and the date/time/place of the District's Board of Education meeting at which award of the Contract will be considered.
26. Substitute Security. The successful Bidder may request substitution of eligible and equivalent securities for any monies withheld by the District to ensure the Contractor's performance under the Contract pursuant to California Public Contract Code §22300. The foregoing notwithstanding, the Bidder to whom the Contract is awarded shall make its written request to the District for substitute security not later than the date of the submission of the first Application for Progress Payment; failure to request substitute security on or prior to such date shall be deemed a waiver of rights under Public Contract Code §22300.
27. Bid Protest.
- 27.1. Submittal of Bid Protest. Any Bidder submitting a Bid Proposal to the District may file a protest of the District's intent to award the Contract provided that all of the following are complied with: (i) the bid protest is in writing; (ii) the bid protest is filed and received by the District's Assistant Superintendent/Chief Business Officer, not more than five (5) calendar days after the date of issuance of the District's Notice of Intent to Award the Contract; and (iii) the written bid protest sets forth, in detail, all grounds for the bid protest, including without limitation all facts, supporting documentation, legal authorities and argument in support of the grounds for the bid protest; any matters not set forth in the written bid protest shall be deemed waived. All factual contentions must be supported by competent, admissible and creditable evidence. Any bid protest not conforming to the foregoing shall be rejected by the District as invalid.
- 27.2. District Review and Disposition of Bid Protest. Provided that a bid protest is filed in strict conformity with the foregoing, the District's Assistant Superintendent/Chief Business Officer, or such individual(s) as may be designated by him/her ("Designee") will review and evaluate the basis of the bid protest. The District's Assistant Superintendent/Chief Business Officer, or Designee shall provide the Bidder submitting the bid protest with a written statement concurring with or denying the bid protest ("Bid Protest Response"). The Bid Protest Response is deemed the final action of the District and not subject to appeal or reconsideration by any other employee or officer of the District or the Board of Education of the District. The issuance of the Bid Protest Response by the District's Assistant Superintendent/Chief Business Officer, or the Designee, is an express condition precedent to the institution of any legal or equitable proceedings relative to the bidding process, the District's intent to award the Contract, the District's disposition of any bid protest or the District's decision to reject all Bid Proposals.

[END OF SECTION]

BID PROPOSAL

Project: Rowland High School Additions BID NO 2015/16:7R

Bidder Name	_____	
Bidder Representative(s)	Name and Title _____	
	Name and Title _____	
Bidder Representative(s) Contact Information	Email Address(es)	Phone/Fax
	_____	(_____) _____ Telephone
	_____	(_____) _____ Fax
Bidder Mailing Address	Address _____	
	City/State/Zip Code _____	
California Contractors' License	Number _____	
	Classification(s) and Expiration Date _____	

1. Bid Proposal.

1.1 Bid Proposal Amount. The undersigned Bidder proposes and agrees to furnish and install the Work including, without limitation, providing and furnishing any and all labor, materials, tools, equipment and services necessary to complete, in a workmanlike manner in accordance with the Contract Documents, all of the Work described as: **Rowland High School Additions BID NO 2015/16:7R**, for the sum of:

\$, , .

_____ Dollars
(in words; printed or typed)

The Bidder confirms that it has checked all of the above figures and understands that neither the District nor any of its agents, employees or representatives shall be responsible for any assumptions, errors or omissions on the part of the undersigned Bidder in preparing and submitting this Bid Proposal.

1.2 Acknowledgment of Bid Addenda. The Bidder confirms that this Bid Proposal incorporates and is inclusive of, all items or other matters contained in Bid Addenda, if any, issued by or on behalf of the District.

(initial) **No Addenda Issued**

(initial) **Addenda Nos.** _____ received, acknowledged and incorporated into this Bid Proposal.

1.3 Alternate Bid Items. The Bidder's proposed pricing for each Alternate Bid Item, if any, are set forth in the accompanying form of Alternate Bid Items Proposal. Failure of a Bidder to propose pricing for each Alternate Bid Item set forth in the accompanying Alternate Bid Items Proposal will result in the Bid Proposal being deemed non-responsive and rejected.

2. Documents Accompanying Bid Proposal. The Bidder has submitted with this Bid Proposal the following:

Bid Security	Iran Contracting Act Certification/Exemption
Subcontractors List	
Non-Collusion Affidavit	

The Bidder acknowledges that if this Bid Proposal and the foregoing documents are not fully in compliance with applicable requirements set forth in the Call for Bids, the Instructions for Bidders and in each of the foregoing documents, the Bid Proposal may be rejected as non-responsive.

3. Award of Contract. If the Bidder submitting this Bid Proposal is awarded the Contract, the undersigned will execute and deliver to the District the Agreement in the form attached hereto within Five (5) calendar days after notification of award of the Contract. Concurrently with delivery of the executed Agreement to the District, the Bidder awarded the Contract shall deliver to the District: (i) Certificates of Insurance evidencing all insurance coverages required under the Contract Documents; (ii) Performance Bond; (iii) Labor and Material Payment Bond; (iv) Certificate of Workers' Compensation Insurance; and (v) Drug-Free Workplace Certificate. Failure of the Bidder awarded the Contract to strictly comply with the preceding may result in the District's rescinding award of the Contract and/or forfeiture of the Bidder's Bid Security. In such event, the District may, in its sole and exclusive discretion elect to award the Contract to the responsible Bidder submitting the next lowest priced Bid Proposal or to reject all Bid Proposals.

4. Contractors' License. The Bidder certifies that: (i) it possesses a valid and in good standing Contractors' License, in the necessary class(es), for performing the Work as set for in the Call for Bids; (ii) that such license shall be in full force and effect throughout the duration of the performance of the Work; and (iii) that all Subcontractors providing or performing any portion of the Work are properly licensed to perform their respective portions of the Work at the time of submitting this Bid Proposal and will remain so properly licensed at all times during their performance of the Work.

5. Acknowledgment and Confirmation. The undersigned Bidder acknowledges its receipt, review and understanding of the Drawings, the Specifications and other Contract Documents pertaining to the proposed Work. The undersigned Bidder certifies that the Contract Documents are, in its opinion, adequate, feasible and complete for providing, performing and constructing the Work in a sound and suitable manner for the use specified and intended by the Contract Documents. The undersigned Bidder certifies that it has, or has available, all necessary equipment, personnel, materials, facilities and technical and financial ability to complete the Work for the amount bid herein within the Contract Time and in accordance with the Contract Documents. The undersigned Bidder certifies that its bid amount includes funds sufficient to allow the Bidder to comply with all applicable local, state and federal laws and regulations governing the labor and services to be provided for the performance of the Work of the Contract and shall indemnify, defend and hold District harmless from and against any and all claims, demands, losses, liabilities and damages arising out of or relating to Bidder's failure to comply with applicable law in this regard.

THE UNDERSIGNED DECLARES UNDER PENALTY OF PERJURY UNDER THE LAWS OF THE STATE OF CALIFORNIA THAT THE REPRESENTATIONS MADE IN THIS BID PROPOSAL ARE TRUE AND CORRECT.

By: _____
(Signature of Bidder's Authorized Officer
or Representative)

(Typed or Printed Name)

Title: _____

ALTERNATE BID ITEMS PROPOSAL

Bidder Name: _____

Bidders must provide a proposal price for each Alternate Bid Item set forth herein; failure to do so will result in rejection of the Bid Proposal for non-responsiveness. The amount proposed for each Alternate Bid Item by the above-identified Bidder is set forth hereinbelow:

1. Alternate Bid Item No.1. [INSERT ALTERNATE DESCRIPTION]

Add to Base Bid Proposal Amount

Deduct From Base Bid Proposal Amount

(Check appropriate box indicating additive or deductive cost; failure to do so will result in rejection of Bid Proposal for non-responsiveness)

\$, , .

_____ Dollars
(in words; printed or typed)

2. Alternate Bid Item No.2. [INSERT ALTERNATE DESCRIPTION]

Add to Base Bid Proposal Amount

Deduct From Base Bid Proposal Amount

(Check appropriate box indicating additive or deductive cost; failure to do so will result in rejection of Bid Proposal for non-responsiveness)

\$, , .

_____ Dollars
(in words; printed or typed)

3. Alternate Bid Item No.3. [INSERT ALTERNATE DESCRIPTION]

Add to Base Bid Proposal Amount

Deduct From Base Bid Proposal Amount

(Check appropriate box indicating additive or deductive cost; failure to do so will result in rejection of Bid Proposal for non-responsiveness)

\$, , .

_____ Dollars
(in words; printed or typed)

4. Alternate Bid Item No.4. [INSERT ALTERNATE DESCRIPTION]

Add to Base Bid Proposal Amount

Deduct From Base Bid Proposal Amount

(Check appropriate box indicating additive or deductive cost; failure to do so will result in rejection of Bid Proposal for non-responsiveness)

\$, , .

_____ Dollars
(in words; printed or typed)

Dated _____

By: _____
(Signature of Bidder's Authorized Officer or Representative)

(Typed or Printed Name)

Title: _____

PRE-BID INQUIRY FORM
(FOR PRE-BID USE ONLY)
PRE-BID REQUEST FOR INFORMATION
ROWLAND UNIFIED SCHOOL DISTRICT

TO: Ledesma & Meyer Construction Co., Inc.
 Email: russh@lmcci.com
juliew@lmcci.com

PHONE: (909) 476-0590 _____
 FAX: (909) 476-0592 _____
 RECEIVED: _____
 (Rowland Unified School District Use Only)

DEADLINE: Friday, May 6, 2016

Date of Pre-Bid RFI: _____
Project: Rowland High School Additions
BID NO 2015/16:7R

Trade Description: _____

Bidder Name: _____

Bidder's Contact: _____
 Bidder's Contact Phone and Fax Numbers;
 Email Address: _____

Bidder's Pre-Bid Request for Information

Additional pages attached by Bidder: ___ Yes ___ No
 Number of additional pages attached by Bidder: _____

Response to Bidder's Pre-Bid Request for Information

Date: _____

Additional pages of RFI Response attached: ___ Yes ___ No
 Number of additional RFI Response pages attached: _____

Response By (Firm Name): _____

Signed: _____

SUBCONTRACTORS LIST

Project **Rowland High School Additions**
BID 2015/16:7R

Name of Bidder: _____

Authorized Signature: _____

(A) Licensed Name of Subcontractor	(B) Subcontractor Office, Mill or Shop Address	(C) Subcontractor Trade or Portion of Work	(D) Subcontractor Contractors' License No.	(E) DVBE
				Yes ____ No ____
				Yes ____ No ____
				Yes ____ No ____
				Yes ____ No ____
				Yes ____ No ____
				Yes ____ No ____
				Yes ____ No ____
				Yes ____ No ____
				Yes ____ No ____

Attach additional page(s) as required

NON-COLLUSION DECLARATION

PROJECT: Rowland High School Additions BID NO 2015/16:7R

The undersigned declares:

I am _____,

(Insert "Sole Owner", "Partner", "President", "Secretary", or other proper title)

of _____

(Insert name of bidder)

As the party submitting a Bid Proposal for the above-identified Project, the undersigned declares, states and certifies that:

1. The Bid Proposal is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization or corporation.

2. The Bid Proposal is genuine and not collusive or sham.

3. The Bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any other bidder or anyone else to put in sham bid, or to refrain from bidding.

4. The Bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price, or that of any other bidder, or to fix any overhead, profit or cost element of the bid price or that of any other bidder, or to secure any advantage against the public body awarding the contract or of anyone interested in the proposed contract.

5. All statements contained in the Bid Proposal and related documents are true.

6. The Bidder has not, directly or indirectly, submitted the bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any person, corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid and has not paid, and will not pay, any person or entity for such purpose.

Executed this ____ day of _____, 20__ at _____.
(City, County and State)

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Signature

(Address)

Name Printed or Typed

(City, County and State)

(_____) _____
(Area Code and Telephone Number)

CERTIFICATE OF WORKERS' COMPENSATION INSURANCE

I, _____ the _____ of
(Name) (Title)

_____, declare, state and certify that:
(Contractor Name)

1. I am aware that California Labor Code § 3700(a) and (b) provides:

“Every employer except the state shall secure the payment of compensation in one or more of the following ways:

- (a) By being insured against liability to pay compensation in one or more insurers duly authorized to write compensation insurance in this state.
- (b) By securing from the Director of Industrial Relations a certificate of consent to self-insure either as an individual employer, or one employer in a group of employers, which may be given upon furnishing proof satisfactory to the Director of Industrial Relations of ability to self-insure and to pay any compensation that may become due to his or her employees.”

2. I am aware that the provisions of California Labor Code §3700 require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of this Contract.

(Contractor Name)

By: _____
(Signature)

(Typed or printed name)

DRUG-FREE WORKPLACE CERTIFICATION

I, _____, am the _____ of
 (Print Name) (Title)

 (Contractor Name)

I declare, state and certify to all of the following:

1. I am aware of the provisions and requirements of California Government Code §§8350 et seq., the Drug Free Workplace Act of 1990.
2. I am authorized to certify, and do certify, on behalf of Contractor that a drug free workplace will be provided by Contractor by doing all of the following:
 - A. Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensation, possession or use of a controlled substance is prohibited in Contractor's workplace and specifying actions which will be taken against employees for violation of the prohibition;
 - B. Establishing a drug-free awareness program to inform employees about all of the following:
 - i. The dangers of drug abuse in the workplace;
 - ii. Contractor's policy of maintaining a drug-free workplace;
 - iii. The availability of drug counseling, rehabilitation and employee-assistance programs; and
 - iv. The penalties that may be imposed upon employees for drug abuse violations;
 - C. Requiring that each employee engaged in the performance of the Contract be given a copy of the statement required by subdivision (A), above, and that as a condition of employment by Contractor in connection with the Work of the Contract, the employee agrees to abide by the terms of the statement.
 - D. Contractor agrees to fulfill and discharge all of Contractor's obligations under the terms and requirements of California Government Code §8355 by, inter alia, publishing a statement notifying employees concerning: (i) the prohibition of any controlled substance in the workplace, (ii) establishing a drug-free awareness program, and (iii) requiring that each employee engaged in the performance of the Work of the Contract be given a copy of the statement required by California Government Code §8355(a) and requiring that the employee agree to abide by the terms of that statement.
3. Contractor and I understand that if the District determines that Contractor has either: (i) made a false certification herein, or (ii) violated this certification by failing to carry out and to implement the requirements of California Government Code §§8355, the Contract awarded herein is subject to termination, suspension of payments, or both. Contractor and I further understand that, should Contractor violate the terms of the Drug-Free Workplace Act of 1990, Contractor may be subject to debarment in accordance with the provisions of California Government Code §§8350, et seq.

4. Contractor and I acknowledge that Contractor and I are aware of the provisions of California Government Code §§8350, et seq. and hereby certify that Contractor and I will adhere to, fulfill, satisfy and discharge all provisions of and obligations under the Drug-Free Workplace Act of 1990.

I declare under penalty of perjury under the laws of the State of California that all of the foregoing is true and correct.

Executed at _____ this ____ day of _____, 20____.
(City and State)

(Signature)

(Printed or Typed Name)

DISABLED VETERAN BUSINESS ENTERPRISE ("DVBE") PARTICIPATION GOAL

- 1. DVBE Participation Policy.** The District is committed to achieving its established Participation Goal for Disabled Veteran Business Enterprises ("DVBEs"). Through the DVBE participation program, the District encourages contractors to ensure maximum opportunities for the participation of DVBEs in the Work of the Contract.
- 2. Definitions.**

 - 2.1 Disabled Veteran.** A "Disabled Veteran" means a veteran of the military, naval, or air service of the United States with at least ten percent (10%) service-connected disability who is domiciled in the State of California.
 - 2.2 Disabled Veteran Business Enterprise.** A "Disabled Veteran Business Enterprise" ("DVBE") means a business enterprise certified by the Office of Small Business and Disabled Veteran Business Enterprise Services, State of California, Department of General Services, pursuant to Military and Veterans Code §999.
- 3. DVBE Participation Goal.** The term "Participation Goal" is a numerically expressed objective for DVBE participation in performing the Work of the Contract. The Participation Goal is not a quota, set-aside or rigid proportion. The District has established a DVBE Participation Goal of Three Percent (3%) of the total Contract Price.
- 4. Monitoring of DVBE Participation and Submission of Report.**

 - 4.1 Certification of Participation.** At the time of execution of the contract, the Contractor shall provide a statement to the District that it will comply with the DVBE requirements as set forth in this Contract.
 - 4.2 Submission of Report.** During performance of the Contract, Contractor shall monitor the Work of the Contract, award of subcontracts and contracts for materials, equipment and supplies for the purpose of determining DVBE participation in the Work of the Contract. Contractor shall report on a monthly basis all DVBEs utilized in the performance of the Work, the type or classification of the Work performed by each such DVBE and the dollar value of the Work performed by each such DVBE. In addition, upon completion of the Work of the Contract, Contractor shall submit a report to the District in the form attached hereto identifying all DVBEs utilized in the performance of the Work, the type or classification of the Work performed by each such DVBE and the dollar value of the Work performed by each such DVBE. The submission to the District of such report shall be deemed a condition precedent to the District's obligation to make payment of the Final Payment under the Contract Documents. The submission of such report shall be in addition to, and not in lieu of, any other conditions precedent set forth in the Contract Documents for the District's obligation to make payment of the Final Payment. The District reserves the right to request additional information or documentation from the Contractor evidencing efforts to comply with the DVBE Participation Goal.
 - 4.3 Contract Audit.** Contractor agrees that the District, or its designee, shall have the right to review, obtain and/or copy any and all writings, materials, documents and other records pertaining to the performance of the Contract. Contractor agrees that the District, or its designee, shall have access to any of Contractor's premises upon reasonable notice, during usual business hours for the purpose of interviewing employees and inspecting and/or copying such writings, materials, documents and other documents which may be relevant to a matter under investigation for the purpose of determining compliance with the DVBE Participation Goal

**CERTIFICATION – PARTICIPATION OF
DISABLED VETERAN BUSINESS ENTERPRISES**

I certify that I have read the foregoing **DISABLED VETERAN BUSINESS ENTERPRISE (“DVBE”)**
PARTICIPATION GOAL and will comply with the requirements as set forth in this Contract.

Signature

Typed or Printed Name

Title

Company

Street Address

City, State, Zip

Telephone

Fax

E-mail

DVBE PARTICIPATION REPORT

Contractor Name: _____

Project Name: _____

Project Bid Number: _____

Date: _____

1) Firm Name of DVBE	2) Trade/Portion of Work	3) Value of Work

Does the cumulative dollar value of the foregoing DVBE participation meet or exceed three percent (3%) of the final Contract Price, as adjusted by all change orders?

YES _____ **NO** _____

If your response is "NO", please attach to this Report a detailed description of the reasons for your failure to achieve the District's DVBE Participation Goal.

**IRAN CONTRACTING ACT CERTIFICATION/EXEMPTION
Public Contract Code §§ 2202-2208**

Prior to bidding on, submitting a proposal or executing a contract or renewal for a contract for goods or services of \$1,000,000 or more, a vendor must either: a) certify it is **not** on the current list of persons engaged in investment activities in Iran created by the California Department of General Services (“DGS”) pursuant to Public Contract Code §2203(b) and is not a financial institution extending twenty million dollars (\$20,000,000) or more in credit to another person, for 45 days or more, if that other person will use the credit to provide goods or services in the energy sector in Iran and is identified on the current list of persons engaged in investment activities in Iran created by DGS; or b) demonstrate it has been exempted from the certification requirement for that solicitation or contract pursuant to Public Contract Code §2203(c) or (d).

To comply with this requirement, please insert your vendor or financial institution name and Federal ID Number (if available) and complete **one** of the options below. Please note: California law establishes penalties for providing false certifications, including civil penalties equal to the greater of \$250,000 or twice the amount of the contract for which the false certification was made; contract termination; and three-year ineligibility to bid on contracts. See Public Contract Code §2205.

OPTION #1 - CERTIFICATION

I, the official named below, certify I am duly authorized to execute this certification on behalf of the vendor/financial institution identified below, and the vendor/financial institution identified below is **not** on the current list of persons engaged in investment activities in Iran created by DGS and is not a financial institution extending twenty million dollars (\$20,000,000) or more in credit to another person/vendor, for 45 days or more, if that other person/vendor will use the credit to provide goods or services in the energy sector in Iran and is identified on the current list of persons engaged in investment activities in Iran created by DGS.

<i>Vendor Name/Financial Institution (Printed)</i>		<i>Federal ID Number (or n/a)</i>
<i>By (Authorized Signature)</i>		
<i>Printed Name and Title of Person Signing</i>		
<i>Date Executed</i>	<i>Executed in</i>	

OPTION #2 – EXEMPTION

Pursuant to Public Contract Code §§ 2203(c) and (d), a public entity may permit a vendor/financial institution engaged in investment activities in Iran, on a case-by-case basis, to be eligible for, or to bid on, submit a proposal for, or enters into or renews, a contract for goods and services.

If you have obtained an exemption from the certification requirement under the Iran Contracting Act, please fill out the information below, and attach documentation demonstrating the exemption approval.

<i>Vendor Name/Financial Institution (Printed)</i>		<i>Federal ID Number (or n/a)</i>
<i>By (Authorized Signature)</i>		
<i>Printed Name and Title of Person Signing</i>		<i>Date Executed</i>

FINGERPRINT CERTIFICATION

I, _____, am the _____ of
(Print Name) (Title)

_____. I declare, state, and certify all of the following:
(Contractor Name)

1. I am aware of the provisions and requirements of California Education Code §45125.1, regarding fingerprinting of persons providing services to school districts.

2. I have personal knowledge of and/or have made due and diligent inquiry with respect to the following, and based on said knowledge and/or inquiry I certify that:

A. The fingerprints of each person identified on Attachment A have been submitted to the California Department of Justice pursuant to Education Code §45125.1; and,

B. The California Department of Justice has issued written or electronic verification that each person identified on Attachment A has not been convicted of a felony, as defined in Education Code §45122.1, and has no criminal felony proceedings, as defined in Education Code §45122.1, pending against him or her.

3. The Contractor shall provide additional Fingerprint Certificates for each and every person who is not identified on Attachment A prior to permitting such person(s) access to the Site or to perform any Work at the Site.

4. Contractor and I understand that if the District determines that Contractor has either: (a) made a false certification herein, or (b) violates this certification by failing to carry out and to implement the requirements of California Education Code §45125.1, the Contract awarded herein is subject to termination, suspension of payments, or both.

5. I am authorized to execute this Fingerprint Certificate on behalf of the Contractor. All of the statements set forth above and all of the information provided in Attachment A are true, correct, complete, and accurate. Further, there are no omissions or misstatements of material fact in the foregoing statements or in the information set forth in Attachment A which would render such statements and/or information to be false or misleading.

I declare under penalty of perjury under the laws of the State of California that all of the foregoing is true and correct.

Executed at _____ this ____ day of _____,
20____. (City and State)

(Signature)

(Handwritten or Typed Name)

**FINGERPRINT CERTIFICATE
ATTACHMENT A**

(The California Department of Justice has issued electronic verification that each person identified below meets the requirements of California Education Code §45125.1.)

**ROOF PROJECT FINANCIAL DISCLOSURE CERTIFICATE
(Public Contract Code §3006(b))**

I, _____ certify that I am the _____ with _____,
(Name) (Title/Position) (Name of Employer)
the _____ and that I have not offered, given, or agreed to give,
(architect, engineer, roofing consultant, contractor,
materials manufacturer, distributor, or vendor)

received, accepted, or agreed to accept, any gift, contribution, or any financial incentive whatsoever to or from any person in connection with the Contract for the roofing work associated with the Project commonly described as **BID NO. 2015/16:7R, Rowland High School Additions**. As used in this Certificate, "person" means any natural person, business, partnership, corporation, union, committee, club, or other organization, entity, or group of individuals. Furthermore,

I, _____, _____, certify that I do not have,
(Name) (Name of Employer)
and throughout the duration of the Contract for this Project, I will not have, any financial relationship in connection with the performance of this Contract with any architect, engineer, roofing consultant, materials manufacturer, distributor, or vendor that is not disclosed below.

I _____, _____ have the following financial
(Name) (Name of Employer)
relationships with an architect, engineer, roofing consultant, materials manufacturer, distributor, or vendor, or other person in connection with the following roof project contract(s):

Name & Address of Building	Contract Date & Number
Attach additional disclosures, if necessary, to this Certificate	

I certify that to the best of my knowledge, the contents of this Certificate are true, or are believed to be true.

Signature

Print Name

Date

Print Name of Employer

AGREEMENT

THIS AGREEMENT is entered into [Click here to enter a date.](#) in the City of Rowland Heights, County of Los Angeles, State of California, by and between **ROWLAND UNIFIED SCHOOL DISTRICT**, a California School District hereinafter "District" and _____ ("Contractor").

WITNESSETH, that the District and the Contractor in consideration of the mutual covenants contained herein agree as follows:

1. **The Work.** Within the Contract Time and for the Contract Price, subject to adjustments thereto pursuant to the Contract Documents, the Contractor shall perform and provide all necessary labor, materials, tools, equipment, utilities, services and transportation to complete in a workmanlike manner all of the Work required in connection with the work of improvement commonly referred to as **Rowland High School Additions**. Contractor shall complete all Work covered by the Contract Documents, including without limitation, the Drawings and Specifications prepared by the Architect, **WLC Architects, Inc.** and other Contract Documents enumerated in Article 5 below, along with all modifications and addenda thereto issued in accordance with the Contract Documents.

2. **Contract Time.** The Contractor shall achieve Substantial Completion the Work within the Contract Time which is _____ (_____) calendar days after the date established in the Notice to Proceed issued by or on behalf of the District for commencement of the Work.

3. **Contract Price.** The District shall pay the Contractor as full consideration for the Contractor's full, complete and faithful performance of the Contractor's obligations under the Contract Documents, subject to adjustments of the Contract Price in accordance with the Contract Documents, the Contract Price of _____ Dollars (\$_____). The District's payment of the Contract Price shall be in accordance with the Contract Documents. The Contract Price is based upon the Contractor's Base Bid Proposal and the following Alternate Bid Items, if any: _____.

4. **Liquidated Damages.** The Contractor shall be subject to assessment of Liquidated Damages set forth in the Special Conditions if the Contractor: (i) fails to submit each Submittal required by the Contract Documents in accordance with the Submittal Schedule incorporated into the Contractor's Construction Schedule; or (ii) fails to achieve Substantial Completion of the Work within the Contract Time, subject to adjustments thereto in accordance with the Contract Documents; or (iii) fails to complete all Punchlist items within the time established pursuant to the Contract Documents.

5. **Limitation on Damages.** In the event of the District's breach or default of its obligations under the Contract Documents, the damages, if any, recoverable by the Contractor shall be limited to general damages which are directly caused by said breach or default of the District and shall exclude any and all special or consequential damages, if any, suffered by the Contractor. By executing this Agreement, the Contractor expressly acknowledges the foregoing limitation to the recovery only of general damages from the District if the District is in breach or default of its obligations under the Contract Documents as more particularly set forth in the Contract Documents. The Contractor expressly waives any right to and foregoes the recovery of any special or consequential damages from the District including, without limitation, damages for: i) lost or impaired bonding capacity; and/or, ii) lost profits arising out of or in connection with any past, present, or future work of improvement, except for the Project which is the subject of the Contract Documents.

6. **The Contract Documents.** The documents forming a part of the Contract Documents consist of the following:

00 11 13	Notice Calling for Bids, including Bid Addenda Nos. _____	00 45 30	Iran Contracting Act Certification/Exemption
00 21 13	Instructions for Bidders	00 45 46	Fingerprint Certification
00 42 13	Bid Proposal	00 50 10	Roof Project Financial Disclosure
00 42 13	Alternate Bid Proposal Form	00 52 00	Agreement
00 43 24	Pre-Bid Inquiry Form	00 61 10	Bid Bond
00 45 00	Subcontractors List	00 61 13	Performance Bond
00 45 19	Non-Collusion Declaration	00 61 14	Labor and Material Payment Bond
00 45 26	Certificate of Workers Compensation	00 65 36	Guarantee Form
00 45 27	Drug-Free Workplace Certification	00 72 00	General Conditions
00 45 28	DVBE Participation Goal	00 73 00	Special Conditions
			Drawings/Specifications

7. Authority to Execute. The individual(s) executing this Agreement on behalf of the Contractor is/are duly and fully authorized to execute this Agreement on behalf of Contractor and to bind the Contractor to each and every term, condition and covenant of the Contract Documents.

CONTRACTORS ARE REQUIRED BY LAW TO BE LICENSED AND REGULATED BY THE CONTRACTORS' STATE LICENSE BOARD. QUESTIONS CONCERNING A CONTRACTOR MAY BE REFERRED TO THE REGISTRAR, CONTRACTORS' STATE LICENSE BOARD, P.O. BOX 2600, SACRAMENTO, CALIFORNIA 95826

IN WITNESS WHEREOF, this Agreement has been duly executed by the District and the Contractor as of the date set forth above.

“DISTRICT”
ROWLAND UNIFIED SCHOOL DISTRICT

“CONTRACTOR”

By _____

Title _____

By: _____

Title: _____

BID BOND

KNOW ALL MEN BY THESE PRESENTS that we, _____, as Surety and _____, as Principal, are jointly and severally, along with their respective heirs, executors, administrators, successors and assigns, held and firmly bound unto **ROWLAND UNIFIED SCHOOL DISTRICT** ("the Obligee") for payment of the penal sum hereof in lawful money of the United States, as more particularly set forth herein.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

WHEREAS, the Principal has submitted the accompanying Bid Proposal to the Obligee for the Work commonly described as **Rowland High School Additions**.

WHEREAS, subject to the terms of this Bond, the Surety and the Principal are jointly and severally firmly bound unto the Obligee in the penal sum equal to Ten Percent (10%) of the maximum amount of the Bid Proposal submitted by the Principal to the Obligee, inclusive of amounts proposed for additive Alternate Bid Items, if any.

NOW THEREFORE, if the Principal shall not withdraw said Bid Proposal within the period specified therein after the opening of the same, or, if no period be specified, for sixty (60) days after opening of said Bid Proposal; and if the Principal is awarded the Contract, and shall within the period specified therefore, or if no period be specified, within five (5) days after the prescribed forms are presented to him for signature, enter into a written contract with the Obligee, in accordance with the Bid Proposal as accepted and give such bond(s) with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of such Contract and for the payment for labor and materials used for the performance of the Contract, or in the event of the withdrawal of said Bid Proposal within the period specified for the holding open of the Bid Proposal or the failure of the Principal to enter into such Contract and give such bonds within the time specified, if the Principal shall pay the Obligee the difference between the amount specified in said Bid Proposal and the amount for which the Obligee may procure the required Work and/or supplies, if the latter amount be in excess of the former, together with all costs incurred by the Obligee in again calling for Bids, then the above obligation shall be void and of no effect, otherwise to remain in full force and effect.

Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or the Call for Bids, the Work to be performed there under, the Drawings or the Specifications accompanying the same, or any other portion of the Contract Documents shall in no way affect its obligations under this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of said Contract, the Call for Bids, the Work, the Drawings or the Specifications, or any other portion of the Contract Documents.

In the event suit or other proceeding is brought upon this Bond by the Obligee, the Surety and Principal shall be jointly and severally liable for payment to the Obligee all costs, expenses and fees

[CONTINUED NEXT PAGE]

incurred by the Obligee in connection therewith, including without limitation, attorneys' fees.

IN WITNESS WHEREOF, the Principal and Surety have executed this instrument this _____ day of _____, 20____ by their duly authorized agents or representatives.

(Bidder/Principal Name)

By: _____
(Signature)

(Typed or Printed Name)

Title: _____

(Attach Notary Public Acknowledgement of Principal's Signature)

(Surety Name)

By: _____
(Signature of Attorney-In-Fact for Surety)

(Typed or Printed Name of Attorney-In-Fact)

(Attach: (i) Attorney-In-Fact Certification; (ii) Notary Public Acknowledgment of Authorizing Signature on Attorney-Fact Certification; and (iii) Notary Public Acknowledgement of Attorney-In-Fact's Signature.)

Contact name, address, telephone number and email address for notices to the Surety

(Contact Name)

(Street Address)

(City, State & Zip Code)

(_____) _____ (_____) _____
Telephone Fax

(Email address)

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS that we, _____, as Surety and _____, as Principal, are jointly and severally, along with their respective heirs, executors, administrators, successors and assigns, held and firmly bound unto **ROWLAND UNIFIED SCHOOL DISTRICT** ("the Obligee") for payment of the penal sum the penal sum of _____ Dollars (\$ _____) in lawful money of the United States, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

WHEREAS, the Obligee, by resolution of its Board of Education has awarded to the Principal a Contract for the Work described as **Rowland High School Additions**.

WHEREAS, the Principal, has entered into a Contract with the Obligee for performance of the Work; the Agreement and all other Contract Documents set forth therein are incorporated herein and made a part hereof by this reference.

WHEREAS, by the terms of the Contract Documents ("Contract"), the Principal is required to furnish a bond ensuring the Principal's prompt, full and faithful performance of the Work of the Contract Documents.

NOW THEREFORE, if the Principal shall promptly, fully and faithfully perform each and all of the obligations and things to be done and performed by the Principal in strict accordance with the terms of the Contract as said Contract may be modified or amended from time to time; and if the Principal shall indemnify and save harmless the Obligee and all of its officers, agents and employees from any and all losses, liability and damages, claims, judgments, stop notices, costs, and fees of every description, whether imposed by law or equity, which may be incurred by the Obligee by reason of the failure or default on the part of the Principal in the performance of any or all of the terms or the obligations of the Contract, including all modifications and amendments thereto, and any warranties or guarantees required thereunder; then this obligation shall be void; otherwise, it shall be, and remain, in full force and effect.

In the event the Principal is declared by the Obligee to be in breach or default in the performance of the Contract, then, after written notice from the Obligee to the Surety, as provided for herein, the Surety shall either remedy the default or breach of the Principal or shall take charge of the Work of the Contract and complete the Contract with a Contractor other than the Principal at its own expense; provided, however, that the procedure by which the Surety undertakes to discharge its obligations under this Bond shall be subject to the advance written approval of the Obligee.

If the Surety does not proceed to cure or remedy the Principal's default(s) of its performance of the Contract with reasonable promptness, the Surety shall be deemed to be in default on this Bond twenty-one (21) calendar days after receipt of a written notice from Obligee to the Surety demanding that the Surety perform its obligations under this Bond, and the Obligee shall be entitled to enforce any remedy available to Obligee.

Within twenty-one (21) calendar days of Obligee's written notice to the Surety of the failure of performance of the Contract by the Principal, it shall be the duty of the Surety to give to the Obligee an unequivocal notice in writing of the Surety's election to remedy the default(s) of the Principal promptly, or to promptly arrange for performance of the Contract, time being of essence to this Bond. In arranging for such performance of the Contract, Surety shall not elect to contract with the Principal for the

completion of the Work of the Project without the prior written consent of Obligee, which consent will not be unreasonably withheld. In said Notice of Election, the Surety shall state the date of commencement of its cure or remedy of the Principal's default(s) or its performance of the Contract. The Surety's obligations for cure or remedy, include but are not limited to: correction of defective or incomplete work and completion of the Contract, additional legal, design professional and delay costs arising from Surety's actions or failure to act; and liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance by the Principal. The Surety shall give prompt written notice to the Obligee upon completion of the cure or remedy of the Principal's default(s) of its performance of the Contract.

In the event the Surety shall fail to issue its Notice of Election to Obligee within the time provided for herein above, the Obligee may thereafter cause the cure or remedy of the Principal's failure of performance or default or to complete the Work. The Principal and the Surety shall be each jointly and severally liable to the Obligee for all damages and costs sustained by the Obligee as a result of the Principal's failure of performance under the Contract Documents or default in its performance of obligations thereunder, including without limitation the costs of cure or completion exceeding the then remaining balance of the Contract Price; provided that the Surety's liability hereunder for the costs of performance, damages and other costs sustained by the Obligee upon the Principal's failure of performance under or default under the Contract Documents shall be limited to the penal sum hereof, which shall be deemed to include the costs or value of any Changes of any Work which increases the Contract Price.

The Surety, for value received, hereby consents, stipulates and agrees absolutely and unconditionally that no change, adjustment, alteration, deletion, addition or modification to the terms of the Contract or Contract Documents, including but not limited to Contract Time or Contract Price, or the Work to be performed thereunder, shall in any way release, limit, restrict, or otherwise affect the obligations of the Surety under this Bond. Surety waives notice of any change, adjustment, alteration, deletion, addition or modification to the terms of the Contract or the Contract Documents, including but not limited to the Contract Time or Contract Price, or the Work to be performed thereunder and agrees to automatically adjust the penal sum of this Bond to reflect any adjustments of the Contract Time or Contract Price which increase the Contract Price. The Surety unconditionally and absolutely waives its entitlement, if any, to the benefits of California Civil Code §2845 concerning any security held by the District. The Surety also agrees that it shall not be exonerated or released from the obligations of this Bond, either by total exoneration or pro tanto, by any overpayment or underpayment made by the Obligee under the Contract. The Surety agrees that none of the aforementioned changes, adjustments, alterations, deletions, additions, modifications or actions shall in any way affect its obligations on this Bond, and it does hereby waive notice of any such changes, adjustments, alterations, deletions, additions, modifications or actions.

Principal and Surety agree that if Obligee is required to engage the services of an attorney in connection with enforcement of this Bond, each shall pay Obligee's costs and reasonable attorney's fees incurred, with or without suit, in addition to the above penal sum.

[CONTINUED NEXT PAGE]

The guarantees contained in this Bond survive Final Completion of the Work called for in the Contract Documents with respect to the obligations and liabilities of the Principal, which survive Final Completion of the Work.

IN WITNESS WHEREOF, the Principal and Surety have executed this instrument this ____ day of _____, 20____ by their duly authorized agent or representative.

(Contractor-Principal Name)

By: _____
(Signature)

(Typed or Printed Name)

Title: _____

(Attach Notary Public Acknowledgement of Principal's Signature)

(Surety Name)

By: _____
(Signature of Attorney-In-Fact for Surety)

(Typed or Printed Name of Attorney-In-Fact)

(Attach: (i) Attorney-In-Fact Certification; (ii) Notary Public Acknowledgment of Authorizing Signature on Attorney-Fact Certification; and (iii) Notary Public Acknowledgement of Attorney-In-Fact's Signature.)

Contact name, address, telephone number and email address for notices to the Surety

(Contact Name)

(Street Address)

(City, State & Zip Code)

(_____) _____ (_____) _____
Telephone Fax

(Email address)

LABOR AND MATERIAL PAYMENT BOND**CIVIL CODE §9554**

KNOW ALL MEN BY THESE PRESENTS that we, _____, as Surety and _____, as Principal, are jointly and severally, along with their respective heirs, executors, administrators, successors and assigns, held and firmly bound unto **ROWLAND UNIFIED SCHOOL DISTRICT** ("the Obligee") for payment of the penal sum the penal sum of _____ Dollars (\$ _____) in lawful money of the United States, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

WHEREAS, the Obligee, by resolution of its Board of Education has awarded to the Principal a Contract for the Work described as **Rowland High School Additions**.

WHEREAS, the Principal, has entered into an Agreement with the Obligee for performance of the Work, the Agreement and all other Contract Documents set forth therein are incorporated herein by this reference and made a part hereof.

WHEREAS, by the terms of the Contract Documents, the Principal is required to furnish a bond for the prompt, full and faithful payment to any Claimant, as hereinafter defined, for all labor materials or services used, or reasonably required for use, in the performance of the Work.

NOW THEREFORE, if the Principal shall promptly, fully and faithfully make payment: (i) to any Claimant for all labor, materials or services used or reasonably required for use in the performance of the Work; (ii) of amounts due under the Unemployment Insurance Code for work or labor performed under the Contract; and (iii) of amounts required to be deducted, withheld and paid to the Employment Development Department from wages of the employees of the Principal and its Subcontractors under Section 13020 of the Unemployment Insurance Code with respect to work and labor under the Contract then this obligation shall be void; otherwise, it shall be, and remain, in full force and effect.

The term "Claimant" shall refer to any person, corporation, partnership, proprietorship or other entity including without limitation, all persons and entities described in California Civil Code §1900, providing or furnishing labor, materials or services used or reasonably required for use in the performance of the Work under the Contract Documents, without regard for whether such labor, materials or services were sold, leased or rented. This Bond shall inure to the benefit of all Claimants so as to give them, or their assigns and successors, a right of action upon this Bond.

In the event that suit is brought on this Bond by any Claimant for amounts due such Claimant for labor, materials or services provided or furnished by such Claimant, the Surety shall pay for the same and reasonable attorney's fees pursuant to California Civil Code §9554.

The Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, deletion, addition, or any other modification to the terms of the Contract Documents, the Work to be performed thereunder, the Specifications or the Drawings, or any other portion of the Contract Documents, shall in any way limit, restrict or otherwise affect its obligations under this Bond; the Surety hereby waives notice from the Obligee of any such change, extension of time, alteration, deletion, addition or other modification to the Contract Documents, the Work to be performed under the Contract Documents, the Drawings or the Specifications of any other portion of the Contract Documents.

IN WITNESS WHEREOF, the Principal and Surety have executed this instrument this _____ day of _____, 20__ by their duly authorized agent or representative.

(Contractor-Principal Name)

By: _____
(Signature)

(Typed or Printed Name)

Title: _____

(Attach Notary Public Acknowledgement of Principal's Signature)

(Surety Name)

By: _____
(Signature of Attorney-In-Fact for Surety)

(Typed or Printed Name of Attorney-In-Fact)

(Attach: (i) Attorney-In-Fact Certification; (ii) Notary Public Acknowledgment of Authorizing Signature on Attorney-Fact Certification; and (iii) Notary Public Acknowledgement of Attorney-In-Fact's Signature)

Contact name, address, telephone number and email address for notices to the Surety

(Contact Name)

(Street Address)

(City, State & Zip Code)

(_____) _____ (_____) _____
Telephone Fax

(Email address)

GUARANTEE

**Project: BID # 2015/16:7R
Rowland High School Additions**

The Contractor hereby warrants and guarantees to the District that all work, materials, equipment and workmanship provided, furnished or installed by or on behalf of Contractor in connection with the above referenced Project (the "Work") have been provided, furnished and installed in strict conformity with the Contract Documents for the Work, including without limitation, the Drawings and the Specifications. Contractor further warrants and guarantees that all work, materials, equipment and workmanship as provided, furnished and/or installed are fit for use as specified and fulfill all applicable requirements of the Contract Documents including without limitation, the Drawings and the Specifications. Contractor shall, at its sole cost and expense, repair, correct and/or replace any or all of the work, materials, equipment and/or workmanship of the Work, together with any other items which may be affected by any such repairs, corrections or replacement, that may be unfit for use as specified or defective within a period of two (2) years from the date of the District's Final Acceptance of the Work, ordinary wear and tear and unusual abuse or neglect excepted.

In the event of the Contractor's failure and/or refusal to comply with the provisions of this Guarantee, within the period of time set forth in the Contract Documents after the District's issuance of the Notice to the Contractor of any defect(s) in the Work, materials, equipment or workmanship, Contractor authorizes the District, without further notice to Contractor, to repair, correct and/or replace any such defective item at the expense of the Contractor. The Contractor shall reimburse the District for all costs, expenses or fees incurred by the District in providing or performing such repairs, corrections or replacements within ten (10) days of the District's presentation of a demand to the Contractor for the same.

The provisions of this Guarantee and the provisions of the Contract Documents for the Work relating to the Contractor's Guarantee(s) and warranty(ies) relating to the Work shall be binding upon the Contractor's Performance Bond Surety and all successors or assigns of Contractor and/or Contractor's Performance Bond Surety.

The provisions of this Guarantee are in addition to, and not in lieu of, any provisions of the Contract Documents for the Work relating to the Contractor's guarantee(s) and warranty(ies) or any guarantee(s) or warranty(ies) provided by any material supplier or manufacturer of any equipment, materials or other items forming a part of, or incorporated into the Work, or any other guarantee or warranty obligation of the Contractor, prescribed, implied or imposed by law.

The undersigned individual executing this Guarantee on behalf of Contractor warrants and represents that he/she is duly authorized to execute this Guarantee on behalf of Contractor and to bind Contractor to each and every provision hereof.

Contractor

(Contractor Name)

(Signature of Contractor's Authorized Employee, Officer Or Representative)

(Printed Name and Title)

(Date)

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**GENERAL CONDITIONS
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GENERAL CONDITIONS**ARTICLE 1: DEFINITIONS**

1.1 District. "District" refers to **ROWLAND UNIFIED SCHOOL DISTRICT** and unless otherwise stated, includes the District's authorized representatives, including the Project Manager, if a Project Manager is designated, the District's Board of Education and the District's officers, employees, agents and representatives.

1.2 Contractor. The Contractor is the person or entity identified as such in the Agreement; references to "Contractor" include the Contractor's authorized representative.

1.3 Architect. The Architect is the person or entity identified as such in the Agreement; references to the "Architect" include, as required by context of usage, the Architect's employees and authorized representative(s) and the Architect's Consultants and their employees and authorized representative(s).

1.4 The Work. The Work is the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment or services provided or to be provided by the Contractor to fulfill the Contractor's obligations under the Contract Documents. The Work may constitute the whole or a part of the Project.

1.5 The Project. The Project is the total construction of which the Work performed by the Contractor under the Contract Documents may be the whole or a part of the Project and which may include construction by the District or by separate contractors.

1.6 Surety. The Surety is the person or entity that executes, as surety, the Contractor's Labor and Material Payment Bond and/or Performance Bond.

1.7 Subcontractors; Sub-Subcontractors. A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work. "Subcontractor" does not include a separate contractor to the District or subcontractors of any separate contractor. A Sub-Subcontractor is a person or entity of any tier, who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the Site. References to "Subcontractor" shall include Sub-Subcontractors.

1.8 Material Supplier. A Material Supplier is any person or entity who only furnishes materials, equipment or supplies for the Work without fabricating, installing or consuming them in the Work.

1.9 Drawings and Specifications. The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing generally, the design, location and dimensions of the Work and may include without limitation, plans, elevations, sections, details, schedules or diagrams. The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards, criteria and workmanship for the Work and related services. The Drawings and Specifications are intended to delineate and describe the Work and its component parts so as to permit skilled and competent contractors to bid upon the Work and prosecute the same to completion.

1.10 Special Conditions; Supplemental Conditions. Special Conditions and/or Supplemental Conditions, if any are special or supplemental provisions, not otherwise provided for in the Agreement or the General Conditions.

1.11 Contract Documents. The Contract Documents consist of the Agreement between the District and the Contractor, Conditions of the Contract (whether General, Special, Supplemental or otherwise), Drawings, Specifications, including addenda thereto issued prior to execution of the Agreement and any other documents listed in the Agreement. The Contract Documents shall include modifications issued after execution of the Agreement. The Contract Documents form the Contract for Construction.

1.12 Intent and Correlation of Contract Documents.

1.12.1 Work of the Contract Documents. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable therefrom as being necessary to produce the intended results. Organization of the Specifications into divisions, sections or articles, and the arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Where any portion of the Contract Documents is silent and information appears elsewhere in the Contract Documents, such other portions of the Contract Documents shall control.

1.12.2 Technical Terms. Unless otherwise stated in the Contract Documents, words or terms which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

1.12.3 Conflict in Contract Documents. Conflicts, inconsistencies or ambiguities in the Contract Documents shall be resolved by the Architect in accordance with Article 3.1.9 of the General Conditions; where conflicts or inconsistencies arise between the Drawings and the Specifications, in resolving such conflicts or inconsistencies, the Architect will be governed generally by the following standards: the Drawings are intended to describe matters relating to placement, type, quantity and the like; the Specifications are intended to describe matters relating to quality, materials, compositions, manufacturers and the like. If conflicts exist between portions of the Contract Documents regarding the quality of any item, product, equipment or materials, unless otherwise directed or authorized by the District, the Contractor shall provide the item, product, equipment or material of the highest or more stringent quality.

1.13 Shop Drawings; Samples; Product Data ("Submittals"). Shop Drawings are diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Material Supplier, or others to illustrate some portion of the Work. Samples are physical examples of materials, equipment or workmanship forming a part of, or to be incorporated into the Work. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work. Shop Drawings, Samples and Product Data prepared or furnished by the Contractor, Subcontractors or Material Suppliers are collectively referred to as "Submittals".

1.14 Division of State Architect ("DSA"). DSA is the California Division of the State Architect including without limitation the DSA's Office of Construction Services, Office of Design Services and the Office of Regulatory Services; references to the DSA in the Contract Documents shall mean the DSA, its offices and its authorized employees and agents. The authority of the DSA over the Work and the performance thereof shall be as set forth in the Contract Documents and Title 24 of the California Code of Regulations.

1.15 Project Inspector. The Project Inspector is the individual designated and employed by the District in accordance with the requirements of Title 24 of the California Code of Regulations.

The Project Inspector shall be authorized to act on behalf of the District as provided for in the Contract Documents and in Title 24 of the California Code of Regulations, as the same may be amended from time to time.

1.16 Contract Document Terms. The term “provide” means “provide complete in place” or to “furnish and install” such item. Unless otherwise provided in the Contract Documents, the terms “approved;” “directed;” “satisfactory;” “accepted;” “acceptable;” “proper;” “required;” “necessary” and “equal” shall mean as approved, directed, satisfactory, accepted, acceptable, proper, required, necessary and equal, in the opinion of the Architect. The term “typical” as used in the Drawings shall require the installation or furnishing of such item(s) of the Work designated as “typical” in all other areas similarly marked as “typical”; Work in such other areas shall conform to that shown as “typical” or as reasonably inferable therefrom.

1.17 Contractor’s Superintendent. The Contractor’s Superintendent is the individual employed by the Contractor whose principal responsibility shall be the supervision and coordination of the Work; the Contractor’s Superintendent shall not perform routine construction labor.

1.18 Record Drawings. The Record Drawings are a set of the Drawings marked by the Contractor during the performance of the Work to indicate completely and accurately the actual as-built condition of the Work. The Record Drawings shall be sufficient for a capable and qualified draftsman to modify the Drawings to reflect and indicate the Work actually in place at Final Completion of the Work.

1.19 Project Manager. The Project Manager, if any, is the individual or entity designated as such in the Special Conditions. The Project Manager is an independent contractor retained by the District and shall be authorized and empowered to act on behalf of the District. In the event that a Project Manager is not designated in the Special Conditions, the District reserves the right to designate a Project Manager at any time during Contractor’s performance of the Work. The District reserves the right to remove or replace the Project Manager during Contractor’s performance of the Work. The designation of a Project Manager, if one has not been designated in the Special Conditions, or the removal or replacement of the designated Project Manager shall not result in adjustment of the Contract Price or the Contract Time or otherwise affect, limit or restrict Contractor’s obligations hereunder.

1.20 Construction Equipment. Construction Equipment is equipment utilized for the performance of any portion of the Work, but which is not incorporated into the Work.

1.21 Site. The Site is the physical area designated in the Contract Documents for Contractor’s performance, construction and installation of the Work.

1.22 Field Clarifications. A written or graphic document consisting of supplementary details, instructions or information issued on behalf of the District which clarifies or supplements the Contract Documents and which becomes a part of the Contract Documents upon issuance. Field Clarifications do not constitute an adjustment of the Contract Time or the Contract Price, unless a Change Order relating to a Field Clarification is authorized and issued under the Contract Documents.

1.23 Defective or Non-Conforming Work. Defective or Non-Conforming Work is any Work which is unsatisfactory, faulty or deficient by: (i) not conforming to the requirements of the Contract Documents; (ii) not conforming to the standards of workmanship of the applicable trade or industry; (iii) not being in compliance with the requirements of any inspection, reference, standard, test, or approval required by the Contract Documents; or (iv) damage occurring prior

to Final Completion of all of the Work.

1.24 Delivery. Delivery used in conjunction with any equipment, materials or other items to be incorporated into the Work shall mean the unloading and storage in a protected condition at the Site pending incorporation into the Work.

1.25 Notice to Proceed. The Notice to Proceed is the written notice issued by or on behalf of the District to the Contractor authorizing the Contractor to proceed with commencement of the Work and which establishes the date for commencement of the Contract Time.

1.26 Progress Reports; Verified Reports. Progress Reports, if required, are written reports prepared by the Contractor and periodically submitted to the District in the form and content as required by the Contract Documents. Verified Reports are periodic written reports prepared by the Contractor and submitted to the DSA; Verified Reports shall be in such form and content as required by the applicable provisions of Title 24 of the California Code of Regulations. A material obligation of the Contractor is the preparation of complete and accurate Progress Reports, if required, and Verified Reports as well as the timely submission of the same.

1.27 Laws. Laws refer to all laws, ordinances, codes, rules and/or regulations promulgated by any governmental or quasi-governmental agency with jurisdiction over any portion of the Work and which apply to any portion of the Work, including those in effect as of the execution of the Agreement, amendments thereto and subsequently enacted Laws that take effect during the performance of the Work. No adjustment of the Contract Time or the Contract Price shall be allowed for the Contractor's compliance with the Laws.

1.28 Construction Change Directive. A Construction Change Directive is a written instrument issued by or on behalf of the District to the Contractor directing a Change to the Work prior to the Contractor and District reaching full agreement on an adjustment of the Contract Time and/or Contract Price on account of such Change. A material obligation of the Contractor is timely performance of Work noted in a Construction Change Directive.

1.29 Beneficial Occupancy. Notwithstanding any common law principal to the contrary or otherwise, occupancy by the District shall be "beneficial" when occupancy for the intended educational or other purpose is fully usable, safe and convenient, considering all visual, sound, odor and aesthetic factors; the Project is weather-tight, fully functional and aesthetically pleasing; all portions of the Project, including finishes, painting, hardware, services, systems and utilities are complete and fully operational; commissioning of all systems has been completed; and any remaining punchlist work may be conveniently and effectively performed at times other than during business hours of the District. Notwithstanding the foregoing, the Contractor shall not be required to exceed the requirements of the Contract Documents to achieve Beneficial Occupancy.

1.30 Days. Unless otherwise expressly stated, references to "days" in the Contract Documents shall be deemed to be calendar days.

1.31 Notice to Proceed. The Notice to Proceed is the written notice issued by or on behalf of the District to the Contractor authorizing the Contractor to proceed with commencement of the Work and which establishes the date for commencement of the Contract Time.

ARTICLE 2: DISTRICT

2.1 Information Required of District

2.1.1 Surveys; Site Information. Information, if any, concerning physical characteristics of the Site, including without limitation, surveys, soils reports, and utility locations, to be

provided by the District are set forth in the Contract Documents. Information not provided by the District or necessary information in addition to that provided by the District concerning physical characteristics of the Site which is required shall be obtained by Contractor without adjustment to the Contract Price or the Contract Time.

2.1.2 Permits, Approvals. Except as otherwise provided in the Contract Documents, the District shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities which relate to the Work. If permits, licenses, approvals or similar approvals relating to the Work, or the installation/construction thereof are designated as the responsibility of the Contractor under the Contract Documents, the Contractor shall obtain the same without adjustment of the Contract Price or the Contract Time.

2.1.3 Drawings and Specifications. Except as otherwise provided for in the Contract Documents, the District shall furnish the Contractor, free of charge, the number of copies of the Drawings and the Specifications as set forth in the Special Conditions. All of the Drawings and the Specifications provided by the District to the Contractor remain the property of the District; the Contractor shall not use the Drawings or the Specifications in connection with any other work of improvement other than the Work.

2.1.4 Furnishing of Information. Information or services to be provided by the District under the Contract Documents shall be furnished by the District with reasonable promptness to avoid delay in the orderly progress of the Work. Information about existing conditions furnished by the District under the Contract Documents is obtained from sources believed to be reliable, but the District neither guarantees nor warrants that such information is complete and accurate. The Contractor shall verify all information provided by the District. If the Contract Documents depict existing conditions on or about the Site, or the Work involves the renovation, removal or remodeling of existing improvements or the Work involves any tie-in or other connection with existing improvements, the conditions and/or existing improvements depicted in the Contract Documents are as they are believed to exist. The Contractor shall bear the risk of any variations between conditions or existing improvements depicted in the Contract Documents and those conditions or existing improvements actually encountered in the performance of the Work. The existence of any variations between conditions or existing improvements depicted in the Contract Documents and those actually encountered in the performance of the Work shall not result in any District liability therefor, nor shall any such variations result in an adjustment of the Contract Time or the Contract Price.

2.2 District's Right to Stop the Work. In addition to the District's right to suspend the Work or terminate the Contract pursuant to the Contract Documents, the District, may, by written order, direct the Contractor to stop the Work, or any portion thereof, until the cause for such stop work order has been eliminated if the Contractor: (i) fails to correct Work which is not in conformity and in accordance with the requirements of the Contract Documents, or (ii) otherwise fails to carry out the Work in conformity and accordance with the Contract Documents. The right of the District to stop the Work hereunder shall not be deemed a duty on the part of the District to exercise such right for the benefit of the Contractor or any other person or entity, nor shall the District's exercise of such right: (i) waive or limit the exercise of any other right or remedy of the District under the Contract Documents or the Laws; or (ii) result in adjustment of the Contract Time or Contract Price.

2.3 Partial Occupancy or Use.

2.3.1 District's Right to Partial Occupancy. The District may occupy or use any completed or partially completed portion of the Work, provided that: (i) the District has obtained the consent of, or is otherwise authorized by, public authorities with jurisdiction thereof, to so occupy or use such portion of the Work and (ii) the District and the

Contractor have accepted, in writing, the responsibilities assigned to each of them for security, maintenance, utilities, damage to the Work, insurance, the period for correction of the Work and commencement of warranties required by the Contract Documents for such portion of the Work partially used or occupied by the District. If the Contractor and the District are unable to agree upon the matters set forth in (ii) above, the District may nevertheless use or occupy any portion of the Work, with the responsibility for such matters subject to resolution in accordance with the Contract Documents. Immediately prior to such partial occupancy or use of the Work, or portions thereof, the District, the Project Inspector, the Project Manager, the Contractor and the Architect shall jointly inspect the portions of the Work to be occupied or to be used to determine and record the condition of the Work. Repairs, replacements or other corrective action noted in such inspection shall be promptly performed and completed by the Contractor so that the portion of the Work to be occupied or used by the District is in conformity with the requirements of the Contract Documents and the District's occupancy or use thereof is not impaired. The District's use or occupancy of the Work or portions thereof pursuant to the preceding shall not be deemed "completion" of the Work as that term is used in Public Contract Code §7107.

2.3.2 No Acceptance of Defective or Nonconforming Work. The District's partial occupancy or use of the Work, or any portion thereof, shall not constitute the District's acceptance of the Work which is defective or non-conforming.

2.3.3 District's Right to Audit. The District shall have the right to review, obtain, inspect, audit, and copy all the written and electronically stored records of Contractor pertaining to the Contract and/or Work and any Claim in connection with any of the foregoing, and regarding all applicable laws and/or regulations pertaining to the Contract. Contractor agrees to provide the District with copies of records in computer readable format as well as hard copies of all relevant information requested in writing within ten (10) days of the request. Contractor agrees to maintain such records and allow such audits for a period of up to five (5) years following the date that the Notice of Completion is recorded. This provision applies equally to electronic records of the Contractor, including any records under its possession, custody or control. Contractor shall require all of its payees (e.g., Subcontractors, suppliers, materialmen, employees, officers, directors and others) to comply with the provisions of this Article by expressly including the requirements hereof in all written contracts with all such payees. Such requirements are to include that these flow-down right to audit provisions shall be included by such payees in all of their contracts with their Subcontractors of any tier, materialmen, etc. The fact that a claim, arbitration, and/or litigation under other sections of the Contract Documents is pending involving the District, Contractor, and/or others, shall not in any way preclude, postpone, or impair in any way, District rights to proceed under this Article.

2.4 The Project Inspector.

2.4.1 Authority of Project Inspector. In addition to the authority and rights of the Project Inspector as provided for elsewhere in the Contract Documents and/or the Laws, all of the Work shall be performed under the observation of the Project Inspector. The foregoing notwithstanding, the Contractor shall not perform any Work deviating from the Contract Documents solely on the basis of direction by the Project Inspector; such deviations shall be deemed defective or non-conforming Work subject to correction or replacement at the sole cost of the Contractor and without adjustment of the Contract Time. The performance of the duties of the Project Inspector shall not relieve or limit the Contractor's performance of its obligations under the Contract Documents.

2.4.2 Limitations on Project Inspector. The Project Inspector does not have authority to interpret the Contract Documents or to modify the Work depicted in the Contract

Documents. The Project Inspector has no authority relative to the content or scope of the Contractor's safety plan/program. The Contractor shall not perform any Work deviating from the Contract Documents solely on the basis of direction by the Project Inspector; such deviations shall be deemed Defective or Non-Conforming Work subject to correction or replacement at the sole cost of the Contractor and without adjustment of the Contract Time.

2.4.3 Contractor Access for Project Inspector. The Contractor shall provide the Project Inspector with access to all parts of the Work at any time, wherever located and whether partially or completely fabricated, manufactured, furnished or installed.

2.4.4 Contractor and District Responsibilities for Costs and Fees of Project Inspector. The District is responsible only for payment of the fees of the Project Inspector for standard eight (8) hour work day Mondays through Fridays, excepting holiday days ("Project Inspector Standard Workdays"). All services provided by the Project Inspector exceeding an eight (8) hour workday Mondays through Fridays and/or the first eight (8) hours on Saturday shall be at 1½ times the Project Inspector's basic hourly rate. All hours of service provided by the Project Inspector in excess of eight (8) hours on Saturdays, and all hours of service provided by the Project Inspector on holiday days or on Sundays are at two (2) times the Project Inspector's basic hourly rate. Fees for services provided by the Project Inspector beyond the Project Inspector Standard Workdays set forth above are the sole responsibility of the Contractor; the District may deduct fees for the Project Inspector which exceeds the Project Inspector Standard Workdays from the Contract Price.

ARTICLE 3: ARCHITECT

3.1 Architect's Administration of the Contract.

3.1.1 Administration of Contract. The Architect will provide administration of the Contract as described in the Contract Documents, and will be one of the District's representatives during construction until the time that Final Payment. The Architect will advise and consult with the District, the Project Manager, if any, and the Project Inspector with respect to the administration of the Contract and the Work. The Architect is authorized to act on behalf of the District to the extent provided for in the Contract Documents; and shall have the responsibilities and authority established by the Laws.

3.1.2 Periodic Site Visits. The Architect will visit the Site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the completed Work and to determine, in general, if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Contract Documents. The Architect is not required to make exhaustive or continuous Site inspections to check quality or quantity of the Work. On the basis of Site observations as an architect, the Architect will keep the District informed of the progress of the Work, and will endeavor to guard the District against defects and deficiencies in the Work.

3.1.3 Contractor Responsibility for Construction Means, Methods and Sequences. The Architect will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, these being solely the Contractor's responsibility. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

3.1.4 Review of Applications for Payment. Pursuant to Article 8 hereof, the Architect will review the Contractor's Payment Applications and for Application For Final Payment, evaluate the extent of Work performed and verify to the District the amount properly due the Contractor.

3.1.5 Rejection of Work. The Architect is authorized to reject Work which is defective or does not conform to the requirements of the Contract Documents. Whenever the

Architect considers it necessary or advisable, for implementation of the intent of the Contract Documents, the Architect is authorized to require additional inspections or testing of the Work, whether or not such Work is fabricated, installed or completed. Neither this authority of the Architect nor a decision made in good faith by the Architect to exercise or not to exercise such authority shall modify requirements of the Contract Documents or any obligation of the Contractor under the Contract Documents.

3.1.6 Submittals.

3.1.6.1 Processing of Submittals. Submittals required by the Contract Documents shall be prepared by or on behalf of the Contractor in accordance with the requirements of the Contract Documents. If the District retains a Project Manager for the Work, Submittals shall be transmitted by the Contractor to the Project Manager for distribution by the Project Manager to the Architect and the District. Upon completion of the Architect's review of a Submittal, the Project Manager shall transmit the reviewed Submittal to the Contractor for the Contractor's distribution to its Subcontractor(s) and other affected parties. If the District does not retain a Project Manager for the Work, Submittals shall be submitted by the Contractor to the Architect or such other party designated in the Contract Documents or by the Architect for review and processing.

3.1.6.2 Architect's Review. The Architect will review and approve or take other appropriate action upon the Contractor's Submittals, but only for the limited purpose of checking for general conformance with information given and the design concept expressed in the Contract Documents. Review of Submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's Submittals shall not relieve the Contractor of its obligations under the Contract Documents. The Architect's review of Submittals shall not constitute approval of safety measures, programs or precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item in a Submittal shall not indicate approval of an assembly of which the item is a component with the Submittal(s) required and relating to such assembly have been reviewed by the Architect.

3.1.6.3 Time for Architect's Review. The Architect's review of Submittals will be conducted promptly so as not to delay or hinder the progress of the Work or the activities of the Contractor, the District or the District's separate contractors while allowing sufficient time, in the Architect's reasonable professional judgment, to permit adequate review of Submittals. The foregoing notwithstanding, the Architect's review and return of Submittals will conform with the time limits and other conditions, if any, set forth in the Specifications or the Submittal Schedule if the Submittal Schedule is required by other provisions of the Contract Documents, but shall, under no circumstance, be less than fifteen (15) days.

3.1.7 Issuance of Construction Change Directive. The Architect is authorized to issue Construction Change Directives.

3.1.8 Changes to the Work; Change Orders. The Architect will prepare Change Orders, and may authorize minor Changes in the Work which do not result in adjustment of the Contract Time or the Contract Price.

3.1.9 Completion. In conjunction with the District, Project Inspector, Project Manager, if any, and the Contractor, the Architect will conduct observations of the Work to determine the date(s) of Substantial Completion and Final Completion. If the District does not designate a Project Manager for the Work, the Architect shall: (i) be authorized

to enforce the Contractor's close-out obligations; and (ii) receive from the Contractor and the records, written warranties and related close-out materials assembled by the Contractor in accordance with the Contract Documents.

3.1.10 Interpretation of Contract Documents. The Architect will interpret and decide matters concerning the requirements of the Contract Documents on written request of either the District or the Contractor. The Architect's response to such requests will be made with reasonable promptness and within the time limits agreed upon, if any. Interpretations and decisions of the Architect will: (i) be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions; (ii) endeavor to secure faithful performance by both the District and the Contractor; (iii) not show partiality to either the District or Contractor; and (iv) not result in liability for results of interpretations or decisions so rendered in good faith. The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

3.1.11 Request for Information. If the Contractor encounters any condition which the Contractor believes, in good faith and with reasonable basis, is the result of an ambiguity, conflict, error or omission in the Contract Documents (collectively "the Conditions"), Contractor shall timely notify the Architect, in writing, of the Conditions encountered and to request information from the Architect necessary to address and resolve any such Conditions before proceeding with any portion of the Work affected or which may be affected by such Conditions. If the Contractor fails to timely notify the Architect in writing of any Conditions encountered and the Contractor proceeds to perform any portion of the Work containing or affected by such Conditions the Contractor shall bear all costs associated with or required to correct, remove, or otherwise remedy any portion of the Work affected thereby without adjustment of the Contract Time or the Contract Price. In requesting information of the Architect to address and resolve any Conditions the Contractor shall act with promptness in submitting any such written request so as to allow the Architect a reasonable period of time to review, evaluate and respond to any such request, taking into account the then current status of the progress and completion of the Work and the actual or potential impact of any such Conditions upon the completion of the Work within the Contract Time. The Contract Time shall not be subject to adjustment in the event that the Contractor shall fail to timely request information from the Architect. The Architect's response to such requests will be made with reasonable promptness and within the time limits agreed upon, if any. The foregoing provisions notwithstanding, if the Architect reasonably determines that any of Contractor's request(s) for information: (i) does not reflect adequate or competent supervision or coordination by the Contractor or any Subcontractor; (ii) does not reflect the Contractor's adequate or competent knowledge of the requirements of the Work or the Contract Documents; or (iii) is not justified for any other reason, Contractor shall be liable to the District for all costs incurred by the District associated with the processing, reviewing, evaluating and responding to any such request for information, including without limitation, fees of the Architect. In responding to any of Contractor's request(s) for information, the Architect shall, in the response, indicate if the Architect has made the determination pursuant to the preceding sentence and, if so, the costs to be borne by the Contractor for the processing, review, evaluation and response to the request for information. Thereafter, the District is authorized to deduct such costs from any portion of the Contract Price then or thereafter due the Contractor.

3.2 Communications; Architect's Role. All communications regarding the Work, the performance thereof or the Contract Documents shall be in writing; verbal communications shall be reduced to writing. If the District does not designate a Project Manager for the Work,

communications between the Contractor and the District shall be through the Architect. Communications between separate contractors, if any, shall be through the Architect.

3.3 Termination of Architect; Substitute Architect. In case of termination of employment of the Architect, the District shall appoint a substitute architect whose status under the Contract Documents shall be that of the Architect.

3.4 Project Manager. If a Project Manager is designated for the Work, the Project Manager shall be a representative of the District until Final Completion is achieved and Final Payment is due the Contractor. The Project Manager is authorized to act on behalf of the District and in connection with the Work as set forth in the Contract Documents, including without limitation: (i) review of the Contractor's Construction Schedule and updates thereto; (ii) review of the Contractor's Applications for Payment and verification of the amount due the Contractor under an Application for Payment; (iii) conducting the Pre-Construction Meeting, Progress Meetings and/or Special Meetings and maintaining minutes thereof; and (iv) enforcement of the Contractor's obligations under the Contract Documents, including the Contractor's close-out obligations.

ARTICLE 4: THE CONTRACTOR

4.1 Contractor Review of Contract Documents.

4.1.1 Examination of Contract Documents. The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the District pursuant to the Contract Documents and shall at once report to the Architect any errors, inconsistencies or omissions discovered. If the Contractor performs any Work knowing, or with reasonable diligence should have known that, it involves an error, inconsistency or omission in the Contract Documents without prior notice to the Architect of the same, the Contractor shall assume full responsibility for such performance and shall bear all costs for correction of the same without adjustment of the Contract Price.

4.1.2 Field Measurements. Prior to commencement of the Work, or portions thereof, the Contractor shall take field measurements and verify field conditions at the Site and shall carefully compare such field measurements and conditions with information provided in the Contract Documents. Errors, inconsistencies or omissions discovered shall be immediately reported to the Architect along with request for clarification or direction.

4.1.3 Dimensions; Layouts and Field Engineering. Unless otherwise expressly provided, dimensions indicated in the Drawings are intended for reference only. The Drawings are intended to be diagrammatic and schematic in nature; the Contractor is solely responsible for dimensioning and coordinating the Work of the Contract Documents. All field engineering required for laying out the Work and establishing grades for earthwork operations shall be by the Contractor at its expense. Any field engineering or other engineering to be provided or performed by the Contractor under the Contract Documents and required or necessary for the proper execution or installation of the Work shall be provided and performed by the an engineer duly registered under the laws of the State of California in the engineering discipline for such portion of the Work.

4.1.4 Work in Accordance With Contract Documents. The Contractor shall perform all of the Work in strict conformity with the Contract Documents, the Laws and Architect accepted Submittals.

4.2 Site Investigation; Subsurface Conditions.

4.2.1 Contractor Investigation. The Contractor is responsible for, and by executing the Agreement acknowledges, that it has carefully examined the Site and has taken all steps it deems reasonably necessary to ascertain all conditions which may affect the Work, or

the cost thereof, including, without limitation, conditions bearing upon transportation, disposal, handling or storage of materials; availability of labor or utilities; access to the Site; and the physical conditions and the character of equipment, materials, labor and services necessary to perform the Work. Any failure of the Contractor to do so will not relieve it from the responsibility for fully and completely performing all Work without adjustment to the Contract Price or the Contract Time. The District assumes no responsibility to the Contractor for any understandings or representations concerning conditions or characteristics of the Site, or the Work, made by any of its officers, employees or agents prior to the execution of the Agreement, unless such understandings or representations are expressly set forth in the Contract Documents.

4.2.2 Subsurface Data. By executing the Agreement, the Contractor acknowledges that it has examined the boring data and other subsurface data available and satisfied itself as to the character, quality and quantity of surface and subsurface materials, including without limitation, obstacles which may be encountered in performance of the Work, insofar as this information is reasonably ascertainable from an inspection of the Site, review of available subsurface data and analysis of information furnished by the District under the Contract Documents. Subsurface data or other soils investigation report provided by the District hereunder are not a part of the Contract Documents. Information contained in such data or report regarding subsurface conditions, elevations of existing grades or below grade elevations are approximate only and are neither guaranteed or warranted by the District to be complete and accurate. The Contractor shall examine all boring and other subsurface data to make its own independent interpretation of the subsurface conditions and acknowledges that its bid is based upon its own opinion of the conditions which may be encountered. The District assumes no responsibility for any conclusions or interpretations made by Contractor on the basis of available subsurface data or other information furnished by District under the Contract Documents.

4.2.3 Procedures. If the Work under the Contract Documents involves digging trenches or other excavations that extend deeper than four feet below the surface, the Contractor shall promptly and before the following conditions are disturbed, notify the Project Inspector, in writing, of any: (i) material that the Contractor believes may be material that is hazardous waste, as defined in California Health and Safety Code §25117, that is required to be removed to a Class I or Class II or Class III disposal site in accordance with provisions of existing law; (ii) subsurface or latent physical conditions at the site differing from those indicated by information about the site made available to Contractor prior to award of the Contract; or (iii) unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in the Work or the character provided for in the Contract Documents. If upon notice to the District of the conditions described above and upon the District's investigation thereof, the District determines that the conditions so materially differ or involve such hazardous materials which require an adjustment to the Contract Price or the Contract Time, the District shall issue a Change Order in accordance with Article 9 hereof. In accordance with California Public Contract Code §7104, any dispute arising between the Contractor and the District as to any of the conditions listed in (i), (ii) or (iii) above, shall not excuse the Contractor from the completion of the Work within the Contract Time and the Contractor shall proceed with all Work to be performed under the Contract Documents. The District reserves the right to terminate the Contract pursuant to Article 15.2 hereof should the District determine not to proceed because of any condition described in (i), (ii) or (iii) above.

4.2.4 Trenching. For all excavations in excess of five (5) feet involving an estimated expenditure in excess of \$25,000, Contractor shall submit to the District for acceptance a detailed Drawing showing the design of shoring, bracing, sloping or other provisions to be made for the protection of workmen from the hazard of caving ground. If such design

varies from the standards established by the Construction Safety Orders of the California Division of Industrial Safety, the Drawing shall be prepared by a registered civil or structural engineer. None of the aforementioned trenching shall be started before Contractor receives notification of acceptance from the District. Contractor shall comply with all other applicable requirements of California Labor Code §6705, and as therein provided, no provisions of that Section or this Article shall be construed to impose tort liability upon the District. Contractor shall procure and pay for all excavation/shoring permits required for the Project. Contractor shall not commence any excavation work until it has secured all necessary permits including the required CAL OSHA excavation/shoring permit. Any permits shall be prominently displayed on the Project premises prior to commencement of any excavation.

4.3 Supervision and Construction Procedures.

4.3.1 Supervision of the Work. The Contractor shall supervise and direct performance of the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract Documents, unless Contract Documents give other specific instructions concerning these matters. The Contractor shall be responsible for inspection of completed or partially completed portions of Work to determine that such portions are in proper condition to receive subsequent Work.

4.3.2 Responsibility for the Work; Coordination of the Work. The Contractor shall be responsible to the District for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and all other persons performing any portion of the Work under a contract with the Contractor. The Contractor shall not be relieved of the obligation to perform the Work in accordance with the Contract Documents either by activities or duties of the Project Manager, Project Inspector or the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor. The Contractor shall be responsible for all necessary or appropriate coordination of the Work and component parts thereof so that Substantial Completion of the Work will be achieved within the Contract Time and the Work will be completed for the Contract Price. The coordination of the Work is a material obligation of the Contractor hereunder and shall include without limitation, conducting regular coordination meetings with its Subcontractors and Material Suppliers, sequencing the operations of Subcontractors and Material Suppliers, and adapting its planned means, methods and sequences of construction operations as necessary to accommodate field or changed conditions at the Site. Contractor shall provide complete, functional and operating systems and related equipment as intended per Contract Documents.

4.3.3 Layouts. The Contractor is solely responsible for laying-out the Work so that construction of the Work conforms to the requirements of the Contract Documents and so that all component parts of the Work are coordinated. The Contractor shall be responsible for maintenance and preservation of benchmarks, reference points and stakes for the Work. The cost of maintenance and preservation of benchmarks, reference points and stakes shall be included within the Contract Price. The Contractor shall be solely responsible for all loss or costs resulting from the loss, destruction, disturbance or damage of benchmarks, reference points or stakes.

4.3.4 Surveys. The Contractor shall prepare or cause to be prepared all detailed surveys necessary for performance of the Work, including without limitation, slope stakes, points, lines and elevations. The Contractor is responsible for the establishment, location, maintenance and preservation of benchmarks, reference points and stakes for the Work without adjustment of the Contract Price. The Contractor is solely responsible for all loss or costs resulting from the loss, destruction, disturbance or damage of benchmarks, reference points or stakes.

4.3.5 Construction Utilities. The District will furnish and pay the costs of utility services for the Work as set forth in the Special Conditions; all other utilities necessary to complete the Work and the Contractor's obligations hereunder shall be obtained by the Contractor without adjustment of the Contract Price or the Contract Time. The Contractor shall furnish and install necessary or appropriate temporary distributions of utilities, including utilities furnished by the District. Any such temporary distributions shall be removed by the Contractor upon completion of the Work. The costs of all such utility services, including the installation, relocations and removal of temporary distributions thereof, shall be borne by the Contractor and included in the Contract Price.

4.3.6 Existing Utilities; Removal, Relocation and Protection.

4.3.6.1 Contractor Responsibility for Locating Utilities. The Contractor is responsible for locating all below grade drainage lines, storm drains, sewers, domestic water, gas, electrical, hot water and irrigation utility services, vaults, duct banks and other similar items or utilities services (collectively "Underground Facilities") which are shown in the Drawings or other portions of the Contract Documents; or (ii) which are identified in information relating to Underground Facilities maintained by the regional notification center, "Underground Service Alert" ("USA"). Contractor shall locate and mark locations of the Underground Facilities shown in the Contract Documents and information relating to Underground Facilities maintained by USA before proceeding with Work that may: (i) damage, destroy or impair Underground Facilities; or (ii) limit, disrupt or interrupt utility services provided through Underground Facilities. Prior to commencing Work in the proximity of Underground Facilities or other underground structures that can be readily inferred from adjacent surface improvements, Contractor shall further locate, by carefully excavating with small equipment, potholing and principally by hand, such utilities or installations that are to remain and that are subject to damage, destruction or disruption.

4.3.6.2 Contractor Responsibility for Damage to Underground Facilities. Without adjustment of the Contract Time or the Contract Price, the Contractor shall repair or replace all damage to or destruction of Underground Facilities occurring during performance of the Work. All such repairs or replacements shall be with materials, equipment and other items consistent with those in place prior to commencement of the Work and when the repair or replacement is completed, the Underground Facilities shall be in the same functional and operational condition as prior to the damage or destruction.

4.3.6.3 Contractor Responsibility for Maintaining Utility Services. The Contractor shall maintain in service all utility services provided through the Underground Facilities unless the Contractor has notified the District and Construction Manager in writing of utility service disruptions at least two (2) working days in advance of the anticipated disruption of utility services. Notwithstanding the Contractor's notice pursuant to the foregoing, the District may, in the sole discretion of the District, direct alternative times/days for the anticipated utility service disruption as necessary for conduct of on-going activities or operations of the District at and about the Site. The Contractor shall be liable for all costs, fees or charges incurred by the District to provide utility services if there is disruption, interruption or limitation of any utility services for which the Contractor has not provided the advance written notice of utility disruption pursuant to the foregoing. The District may deduct such costs, fees or charges from the Contract Price then or thereafter due the Contractor.

4.3.6.4 Unmarked; Unknown Utilities. Additional Underground Facilities not shown in the Contract Documents or USA data may exist on or about the Site. The Contractor shall be alert to their existence; if they are encountered, Contractor shall immediately report such Underground Facilities to the Project

Inspector, Construction Manager and District for disposition of the same prior to disturbing any existing condition. In accordance with California Government Code §4215, the District is responsible for the timely removal, relocation, or protection of existing main or trunkline utility facilities located on the Site which are not identified in the Contract Documents. Contractor shall be compensated for the costs of locating, repairing damage not due to the Contractor's failure to exercise reasonable care, and removing or relocating such utility facilities not indicated in the Contract Documents with reasonable accuracy, and for equipment on the Site necessarily idled during such work. Contractor shall not be assessed Liquidated Damages for delay in completion of the Work when such delay is caused by the failure of the District or the District of the utility to provide for removal or relocation of such utility facilities. Nothing in this Article 4.3.5 shall be deemed to require the District to indicate the presence of existing service laterals or appurtenances whenever the presence of such utilities on the Site can be inferred from the presence of other visible facilities, such as buildings, meters and junction boxes, on or adjacent to the Site. If such utility facilities are owned by a public utility, the public utility shall have the sole discretion to perform repairs or relocation work or permit the Contractor to do such repairs or relocation work at a reasonable price.

4.3.7 Conferences and Meetings. A material obligation of the Contractor under the Contract Documents is the attendance at meetings and conferences relating to the Work by the Contractor's supervisory personnel for the Work and the Contractor's management personnel as required by the Contract Documents or as requested by the District. The Contractor's personnel participating in conferences and meetings relating to the Work shall be authorized to act on behalf of the Contractor and to bind the Contractor. The Contractor is solely responsible for arranging for the attendance by Subcontractors, Material Suppliers at meetings and conferences relating to the Work as necessary, appropriate or as requested by the District.

4.3.7.1 Pre-Construction Conference. The Contractor's representatives (and representatives of Subcontractors as requested by the District) shall attend a Pre-Construction Conference at such time and place as designated by the District. The Pre-Construction Conference will address items such as the Contractor's access to the Site, review of construction procedures and requirements and other matters pertaining generally to construction of the Work.

4.3.7.2 Progress Meetings. Progress meetings will be conducted on regular intervals (weekly unless otherwise expressly indicated elsewhere in the Contract Documents). The Contractor's representatives and representatives of Subcontractors (as requested by the District) shall attend Progress Meetings. Progress Meetings will be chaired by the Architect or the Project Manager and will generally include as agenda items: Site safety, field issues, coordination of Work, construction progress and impacts to timely completion, if any. The purposes of the Progress Meetings include without limitation: a formal and regular forum for discussion of the status and progress of the Work by all Project participants, a review of progress or resolution of previously raised issues and action items assigned to the Project participants, and reviews of the Construction Schedule and Submittals.

4.3.7.3 Pre-Installation Conference. The Contractor's representatives (and representatives of Subcontractors as requested by the District or the Project Manager) shall attend a Pre-Installation Conference prior to the initiation of a new phase of Work or in connection with the delivery and installation of major items of equipment incorporated into the Work. Pre-Installation Conferences will generally address the requirements of the new phase of Work and Contract

Documents, and/or to coordinate delivery and installation of major equipment items.

4.3.7.4 Special Meetings. As deemed necessary or appropriate by the District, Special Meetings will be conducted with the participation of the Contractor, Subcontractors and other Project participants as requested by the District.

4.3.7.5 Minutes of Meetings. Following conclusion of the Pre-Construction Conference, Progress Meetings and Special Meetings, the Architect or the Project Manager will prepare and distribute minutes reflecting the items addressed and actions taken at a meeting or conference. Unless the Contractor notifies the Architect or the Project Manager in writing of objections or corrections to minutes prepared hereunder within five (5) days of the date of distribution of the minutes, the minutes as distributed shall constitute the official record of the meeting or conference. No objections or corrections of any Subcontractor or Material Supplier shall be submitted directly to the Architect or the Project Manager; such objections or corrections shall be submitted to the Architect and the Project Manager through the Contractor. If the Contractor timely interposes objections or notes corrections, the resolution of such matters shall be addressed at the next scheduled Progress Meeting.

4.4 Labor and Materials.

4.4.1 Payment for Labor, Materials and Services. Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, Construction Equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated in the Work.

4.4.2 Employee Discipline. The Contractor shall enforce strict discipline and good order among the Contractor's employees, the employees of any Subcontractor or Sub-subcontractor, and all other persons performing any part of the Work at the Site. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. The Contractor shall dismiss from its employ and direct any Subcontractor or Sub-subcontractor to dismiss from their employment any person deemed by the District to be unfit or incompetent to perform Work and thereafter, the Contractor shall not employ nor permit the employment of such person for performance of any part of the Work without the prior written consent of the District, which consent may be withheld in the reasonable discretion of the District.

4.4.3 Compliance with Immigration Reform and Control Act of 1986. The Contractor is solely and exclusively responsible for employment of individuals for the Work of the Contract in conformity with the Immigration Reform and Control Act of 1986, 8 USC §§1101 et seq. (the "IRCA"); the Contractor shall also require Subcontractors and any other person or entity employing labor in connection with any of the Work to so similarly comply with the IRCA. The foregoing includes without limitation, verification that individuals engaged in any Work are legally entitled to do so.

4.4.4 Contractor's Project Manager and Superintendent

4.4.4.1 Qualifications of Contractor Superintendent and Contractor Project Manager. Prior to start of Work at the Site, the Contractor shall submit in writing to the District and Construction Manager, the qualifications of the Contractor's proposed superintendent ("Contractor Superintendent") and the Contractor's proposed Project Manager ("Contractor PM") for acceptance by the Construction Manager and District. The Contractor's proposed Contractor Superintendent and proposed Contractor PM shall each have recent experience in similar types of

construction to the Work. The Contractor's proposed Contractor Superintendent and Contractor PM shall be satisfactory to the District and Construction Manager and shall not be changed during the Work unless the Contractor's employment of the Contractor Superintendent or Contractor PM is terminated by the Contractor for cause or the Contractor Superintendent or Contractor PM voluntarily ceases employment by the Contractor. The Contractor shall dismiss the Contractor Superintendent or the Contractor PM if they are deemed, in the sole reasonable judgment of the District, to be unfit, incompetent or incapable of performing the functions assigned to them. In such event, the District shall have the right to approve of the replacement Contractor Superintendent or Contractor Project Manager, as applicable.

4.4.4.2 Contractor Superintendent. Competency of the Contractor Superintendent shall include, without limitation, a minimum of three (3) years prior experience as a superintendent for a general contractor on projects similar in size, scope and complexity to the Work. The Contractor's communications relating to the Work or the Contract Documents shall be through the Contractor Superintendent. The Contractor Superintendent shall represent the Contractor and communications given to the Contractor Superintendent shall be binding as if given to the Contractor.

4.4.4.3 Contractor Project Manager. The Contractor shall employ a Contractor PM who shall be a senior management employee of the Contractor. The Contractor PM shall be at the Site periodically to observe the progress and quality of the Work in progress and in place. The Contractor PM shall be responsible for directing and coordinating human and material resources of the Contractor and Subcontractors throughout the course of the Work using management techniques so that the Work is completed for the Contract Price and within the Contract Time. Prohibition on Harassment.

4.4.5 District's Policy Prohibiting Harassment. The District is committed to providing a campus and workplace free of sexual harassment and harassment based on factors such as race, color religion, national origin, ancestry, age, medical condition, marital status, disability, veteran status or other legally protected classification. Harassment includes without limitation, verbal, physical or visual conduct which creates an intimidating, offensive or hostile environment such as racial slurs; ethnic jokes; posting of offensive statements, posters or cartoons or similar conduct. Sexual harassment includes without limitation the solicitation of sexual favors, unwelcome sexual advances, or other verbal, visual or physical conduct of a sexual nature.

4.4.5.1 Contractor's Adoption of Anti-Harassment Policy. Contractor shall adopt and implement all appropriate and necessary policies prohibiting any form of discrimination in the workplace, including without limitation harassment on the basis of any classification protected under local, state or federal law, regulation or policy. Contractor shall take all reasonable steps to prevent harassment from occurring, including without limitation affirmatively raising the subject of harassment among its employees, expressing strong disapproval of any form of harassment, developing appropriate sanctions, informing employees of their right to raise and how to raise the issue of harassment and informing complainants of the outcome of an investigation into a harassment claim. Contractor shall require that any Subcontractor or Sub-subcontractor performing any portion of the Work to adopt and implement policies in conformity with this Article 4.4.5.

4.4.5.2 Prohibition on Harassment at the Site. Contractor shall not permit any person, whether employed by Contractor, a Subcontractor, or any other person or entity, performing any Work at or about the Site to engage in any prohibited form of harassment. Any such person engaging in a prohibited form of

harassment directed to any individual performing or providing any portion of the Work at or about the Site shall be subject to appropriate sanctions in accordance with the anti-harassment policy adopted and implemented pursuant to Article 4.4.5.2 above. Any person, performing or providing Work on or about the Site engaging in a prohibited form of harassment directed to any student, faculty member or staff of the District or directed to any other person on or about the Site shall be subject to immediate removal and shall be prohibited thereafter from providing or performing any portion of the Work. Upon the District's receipt of any notice or complaint that any person employed directly or indirectly by Contractor in performing or providing the Work has engaged in a prohibited form of harassment, the District will promptly undertake an investigation of such notice or complaint. If the District, after such investigation, reasonably determines that a prohibited form of harassment has occurred, the District shall promptly notify the Contractor of the same and direct that the person engaging in such conduct be immediately removed from the Site. Unless the District's determination that a prohibited form of harassment has occurred is grossly negligent or without reasonable cause, District shall have no liability for directing the removal of any person determined to have engaged in a prohibited form of harassment nor shall the Contract Price or the Contract Time be adjusted on account thereof. Contractor and the Surety shall defend, indemnify and hold harmless the District and its employees, officers, Board of Education, agents, and representatives from any and all claims, liabilities, judgments, awards, actions or causes of actions, including without limitation, attorneys' fees, which arise out of, or pertain in any manner to: (i) the assertion by any person dismissed from performing or providing work at the direction of the District pursuant to this Article 4.4.5.3; or (ii) the assertion by any person that any person directly or indirectly under the employment or direction of the Contractor has engaged in a prohibited form of harassment directed to or affecting such person. The obligations of the Contractor and the Surety under the preceding sentence are in addition to, and not in lieu of, any other obligation of defense, indemnity and hold harmless whether arising under the Contract Documents, at law or otherwise; these obligations survive completion of the Work or the termination of the Contract.

4.5 Taxes. The Contractor shall pay, without adjustment of the Contract Price, all sales, consumer, use and other taxes for the Work or portions thereof provided by the Contractor under the Contract Documents.

4.6 Permits, Fees and Notices; Compliance With Laws.

4.6.1 Payment of Permits, Fees. The Contractor shall secure and pay for permits, approvals governmental fees, licenses and inspections necessary or required for the proper execution and completion of the Work which are designated in the Contract Documents as the responsibility of the Contractor.

4.6.2 Compliance With Laws. The Contractor shall comply with and give notices required by the Laws and other orders of public authorities bearing on performance of the Work.

4.6.3 Notice of Variation From Laws. If the Contractor knows, or has reason to believe, that any portion of the Contract Documents are at variance with the Laws, the Contractor shall promptly notify the Architect, Project Manager and the Project Inspector, in writing, of the same. If the Contractor performs Work knowing, or with reasonable diligence should have known, it to be contrary to the Laws without such notice to the Architect, Project Manager and the Project Inspector, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs arising or associated therefrom, including without limitation, the removal, replacement or correction of the same.

4.7 Submittals.

4.7.1 Purpose of Submittals. Submittals are not Contract Documents. Submittals are for the purpose of demonstrating, for those portions of the Work for which Submittals are required, the manner in which the Contractor proposes to provide or incorporate such item of the Work in conformity with the information given and the design concept expressed in the Contract Documents.

4.7.2 Contractor's Submittals.

4.7.2.1 Prompt Submittals. The Contractor shall review, approve and submit to the Architect or such other person or entity designated by the District or the Contract Documents, the number of copies of Submittals required by the Contract Documents. All Submittals required by the Contract Documents shall be prepared, assembled and submitted by the Contractor within the time frames set forth in the Submittal Schedule incorporated and made a part of the Approved Construction Schedule. Contractor's submission of Submittals in conformity with the Submittal Schedule is a material obligation of the Contractor. If the Contractor fails or refuses to deliver Submittals in accordance with the Submittal Schedule, the Contractor shall be subject to per diem assessments in the amount set forth in the Special Conditions for each day of delayed submission for any Submittal beyond the date set forth in the Submittal Schedule for Contractor's submission of such Submittal. Contractor and the District acknowledge and agree that the per diem assessment for delayed submission of Submittals set forth in the Special Conditions represents a reasonable estimate of costs and expenses the District will incur as a result of delayed submission of Submittals and that the same is not a penalty. Notwithstanding Contractor's submission of all required Submittals in accordance with the Submittal Schedule, in the event that the District or the Architect reasonably determines that all or any portion of such Submittals fail to comply with the requirements of Articles 4.7.2.2, 4.7.2.3 and 4.7.2.4 of these General Conditions and/or such Submittals are not otherwise complete and accurate so as to require re-submission, Contractor shall bear all costs associated with the review and approval of resubmitted Submittals, including without limitation Architect's fees incurred in connection therewith; provided that such costs are in addition to, and not in lieu of, Liquidated Damages imposed under this Article 4.7.2.1 for Contractor's delayed submission of Submittals. If Liquidated Damages are assessed for the Contractor's delayed submission of Submittals or if the Contractor is assessed Architect fees to review incomplete or inaccurate Submittals, the District may deduct the same from any portion the Contract Price then or thereafter due the Contractor. Submittals not required by the Contract Documents or which do not otherwise conform to the requirements of the Contract Documents may be returned without action. No adjustment to the Contract Time or the Contract Price shall be granted to the Contractor on account of its failure to timely submit of any Submittal.

4.7.2.2 Approval of Subcontractor Submittals. All Submittals prepared by Subcontractors, Material Suppliers, manufacturers or distributors shall bear the written approval of the Contractor thereto prior to submission to the Architect for review. Any Submittal not bearing the Contractor's written approval shall be subject to return to the Contractor for re-submittal in conformity herewith, with the same being deemed to not have been submitted. Any delay, impact or cost associated therewith shall be the sole and exclusive responsibility of the Contractor without adjustment to the Contract Time or the Contract Price.

4.7.2.3 Verification of Submittal Information. By approving and submission of Submittals, the Contractor represents to the District and Architect that the Contractor has determined and verified materials, field measurements, field

construction criteria, catalog numbers and similar data related thereto and has checked and coordinated the information contained within such Submittals with the requirements of the Work and of the Contract Documents.

4.7.2.4 Information Included in Submittals. All Submittals shall be accompanied by a written transmittal or other writing by the Contractor providing an identification of the portion of the Drawings or the Specifications pertaining to the Submittal, with each Submittal numbered consecutively for ease of reference along with the following information: (i) date of submission; (ii) project name; (iii) name of submitting Subcontractor; and (iv) if applicable, the revision number. The foregoing information is in addition to, and not in lieu of, any other information required by the Contract Documents for the Architect's review, evaluation and acceptance of the Contractor's Submittals.

4.7.2.5 Contractor Responsibility for Deviations. The Contractor shall not be relieved of responsibility for correcting deviations from the requirements of the Contract Documents by the Architect's review of Submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submission of the Submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Submittals by the Architect's review thereof.

4.7.2.6 No Performance of Work Without Architect Review. The Contractor shall perform no portion of the Work requiring the Architect's review of Submittals until the Architect has completed its review and returned the Submittal to the Contractor indicating "No Exception Taken" to such Submittal. The Contractor shall not perform any portion of the Work forming a part of a Submittal or which is affected by a related Submittal until the entirety of the Submittal or other related Submittal has been fully processed. Such Work shall be in accordance with the final action taken by the Architect in review of Submittals and other applicable portions of the Contract Documents.

4.7.3 Architect Review of Submittals. The purpose of the Architect's review of Submittals and the time for the Architect's return of Submittals to the Contractor shall be as set forth elsewhere in the Contract Documents. If the Architect returns a Submittal as rejected or requiring correction(s) with re-submission, the Contractor, so as not to delay the progress of the Work, shall promptly thereafter resubmit a Submittal conforming to the requirements of the Contract Documents; the resubmitted Submittal shall indicate the portions thereof modified in accordance with the Architect's direction. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications accompanying Submittals. The Architect's review of the Submittals is for the limited purposes described in the Contract Documents. The Architect will review each submittal twice. Should additional submittals be required as a result of failure of the Contractor to address comments, the Contractor will pay for the Architect's services on a time and material basis for each subsequent review. The following notations or notations of a similar nature noted on a reviewed Submittal will require the Contractor action noted below.

Notation	Action Required
No Exceptions Taken	No formal revision required
Make Corrections Noted	Make revision noted; re-submission of revised Submittal not required
Revise and Re-Submit	Revise Submittal in accordance with notations and re-submit for revision
Rejected Re-Submit	Prepare new alternative Submittal and

	re-submit for review
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4.7.4 Deferred Approval Items. If any portion of the Work is designated in the Contract Documents as a “Deferred Approval” item, Contractor shall be solely and exclusively responsible for: (i) the design, engineering and specifying the materials/equipment forming any part of the Deferred Approval Item; (ii) integrating and/or coordinating the Deferred Approval Item with other portions of the Work; (iii) preparation of Submittals for such item(s) in a timely manner so as not to delay or hinder the completion of the Work within the Contract Time; and (iv) timely obtaining DSA approval thereof.

4.8 Materials and Equipment.

4.8.1 Specified Materials, Equipment. References in the Contract Documents to any specific article, device, equipment, product, material, fixture, patented process, form, method or type of construction, by name, make, trade name, or catalog number, with or without the words “or equal” shall be deemed to establish a minimum standard of quality or performance, and shall not be construed as limiting competition.

4.8.2 Approval of Substitutions or Alternatives. The Contractor may propose to furnish alternatives or substitutes for a particular item specified in the Contract Documents, provided that: (i) such proposed substitution or alternative complies with the requirements of the Specifications relating to substitutions of specified items; (ii) the Contractor certifies to the Architect and District that the quality, performance capability and functionality (including visual and/or aesthetic effect) of the proposed alternative or substitute meet or exceed the quality, performance capability and functionality of the item or process specified; and (iii) demonstrate to the reasonable satisfaction of the Architect and District that the use of the substitution or alternative is appropriate and will not delay completion of the Work or result in an increase to the Contract Price. The Contractor shall submit calculations engineering, construction, dimension, visual, aesthetic and performance data to the Architect to permit its proper evaluation of the proposed substitution or alternative. If requested by the Architect, Contractor shall promptly furnish any additional information or data regarding a proposed substitution or alternative which the Architect deems reasonably necessary for the evaluation of the proposed substitution or alternative. The Contractor shall not provide, furnish or install any substitution or alternative without the Architect’s review and final action on the proposed substitution or alternative; any alternative or substitution installed or incorporated into the Work without first obtaining the Architect’s review and final action of the same shall be subject to removal pursuant to Article 12 hereof. The Architect’s decision evaluating the Contractor’s proposed substitutions or alternatives shall be final. Neither the Contract Time nor the Contract Price shall be increased on account of any substitution or alternative proposed by the Contractor and which is accepted by the Architect; provided, however, that in the event a substitution or alternative accepted by the Architect and purchase, fabrication and/or installation or such accepted substitution or alternative shall be less expensive than the originally specified item, the Contract Price shall be reduced by the actual cost savings realized by the Contractor’s furnishing and/or installation of such approved substitution or alternative. The Contractor shall be solely responsible for all costs and fees incurred by the District to review a proposed substitution or alternative, including without limitation fees of the Architect, and/or governmental agencies to review and/or approve any proposed substitution or alternative. The Contractor shall be solely responsible for any increase in the cost of any accepted substitution or alternative or any Work affected by such alternative or substitution. The foregoing notwithstanding, all requests for the Architect’s review and approval of any proposed substitution or alternative and all engineering, construction, dimension and performance data substantiating the equivalency of the proposed substitution or alternative shall be submitted by Contractor not later than thirty-five (35) days following the date of the

District's award of the Contract to Contractor by action of the District's Board of Education; any request for approval of proposed alternatives or substitutions submitted thereafter may be rejected summarily. The foregoing process and time limits shall apply to any proposed substitution or alternative regardless of whether the substitute or alternate item is to be provided, furnished or installed by Contractor, any Subcontractor, any Sub-Subcontractor, Material Supplier or Manufacturer.

4.8.3 "Sole Source" Products. If any material, equipment, or other item is identified in the Contract Documents as being the only source of the material, equipment or other item necessary to accomplish the intended result(s), such material, equipment or other item shall not be subject to substitution.

4.8.4 Placement of Material and Equipment Orders. Contractor shall, after award of the Contract, promptly and timely place all orders for materials and/or equipment necessary for completion of the Work so that delivery of the same shall be made without delay or interruption to the timely completion of the Work. Contractor shall require that any Subcontractor similarly place orders for all materials and/or equipment to be furnished by any such Subcontractor in a prompt and timely manner so that delivery of the same shall be made without delay or interruption to the timely completion of the Work. Upon request of the District, Project Manager or the Architect, the Contractor shall furnish reasonably satisfactory written evidence of the placement of orders for materials and/or equipment necessary for completion of the Work, including without limitation, orders for materials and/or equipment to be provided, furnished or installed by any Subcontractor.

4.8.5 District's Right to Place Orders for Materials and/or Equipment. Notwithstanding any other provision of the Contract Documents, if the Contractor shall, upon request of the District, Project Manager or the Architect, fails or refuses, for any reason, to provide reasonably satisfactory written evidence of the placement of orders for materials and/or equipment necessary for completion of the Work, or should the District determine, in its sole and reasonable discretion, that any orders for materials and/or equipment have not been placed in a manner so that such materials and/or equipment will be delivered to the Site so the Work can be completed without delay or interruption, the District shall have the right, but not the obligation, to place such orders on behalf of the Contractor. If the District exercises the right to place orders for materials and/or equipment pursuant to the foregoing, the District's conduct shall not be deemed to be an exercise, by the District, of any control over the means, methods, techniques, sequences or procedures for completion of the Work, all of which remain the responsibility and obligation of the Contractor. Notwithstanding the right of the District to place orders for materials and/or equipment pursuant to the foregoing, the election of the District to exercise, or not to exercise, such right shall not relieve the Contractor from any of Contractor's obligations under the Contract Documents, including without limitation, completion of the Work within the Contract Time and for the Contract Price. If the District exercises the right hereunder to place orders for materials and/or equipment on behalf of Contractor pursuant to the foregoing, Contractor shall reimburse the District for all costs and fees incurred by the District in placing such orders; such costs and fees may be deducted by the District from the Contract Price then or thereafter due the Contractor.

4.8.6 Contractor and Subcontractor Communication. All written communications between the Contractor and any Subcontractor, Material Supplier or others directly or indirectly engaged by the Contractor to perform or provide any portion of the Work shall be available to the District, the Project Manager and the Architect for review, inspection and reproduction as may be requested from time to time. The foregoing is a material obligation of the Contractor hereunder.

4.9 Safety.

4.9.1 Safety Programs. The Contractor shall be solely responsible for initiating,

maintaining and supervising all safety programs required by the Laws required by the type or nature of the Work. Without limiting or relieving the Contractor of its obligations hereunder, the Contractor shall require that its Subcontractors similarly initiate and maintain all appropriate or required safety programs.

4.9.2 Contractor Safety Plan. Prior to commencement of Work at the Site, the Contractor shall submit to the District and the Project Manager, if any, the Contractor's Safety Plan for the Work for review and acceptance by the District. Acceptance by the District is subject to the Safety Plan conforming to requirements of the Laws, conditions at or about the Site and the nature of the Work. The Contractor shall modify its Safety Plan as necessary to obtain the District's acceptance thereof. Notwithstanding the District's acceptance of the Contractor's Safety Plan, the Contractor shall remain solely responsible for implementing the Safety Plan and implementing measures as necessary to maintain safety of persons and property at and about the Site. The District's acceptance of the Contractor's Safety Plan shall not limit, restrict or otherwise modify the Contractor's obligations relating to safety at or about the Site in accordance with the Contract Documents and the Laws.

4.9.3 Safety Precautions. The Contractor shall be solely responsible for initiating and maintaining reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to: (i) employees on the Work and other persons who may be affected thereby; (ii) the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site, under care, custody or control of the Contractor or Subcontractors; and (iii) other property or items at the Site, or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement.

4.9.4 Safety Signs, Barricades. The Contractor shall erect and maintain, as required by existing conditions and conditions resulting from performance of the Contract, reasonable safeguards for safety and protection of property and persons, including, without limitation, posting danger signs and other warnings against hazards, barricades, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

4.9.5 Safety Notices. The Contractor shall give or post all safety notices required by the Laws and comply with the Laws bearing on safety of persons or property or their protection from damage, injury or loss.

4.9.6 Safety Coordinator. The Contractor shall designate a responsible member of the Contractor's organization at the Site whose duty shall be the prevention of accidents and the implementation and maintenance safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Project Manager, Project Inspector and the Architect.

4.9.7 Emergencies. In an emergency affecting safety of persons or property, the Contractor shall act, to prevent threatened damage, injury or loss.

4.9.8 Hazardous Materials.

4.9.8.1 General. If the Contractor, any Subcontractor or anyone employed directly or indirectly by them shall use, at the Site, or incorporate into the Work, any material or substance deemed to be hazardous or toxic under any law, rule, ordinance, regulation or interpretation thereof (collectively "Hazardous Materials"), the Contractor shall comply with all Laws applicable thereto and shall exercise all necessary safety precautions relating to the use, storage or disposal thereof.

4.9.8.2 Prohibition on Use of Asbestos Construction Building Materials ("ACBMs"). Notwithstanding any provision of the Drawings or the Specifications to the contrary, it is the intent of the District that ACBMs not be used or incorporated into any portion of the Work. In the event that any portion of the Work depicted in the Drawings or the Specifications shall require materials or

products which the Contractor knows, or should have known with reasonably diligent investigation, to contain ACBMs, Contractor shall promptly notify the Architect and the Project Inspector of the same so that an appropriate alternative can be made in a timely manner so as not to delay the progress of the Work. Contractor warrants to the District that there are no materials or products used or incorporated into the Work which contain ACBMs. Whether before or after completion of the Work, if it is discovered that any product or material forming a part of the Work or incorporated into the Work contains ACBMs, the Contractor shall at its sole cost and expense remove such product or material in accordance with any laws, rules, procedures and regulations applicable to the handling, removal and disposal of ACBMs and to replace such product or material with non-ACBM products or materials and to return the affected portion(s) of the Work to the finish condition depicted in the Drawings and Specifications relating to such portion(s) of the Work. Contractor's obligations under the preceding sentence shall survive the termination of the Contract, the warranty period provided under the Contract Documents, the Contractor's completion of the Work or the District's acceptance of the Work. If the Contractor fails or refuses, for any reason, to commence the removal and replacement of any material or product containing ACBMs forming a part of, or incorporated into the Work, within ten (10) days of the date of the District's written notice to the Contractor of the existence of ACBM materials or products in the Work, the District may thereafter proceed to cause the removal and replacement of such materials or products in any manner which the District determines to be reasonably necessary and appropriate; all costs, expenses and fees, including without limitation fees and costs of consultants and attorneys, incurred by the District in connection with such removal and replacement shall be the responsibility of the Contractor and the Surety.

4.9.8.3 Disposal of Hazardous Materials. Contractor shall be solely and exclusively responsible for the disposal of any Hazardous Materials on or about the Site. The Contractor's obligations hereunder shall include without limitation, the transportation and disposal of any Hazardous Materials in strict conformity with the Laws.

4.9.9 Temporary Sanitary Facilities. At all times during Work at the Site, the Contractor shall obtain and maintain temporary sanitary facilities in conformity with applicable law, rule or regulation. The Contractor shall maintain temporary sanitary facilities in a neat and clean manner with sufficient toilet room supplies. Personnel engaged in the Work are not permitted to use toilet facilities at or about the Site.

4.9.10 Noise and Dust Control

4.9.10.1 Noise Control. The Contractor shall install noise reducing devices on construction equipment. Contractor shall comply with the requirements of the city and county having jurisdiction with regard to noise ordinances governing construction sites and activities. Construction Equipment noise at the Site shall be limited and only as permitted by applicable law, rule or regulation. If classes are in session at any point during the progress of the Work, and, in the District's reasonable discretion, the noise from any Work disrupts or disturbs the students or faculty or the normal operation of the School District, at the District's request, the Contractor shall schedule the performance of all such Work around normal District hours or make other arrangements so that the Work does not cause such disruption or disturbance. In no event shall such arrangements result in adjustment of the Contract Price or the Contract Time.

4.9.10.2 Dust Control. The Contractor shall be fully and solely responsible for maintaining and upkeeping all areas of the Site and adjoining areas, outdoors and indoors, free from flying debris, grinding powder, sawdust, dirt and dust as well as any other product, product waste or work waste, that by becoming

airborne may cause respiratory inconveniences to persons, particularly to students and District personnel. Additionally, the Contractor shall take specific care to avoid deposits of airborne dust or airborne elements. Such protection devices, systems or methods shall be in accordance with the Laws, including, without limitation, the EPA, OSHA and Cal-OSHA,. Additionally, the Contractor shall be the sole party responsible to regularly and routinely clean up and remove any and all deposits of dust and other elements. Damage and/or any liability derived from the Contractor's failure to comply with these requirements shall be exclusively at the cost of the Contractor, including, without limitation, any and all penalties that may be incurred for violations of applicable law, rule or regulation, and any amounts expended by the District to pay such damages shall be due and payable to the District on demand. Contractor shall replace any damaged property or part thereof and professionally clean any and all items that become covered or partially covered to any degree by dust or other airborne elements. If classes are in session at any point during the progress of Work, and, in the District's reasonable discretion, flying debris, grinding powder, sawdust, dirt or dust from any Work disrupts or disturbs the students or faculty or the normal operation of the District, at the District's request, the Contractor shall schedule the performance of all such Work around normal District hours and make other arrangements so that the Work does not cause such disruption or disturbance. In no event shall such arrangements result in adjustment of the Contract Price or the Contract Time.

4.9.10.3 Air Pollution. The Contractor shall comply with all applicable air pollution control rules, regulations, ordinances, or statutes. Neither the Contract Time nor the Contract Price shall be subject to adjustment for measures of the Contractor to comply with air pollution control requirements. The Contractor shall be solely responsible for implementing measures required by any governmental or quasi-governmental agency with jurisdiction and/or authority to enforce air pollution control measures without adjustment of the Contract Time or the Contract Price. If in performance of the Work, the Contractor violates applicable air pollution control requirements, the Contractor shall be solely responsible for discharging and satisfying any fine, penalty or remedial measure imposed by a governmental or quasi-governmental agency with authority or jurisdiction to enforce air pollution control measures. The scope of the Contractor's indemnity obligations under the Contract Documents shall include, without limitation, the defense, indemnity and hold harmless of the Indemnified Parties from any fine, penalty or remedial measure imposed by a governmental or quasi-governmental agency with authority or jurisdiction to enforce air pollution control measures as a result of the Contractor's failure or refusal to comply with its obligations hereunder.

4.9.10.4 Contractor Failure to Comply. If the Contractor fails to comply with the requirements for dust control, noise control, or any other maintenance or clean up requirement of the Contract Documents, the District, Architect, District Inspector or Construction Manager are each authorized to notify the Contractor in writing of such failure and the Contractor shall take immediate action. Should the Contractor fail to respond with immediate and responsive action and not later than twenty-four (24) hours from such notification, the District shall have the absolute right to proceed as it may deem necessary to remedy such matter. Any and all costs incurred by the District in connection with such actions shall be the sole responsibility of, and be borne by, the Contractor; the District may deduct such amounts from the Contract Price then or thereafter due the Contractor.

4.10 Maintenance of Documents.

4.10.1 Documents at Site. The Contractor shall maintain at the Site: (i) one record copy of the Drawings, Specifications and all addenda thereto; (ii) Change Orders approved by the District and all other modifications to the Contract Documents; (iii) Submittals reviewed by the Architect; (iv) Record Drawings; (v) Material Safety Data Sheets ("MSDS") accompanying any materials, equipment or products delivered or stored at the Site or incorporated into the Work; and (vi) all building and other codes or regulations applicable to the Work, including without limitation, Title 24, Part 2 of the California Code of Regulations. During performance of the Work, all documents maintained by Contractor at the Site shall be available to the District, the Project Manager, the Architect, the Project Inspector and DSA for review, inspection or reproduction. Upon completion of the Work, all documents maintained at the Site by the Contractor pursuant to the foregoing shall be assembled and transmitted to the Architect for delivery to the District.

4.10.2 Maintenance of Record Drawings. During its performance of the Work, the Contractor shall maintain Record Drawings consisting of a set of the Drawings which are marked to indicate all field changes made to adapt the Work depicted in the Drawings to field conditions, changes resulting from Change Orders and all concealed or buried installations, including without limitation, piping, conduit and utility services. All buried or concealed items of Work shall be completely and accurately marked and located on the Record Drawings. The Record Drawings shall be clean and all changes, corrections and dimensions shall be marked in a neat and legible manner in a contrasting color. Record Drawings relating to the Structural, Mechanical, Electrical and Plumbing portions of the Work shall indicate without limitation, circuiting, wiring sizes, equipment/member sizing and shall depict the entirety of the as built conditions of such portions of the Work. The Record Drawings shall be continuously maintained by the Contractor during the performance of the Work. At any time during the Contractor's performance of the Work, upon the request of the District, the Project Inspector or the Architect, the Contractor shall make the Record Drawings maintained here under available for the District's review and inspection. The District's review and inspection of the Record Drawings during the Contractor's performance of the Work shall be only for the purpose of generally verifying that Contractor is continuously maintaining the Record Drawings in a complete and accurate manner; any such inspection or review shall not be deemed to be the District's approval or verification of the completeness or accuracy thereof. The failure or refusal of the Contractor to continuously maintain complete and accurate Record Drawings or to make available the Record Drawings for inspection and review by the District may be deemed by the District to be Contractor's default of a material obligation hereunder. Without waiving, restricting or limiting any other right or remedy of the District for the Contractor's failure or refusal to continuously maintain the Record Drawings, the District may, upon reasonably determining that the Contractor has not, or is not, continuously maintaining the Record Drawings in a complete and accurate manner, take appropriate action to cause the continuous maintenance of complete and accurate Record Drawings, in which event all fees and costs incurred or associated with such action shall be charged to the Contractor and the District may deduct the amount of such fees and costs from any portion of the Contract Price then or thereafter due the Contractor. In accordance with Article 8.4.2 of these General Conditions, prior to receipt of the Final Payment, Contractor shall deliver the Record Drawings to the Architect.

4.10.3 Daily Reports By Contractor. At the end of each work day, the Contractor shall submit a daily report to the Construction Manager and the Project Inspector for document control listing all labor, materials, and equipment involved with the Work for that day, including but not limited to: (i) Labor, number of classifications of work by contractor/subcontractors, (ii) Materials used, by contractor/subcontractor, (iii) Equipment used, by contractor/subcontractors, (iv) Any inspections or testing performed, (v) Any other authorized services or expenditures.

4.11 Site.

4.11.1 Contractor Use of Site. The Contractor shall confine operations at the Site to areas permitted by the Laws or permits relating to the Work, subject to any restrictions or limitations set forth in the Contract Documents. The Contractor shall not unreasonably encumber the Site or adjoining areas with materials or equipment. The Contractor is solely responsible for providing security at the Site with all such costs included in the Contract Price. The District shall at all times have access to the Site.

4.11.2 Limitations Upon Site Activities. Except in the circumstances of an emergency, no construction activities shall be permitted at or about the Site except during the District's hours and days set forth in the Special Conditions. Work performed outside of the hours and days noted in the Special Conditions will not result in adjustment of the Contract Time or the Contract Price; unless Work outside of the hours and days noted in the Special Conditions is expressly authorized by the District. Additional or premium costs incurred by the District for Work performed outside the hours and days of Work permitted at the Site shall be borne solely and exclusively by the Contractor. The District may deduct such additional or premium costs from the Contract Price then or thereafter due the Contractor.

4.12 Clean-Up. The Contractor shall at all times keep the Site and all adjoining areas free from the accumulation of any waste material or rubbish caused or generated by performance of the Work. Without limiting the generality of the foregoing, Contractor shall maintain the Site in a "rake-clean" standard on a daily basis. If the Work includes painting and/or the installation of floor covering, before any painting operations or the installation of any flooring covering, the area and adjoining areas of the Site where paint is to be applied or floor covering is to be installed shall be in a "broom-clean" condition. Prior to completion of the Work, Contractor shall remove from the Site all rubbish, waste materials, excess excavated materials, tools, Construction Equipment, machinery, surplus materials and any other items which are not the property of the District under the Contract Documents. Upon completion of the Work, the Site and all adjoining areas shall be left by the Contractor in a neat and broom clean condition satisfactory to District. The Project Inspector or Project Manager shall be authorized to direct the Contractor's clean-up obligations hereunder. If the Contractor fails to clean up as provided for in the Contract Documents, the District may do so, and all costs incurred in connection therewith shall be charged to the Contractor; the District may deduct such costs from any portion of the Contract Price then or thereafter due the Contractor.

4.13 Access to the Work. The Contractor shall provide DSA, the District, the Project Manager, the Project Inspector and the Architect access to the Work, whether in place, preparation and progress and wherever located.

4.14 Facilities and Information for the Project Inspector.

4.14.1 Information to Project Inspector. The Contractor shall furnish the Project Inspector access to the Work for obtaining such information as may be necessary to keep the Project Inspector fully informed respecting the progress, quality and character of the Work and materials, equipment or other items incorporated therein.

4.14.2 Facilities for Project Inspector. Facilities, services or other items to be provided by the Contractor for use by the Project Inspector, if any, shall be as set forth in the Special Conditions. If any such facilities, services or other items are designated in the Special Conditions and the Contractor fails or refuses to provide the same, the District may furnish such facilities, services or other items, with the costs, fees or expenses incurred to furnish the same being deducted from the Contract Price.

4.15 Patents and Royalties. The Contractor and the Surety shall defend, indemnify and hold harmless the District and its agents, employees and officers from any claim, demand or legal proceeding arising out of or pertaining, in any manner, to any actual or claimed infringement of

patent rights in connection with performance of the Work.

4.16 Cutting and Patching. The Contractor is responsible for cutting, fitting or patching required to complete the Work or to make the component parts thereof fit together properly. The Contractor shall not damage or endanger any portion of the Work, or the fully or partially completed construction of the District or separate contractors by cutting, patching, excavation or other alteration. The Contractor shall not cut, patch or otherwise alter the construction by the District or separate contractor without the prior written consent of the District or separate contractor thereto, which consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold consent to the request of the District or separate contractor to cut, patch or otherwise alter the Work.

4.17 Encountering of Hazardous Materials. If the Contractor encounters Hazardous Materials at the Site which have not been rendered harmless or for which there is no provision in the Contract Documents for containment, removal, abatement or handling of such Hazardous Materials, the Contractor shall immediately stop the Work in the affected area, but shall diligently proceed with the Work in all other unaffected areas. Upon encountering such Hazardous Materials, the Contractor shall immediately notify the Project Inspector and the Architect, in writing, of such condition. The Contractor shall proceed with the Work in such affected area only after such Hazardous Materials have been rendered harmless, contained, removed or abated. If such Hazardous Materials are encountered, the Contractor shall be entitled to an adjustment of the Contract Time to the extent that the Work is stopped and Substantial Completion of the Work is affected thereby. In no event shall there be an adjustment to the Contract Price solely on account of the Contractor encountering such Hazardous Materials.

4.18 Public Works Requirements: Registration, Wage Rates and Employment of Labor.

4.18.1 Public Works Project. This is a public works project as defined in Labor Code §1720, and must be performed in accordance with the requirements of Labor Code §§1720 to 1815, 1860 and 1861, and Title 8 of the California Code of Regulations, §§16000 to 17270, which govern the requirements to register with the Department of Industrial Relations (“DIR”) and the payment of prevailing wage rates on public works projects. Contractor and Subcontractors, of any tier, shall comply with the registration and compliance monitoring provisions of the Labor Code for public works projects, including but not limited to furnishing Certified Payroll Records to the California Labor Commissioner and complying with any applicable enforcement by DIR.

4.18.2 Registration with the Department of Industrial Relations.

Contractor and Subcontractors, of any tier, shall comply with California Labor Code §1725.5, including without limitation the registration requirements to be qualified to bid on, be listed in a bid proposal, subject to the requirements of Section 4104 of the Public Contract Code, or engage in the performance of the Contract. Contractor represents that all Subcontractors, of any tier, are registered pursuant to California Labor Code §1725.5.

4.18.2.1 Subcontractor Substitution. Pursuant to California Labor Code 1771.1 (d), failure to be registered with DIR by a Subcontractor, of any tier, shall be grounds under California Public Contract Code §4107, with the District’s consent, to substitute a Subcontractor who is registered in place of the unregistered Subcontractor.

4.18.2.2 Cancellation of Contract. Pursuant to California Labor Code 1771.1 (f), failure by the Contractor or the Subcontractors, of any tier, to have or maintain their DIR registration during the duration of the Contract and project may result in cancellation of the Contract. The cancellation of the Contract by the District due to the failure by the Contractor or any Subcontractor of any tier to have or

maintain their DIR registration will not affect or exonerate the obligations of the surety or sureties providing the payment and performance bonds for the Contract.

4.18.3 Prevailing Wage Rates.

4.18.3.1 Prevailing Wage Rate Determinations. Pursuant to the provisions of Division 2, Part 7, Chapter 1, Article 2 of the California Labor Code at §§1770 et seq., the District has obtained from the Director of DIR determinations of the general prevailing rate of per diem wages and the prevailing rates for Saturday, Sunday, holiday and overtime work in the locality in which the Work is to be performed. Copies of these prevailing wage determinations are on file and available to any interested party upon request at the District's principal office and at www.dir.ca.gov/OPRL/DPreWageDetermination.htm. Holidays shall be as defined in the collective bargaining agreement applicable to each particular craft, classification or type of worker employed under the Contract. Per diem wages include employer payments for health and welfare, pensions, vacation, travel time and subsistence pay as provided in California Labor Code §1773.9, apprenticeship or other training programs authorized by California Labor Code §3093, and similar purposes when the term "per diem wages" is used herein. Saturday, Sunday, holiday and overtime work, when permitted by law, shall be paid for at the rate of at least one and one-half (1½) times the above specified rate of per diem wages, unless otherwise specified. The Contractor shall post, at appropriate and conspicuous locations on the Site, a schedule showing all determined general prevailing wage rates.

4.18.3.2 Contractor Responsibility. Contractor is responsible for ascertaining and complying with all rates for crafts which are not listed, and for any and all determinations subsequent to those listed. Questions pertaining to prevailing wage rates should be directed to the DIR, Office of the Director – Research Unit, P.O. Box 420603, San Francisco, CA 94142, tel. (415) 703-4774.

4.18.3.3 Payment of Prevailing Rates. There shall be paid each worker of the Contractor and Subcontractors, of any tier, engaged in the Work, not less than the general prevailing wage rate, regardless of any contractual relationship which may be alleged to exist between the Contractor or any Subcontractor, of any tier, and such worker. Contractor, consistent with California Public Contract Code §6109, is prohibited from performing a portion of work with a Subcontractor, of any tier, who is debarred pursuant to Labor Code §§1777.1 or 1777.7.

4.18.3.4 Prevailing Wage Rate Penalty. The Contractor shall, as a penalty, forfeit not more than Two Hundred Dollars (\$200.00) to the District for each calendar day or portion thereof, for each worker paid less than the prevailing rates as determined by the Director of DIR for such work or craft in which such worker is employed for the Work by the Contractor or by any Subcontractor, of any tier, in connection with the Work. The amount of the penalty for failure to pay applicable prevailing wage rates shall be determined by the California Labor Commissioner. When the penalty amount due hereunder is collected from the Contractor or Subcontractor, any outstanding wage claim under Chapter 1 (commencing with Section 1720) of Part 7 of Division 2 against that Contractor or Subcontractor shall be satisfied before applying that amount to the penalty imposed on that Contractor or Subcontractor hereunder. Pursuant to California Labor Code §1775, the difference between prevailing wage rates and the amount paid to each worker each calendar day, or portion thereof, for which each worker paid less than the prevailing wage rate, shall be paid to each worker by the Contractor and/or the applicable Subcontractor, of any tier.

4.18.3.5 Prevailing Wage Laws Monitoring and Enforcement. During the duration of the Contract and performance of the Work, and pursuant to Labor Code §1771.4, DIR will monitor and enforce prevailing wage laws, including but

not limited to the obligation of the Contractor and Subcontractors of every tier to pay laborers performing any portion of the Work the Prevailing Wage Rate established for the classification of work/labor performed. In the event that additional or revised information is required pursuant to the monitoring and enforcement of the prevailing wage laws by DIR, such requirement shall not result in an increase to the Contract Time or the Contract Price.

4.18.4 Payroll Records.

4.18.4.1 Certified Payroll Records. Pursuant to California Labor Code §1776, the Contractor and each Subcontractor, of any tier, shall keep an accurate payroll record, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each person employed for the Work. If there is no work in a given week or on a given day, Contractor and each Subcontractor, of any tier, must keep a certified Non-Performance payroll record, indicating “no work” for that week or day(s).

4.18.4.2 Submittal of Certified Payroll Records to the California Labor Commissioner. The Contractor and all Subcontractors, of any tier, shall prepare and submit Certified Payroll Records to the Labor Commissioner in compliance with requirements established in California Labor Code §1771.4. The form and content of Certified Payroll Records shall be as established by the California Labor Commissioner and the frequency of Certified Payroll Records submittal to the Labor Commissioner shall be pursuant to California Labor Code §1771.4.

4.18.4.3 Inspection and Copies of Certified Payroll Records. The payroll records shall be certified and available for inspection at all reasonable hours at the principal office of the Contractor on the following basis: (i) a certified copy of an employee’s payroll record shall be made available for inspection or furnished to such employee or his/her authorized representative on request; (ii) a certified copy of all payroll records shall be made available for inspection or furnished upon request to the District, the Labor Commissioner, the Division of Labor Standards Enforcement (“DLSE”) and the Division of Apprenticeship Standards of DIR (“Apprenticeship Council”); (iii) a certified copy of payroll records shall be made available upon request to the public for inspection or copies thereof made; provided, however, that a request by the public shall be made through either the District, the Labor Commissioner, DLSE and the Apprenticeship Council. If the requested payroll records have not been provided, the requesting party shall, prior to being provided the records, reimburse the cost of preparation by the Contractor, Subcontractors and the entity through which the request was made; the public shall not be given access to such records at the principal office of the Contractor; (iv) the Contractor shall file a certified copy of the payroll records with the entity that requested such records within ten (10) days after receipt of a written request; (v) except as provided in California Labor Code §1776 (f), any copy of records made available for inspection as copies and furnished upon request to the public or any public agency by the District, the Labor Commissioner, the DLSE or the California Apprenticeship Council shall be marked or obliterated in such a manner as to prevent disclosure of an individual’s name, address and social security number. The name and address of the Contractor or any Subcontractor, of any tier, performing a part of the Work shall not be marked or obliterated. The Contractor shall inform the District of the location of payroll records, including the street address, city and county and shall, within five (5) working days, provide a notice of a change or location and address. In the event of noncompliance with the foregoing requirements, the Contractor shall have ten (10) days in which to comply, subsequent to receipt of written notice specifying in what respects the Contractor must comply herewith. Should

noncompliance still be evident after such ten (10) day period, the Contractor shall, as a penalty to the District, forfeit One Hundred Dollars (\$100.00) for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Labor Commissioner, the DLSE or the California Apprenticeship Council, such penalties shall be withheld from any portion of the Contract Price then or thereafter due the Contractor. The Contractor is solely responsible for compliance with the foregoing provisions.

4.18.4.4 Liquidated damages. Should Contractor or the Subcontractors, of any tier, neglect, fail or refuse to submit any documents pursuant to this Article 4.18.4, Contractor agrees to pay to the District the sum of One Hundred Dollars (\$100) per worker per day in liquidated damages, not as a penalty but as liquidated damages, for every day beyond ten (10) days after such documents are due. The liquidated damages amounts are agreed upon by and between the Contractor and the District because of the difficulty of fixing the District's actual damages in the event of failure to submit such documents. The Contractor and District specifically agree that said amounts are reasonable estimates of the District's damages in such event, and that such amounts do not constitute a penalty. The Contractor and District acknowledge and agree that the liquidated damages contained in this provision are reasonable under the circumstances existing at the time of the Contractor's execution of the Contract

4.18.5 Hours of Work.

4.18.5.1 Limits on Hours of Work. Pursuant to California Labor Code §1810, eight (8) hours of labor shall constitute a legal day's work. Pursuant to California Labor Code §1811, the time of service of any worker employed at any time by the Contractor or by a Subcontractor, of any tier, upon the Work or upon any part of the Work, is limited and restricted to eight (8) hours during any one calendar day and forty (40) hours during any one calendar week, except as hereafter provided. Notwithstanding the foregoing provisions, Work performed by employees of Contractor or any Subcontractor, of any tier, in excess of eight (8) hours per day and forty (40) hours during any one week, shall be permitted upon compensation for all hours worked in excess of eight (8) hours per day at not less than one and one-half (1½) times the basic rate of pay. All work performed on Saturday, Sunday, and/or on a holiday shall be paid pursuant to the applicable prevailing wage determination.

4.18.5.2 Penalty for Excess Hours. The Contractor shall pay to the District a penalty of Twenty-five Dollars (\$25.00) for each worker employed on the Work by the Contractor or any Subcontractor, of any tier, for each calendar day during which such worker is required or permitted to work more than eight (8) hours in any calendar day and forty (40) hours in any one calendar week, in violation of the provisions of the California Labor Code.

4.18.5.3 Contractor Responsibility. Any Work performed by workers necessary to be performed after regular working hours or on Saturdays, Sundays or other holidays shall be performed without adjustment to the Contract Price or any other additional expense to the District. The Contractor shall be responsible for costs incurred by the District which arise out of Work performed by the Contractor at times other than regular working hours and regular working days. Upon determination of such costs, the District may deduct such costs from the Contract Price then or thereafter due the Contractor.

4.18.6 Apprentices.

4.18.6.1 Employment of Apprentices. California Labor Code §1777.5 and Title 8 of the California Code of Regulations §200 et seq. provide detailed requirements for employing apprentices on public works projects. Contractor is responsible for compliance with California Labor Code §1777.5 and all applicable

regulations on the Project. This responsibility includes, but is not limited to, the obligation to employ properly registered apprentices and pay such apprentices at least the prevailing wage rate for their appropriate apprentice classification. Only apprentices, as defined in California Labor Code §3077 who are in training under apprenticeship standards and written apprenticeship agreements under California Labor Code §§3070 et seq. are eligible to be employed for the Work. The employment and training of each apprentice shall be in accordance with the provisions of the apprenticeship standards and apprentice agreements under which such apprentice is training. Any apprentices employed to perform any of the Work shall be paid the standard wage paid to apprentices under the regulations of the craft or trade for which such apprentice is employed, and such individual shall be employed only for the work of the craft or trade to which such individual is registered. The term "Apprenticeable Craft or Trade," as used herein shall mean a craft or trade determined as an apprenticeable occupation in accordance with rules and regulations prescribed by the California Apprenticeship Council.

4.18.6.2 Apprenticeship Certificate. When the Contractor or any Subcontractor, of any tier, in performing any of the Work employs workers in any Apprenticeable Craft or Trade, the Contractor and such Subcontractor shall employ apprentices in at least the ratio set forth in California Labor Code §1777.5 and may apply to any apprenticeship program in the craft or trade that can provide apprentices to the site of the Work for a certificate approving the Contractor or such Subcontractor under the apprenticeship standards for the employment and training of apprentices in the area or industry affected. However, the decision of the apprenticeship program to approve or deny a certificate shall be subject to review by the Administrator of Apprenticeship. The apprenticeship program or programs, upon approving the Contractor or Subcontractor, shall arrange for the dispatch of apprentices to the Contractor or such Subcontractor in order to comply with California Labor Code §1777.5. Contractors or Subcontractors covered by an apprenticeship program's standards shall not be required to submit any additional application to include additional public works contracts under that program. Prior to the commencement of the Work, the Contractor and Subcontractors, of any tier, must submit contract award information (on Form DAS-140) to an applicable apprenticeship program that can supply apprentices to the site of the Work. The information submitted shall include an estimate of journeyman hours to be performed under the Contract, the number of apprentices to be employed, and the approximate dates the apprentices will be employed. Concurrently with submission of this information to the apprenticeship program(s), Contractor shall deliver a copy of the submittal to the District and the Construction Manager. The apprenticeship program that can supply apprentices to the site of the Work shall ensure equal employment and affirmative action and apprenticeship for women and minorities.

4.18.6.3 Submittal of Contract Award Information. Contractor shall submit contract award information using the Division of Apprenticeship Standards (DAS 140) Form to the applicable apprenticeship committee within ten (10) days of the date of execution of contract and no later than the first day of work as per Title 8 of the California Code of Regulations §230. Concurrently with submission of contract information on Form DAS-140 to the Apprenticeship Council, the Contractor shall deliver a copy of its completed DAS-140 form to the District and the Construction Manager.

4.18.6.4 Ratio of Apprentices to Journeymen. The ratio of work performed by apprentices to journeymen employed in a particular craft or trade on the Work may be no higher than the ratio stipulated in the apprenticeship standards under

which the apprenticeship program operates, but in no case shall the ratio be less than one hour of apprentice work for each five hours of labor performed by a journeyman, except as otherwise provided in California Labor Code §1777.5. Any applicable ratio shall apply during any day or portion of a day when any journeyman is employed at the site of the Work and shall be computed on the basis of the hours worked during the day by journeymen so employed. Any Work performed by a journeyman in excess of eight hours per day or 40 hours per week shall not be used to calculate the ratio. The Contractor and Subcontractor, of any tier, shall employ apprentices for the number of hours computed as above before the completion of the Contract or subcontract. The Contractor and Subcontractor, of any tier, shall, however, endeavor, to the greatest extent possible, to employ apprentices during the same time period that the journeymen in the same craft or trade are employed at the site of the Work. Where an hourly apprenticeship ratio is not feasible for a particular craft or trade, the Administrator of Apprenticeship, upon application of an apprenticeship program, may order a minimum ratio of not less than one apprentice for each five journeymen in a craft or trade classification. The Contractor or any Subcontractor covered by this Article and California Labor Code §1777.5, upon the issuance of the approval certificate, or who has been previously approved for an apprenticeship program in the craft or trade, shall employ the number of apprentices or the ratio of apprentices to journeymen stipulated in the applicable apprenticeship standards, but in no event less than the 1 to 5 ratio required by California Labor Code §1777.5 (g). Upon proper showing by the Contractor or Subcontractor, of any tier, that it employs apprentices in such craft or trade in the State of California on all of its contracts on an annual average of not less than one hour of apprentice work for every five hours of labor performed by journeymen, the Administrator of Apprenticeship may grant a certificate exempting the Contractor from the 1-to-5 hourly ratio as set forth in this Article and California Labor Code §1777.5 in that craft or that trade.

4.18.6.5 Exemption From Ratios. An apprenticeship program has the discretion to grant a participating Contractor or contractor association a certificate, which shall be subject to the approval of the Administrator of Apprenticeship, exempting the Contractor from the 1-to-5 ratio set forth in this Article when it finds that any one of the following conditions are met: (i) unemployment for the previous three-month period in such area exceeds an average of fifteen percent (15%) or; (ii) the number of apprentices in training in such area exceeds a ratio of 1-to-5 in relation to journeymen, or; (iii) the Apprenticeable Craft or Trade is replacing at least one-thirtieth (1/30) of its journeymen annually through apprenticeship training, either on a statewide basis or on a local basis, or; (iv) if assignment of an apprentice to any Work performed under the Contract Documents would create a condition which would jeopardize such apprentice's life or the life, safety or property of fellow employees or the public at large, or if the specific task to which the apprentice is to be assigned is of such a nature that training cannot be provided by a journeyman. When such exemptions from the 1-to-5 ratio between apprentices and journeymen are granted to an organization which represents contractors in a specific trade on a local or statewide basis, the member contractors will not be required to submit individual applications for approval to local joint apprenticeship committees, provided they are already covered by the local apprenticeship standards.

4.18.6.6 Contributions to Trust Funds. The Contractor or any Subcontractor, of any tier, who, performs any of the Work by employment of journeymen or apprentices in any Apprenticeable Craft or Trade and who is not contributing to a fund or funds to administer and conduct the apprenticeship program in any

such craft or trade in the area of the site of the Work, to which fund or funds other contractors in the area of the site of the Work are contributing, shall contribute to the fund or funds in each craft or trade in which it employs journeymen or apprentices in the same amount or upon the same basis and in the same manner as the other contractors do, but where the trust fund administrators are unable to accept such funds, contractors not signatory to the trust agreement shall, using California Apprenticeship Council Training Fund Contributions Form CAC-2, pay a like amount to the California Apprenticeship Council. The DLSE is authorized to enforce the payment of such contributions to such fund(s) as set forth in California Labor Code §227. Such contributions shall not result in an increase in the Contract Price.

4.18.6.7 Contractor's Compliance. The responsibility of compliance with this Article and with California Labor Code §1777.5 for all Apprenticeable Trades or Crafts is solely and exclusively that of the Contractor. In the event the Contractor knowingly violates the provisions of this Article and California Labor Code §1777.5, pursuant to California Labor Code §1777.7, the Contractor shall: forfeit, as a civil penalty, not more than One Hundred Dollars (\$100.00) for each calendar day of noncompliance. A contractor or subcontractor that knowingly commits a second or subsequent violation of this Article and California Labor Code §1777.5 within a three year period, shall forfeit as a civil penalty not more than Three Hundred Dollars (\$300.00) for each calendar day of noncompliance.

4.18.7 Employment of Independent Contractors. Pursuant to California Labor Code §1021.5, Contractor shall not willingly and knowingly enter into any agreement with any person, as an independent contractor, to provide any services in connection with the Work where the services provided or to be provided requires that such person hold a valid contractors' license issued pursuant to California Business and Professions Code §§7000 et seq. and such person does not meet the burden of proof of his/her independent contractor status pursuant to California Labor Code §2750.5. If the Contractor employs any person in violation of the foregoing, Contractor shall be subject to the civil penalties under California Labor Code §1021.5 and any other penalty provided by law. In addition to the penalties provided under California Labor Code §1021.5, Contractor's violation of this Article 4.18.7 or the provisions of California Labor Code §1021.5 shall be deemed an event of Contractor's default of a material obligation of the Contract Documents. The Contractor shall require any Subcontractor of any tier performing or providing any portion of the Work to adhere to and comply with the foregoing provisions.

4.18.8 Workers' Compensation.

4.18.8.1 Pursuant to California Labor Code §1860, the Contractor and the Subcontractors, of any tier, are required to secure the payment of compensation to their employees in accordance with California Labor Code §3700.

4.18.8.2 Certification. Prior to performing the Work under the Contract, Contractor and Subcontractors, of any tier, must sign and submit the following certification: "I am aware of the provisions of California Labor Code §3700 which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing performance of the work under this contract."

4.18.9 Sufficient Contract Price. Contractor represents and warrants that the Contract Price includes sufficient funds to allow Contractor and all Subcontractors to comply with all applicable laws and contractual agreements. Contractor shall defend, indemnify and hold the District harmless from and against any and all claims, demands, losses, liabilities and damages arising out of or relating to the failure of Contractor or any Subcontractor to comply with any applicable law in this regard, including, but not limited

to Labor Code §2810. Contractor agrees to pay any and all wages, penalties, forfeitures and liquidated damages, made or asserted against the District in relation to any such failure.

4.18.10 Withholding of Contract Payments. The District shall withhold from Contractor payment(s) after an investigation and/or at the direction of the Labor Commissioner, the DLSE or the Division of Apprenticeship Standards, in amounts equal to back wages, penalties, and/or liquidated damages assessed against Contractor and/or Subcontractor of any tier by these agencies, as authorized by the Labor Code and/or the District's general conditions. Contractor's appeal process pertaining to a payment withholding is described in the Civil Wage and Penalty Assessment document or as otherwise provided by the Labor Commissioner, the DLSE or the Division of Apprenticeship Standards.

4.18.11 Joint and Several Liability. Contractor and any Subcontractor, of any tier, shall be jointly and severally liable for all amounts equal to back wages, penalties, and/or liquidated damages as authorized by the Labor Code. The Contractor and the Surety shall be jointly and severally liable for the underpayment of back wages, penalties, and liquidated damages if the responsible employer fails to pay identified assessments within sixty (60) days after receipt of the first notice or as otherwise provided by law, including Labor Code §1743.

4.19 Assignment of Antitrust Claims. Pursuant to California Government Code §4551, the Contractor and its Subcontractor(s), of any tier, hereby offers and agrees to assign to the District all rights, title and interest in and to all causes of action they may have under Section 4 of the Clayton Act, (15 U.S.C. §15) or under the Cartwright Act (California Business and Professions Code §§16700 et seq.), arising from purchases of goods, services or materials hereunder or any Subcontract. This assignment shall be made and become effective at the time the District tenders Final Payment to the Contractor, without further acknowledgment by the parties. If the District receives, either through judgment or settlement, a monetary recovery in connection with a cause of action assigned under California Government Code §§4550 et seq., the assignor thereof shall be entitled to receive reimbursement for actual legal costs incurred and may, upon demand, recover from the District any portion of the recovery, including treble damages, attributable to overcharges that were paid by the assignor but were not paid by the District as part of the Contract Price, less the expenses incurred by the District in obtaining that portion of the recovery. Upon demand in writing by the assignor, the District shall, within one year from such demand, reassign the cause of action assigned pursuant to this Article if the assignor has been or may have been injured by the violation of law for which the cause of action arose: and (i) the District has not been injured thereby; or (ii) the District declines to file a court action for the cause of action.

4.20 Employee Fingerprinting; Contractor's Compliance With Education Code §§ 45125.1 and 45125.2

4.20.1 General; School Session Requirements. The Contractor acknowledges that the safety of students on or about the Site is of paramount importance and that Contractor's compliance with these provisions is a material obligation of the Contractor under the Contract Documents. To ensure the safety of students on or about the Site, the Contractor agrees that if at any time during performance of any Work at or about the Site occurs when classes are in session at the Site or during school related functions at the Site, no personnel of the Contractor, Subcontractor, Material Supplier or others performing or providing any portion of the Work of the Contract Documents will be permitted access to the Site unless such personnel are specifically identified in Exhibit A to a Fingerprint Certification. Any personnel at the Site who is not identified in Exhibit A to a Fingerprint Certification will be immediately removed from the Site and will not be permitted access until a Fingerprint Certification is submitted to the District identifying

such personnel in Exhibit A thereto. Neither the Contract Time nor the Contract Price shall be adjusted on account of the removal of any personnel from the Site pursuant to the foregoing.

4.20.2 Non-School Session. If at any time during performance of Work at or about the Site which when classes are not in session at the Site or when there are no other school related functions at the Site, personnel of the Contractor, Subcontractors, Material Suppliers or others performing or providing any portion of the Work will be permitted access to the Site without such personnel being specifically identified in Exhibit A to a Fingerprint Certification. The foregoing notwithstanding, during such times, the Contractor shall comply with the provisions of Education Code §42125.2 by either: (a) erecting physical barriers to limit contact with students or (b) continual supervision and monitoring of personnel at the Site by an employee of the Contractor who has been verified by the California Department of Justice as not having been convicted of a violent or serious felony. If the Contractor elects the procedure under (b) in the preceding sentence, the Contractor shall submit a Fingerprint Certification attesting to the Department of Justice verification that such employee has not been convicted of a violent or serious felony and has no felony proceedings pending against her/him. The provisions of Education Code §45125.2 notwithstanding, there will be no surveillance of the personnel of the Contractor, Subcontractors, Material Suppliers or others performing or providing Work at the Site by the personnel of the District, Architect, Construction Manager, or the Inspector.

4.20.3 District Required Identification. In addition to compliance with the foregoing, if the District requires the issuance of identification badges or other means of identification, no person will be permitted access to the Site until the District has issued such person an identification badge or other means of identification. Notwithstanding compliance with the foregoing requirements, if the District requires that identification badges be issued and worn at the Site, any person providing or performing Work at the Site who has not been issued or who is not wearing his/her identification badge will be immediately removed from the Site; such person will not be permitted access to the Site until the District has issued such person an identification badge and/or such person wears her/her identification badge issued by the District. The removal of any personnel from the Site under the foregoing provisions shall not result in adjustment of the Contract Price or the Contract Time.

4.21 DSA Construction Oversight. All of the Work is subject to DSA Construction Oversight processes and procedures; a material obligation of the Contractor hereunder is the Contractor's compliance with the processes and procedures established by DSA for the Work. As applicable, the foregoing shall include without limitation, the processes and procedures established under DSA PR 13-01 in effect at the time of performing the Work hereunder. The foregoing shall include:

4.21.1 DSA Approved Documents. The Contractor shall carefully study the DSA approved documents and shall plan a schedule of operations well ahead of time.

4.21.2 Correction of Non-Conforming Work. If at any time it is discovered that Work is not in accordance with the DSA approved construction documents, the Contractor shall correct the Work immediately.

4.21.3 Verification of DSA 152 Forms. The Contractor shall verify that DSA 152 forms were issued for prior to the commencement of construction.

4.21.4 Test/Inspection Communications. The Contractor shall meet with the Architect, Construction Manager, the Laboratory of Record retained by the District for special tests/inspections and the Project Inspector to mutually communicate and understand the testing and inspection program, and the methods of communication appropriate for the

Work.

4.21.5 DSA Form 156 Notifications to Project Inspector. The Contractor shall notify the Project Inspector, in writing, of the commencement of construction of each and every aspect of the Work at least 48 hours in advance by submitting Commencement/Completion of Work Notification (form DSA 156), or other agreed upon written documents, to the Project Inspector. The Contractor shall notify the Project Inspector of the completion of construction of each and every aspect of the Work by submitting form DSA 156 (or other agreed upon written documents) to the Project Inspector.

4.21.6 Limitations on Contractor Work. Until the Project Inspector has signed off applicable blocks and sections of the form DSA 152, the Contractor may be prohibited from proceeding with subsequent construction activities that cover up the unapproved Work. Any subsequent construction activities, that cover up the unapproved Work, will be subject to a "Stop Work Order" from DSA or the District, and are subject to removal and remediation if found to be in non-compliance with the DSA approved construction documents.

4.21.7 Final Verified Report. The Contractor shall submit the final Contractor Verified Report. (form DSA 6-C) to DSA and the Project Inspector. The DSA 6-C reports are required to be submitted by the Contractor upon occurrence of any of the following events: (i) the Work is substantially complete (DSA considers the Work to be complete when the construction is sufficiently complete in accordance with the DSA approved construction documents so that the owner can occupy or utilize the Work); (ii) Work is suspended for a period of more than one (1) month; (iii) services of the Contractor are terminated for any reason prior to the completion of the Work; or (iv) DSA requests a verified report.

4.22 DSA Verified Reports

4.22.1 Contractor Actions. The Contractor acknowledges and agrees that a material obligation of the Contractor under the Contract Documents is the completion by the Contractor of all actions and activities which by the Contract Documents or by the Laws are the responsibility of the Contractor relating to DSA reporting requirements pursuant to Education Code §81141 (including amendments thereto) and issuance of DSA's Certificate of Compliance for the Project pursuant to Education Code §81147 (including amendments thereto) upon completion of the Work. The foregoing shall include without limitation, the timely preparation, completion and filing of Verified Reports during Project construction and the filing of the Final Verified Report with DSA within thirty (30) days of the determination of Final Completion. The Contractor shall provide the District, the Project Inspector, Architect, Construction Manager with copies of all Verified Reports completed by the Contractor and submitted to DSA; such copies shall be provided to the Project Inspector, Architect, the Construction Manager and the District concurrently with the Contractor's submission thereof to DSA.

4.22.2 District Withholdings From Final Payment. Notwithstanding any provision of the Contract Documents to the contrary, the completion and filing of the Final Verified Report with DSA by the Contractor is an express condition precedent to the District's disbursement of the Final Payment. If the Contractor fails to prepare and file the Final Verified Report with DSA within thirty (30) days of the determination of Final Completion, the District may in the sole and exclusive discretion of the District retain and withhold ten percent (10%) of the Final Payment from disbursement to the Contractor as damages for the failure of the Contractor to have timely and completely discharged its obligations hereunder. The Contractor acknowledges and agrees that the foregoing withholdings by the District is a reasonable estimate of the damages and other losses the District will sustain due to the failure of the Contractor to have timely and fully discharged its obligations hereunder.

ARTICLE 5: SUBCONTRACTORS

5.1 Subcontracts. Any Work performed for the Contractor by a Subcontractor shall be pursuant to a written agreement between the Contractor and such Subcontractor which specifically incorporates by reference the Contract Documents and which specifically binds the Subcontractor to the applicable terms and conditions of the Contract Documents, including without limitation, the policies of insurance required under Article 6 of these General Conditions and obligates the Subcontractor to assume toward the Contractor all the obligations and responsibilities of the Contractor which by the Contract Documents the Contractor assumes toward the District and the Architect. The foregoing notwithstanding, no contractual relationship shall exist, or be deemed to exist, between any Subcontractor and the District, unless the Contract is terminated and District, in writing, elects to assume the Subcontract. Each Subcontract for a portion of the Work shall provide that such Subcontract may be assigned to the District if the Contract is terminated by the District pursuant to Article 15 hereof, subject to the prior rights of the Surety if the District terminates the Contract for the Contractor's default. The Contractor shall provide to the District copies of all executed Subcontracts and Purchase Orders to which Contractor is a party within thirty (30) days after Contractor's execution of the Agreement. During performance of the Work, the Contractor shall, from time to time, as and when requested by the District, the Architect or the Project Manager provide the District with copies of any and all Subcontracts or Purchase Orders relating to the Work and all modifications thereto. The Contractor's failure or refusal, for any reason, to provide copies of such Subcontracts or Purchase Orders in accordance with the two preceding sentences is Contractor's default of a material term of the Contract Documents.

5.2 Subcontractor DIR Contractor Registration.

5.2.1 No Subcontractor Performance of Work Without DIR Registration. No portion of the Work is permitted to be performed by a Subcontractor unless the Subcontractor is a DIR Registered contractor. The foregoing DIR contractor registration requirement is applicable for all Subcontractors, including without limitation, lower tier Subcontractors and Subcontractors who are not identified in the Contractor's Subcontractors List.

5.2.2 Contractor Obligation to Verify Subcontractor DIR Registration Status. An affirmative and on-going obligation of the Contractor under the Contract Documents is the Contractor's verification that all Subcontractors are at all times during performance of the Work in full and strict compliance with DIR contractor registration requirements. The Contractor shall not permit or allow any Subcontractor to perform any Work without the Contractor's verification that the Subcontractor is in full and strict compliance with DIR contractor registration requirements.

5.2.3 Contractor Obligation to Request Substitution of Listed Subcontractor Who Is Not DIR Registered Contractor. If any Subcontractor identified in the Contractor's Subcontractors List submitted with the Contractor's proposal for the Work is not a DIR registered contractor at the time of opening of proposals for the Work or if a Subcontractor's DIR contractor registration lapses prior to or during a Subcontractor's performance of Work, the Contractor shall request the District's consent to substitute the Subcontractor who is not a DIR registered contractor pursuant to Labor Code §1771.1(c)(3) and/or Labor Code §1771.1(d).

5.3 Substitution of Listed Subcontractor.

5.3.1 Substitution Process. Request of the Contractor to substitute a listed Subcontractor will be considered only if in strict conformity with this Article 5.3 and California Public Contract Code §4107. All costs incurred by the District, including without limitation, costs of the Project Inspector, the Architect, the Project Manager or attorney's fees in the review and evaluation of a request to substitute a listed Subcontractor shall be borne by the Contractor; such costs may be deducted by the District from the Contract Price then or thereafter due the Contractor.

5.3.2 Responsibilities of Contractor Upon Substitution of Subcontractor. The District's consent to Contractor's substitution of a listed Subcontractor shall not relieve Contractor from its obligation to complete the Work within the Contract Time and for the Contract Price. The substitution of a listed Subcontractor shall not, under any circumstance, result in, or give rise to any to any increase of the Contract Price or the Contract Time on account of such substitution. If the District consents to substitution of a listed Subcontractor, the Architect shall determine the extent to which, if any, revised or additional Submittals will be required of the newly substituted Subcontractor ("Substituted Subcontractor"). If the Architect determines that revised or additional Submittals are required of a Substituted Subcontractor, the Architect shall promptly notify the Contractor, in writing, of such requirement. In such event, revised or additional Submittals shall be submitted to Architect not later than thirty (30) days following the date of the Architect's written notice to the Contractor pursuant to the foregoing sentence; provided that if in the reasonable and good faith judgment of the Architect, the progress of the Work or completion of the Work requires submission of additional or revised Submittals by a Substituted Subcontractor in less than thirty (30) days, the Architect shall so state in its written notice to the Contractor. If the revised or additional Submittals are not submitted by Contractor within thirty (30) days, or such earlier time as determined by the Architect pursuant to the preceding sentence, following the Architect's written notice of the requirement for revised or additional Submittals, Contractor shall be subject to the per diem assessments for late Submittals as set forth in Article 4.7.2.1 of these General Conditions. Any revised or additional Submittals required pursuant to this Article 5.3.2 shall conform to the requirements of Article 4.7 of these General Conditions. Contractor shall reimburse the District for all fees and costs, including without limitation fees of the Architect, the District's administrative costs and DSA fees, incurred or associated with the processing, review and evaluation of any revised or additional Submittals required pursuant to this Article 5.3.2; the District may deduct such fees and costs from any portion of the Contract Price then or thereafter due the Contractor. In the event that additional or revised Submittals are required pursuant to this Article 5.3.2, such requirement shall not result in an increase to the Contract Time or the Contract Price.

5.4 Subcontractors' Work. Whenever the Work of a Subcontractor is dependent upon the Work of the Contractor or another Subcontractor, the Contractor shall require the Subcontractor to: (i) coordinate its Work with the dependent Work; (ii) provide necessary dependent data and requirements; (iii) supply and/or install items to build into the dependent Work of others; (iv) make appropriate provisions for dependent Work of others; (v) carefully examine and understand the portions of the Contract Documents (including Drawings, Specifications and Field Clarifications) and Submittals relating to the dependent Work; and (vi) examine the existing dependent Work and verify that the dependent Work is in proper condition for the Subcontractor's Work. If the dependent Work is not in a proper condition, the Subcontractor shall notify the Contractor in writing and not proceed with the Subcontractor's Work until the dependent Work has been corrected or replaced and is in a proper condition for the Subcontractor's Work.

5.5 Prequalification of Subcontractors for State Funded Projects of \$1,000,000 or More. The District's prequalification of all general contractors and/or electrical, mechanical and/or plumbing subcontractors in compliance with Public Contract Code § 20111.6 does not and shall not constitute a recommendation or referral by the District of any prequalified general contractor and/or electrical, mechanical and/or plumbing subcontractor. The District assumes no responsibility for and shall not be liable to Contractor for the acts or omissions of any general contractor and/or electrical, mechanical and/or plumbing subcontractor prequalified in compliance with Public Contract Code § 20111.6, including, without limitation, contractor's pricing, refusal to execute a subcontract, performance of work, quality of work, and/or voluntary

or involuntary bankruptcy or other termination. General contractors and/or electrical, mechanical and/or plumbing subcontractors who have not been prequalified by the District as required by Public Contract Code § 20111.6 and are not on the District's list of prequalified contractors may submit a Prequalification Application to the District in advance of a scheduled Bid Opening, provided that the Prequalification Application is submitted and approved by the District in accordance with the District's Prequalification process and timelines.

5.6 Waiver of Claims. Contractor acknowledges and agrees that it shall bear full responsibility and liability for completing its own due diligence and making its own independent determinations as to whether a general contractor and/or electrical, mechanical and/or plumbing subcontractor is qualified, having the requisite experience and financial wherewithal to perform and complete the subcontract work of the Project, and is responsible, as defined in Public Contract Code § 1103, prior to soliciting bids from and/or contracting with any prequalified general contractors, electrical, mechanical and/or plumbing subcontractors. By executing the Agreement, Contractor hereby waives any and all claims that has, or that may accrue, against the District arising out of or in connection and the District's prequalification of general contractors and/or electrical, mechanical and/or plumbing subcontractors in conformance with Public Contract Code § 20111.6

ARTICLE 6: INSURANCE; INDEMNITY; BONDS

6.1 Workers' Compensation Insurance; Employer's Liability Insurance. The Contractor shall purchase and maintain Workers' Compensation Insurance as will protect the Contractor from claims under workers' or workmen's compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. Contractor shall purchase and maintain Employer's Liability Insurance covering bodily injury (including death) by accident or disease to any employee which arises out of the employee's employment by Contractor. The Employer's Liability Insurance required of Contractor hereunder may be obtained by Contractor as a separate policy of insurance or as an additional coverage under the Workers' Compensation Insurance required to be obtained and maintained by Contractor hereunder. The limits of liability for the Employer's Liability Insurance required hereunder shall be as set forth in the Special Conditions.

6.2 Commercial General Liability and Property Insurance. The Contractor shall purchase and maintain Commercial General Liability and Property Insurance covering the types of claims set forth below which may arise out of or result from Contractor's operations under the Contract Documents and for which the Contractor may be legally responsible: (i) claims for damages because of bodily injury, sickness or disease or death of any person other than the Contractor's employees; (ii) claims for damages insured by usual personal injury liability coverage which are sustained (a) by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor, or (b) by another person; (iii) claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom; (iv) claims for damages because of bodily injury, death of a person or property damages arising out of ownership, maintenance or use of a motor vehicle; (v) contractual liability insurance applicable to the Contractor's obligations under the Contract Documents; (vi) Completed Operations; and (vii) pollution liability.

6.3 Builder's Risk "All-Risk" Insurance. The District shall provide Builder's Risk coverage for materials, supplies and equipment that are intended for specific installation in the Project while such materials, supplies and equipment are located at the Site, in transit or while temporarily located away from the Site for the purpose of repair, adjustment or storage at the risk of an

Insured Party. Such coverage shall insure the interests of the District and the Contractor. Coverage shall include insurance against the perils of fire and extended coverage (theft, vandalism, malicious mischief, collapse, false work, temporary buildings and debris removal, including demolition occasioned by enforcement of any applicable legal requirements).

6.3.1 Exclusions to Builder's Risk Insurance. The Builder's Risk insurance provided by the District shall exclude coverage for (1) loss or damage caused by earthquake, subsidence or flood; (2) loss or damage to tools or clothing of workers; and (3) loss or damage to tools, equipment, protective fencing, scaffolding, temporary structures, coffer damming, pipe stulling or bracing and forms owned, rented, or used in the performance of the Work. The District, its Board of Education, officers, agents, employees, representatives and consultants shall not be liable or responsible for loss or damage to the items listed in (2) and (3) set forth in the foregoing sentence and Contractor shall defend, indemnify and hold harmless the District, its Board of Education, officers, agents, employees, representatives and consultants from claims or causes of action brought by any person or entity arising out of or related to loss or damage to such excluded items.

6.3.2 Deductible for Builder's Risk Insurance. Contractor shall be responsible for the first Two Thousand Five Hundred Dollars (\$2,500) of each loss or damage covered by the Builder's Risk Insurance provided by the District which is caused by the Contractor or any Subcontractor or Sub-Subcontractor or for which the Contractor, Subcontractor or Sub-Subcontractor is liable, and for all uninsured losses. No loss or damage, if any, incurred hereunder shall excuse Contractor's complete and satisfactory performance of the provisions of the Contract Documents.

6.3.3 Contractor Responsibility to Repair Damaged Work. Notwithstanding the provisions of this Article 6.3, and until Final Acceptance of the Work by the District, the Contractor shall have full and complete charge and care of and shall bear all risk of loss of, and injury or damage to, the Work or any portion thereof (including District furnished supplies, material, equipment or other items to be utilized with or incorporated in the Work) to the fullest extent of the law. The Contractor shall rebuild, repair, restore and make good losses of, and injuries or damages to, the Work or any portion thereof (including District furnished supplies, material, equipment or other items to be utilized with or incorporated in the Work) before Final Acceptance of the Work. Such rebuilding, repair or restoration shall be at the Contractor's sole cost and expense; provided, however, that District will make available applicable proceeds from the District's Builder's Risk policy.

6.4 Coverage Amounts. The insurance required of the Contractor hereunder shall be written for not less than any limits of liability specified in the Contract Documents, or required by law, whichever is greater. In the event of any loss or damage covered by a policy of insurance required to be obtained and maintained by the Contractor hereunder, the Contractor shall be solely and exclusively responsible for the payment of the deductible, if any, under such policy of insurance, without adjustment to the Contract Price on account thereof.

6.5 Required Qualifications of Insurers. The Contractor and Subcontractors' policies of Commercial General Liability and Property/Casualty insurance and the Contractor's Builders Risk insurance will be accepted by the District only if the insurer(s) are: (a) A.M. Best rated A- or better; (b) A.M. Best Financial Size Category VII or higher; and (c) authorized under California law to transact business in the State of California and authorized to issue insurance policies in the State of California. If at any time during performance of the Work, the insurer(s) issuing a policy of insurance covering Commercial General Liability or Property/Casualty is/are not A.M. Best rated A- or better and is/are not A.M. Best Financial Size Category VII or higher, the

Contractor or Subcontractor, as applicable shall within thirty (30) days of the District's written notice of the insufficiency of an insurer to the Contractor, obtain insurance coverage(s) from alternative insurer(s) who is/are then A.M. Best rated A- or better and who is/are A.M. Best Financial Size Category VII or higher. If the Contractor fails to deliver Certificate(s) of Insurance from an alternative insurer(s) meeting or exceeding the A.M. Best rating and A.M. Best Financial Size Category set forth above, within thirty (30) days of the date of the District's issuance of a written notice pursuant to the preceding sentence, in addition to any other right or remedy of the District under the Contract Documents or arising by operation of law, the District may withhold disbursement of any Progress Payment otherwise due hereunder until the Contractor has delivered such Certificate(s) of Insurance from an alternative insurer(s).

6.6 Evidence of Insurance; Subcontractor's Insurance.

6.6.1 Certificates of Insurance. Prior to commencing the Work, Contractor shall deliver to the District Certificates of Insurance evidencing the insurance coverages required by the Contract Documents. Failure or refusal of the Contractor to so deliver Certificates of Insurance may be deemed by the District to be a default of a material obligation of the Contractor under the Contract Documents, and thereupon the District may proceed to exercise any right or remedy provided for under the Contract Documents or at law. The Certificates of Insurance and the insurance policies required by the Contract Documents shall contain a provision that coverages afforded under such policies will not be canceled or allowed to expire until at least thirty (30) days prior written notice has been given to the District. The insurance policies required of Contractor hereunder shall also name the District as an additional insured as its interests may appear. The additional Insured acknowledgement shall be submitted as a separate declaration from the Contractor's insurance provider (ACCORD form modifications are not acceptable). Should any policy of insurance be canceled before Final Acceptance of the Work by the District and the Contractor fails to immediately procure replacement insurance as required, the District reserves the right to procure such insurance and to deduct the premium cost thereof and other costs incurred by the District in connection therewith from any sum then or thereafter due the Contractor under the Contract Documents. The Contractor shall, from time to time, furnish the District, when requested, with satisfactory proof of coverage of each type of insurance required by the Contract Documents; failure of the Contractor to comply with the District's request may be deemed by the District to be a default of a material obligation of the Contractor under the Contract Documents.

6.6.2 Subcontractors' Insurance. Contractor shall require that every Subcontractor, to obtain and maintain the policies of insurance set forth in Articles 6.1 and 6.2 of these General Conditions; the coverages and limits of liability of such policies of insurance to be obtained and maintained by Subcontractors shall be as set forth in the Special Conditions. The policies of insurance to be obtained and maintained by Subcontractors hereunder are in addition to, and not in lieu of, Contractor obtaining and maintaining such policies of insurance. Each of the policies of insurance obtained and maintained by a Subcontractor hereunder shall conform to the requirements of this Article 6. Upon request of the District, Contractor shall promptly deliver to the District Certificates of Insurance evidencing that the Subcontractors have obtained and maintained policies of insurance in conformity with the requirements of this Article 6. Failure or refusal of the Contractor to provide the District with Subcontractors' Certificates of Insurance evidencing the insurance coverages required hereunder is a material default of Contractor hereunder.

6.7 Maintenance of Insurance. Any insurance bearing on the adequacy of performance of Work shall be maintained after the District's Final Acceptance of all of the Work for the full one year correction of Work period and any longer specific guarantee or warranty periods set forth in the Contract Documents. Should such insurance be canceled before the end of any such

periods and the Contractor fails to immediately procure replacement insurance as specified, the District reserves the right to procure such insurance and to charge the cost thereof to the Contractor. Nothing contained in these insurance requirements is to be construed as limiting the extent of the Contractor's responsibility for payment of damages resulting from its operations or performance of the Work under the Contract Documents, including without limitation the Contractor's obligation to pay Liquidated Damages. In no instance will the District's exercise of its option to occupy and use completed portions of the Work relieve the Contractor of its obligation to maintain insurance required under this Article until the date of Final Acceptance of the Work by the District, or such time thereafter as required by the Contract Documents. The insurer providing any insurance coverage required hereunder shall be to the reasonable satisfaction of the District.

6.8 Contractor's Insurance Primary. All insurance and the coverages thereunder required to be obtained and maintained by Contractor hereunder, if overlapping with any policy of insurance maintained by the District, shall be deemed to be primary and non-contributing with any policy maintained by the District and any policy or coverage thereunder maintained by District shall be deemed excess insurance. To the extent that the District maintains a policy of insurance covering property damage arising out of the perils of fire or other casualty covered by the Contractor's Builder's Risk Insurance or the Comprehensive General Liability Insurance of the Contractor or any Subcontractor, the District, Contractor and all Subcontractors waive rights of subrogation against the others. The costs for obtaining and maintaining the insurance coverages required herein shall be included in the Contract Price.

6.9 Indemnity. Unless arising out of the sole or active negligence, gross negligence or willful misconduct of the District, the Architect, the Project Inspector or the Project Manager, the Contractor shall indemnify, defend and hold harmless the Indemnified Parties who are: (i) the District and its Board of Education, officers, employees, agents and representatives (including the Project Inspector); (ii) the Architect and its consultants for the Work and their respective agents and employees; and (iii) the Project Manager and its agents and employees. The Contractor's obligations hereunder include indemnity, defense and hold harmless of the Indemnified Parties from and against any and all damages, losses, claims, demands or liabilities whether for damages, losses or other relief, including, without limitation attorneys' fees and costs which arise, in whole or in part, from the Work, the Contract Documents or the acts, omissions or other conduct of the Contractor, any Subcontractor or any person or entity engaged by them for the Work. The Contractor's obligations under the foregoing include without limitation: (i) injuries to or death of persons; (ii) damage to property; or (iii) theft or loss of property; (iv) Stop Payment Notice claims asserted by any person or entity in connection with the Work; and (v) other losses, liabilities, damages or costs resulting from, in whole or part, any acts, omissions or other conduct of Contractor, any of Contractor's Subcontractors, of any tier, or any other person or entity employed directly or indirectly by Contractor in connection with the Work and their respective agents, officers or employees. The obligations of the Contractor, as set forth in (v) above shall include, without limitation losses, costs, expenses, damages and other claims asserted by any other Contractor to the District in connection with the Work or in connection with a work of improvement related to or affected by the Work. If any action or proceeding, whether judicial, administrative, arbitration or otherwise, shall be commenced on account of any claim, demand or liability subject to Contractor's obligations hereunder, and such action or proceeding names any of the Indemnified Parties as a party thereto, the Contractor shall, at its sole cost and expense, defend the named Indemnified Parties in such action or proceeding with counsel reasonably satisfactory to the named Indemnified Parties. In the event that there shall be any judgment, award, ruling, settlement, or other relief arising out of any such action or proceeding to which any of the Indemnified Parties are subject to, or bound by, Contractor shall pay, satisfy or otherwise discharge any such judgment, award, ruling, settlement or relief; Contractor shall indemnify and hold harmless the Indemnified Parties from any and all liability or responsibility

arising out of any such judgment, award, ruling, settlement or relief. The Contractor's obligations hereunder are binding upon Contractor's Performance Bond Surety and these obligations shall survive notwithstanding Contractor's completion of the Work or the termination of the Contract.

6.10 Payment Bond; Performance Bond. Prior to commencement of the Work, the Contractor shall furnish a Performance Bond as security for Contractor's faithful performance of the Contract and a Labor and Material Payment Bond as security for payment of persons or entities performing work, labor or furnishing materials in connection with Contractor's performance of the Work under the Contract Documents. The penal sum of the Performance Bond and the Payment Bond shall each be one hundred percent (100%) of the Contract Price. Said Labor and Material Payment Bond and Performance Bond shall be in the form and content set forth in the Contract Documents. The failure or refusal of the Contractor to furnish either the Performance Bond or the Labor and Material Payment Bond in strict conformity with this Article 6.9 may be deemed by the District as a default by the Contractor of a material obligation hereunder. Upon request of the Contractor, the District may consider and accept, but is not obligated to do so, multiple sureties on such bonds. The Surety on any bond required under the Contract Documents shall be an Admitted Surety Insurer as that term is defined in California Code of Civil Procedure §995.120.

ARTICLE 7: CONTRACT TIME

7.1 Substantial Completion of the Work Within Contract Time. Unless otherwise expressly provided in the Contract Documents, the Contract Time is the period of time, including authorized adjustments thereto, allotted in the Contract Documents for achieving Substantial Completion of the Work. The date for commencement of the Work is the date established by the Notice to Proceed issued by the District pursuant to the Agreement, which shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible. The date of Substantial Completion is the date certified by the Architect and the Project Inspector as such in accordance with the Contract Documents.

7.2 Progress and Completion of the Work.

7.2.1 Time of Essence. Time limits stated in the Contract Documents are of the essence. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing and achieving Substantial Completion of the Work. The Contractor shall employ and supply a sufficient force of workers, material and equipment, and prosecute the Work with diligence so as to maintain progress, to prevent Work stoppage and to achieve Substantial Completion of the Work within the Contract Time.

7.2.2 Substantial Completion. Substantial Completion is that stage in the progress of the Work when the Work is complete in accordance with the Contract Documents so the District can take Beneficial Occupancy. Substantial Completion shall be determined by the Architect, the Project Manager and the Project Inspector upon request by the Contractor in accordance with the Contract Documents. The good faith and reasonable determination of Substantial Completion by the Project Inspector, the Project Manager and the Architect shall be controlling and final.

7.2.3 Correction or Completion of the Work After Substantial Completion.

7.2.3.1 Punchlist. Upon achieving Substantial Completion of the Work, the District, the Project Inspector, the Project Manager, if any, the Architect and the Contractor shall jointly inspect the Work and prepare a comprehensive list of items of the Work to be corrected or completed by the Contractor ("the Punchlist"). The exclusion of, or failure to include, any item on the Punchlist shall not alter or limit the obligation of the Contractor to complete or correct any portion of the Work in accordance with the Contract Documents.

7.2.3.2 Time for Completing Punchlist Items. In addition to establishing the

Punchlist items pursuant to Article 7.2.3.1, the Project Manager, if any, Contractor and Architect shall, after the joint inspection, establish a reasonable time for Contractor's completion of all Punchlist items. If mutual agreement is not reached to establish the time for the Contractor's completion of Punchlist items, the Architect shall determine such time, and in such event, the time determined by the Architect shall be final and binding upon the District and Contractor so long as the Architect's determination is made in good faith. The Contractor shall promptly and diligently proceed to complete all Punchlist items within the time established. If the Contractor fails or refuses, for any reason, to complete all Punchlist items within the time established, Contractor shall be subject to assessment of Liquidated Damages in accordance with Article 7.4 hereof. The foregoing notwithstanding, if the Contractor fails or refuses to complete all Punchlist items, the District may in its sole and exclusive discretion and without further notice to Contractor, elect to cause the completion of all remaining Punchlist items provided, however that such election by the District is in addition to and not in lieu of any other right or remedy of the District under the Contract Documents or at law. If the District elects to complete Punchlist items of the Work, pursuant to the foregoing, Contractor shall be responsible for all costs incurred by the District in connection herewith and the District may deduct such costs from the Contract Price then or thereafter due the Contractor, if these costs exceed the remaining Contract Price due to the Contractor, the Contractor and the Performance Bond Surety are jointly and severally liable to District for any such excess costs.

7.2.4 Final Completion. Final Completion is that stage of the Work when all Work has been completed in accordance with the Contract Documents, including without limitation, all Punchlist items noted upon Substantial Completion, and the Contract has been otherwise fully performed by the Contractor. Final Completion shall be determined by the Architect, Project Manager, if any and the Project Inspector upon request of the Contractor. The good faith and reasonable determination of Final Completion by the Project Inspector, Project Manager, if any, and the Architect shall be controlling and final.

7.2.5 Contractor Responsibility for Multiple Inspections. If the Contractor requests determination of Substantial Completion or Final Completion by the Project Inspector, Project Manager, if any, and the Architect and it is determined by the Project Inspector, Project Manager, if any, or the Architect that the Work does not then justify certification of Substantial Completion or Final Completion and re-inspection is required at a subsequent time to make such determination, the Contractor shall be responsible for all costs of such re-inspection, including without limitation, the fees of the Architect, Project Manager, if any, and the Project Inspector. The District may deduct such costs from the Contract Price then due or thereafter due to the Contractor.

7.2.6 Final Acceptance. Final Acceptance of the Work shall occur upon approval of the Work by the District's Board of Education; such approval shall be submitted for adoption at the next regularly scheduled meeting of the District's Board of Education after the determination of Final Completion. The commencement of any warranty or guarantee period under the Contract Documents is the date upon which the District's Board of Education approves of the Final Acceptance of the Work.

7.3 Construction Schedule.

7.3.1 Preliminary Construction Schedule. Contractor shall prepare and submit to the District, the Project Manager and the Architect a Preliminary Construction Schedule as set forth in Section 01 32 16 of the Contract Specifications. The Contractor may submit a Preliminary Construction Schedule depicting completion of the Work in a duration shorter than the Contract Time; provided that such Preliminary Construction Schedule shall not be a basis for adjustment to the Contract Price in the event that completion of

the Work shall occur after the time depicted therein, nor shall such Preliminary Construction Schedule be the basis for any extension of the Contract Time. The Contractor's entitlement to any extension of the Contract Time shall be based upon the Contract Time and not on any shorter duration which may be depicted in the Contractor's Preliminary Construction Schedule. If the Construction Schedules required under this Article 7.3 incorporate therein any "float" time, such float shall be deemed to jointly belong to and owned by the District and the Contractor. As used herein, "float time" shall be deemed to refer to the time between earliest finish date and the latest finish date of each activity shown on the Construction Schedule. Review of the Preliminary Progress Schedule and any comments thereto by the District, the Project Manager and/or the Architect shall not be deemed to be the assumption of construction means, methods or sequences by the District, the Project Manager or the Architect, all of which remain the Contractor's obligations under the Contract Documents.

7.3.2 Approved Construction Schedule. Contractor shall prepare and submit a Construction Schedule as set forth in Section 01 32 16 of the Contract Specifications. Upon the District's approval of the form and content of a Construction Schedule, the same shall be deemed the "Approved Construction Schedule." The District's approval of a Construction Schedule shall be for the sole and limited purpose of determining conformity with the requirements of the Contract Documents. By the Approved Construction Schedule, the District shall not be deemed to have exercised control over, or approval of, construction means, methods or sequences, all of which remain the responsibility and obligation of the Contractor in accordance with the terms of the Contract Documents. Further, the Approved Construction Schedule shall not operate to limit or restrict any of Contractor's obligations under the Contract Documents nor relieve the Contractor from the full, faithful and timely performance of such obligations in accordance with the terms of the Contract Documents. The activities, commencement and completion dates of activities, and the sequencing of activities depicted on the Approved Construction Schedule shall not be modified or revised by the Contractor without the prior consent, or direction, of the District and the Architect. Updates to the Approved Construction Schedule shall not be deemed revisions to the Approved Construction Schedule. In the event that the Approved Construction Schedule shall depict completion of the Work in a duration shorter than the Contract Time, the same shall not be a basis for an adjustment of the Contract Time or the Contract Price in the event that actual completion of the Work shall occur after such the time depicted in such Approved Construction Schedule. In such event, the Contract Price shall not be subject to adjustment on account of any additional costs incurred by the Contractor to complete the Work prior to the Contract Time, as adjusted in accordance with the terms of the Contract Documents. Any adjustment of the Contract Time or the Contract Price shall be based upon the Contract Time set forth in the Contract Documents and not any shorter duration which may depicted in the Approved Construction Schedule.

7.3.3 Revisions to Approved Construction Schedule. In the event that the progress of the Work or the sequencing of the activities of the Work shall materially differ from that indicated in the Approved Construction Schedule, as determined by the District in its reasonable discretion and judgment, the District may direct the Contractor to revise the Approved Construction Schedule; within fifteen (15) days of the District's direction, the Contractor shall prepare and submit to the Architect and the Project Manager a revised Approved Construction Schedule, for review and approval by the District. The Contractor may request consent of the District to revise the Approved Construction Schedule. Any such request shall be considered by the District only if in writing setting forth the Contractor's proposed revision(s) to the Approved Construction Schedule and the reason(s) therefor. The District may consent to, or deny, any such request of the Contractor to revise the Approved Construction Schedule in its reasonable discretion.

7.3.4 Updates to Approved Construction Schedule. The Contractor shall monitor and

update the Approved Construction Schedule on a monthly basis, or more frequently as required by the conditions or progress of the Work, or as may be requested by the District. The Contractor shall provide the District, the Project Manager and the Architect with updated Approved Construction Schedules indicating progress achieved and activities commenced or completed within the prior updated Approved Construction Schedule. Updates to the Approved Construction Schedule shall not include any revisions to the activities, commencement and completion dates of activities or the sequencing of activities depicted on the Approved Construction Schedule. Any such revisions to the Approved Construction Schedule shall result in the District's rejection of such update and Contractor shall, within seven (7) days of the District's rejection of such update, submit to the Architect and the Project Manager an Updated Approved Construction Schedule which does not incorporate any such revisions. If requested by the District, the Contractor shall also submit, with its updates to the Approved Construction Schedule a narrative statement including a description of current and anticipated problem areas of the Work, delaying factors and their impact, and an explanation of corrective action taken or proposed by the Contractor. If the progress of the Work is behind the Approved Construction Schedule, the Contractor shall indicate what measures will be taken to place the Work back on schedule. The District may, from time to time, and in the District's sole and exclusive discretion, transmit to the Contractor's Performance Bond Surety the Approved Construction Schedule, any updates thereof and the narrative statement described hereinabove. The District's election to transmit, or not to transmit such information, to the Contractor's Performance Bond Surety shall not limit the Contractor's obligations under the Contract Documents.

7.3.5 Contractor Responsibility for Construction Schedule. The Contractor shall be responsible for the preparation, submittal and maintenance of the Construction Schedules required by the Contract Documents, and any failure of the Contractor to do so may be deemed by the District as the Contractor's default in the performance of a material obligation under Contract Documents. Any and all costs or expenses required or incurred to prepare, submit, maintain, and update the Construction Schedules shall be solely that of the Contractor and no such cost or expense shall be charged to the District. The Contract Price shall not be subject to adjustment on account of costs, fees or expenses incurred or associated with the Contractor's preparation, submittal, maintenance or updating of the Construction Schedules.

7.4 Adjustment of Contract Time. If Substantial Completion is delayed, adjustment, if any, to the Contract Time on account of such delay shall be in accordance with this Article 7.4.

7.4.1 Excusable Delays. If Substantial Completion of the Work is delayed by Excusable Delays, the Contract Time shall be subject to adjustment for such reasonable period of time as determined by the Architect; Excusable Delays shall not result in any increase in the Contract Price. Excusable Delays refer to unforeseeable and unavoidable casualties or other unforeseen causes beyond the control, and without fault or neglect, of the Contractor, any Subcontractor, Material Supplier or other person directly or indirectly engaged by the Contractor in performance of any portion of the Work. Excusable Delays include unanticipated and unavoidable labor disputes, unusual and unanticipated delays in transportation of equipment, materials or Construction Equipment reasonably necessary for completion and proper execution of the Work, unanticipated unusually severe weather conditions or DSA directive to stop the Work. Neither the financial resources of the Contractor or any person or entity directly or indirectly engaged by the Contractor in performance of any portion of the Work shall be deemed conditions beyond the control of the Contractor. If an event of Excusable Delay occurs, the Contract Time shall be subject to adjustment hereunder only if the Contractor establishes: (i) full compliance with all applicable provisions of the Contract Documents relative to the method, manner and time for Contractor's notice and request for

adjustment of the Contract Time; (ii) that the event(s) forming the basis for Contractor's request to adjust the Contract Time are outside the reasonable control and without any fault or neglect of the Contractor or any person or entity directly or indirectly engaged by Contractor in performance of any portion of the Work; and (iii) that the event(s) forming the basis for Contractor's request to adjust the Contract Time directly and adversely impacted the progress of the Work as indicated in the Approved Construction Schedule or the most recent updated Approved Construction Schedule relative to the date(s) of the claimed event(s) of Excusable Delay. The foregoing provisions notwithstanding, if the Special Conditions set forth a number of "Rain Days" to be anticipated during performance of the Work, the Contract Time shall not be adjusted for rain related unusually severe weather conditions until and unless the actual number of Rain Days during performance of the Work exceeds those noted in the Special Conditions and such additional Rain Days directly and adversely impact the critical path progress of the Work as depicted in the Approved Construction Schedule or the most recent updated Approved Construction Schedule relative to the date(s) of such additional Rain Days.

7.4.2 Compensable Delays. If Substantial Completion of the Work is delayed and such delay is caused by the acts or omissions of the District, the Architect, or separate contractor employed by the District (collectively "Compensable Delays"), upon Contractor's request and notice, in strict conformity with Articles 7 and 9 of these General Conditions, the Contract Time will be adjusted by Change Order for such reasonable period of time as determined by the Architect and the District. In accordance with California Public Contract Code §7102, if the Contractor's progress is delayed by any of the events described in the preceding sentence, Contractor shall not be precluded from the recovery of damages directly and proximately resulting therefrom, provided that the District is liable for the delay, the delay is unreasonable under the circumstances involved and the delay was not within the reasonable contemplation of the District and the Contractor at the time of execution of the Agreement. In such event, Contractor's damages, if any, shall be limited to direct, actual and unavoidable additional costs of labor, materials or Construction Equipment directly resulting from such delay, and shall exclude indirect or other consequential damages, including without limitation, home office expenses, bond capacity impairment or loss of prospective economic advantage. In no event shall Contractor seek costs or damages for delays, interruptions, hindrances or disruptions to the Work for on-Site or off-Site costs or damages based upon formulas, e.g. Eichleay or other formula. Except as expressly provided for herein, Contractor shall not have any other claim, demand or right to adjustment of the Contract Price arising out of delay, interruption, hindrance or disruption to the progress of the Work. Adjustments to the Contract Price and the Contract Time, if any, on account of Changes to the Work or Suspension of the Work shall be governed by the applicable provisions of the Contract Documents, including without limitation, Articles 9 and 14 of these General Conditions.

7.4.3 Unexcusable Delays. Unexcusable Delays refer to any delay to the progress of the Work caused by events or factors other than those specifically identified in Articles 7.4.1 and 7.4.2 above. Neither the Contract Price nor the Contract Time shall be adjusted on account of Unexcusable Delays.

7.4.4 Procedure for Adjustment of Contract Time. The Contract Time shall be subject to adjustment only in strict conformity with applicable provisions of the Contract Documents. Failure of Contractor to request adjustment(s) of the Contract Time in strict conformity with applicable provisions of the Contract Documents shall be deemed Contractor's waiver of the same.

7.4.5 Limitations Upon Adjustment of Contract Time on Account of Delays. Any adjustment of the Contract Time on account of an Excusable Delay or a Compensable Delay shall be limited as set forth herein. If an Excusable Delay and a Compensable Delay occur concurrently, the maximum extension of the Contract Time shall be the number of days from the commencement of the first delay to the cessation of the delay

which ends last. If an Unexcusable Delay occurs concurrently with either an Excusable Delay or a Compensable Delay, the maximum extension of the Contract Time shall be the number of days, if any, which the Excusable Delay or the Compensable Delay exceeds the period of time of the Unexcusable Delay. In addition to the foregoing limitations upon extension of the Contract Time, no adjustment of the Contract Time shall be made on account of any Excusable Delays or Compensable Delays unless such delay(s) actually and directly impact Work or Work activities on the critical path of the then current and updated Approved Construction Schedule as of the date on which such delay first occurs. The District shall not be deemed in breach of, or otherwise in default of any obligation hereunder, if the District shall deny any request by the Contractor for an adjustment of the Contract Time for any delay which does not actually and directly impact Work or Work activities on the critical path of the then current and updated Approved Construction Schedule.

7.5 Liquidated Damages. Pursuant to Government Code §53069.85, should the Contractor not achieve Substantial Completion of the Work within the Contract Time, as adjusted, or to complete a Milestone in accordance with the times specified or provided for in the Contract Documents, the Contractor shall forfeit and pay to the District the amount of per diem Liquidated Damages set forth in the Special Conditions, for every day beyond the Contract Time, as adjusted, or Milestone, the Work is achieved. Any such Liquidated Damages are automatically and without notice of any kind forfeited by Contractor upon the accrual of each day of delay. The District may at any time deduct Liquidated Damages from any payments due or to become due to the Contractor. Neither the District's failure or delay in deducting Liquidated Damages from payments otherwise due the Contractor, nor the District's failure or delay in notifying Contractor of the forfeiture of Liquidated Damages, shall be deemed a waiver of the District's right to Liquidated Damages. The Contractor and the Surety shall be liable for and pay to the District the entire amount of Liquidated Damages including any portion that exceeds the amount of the Contract Price then held, retained or controlled by the District. The Contractor and District acknowledge and agree that the Liquidated Damages and the provisions of this Article 7.5 are reasonable and necessary under the circumstances existing at the time this Contract is made because of the difficulty of fixing the District's actual damages in the event of delayed completion of the Work. The Contractor and the District agree that the Liquidated Damages do not constitute a penalty.

7.6 District Right to Take-Over Work.

7.6.1 Progress of Work. Unless caused by the District, Architect, Project Manager or the Project Inspector, if the Contractor fails or refuses, for any reason and at any time, to furnish adequate materials, labor, equipment or services to maintain progress of the Work in accordance with the then current Construction Schedule after seventy-two (72) hour advance written notice from the Project Manager to the Contractor of its failure or refusal, the District may, without terminating the Contract or waiving, limiting or conditioning any right or remedy of the District, thereafter furnish or cause to be furnished such materials, labor, equipment or services necessary to maintain progress of the Work in accordance with the then current Construction Schedule. All costs, expenses or other charges (whether direct, indirect and administrative) incurred by the District in furnishing such materials, labor, equipment or services shall be at the sole cost of the Contractor and the District may deduct the same from the Contract Price then or thereafter due the Contractor. The District's exercise of rights pursuant to the foregoing shall not be deemed a waiver or limitation of any other right or remedy of the District under the Contract Documents.

7.6.2 Non-exclusive Remedy. The District's exercise of rights pursuant to the foregoing

shall not be deemed a waiver or limitation of any other right or remedy of the District under the Contract Documents or the Laws.

ARTICLE 8: CONTRACT PRICE

8.1 Contract Price. The Contract Price is the amount stated in the Agreement and subject to adjustments thereto in accordance with the Contract Documents, is the total amount payable by the District to the Contractor for completion of the Work and other obligations of the Contractor under the Contract Documents. The District's payment of the Contract Price to the Contractor shall be in accordance with the Contract Documents.

8.2 Cost Breakdown (Schedule of Values). Contractor shall furnish a detailed and complete tabular Cost Breakdown (Schedule of Values) of the Contract Price consistent with the cost-loaded work activities included in the Approved Construction Schedule. In preparing the Cost Breakdown, Contractor shall carefully list the true cost of each activity or item for which payment will be requested. The Contractor shall not "front-load" the Cost Breakdown with false dollar amounts for activities to be performed in the early stages of the Project. The District may, in its sole discretion, utilize the costs listed in the Cost Breakdown (Schedule of Values) as the true cost of items to be deducted from the Contract Price through credit or deductive Change Order. The values for each line item shall include the amount of overhead and profit applicable to each item of work and shall include, at a minimum, a breakdown between rough and finish Work for the basic trades as well as individual dollar figures for large dollar equipment and materials to be installed or furnished for the Project. No individual line item or scope of work in the Cost Breakdown shall exceed \$50,000, except with the express, written consent of the District. Exceptions will be given by the District for a single item of Equipment for which the true cost exceeds \$50,000. The Cost Breakdown shall be subject to the District's review and approval of the form and content thereof. Upon request, Contractor shall provide District with data and documentation substantiating the accuracy of the proposed line items. In the event that the District shall reasonably object to any portion of the Cost Breakdown, within ten (10) days of the District's receipt of the Cost Breakdown, the District shall notify the Contractor, in writing of the District's objection(s) to the Cost Breakdown together with any request for substantiating data or documentation. Within five (5) days of the date of the District's written objection(s) and request for substantiating data and documentation, Contractor shall submit a revised Cost Breakdown to the District for review and approval together with the requested data and documentation. The foregoing procedure for the preparation, review and approval of the Cost Breakdown shall continue until the District has approved of the entirety of the Cost Breakdown. Once the Cost Breakdown is approved by the District, the Cost Breakdown shall not be thereafter modified or amended by the Contractor without the prior consent and approval of the District, which may be granted or withheld in the sole reasonable discretion of the District. Notwithstanding any provision of the Contract Documents to the contrary, payment of the Contractor's overhead, supervision and general conditions costs and profit, as such items are reflected in the Cost Breakdown, shall be made incrementally as included in the activities included in

8.3 Progress Payments.

8.3.1 Applications for Progress Payments. During the Contractor's performance of the Work, the Contractor shall submit monthly, on the first working day of each month, to the District, Project Inspector, Project Manager, if any, and the Architect, Applications for Progress Payments ("Payment Applications"), on forms approved by the District, setting forth an itemized estimate of Work completed in the preceding month for the purpose of the District's making of Progress Payments thereon. Values utilized in the Payment Applications shall be based upon the District approved Cost Breakdown pursuant to Article 8.2 above provided that such values are only for determining the basis of Progress Payments to Contractor, and shall not be considered as fixing a basis for adjustments,

whether additive or deductive, to the Contract Price, or for determining the extent of Work actually completed.

8.3.2 Payment Application Review for Determination of Proper Payment Application.

In accordance with Public Contract Code §20104.50, upon receipt of an Application for Progress Payment, the District shall cause the same to be reviewed by the Project Inspector, the Project Manager, if one is designated by the District, and the Architect, as soon as is practicable after receipt of such Application for Progress Payment. Such review shall be for the purpose of determining that the Application for Progress Payment is a proper Progress Payment request. For purposes of this Article 8.3.2, an Application for Progress Payment shall be deemed "proper" only if it is submitted on the form approved by the District, with all of the requested information of such form of Application for Progress Payment completely and accurately provided by the Contractor and such completed Application for Progress Payment is accompanied by: (i) duly completed and executed forms of Conditional Waiver and Release of Rights Upon Progress Payment in accordance with California Civil Code §8132 of the Contractor, all Subcontractors of any tier, and Material Suppliers covering the Progress Payment requested; (ii) duly completed and executed forms of Unconditional Waiver and Release of Rights upon Progress Payment in accordance with California Civil Code §8134 of the Contractor, all Subcontractors of any tier, and Material Suppliers covering the Progress Payment received by the Contractor under the prior Application for Progress Payment; (iii) a certification by the Contractor that it has continuously maintained, or caused to be maintained, the Record Drawings reflecting the actual as-built conditions of the Work performed for which the Progress Payment is requested, it being understood that such certification is subject to verification by the District, Architect or the Project Manager prior to disbursement of the Progress Payment; and (iv) an updated Construction Schedule in accordance with Article 7.3.4 of the General Conditions and Section 013213; and (v) updated measures to achieve scheduled completion, if requested by the District pursuant to Article 7.3.4. In accordance with Public Contract Code §20104.50, an Application for Progress Payment determined by the District not to be a proper Application for Progress Payment shall be returned by the District to the Contractor as soon as is practicable after receipt of the same from the Contractor, but in no event not more than seven (7) days after the District's receipt thereof. The District's return of any Application for Progress Payment pursuant to the preceding sentence shall be accompanied by a written document setting forth the reason(s) why the Application for Progress Payment is not proper.

8.3.3 Verification of Work Completed. Upon receipt of a Payment Application, the Architect, Project Manager, if any and the Project Inspector shall inspect and verify the Work to determine whether it has been performed in accordance with requirements of the Contract Documents and to determine the portion of the Payment Application which is properly due to the Contractor under the terms of the Contract Documents.

8.3.4 District's Disbursement of Progress Payments.

8.3.4.1 Timely Disbursement of Progress Payments. Pursuant to Public Contract Code §20104.50, within thirty (30) days after the District's receipt of a proper Payment Application, there shall be paid, by District, to Contractor a sum equal to ninety-five percent (95%) of the value of the Work indicated in the Payment Application which is actually in place as of the date of the Payment Application, as verified by the Project Inspector, Project Manager, if any, and the Architect and the pro rata portion of the Contractor's overhead, supervision and general conditions costs and profit for that month; provided, however, that the District's obligation to disburse any Progress Payment shall be subject to the District's receipt of all documents set forth in Article 8.3.2 above, each and all of which are conditions precedent to the District's obligation to disburse Progress Payments. If a Payment Application is determined not to be proper due to the

failure or refusal of the Contractor to submit documents with the Payment Application, as required by Article 8.3.2, or incompleteness or inaccuracies in any such documents submitted or if it is reasonably determined that the Record Drawings have not been continuously maintained to reflect the actual as built conditions of the Work completed in the period for which the Progress Payment is requested, the thirty (30) day period hereunder for the District's timely disbursement of a Progress Payment is deemed to commence on the date that the District is actually in receipt of documents not submitted with the Payment Application, or corrections to documents with the Payment Application so as to render them complete and accurate, or the date upon which the Contractor accurately and fully completes preparation of the Record Drawings relating to the Work for which the Progress Payment is requested.

8.3.4.2 Untimely Disbursement of Progress Payments. Pursuant to Public Contract Code §20104.50, if the District fails to make a Progress Payment within thirty (30) days after receipt of an undisputed and proper Payment Application, the District shall pay the Contractor interest on the undisputed amount of such Payment Application at the legal rate of interest set forth in California Code of Civil Procedure §685.010(a). The foregoing notwithstanding, if the District determines that any Payment Application is not proper, pursuant to Article 8.3.2 above, and the District does not return such Payment Application within the seven (7) day period provided for in Article 8.3.2, the period of time for the District's disbursement of the Progress Payment on such Payment Application without incurring interest liability shall be reduced by the number of days exceeding the seven (7) day return period.

8.3.4.3 District's Right to Disburse Payments by Joint Checks. The District, may, in its sole discretion, issue joint checks to the Contractor and Subcontractors/Material Suppliers in satisfaction of its obligation to make Progress Payments or the Final Payment due hereunder.

8.3.4.4 No Waiver of Defective or Non-Conforming Work. The approval of any Payment Application or the disbursement of any Progress Payment to the Contractor shall not be deemed nor constitute acceptance of defective or non-conforming Work.

8.3.5 Progress Payments for Changed Work. The Contractor's Payment Applications may include requests for payment on account of Changes in the Work which have been properly authorized and approved by the Project Inspector, the Architect and all other governmental agencies with jurisdiction over such Change in accordance with the terms of the Contract Documents and for which a Change Order has been issued. Except as provided for herein, no other payment shall be made by the District for Changes in the Work.

8.3.6 Materials or Equipment Not Incorporated Into the Work.

8.3.6.1 Limitations Upon Payment. Except as expressly provided for herein, no payments shall be made by the District on account of any item of the Work, including without limitation, materials or equipment which, at the time of the Contractor's submittal of a Payment Application, has/have not been incorporated into and made a part of the Work.

8.3.6.2 Materials or Equipment Delivered and Stored at the Site. The District may, in its sole and exclusive discretion, make payment for materials or equipment not yet incorporated into the Work if, at or prior to the time of the Contractor's submittal of a Payment Application requesting payment for such materials or equipment if all of the following are complied with: (i) the materials or equipment have been delivered to the Site; (ii) adequate arrangements, reasonably satisfactory to the District, have been made by the Contractor to store and protect such materials or equipment at the Site including without limitation,

insurance reasonably satisfactory to the District, covering and protecting against the risk of loss, destruction, theft or other damage to such materials or equipment while in storage; and (iii) the establishment of procedures reasonably satisfactory to the District by which title to such materials or equipment will be vested in the District upon the District's payment therefor. The Contractor acknowledges that the discretion to make, or not to make, payment for materials or equipment delivered or stored at the Site pursuant to the preceding sentence shall be exercised exclusively by the District; the District's exercise of discretion not to make payment shall not be deemed the District's default hereunder. If the District elects to make payment for materials or equipment delivered and stored at the Site, the costs and expenses incurred to comply with the requirements of (ii) and (iii) of this Article 8.3.6.2 shall be borne solely and exclusively by the Contractor and no payment shall be made by the District on account of such costs and expenses.

8.3.6.3 Materials or Equipment Not Delivered or Stored at the Site. No payments shall be made by the District for materials or equipment to be incorporated into the Work where such materials or equipment have not been delivered or stored at the Site or which are in the process of fabrication or transportation to the Site.

8.3.6.4 Materials or Equipment in Fabrication or Transit. The provisions of this Article 8.3.6.4 notwithstanding, the District shall not make any payment on account of any materials or equipment which are in the process of being fabricated or which are in transit to the Site or other storage location.

8.3.7 Exclusions From Progress Payments. In addition to the District's right to withhold disbursement of any Progress Payment provided for in the Contract Documents, neither the Contractor's Payment Application shall include, nor shall the District be obligated to disburse any portion of the Contract Price for amounts which the Contractor does not intend to pay any Subcontractor or Material Supplier because of a dispute or any other reason.

8.3.8 Title to Work. The Contractor warrants that title to all Work covered by a Payment Application will pass to the District no later than the time of payment. The Contractor further warrants that upon submittal of a Payment Application, all Work for which a Progress Payment has been previously disbursed and the Contractor has received payment from the District therefor shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, stop notices, security interests or encumbrances in favor of the Contractor, Subcontractors, Material Suppliers or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

8.3.9 Substitute Security for Retention. Pursuant to California Public Contract Code §22300, eligible and equivalent securities may be substituted for any monies withheld by the District to ensure the Contractor's performance under the Contract Documents at the request and expense of the Contractor and in conformity with the provisions of California Public Contract Code §22300. The foregoing and the provisions of California Public Contract Code §22300 notwithstanding, failure of the Contractor to request the substitution of eligible and equivalent securities for monies to be withheld by the District within ten (10) days following the date of award of the Contract to Contractor shall be deemed a waiver of such right.

8.4 Final Payment.

8.4.1 Application for Final Payment. When the Contractor has achieved Final Completion of the Work and has otherwise fully performed its obligations under the Contract Documents, the Contractor shall submit an Application for Final Payment on such form as approved by the District. Thereupon, the Architect, Project Manager, if

any, and the Project Inspector will promptly make a final inspection of the Work and when the Architect, Project Manager, if any and the Project Inspector find the Work acceptable under the Contract Documents and that the Contract has been fully performed by the Contractor, the Architect, Project Manager, if any, and the Project Inspector will thereupon promptly approve the Application for Final Payment, stating that to the best their knowledge, information and belief, the Work has been completed in accordance with the terms of the Contract Documents. The Final Payment shall include the remaining balance of the Contract Price and any retention from Progress Payments previously withheld by the District.

8.4.2 Conditions Precedent to Disbursement of Final Payment. Neither Final Payment nor any remaining Contract Price shall become due until the Contractor submits to the District each and all of the following, the submittal of which are conditions precedent to the District's obligation to disburse the Final Payment: (i) an affidavit or certification by the Contractor that payrolls, bills for materials and other indebtedness incurred in connection with the Work for which the District or the District's property may or might be responsible or encumbered have been paid or otherwise satisfied; (ii) a certificate evidencing that insurance required by the Contract Documents to remain in force after the Contractor's receipt of Final Payment is currently in effect; (iii) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover any period following Final Payment as required by the Contract Documents; (iv) consent of the Surety on the Labor and Material Payment Bond and Performance Bond, to Final Payment if required; (v) duly completed and executed forms of Conditional or Unconditional Waivers and Releases of rights upon Final Payment of the Contractor, Subcontractors/Material Suppliers in accordance with California Civil Code §§8136 and 8138, with each of the same stating that there are, or will be, no claims for additional compensation after disbursement of the Final Payment; (vi) Operations and Maintenance manuals and separate warranties provided by any manufacturer or distributor of any materials or equipment incorporated into the Work; (vii) the Record Drawings; (viii) the form of Guarantee included in the Contract Documents duly executed by an authorized representative of the Contractor; (ix) any and all other items or documents required by the Contract Documents to be delivered to the District upon completion of the Work; (x) the completion and submittal of all reports required by the Contract Documents, including without limitation, verified reports required by applicable provisions of the California Code of Regulations; and (xi) if required by the District, such other data establishing payment or satisfaction of obligations such as receipts, releases and waivers of liens, stop notices, claims, security interest or encumbrances arising out of the Contract to the extent and in such form as may be required by the District.

8.4.3 Disbursement of Final Payment. Provided that the District is then in receipt of all documents and other items in Article 8.4.2 above as conditions precedent to the District's obligation to disburse Final Payment, not later than sixty (60) days following Final Acceptance the District shall disburse the Final Payment to the Contractor. Pursuant to California Public Contract Code §7107, if there is any dispute between the District and the Contractor at the time that disbursement of the Final Payment is due, the District may withhold from disbursement of the Final Payment an amount not to exceed one hundred fifty percent (150%) of the amount in dispute. If the Contractor fails to timely submit completed DSA Reports in accordance with Article 4.21.1 above, the Final Payment due the Contractor shall be reduced in accordance with Article 4.21.2 above.

8.4.4 Claims Asserted After Final Payment. Any lien, stop notice or other claim filed or asserted after the Contractor's acceptance of the Final Payment by any Subcontractor, laborer, Material Supplier or others in connection with or for Work performed under the Contract Documents shall be the sole and exclusive responsibility of the Contractor and the Surety. The Contractor and Surety shall indemnify, defend and hold harmless the District and its officers, agents, representatives and employees from and against any

claims, demands or judgments arising or associated therewith, including without limitation attorney's fees incurred by the District in connection therewith.

8.5 Withholding of Payments. The District may withhold any Progress Payment or the Final Payment, in whole or in part, or backcharge the Contractor to the extent it may deem advisable to protect the District on account of: (i) defective Work or Work not in conformity with the requirements of the Contract Documents which is not remedied; (ii) failure of the Contractor to make payments when due Subcontractors/Material Suppliers; (iii) claims filed or reasonable evidence of the probable filing of claims by Subcontractors, laborers, Material Suppliers, or others performing any portion of the Work under the Contract Documents for which the District may be liable or responsible including, without limitation, Stop Notice Claims filed with the District pursuant to California Civil Code §9350 et seq.; (iv) a reasonable doubt that the Contract can be completed for the then unpaid balance of the Contract Price; (v) tax demands filed in accordance with California Government Code §12419.4; (vi) other claims, penalties and/or forfeitures for which the District is required or authorized to retain funds otherwise due the Contractor; (vii) any amounts due from the Contractor to the District under the terms of the Contract Documents; or (viii) the Contractor's failure to perform any of its obligations under the Contract Documents, its default under the Contract Documents or its failure to maintain adequate progress of the Work. In addition to the foregoing, the District shall not be obligated to process any Payment Application or Application for Final Payment, nor shall Contractor be entitled to any Progress Payment or Final Payment so long as any lawful or proper direction concerning the Work or the performance thereof or any portion thereof, given by the District, the Project Inspector, the Architect or any public authority having jurisdiction over the Work, or any portion thereof, shall not be fully and completely complied with by the Contractor. When the District is reasonably satisfied that the Contractor has remedied any such deficiency, payment shall be made of the amount withheld.

8.6 Payments to Subcontractors. The Contractor shall pay all Subcontractors for and on account of Work of the Contract performed by such Subcontractors in accordance with the terms of their respective subcontracts and as provided for pursuant to California Public Contract Code §10262, the provisions of which are deemed incorporated herein by this reference. If the Contractor fails to make payment to Subcontractors in conformity with California Public Contract Code §10262, the provisions of California Public Contract Code §10253 shall apply; by this reference, the provisions of California Public Contract Code §10253 are incorporated herein in its entirety, except that the references in said Section 10253 to "the director" shall be deemed to refer to the District. The Contractor shall timely make payment of retention due Subcontractors in accordance with Public Contract Code §7107.

8.7 Computerized Job Cost Reporting System.

8.7.1 Job Cost Reporting. The Contractor and each Subcontractor with a Subcontract valued at One Million Dollars (\$1.0M) or greater shall maintain a computerized job cost reporting system conforming to the requirements set forth herein. The computer program(s) utilized by the Contractor and applicable Subcontractors shall be subject to the review and acceptance by the District. The job cost reporting systems for the Work shall be updated in regular intervals of not more than one (1) calendar month.

8.7.2 Job Cost Reporting System Requirements. The computerized job cost programs utilized by the Contractor and applicable Subcontractors shall conform and comply with generally accepted accounting principles applied in a consistent manner and with recognized and generally accepted construction industry accounting standards, guidelines and procedures. The job cost reporting system format and configuration shall follow the general format of the District approved Cost Breakdown and budgets established for each line item shall be traceable to a bid estimate of costs. The job cost reporting systems utilized by the Contractor and applicable Subcontractors shall be

capable of: (i) providing overall cost status on a monthly and cumulative basis; (ii) providing comparative analysis of the original budgeted costs, actual costs, remaining budget, and projected cost of completion; the job cost reporting system shall be capable of providing comparative analysis for individual line items and the totality of the Work reflected in the job cost report and; (ii) tracking adjustments to original budget amounts for Changes to the Work (including, without limitation, issued, pending and potential Change Orders).

8.7.3 Job Cost System Information. Upon request of the District, the Contractor and applicable Subcontractors shall make available written job cost reports and/or provide the District with the electronic files of the then current or requested job cost report. The Contractor's obligations hereunder are material.

ARTICLE 9: CHANGES

9.1 Changes in the Work. The District, at any time, by written order, may make Changes within the general scope of the Work under the Contract Documents or issue additional instructions, require additional Work or direct deletion of Work. The Contractor shall not proceed with any Change involving an increase or decrease in the Contract Price or the Contract Time without prior written authorization from the District. The foregoing notwithstanding, the Contractor shall promptly commence and diligently complete any Change to the Work subject to the District's written authorization issued pursuant to the preceding sentence; the Contractor is not relieved or excused from its obligation to promptly commence and diligently complete any Change subject to the District's written authorization by virtue of the absence or inability of the Contractor and the District to agree upon the extent of any adjustment to the Contract Time or the Contract Price on account of such Change. The issuance of a Change Order pursuant to this Article 9 in connection with any Change authorized by the District under this Article 9.1 is not a condition precedent to Contractor's obligation to promptly commence and diligently complete any such Change authorized by the District hereunder. The District's right to make Changes shall not invalidate the Contract nor relieve the Contractor of any liability or other obligations under the Contract Documents. Any requirement of notice of Changes in the scope of Work to the Surety shall be the responsibility of the Contractor. Changes to the Work depicted or described in the Drawings or the Specifications shall be subject to approval by the DSA. The District may make Changes to bring the Work or the Project into compliance with environmental requirements or standards established by Laws enacted after award of the Contract.

9.2 Construction Change Directive. A Construction Change Directive is a written instrument issued by or on behalf of the District directing a Change to the Work prior to the Contractor and District reaching full agreement on an adjustment of the Contract Time and/or Contract Price on account of such Change. The Contractor shall promptly commence and diligently complete any Change to the Work subject to a Construction Change Directive issued hereunder. The issuance of a Change Order pursuant to this Article 9 in connection with any Construction Change Directive authorized by the District is not a condition precedent to Contractor's obligation to promptly commence and diligently complete any such Construction Change Directive. Upon completion of the Work subject to a Construction Change Directive, if the Contractor and District have not agreed on the adjustment of Contract Time and/or Contract Price for such Change, District shall issue a Unilateral Change Order pursuant to this Article 9.

9.3 Oral Order of Change in the Work. Any oral order, direction, instruction, interpretation, or determination from the District or the Architect which in the opinion of the Contractor constitutes a Change to the Work, or otherwise requires an adjustment to the Contract Price or the Contract Time, shall be treated as a Change only if the Contractor gives the Architect, Project Manager, if any and the Project Inspector written notice within ten (10) days of the order, directions, instructions, interpretation or determination and prior to acting in accordance therewith. Time is of the essence in Contractor's written notice pursuant to the preceding

sentence. Accordingly, Contractor acknowledges that its failure, for any reason, to give written notice within ten (10) days of such order, direction, instruction, interpretation or determination is the Contractor's waiver of any right to assert or claim any entitlement to an adjustment of the Contract Time or the Contract Price on account of such order, direction, instruction, interpretation or determination. The written notice shall state the date, circumstances, extent of adjustment to the Contract Price or the Contract Time, if any, requested, and the source of the order, directions, instructions, interpretation or determination that the Contractor regards as a Change. Unless the Contractor acts in strict accordance with this procedure, any such order, direction, instruction, interpretation or determination shall not be treated as a Change and the Contractor waives any claim for any adjustment to the Contract Price or the Contract Time on account thereof.

9.4 Contractor Submittal of Data. Within thirty (30) days after receipt of a written order directing a Change in the Work or furnishing the written notice regarding any oral order directing a Change in the Work, the Contractor shall submit to the Architect, Project Manager, if any, the Project Inspector and the District a detailed written statement setting forth the general nature of the Change, the adjustment to the Contract Price on account thereof, properly itemized and supported by sufficient substantiating data to permit evaluation of the same, and the extent of adjustment of the Contract Time, if any, required by such Change. No claim or adjustment to the Contract Price or the Contract Time shall be allowed if not asserted by the Contractor in strict conformity herewith or if asserted after Final Payment is made under the Contract Documents.

9.5 Adjustment to Contract Price and Contract Time on Account of Changes to the Work.

9.5.1 Adjustment to Contract Price. Adjustments to the Contract Price due to Changes in the Work shall be determined by application of one of the following methods, in the following order of priority. Costs computed to any of the following methods shall exclude: (i) fees, salaries or other compensation for: field/office supervisory personnel, project engineers, scheduler, estimator, drafting/detailing; (ii) vehicles not directly engaged in performance of a Change; (iii) field/home office expenses, including personnel, materials, supplies, etc.; (iv) on-Site or off-Site trailer, storage costs (whether rented, leased or owned); and (v) except as incorporated into an applicable Prevailing Wage Rate for labor required to complete a Change, insurance (including without limitation, general liability, automobile liability, employer's liability and workers compensation)

9.5.1.1 Mutual Agreement. By negotiation and mutual agreement, on a lump sum basis, between the District and the Contractor on the basis of the estimate of the actual and direct increase or decrease in costs on account of the Change. Upon request of the District, Project Manager, if any, or the Architect, the Contractor shall provide a detailed estimate of increase or decrease in costs directly associated with performance of the Change along with cost breakdowns of the components of the Change and supporting data and documentation. The Contractor's estimate of increase or decrease in costs pursuant to the foregoing, if requested, shall be in sufficient detail and in such form as to allow the District, the Project Inspector and the Architect to review and assess the completeness and accuracy thereof. The Contractor shall be solely responsible for any additional costs or additional time arising out of, or related in any manner to, its failure to provide the estimate of costs within the time specified in the request of the District or the Architect for such estimate.

9.5.1.2 Determination by the District. By the District, whether or not negotiations are initiated pursuant to Article 9.5.1.1 above, based upon actual and necessary costs incurred by the Contractor as determined by the District on the basis of the Contractor's records. In the event that the procedure set forth in this Article 9.5.1.2 is utilized to determine the extent of adjustment to the Contract

Price on account of Changes to the Work, promptly upon determining the extent of adjustment to the Contract Price, the District shall notify the Contractor in writing of the same; the Contractor is deemed to have accepted the District's determination of the amount of adjustment to the Contract Price on account of a Change to the Work unless Contractor notifies the District, the Architect, Project Manager, if any and the Project Inspector, in writing, not more than fifteen (15) days from the date of the District's written notice, of any objection to the District's determination. Failure of the Contractor to timely notify the District, the Project Manager, the Architect and the Project Inspector of Contractor's objections to the District's determination of the extent of adjustment to the Contract Price shall be deemed Contractor's acceptance of the District's determination and a waiver of any right or basis of the Contractor to thereafter protest or otherwise object to the District's determination. Notwithstanding any objection of the Contractor to the District's determination of the extent of any adjustment to the Contract Price pursuant to this Article 9.5.1.2, Contractor shall, pursuant to Article 9.8 below, diligently proceed to perform and complete any such Change.

9.5.1.3 Basis for Adjustment of Contract Price. If Changes in the Work require an adjustment of the Contract Price pursuant to Articles 9.5.1.1 or 9.5.1.2 above, the basis for adjustment of the Contract Price shall be as follows:

9.5.1.3.1 Allowable Labor Costs. Except in the event adjustment of the Contract Price for a District authorized Change is computed by unit prices, the labor costs allowable for incorporation into a Contract Price adjustment for a Change shall be limited as set forth herein.

9.5.1.3.1.1 Limitation to Field Labor and Prevailing Wage Rates. The Contract Price adjustment for labor necessary to complete a Change shall be limited to the laborers of the Contractor or Subcontractors actually and necessarily engaged in the performance of the Change and for which there is a prevailing wage rate classification. Wage rates for laborers shall not exceed the applicable prevailing wage rate in the locality of the Site for the classification(s) of labor necessary to complete a Change. Use of a prevailing wage rate classification which increases the costs of a Change shall not be allowed. Overtime labor charges for performing any part of the Change shall only be allowed if authorized in writing by the Architect, Construction Manager and the District prior to Contractor's performance of the overtime labor. Use of a labor classification which would increase labor costs associated with any Change shall not be permitted.

9.5.1.3.1.2 Fringe Benefits, Payroll Taxes and Labor Burdens. The Contractor or Subcontractor may adjust the prevailing wage rate for allowable labor costs to reflect fringe benefits, payroll taxes and labor burdens actually incurred by Contractor and provided to such labor directly engaged in performing a Change. The allowable adjustment for fringe benefit payments, payroll taxes and labor burdens shall not, however, exceed fifteen percent (15%) of the applicable prevailing wage rate and shall not be subject to the additional mark-up set forth in Article 9.5.1.3.4 and the Special Conditions.

9.5.1.3.1.3 Excluded Labor Costs. The Contract Price adjustment for labor costs on account of a Change shall exclude costs: (i) for preparing estimate(s) of the costs of the Change; (ii) to maintain records relating to the costs of the Change; (iii) for coordination and assembly of materials and information relating to the Change

or performance thereof; (iv) to supervise, coordinate or manage the Work of a Change; or (v) any other general administrative overhead or general conditions costs associated with the Change or performance thereof as such costs are incorporated into the overhead and general conditions mark-up costs set forth in Article 9.5.1.3.4.

9.5.1.3.2 Materials and Equipment. Contractor shall be compensated for the costs of materials and equipment necessarily and actually used or consumed in connection with the performance of Changes. Costs of materials and equipment may include reasonable costs of transportation from a source closest to the site of the Work and delivery to the Site. If discounts by Material Suppliers are available for materials necessarily used in the performance of Changes, they shall be credited to the District. If materials and/or equipment necessarily used in the performance of Changes are obtained from a supplier or source owned in whole or in part by the Contractor, compensation therefor shall not exceed the current wholesale price for such materials or equipment. If, in the reasonable opinion of the District, the costs asserted by the Contractor for materials and/or equipment in connection with any Change is excessive, or if the Contractor fails to provide satisfactory evidence of the actual costs of such materials and/or equipment from its supplier or vendor of the same, the costs of such materials and/or equipment and the District's obligation for payment of the same shall be limited to the then lowest wholesale price at which similar materials and/or equipment are available in the quantities required to perform the Change. The District may elect to furnish materials and/or equipment for Changes to the Work, in which event the Contractor shall not be compensated for the costs of furnishing such materials and/or equipment or any mark-up thereon.

9.5.1.3.3 Construction Equipment. Contractor shall be compensated for the actual cost of the necessary and direct use of Construction Equipment in the performance of Changes to the Work. Use of such Construction Equipment in the performance of Changes to the Work shall be compensated in increments of fifteen (15) minutes. Rental time for Construction Equipment moved by its own power shall include time required to move such Construction Equipment to the site of the Work from the nearest available rental source of the same. If Construction Equipment is not moved to the Site by its own power, Contractor will be compensated for the loading and transportation costs in lieu of rental time. The foregoing notwithstanding, neither moving time or loading and transportation time shall be allowed if the Construction Equipment is used for performance of any portion of the Work other than Changes to the Work. Unless prior approval in writing is obtained by the Contractor from the Architect, Project Manager, if any, the Project Inspector and the District, no costs or compensation shall be allowed for time while Construction Equipment is inoperative, idle or on standby, for any reason. The Contractor shall not be entitled to an allowance or any other compensation for Construction Equipment or tools used in the performance of Changes to the Work where such Construction Equipment or tools have a replacement value of \$500.00 or less. Construction Equipment costs claimed by the Contractor in connection with the performance of any Change to the Work shall not exceed rental rates established by distributors or construction equipment rental agencies in the locality of the Site; any costs asserted which exceed such

rental rates shall not be allowed or paid. Unless otherwise specifically approved in writing by the Architect, Project Manager, if any, the Project Inspector and the District, the allowable rate for the use of Construction Equipment in connection with Changes to the Work shall constitute full compensation to the Contractor for the cost of rental, fuel, power, oil, lubrication, supplies, necessary attachments, repairs or maintenance of any kind, depreciation, storage, insurance, labor (exclusive of labor costs of the Construction Equipment operator), and any all other costs incurred by the Contractor incidental to the use of such Construction Equipment.

9.5.1.3.4 Mark-up on Costs of Changes to the Work. In determining the cost to the District and the extent of increase to the Contract Price resulting from a Change adding to the Work, the allowance for mark-ups on the costs of the Change for all overhead (including home office and field overhead), general conditions costs and profit associated with the Change shall not exceed the percentage set forth in the Special Conditions, regardless of the number of Subcontractors, of any tier, performing any portion of any Change to the Work. If a Change to the Work reduces the Contract Price, no profit, general conditions or overhead costs shall be paid by the District to the Contractor for the reduced or deleted Work. In such event, the adjustment to the Contract Price shall be the actual cost reduction realized by the reduced or deleted Work multiplied by the percentage set forth in the Special Conditions for mark-ups on the cost of a Change deleting the scope of the Work.

9.5.1.4 Contractor Maintenance of Records. If the Contractor is directed to perform any Changes to the Work pursuant to Article 9.1, 9.2 or 9.3, or should the Contractor encounter conditions which the Contractor believes to obligate the District to adjust the Contract Price and/or the Contract Time, Contractor shall maintain detailed records on a daily basis. Such records shall include without limitation hourly records for labor and Construction Equipment and itemized records of materials and equipment used that day in connection with the performance of any Change to the Work. If more than one Change to the Work is performed by the Contractor in a calendar day, Contractor shall maintain separate records of labor, Construction Equipment, materials and equipment for each such Change. If any Subcontractor provides or performs any portion of a Change to the Work, Contractor shall require that each such Subcontractor maintain records in accordance with this Article. Each daily record maintained hereunder shall be signed by Contractor's Superintendent or Contractor's authorized representative which shall constitute the Contractor's representation and warranty to the District that all information contained therein is true, accurate, complete and relate only to the Change referenced therein. All records maintained by a Subcontractor relating to the costs of a Change to the Work shall be signed by such Subcontractor's authorized representative or Superintendent. All records maintained hereunder shall be subject to inspection, review and/or reproduction by the District, the Architect, Project Manager, if any or the Project Inspector upon request. If the Contractor fails or refuses, for any reason, to maintain or make available for inspection, review and/or reproduction such records and the adjustment to the Contract Price on account of any Change to the Work, the District's reasonable good faith determination of the extent of adjustment to the Contract Price on account of such Change shall be final, conclusive, dispositive and binding upon Contractor. Contractor's obligation to maintain records hereunder is in addition to, and not in lieu of, any other Contractor obligation under the Contract Documents with respect to Changes to the Work.

9.5.2 Adjustment to Contract Time. In the event of any Change(s) to the Work pursuant to this Article 9, the Contract Time shall be extended or reduced by Change Order for a period of time commensurate with the time reasonably necessary to perform such Change. Such time shall be requested in writing by the Contractor with the Contract price Adjustment Proposal. The time extension request shall be justified by the Contractor by submittal of a CPM analysis accurately portraying the impact of the change on the critical path of the project schedule. Changes performed within available float as indicated in the updated Approved Construction Schedule shall not justify a time extension to the Contract. When agreement is reached between the District and Contractor that a Change shall require an extension of the contract time, the Contractor shall not be subject to Liquidated Damages for such period of time. If completion of the Work is delayed by causes for which the District is responsible and the delay is unreasonable under the circumstances involved, and not within the contemplation of the Contractor and the District at the time of execution of the Agreement, the Contractor shall not be precluded from the recovery of damages arising therefrom. Utility owners and DSA are not within the control or responsibility of the District.

9.5.3 Addition or Deletion of Alternate Bid Item(s). If the Bid Proposal for the Work includes proposal(s) for Alternate Bid Item(s), during Contractor's performance of the Work, the District may elect, pursuant to this Article to add any such Alternate Bid Item(s) if the same did not form a basis for award of the Contract or delete any such Alternate Bid Item(s) if the same formed a basis for award of the Contract. If the District elects to add or delete any such Alternate Bid Item(s) pursuant to the foregoing, the cost or credit for such Alternate Bid Item(s) shall be as set forth in the Contractor's Bid. If any Alternate Bid Item is added or deleted from the Work pursuant to the foregoing, the Contract Time shall be adjusted by the number of days allocated for the added or deleted Alternate Bid Item in the Contract Documents; if days are not allocated for any Alternate Bid Item added or deleted pursuant to the foregoing, the Contract Time shall be equitably adjusted.

9.6 Change Orders. If the District approves of a Change, a written Change Order prepared by the Architect on behalf of the District shall be forwarded to the Contractor describing the Change and setting forth the adjustment to the Contract Time and the Contract Price, if any, on account of such Change. All Change Orders shall be in full payment and final settlement of all claims for direct, indirect and consequential costs, costs of delays or impacts related to, or arising out of, items covered and affected by the Change Order, including without limitation: impacts of any kind; preparation and processing of any and all related RFIs, ASIs, Bulletins, FCDs, Quotes, and/or CCDs; inefficiencies; productivity losses; delay; acceleration; field and home office overhead; and any and all other incidental costs for all of the work described in the Change Order, as well as any and all adjustments to the Contract Time necessitated thereby. Any claim or item relating to any Change incorporated into a Change Order not presented by the Contractor for inclusion in the Change Order shall be deemed waived. The Contractor shall execute the Change Order prepared pursuant to the foregoing; once the Change Order has been prepared and forwarded to the Contractor for execution, without the prior approval of the District which may be granted or withheld in the sole and exclusive discretion of the District, the Contractor shall not modify or amend the form or content of such Change Order, or any portion thereof. The Contractor's attempted or purported modification or amendment of any such Change Order, without the prior approval of the District, shall not be binding upon the District; any such unapproved modification or amendment to such Change Order shall be null, void and unenforceable. Unless otherwise expressly provided for in the Contract Documents or in the Change Order, any Change Order issued hereunder shall be binding upon the District only upon action of the District's Board of Education approving and ratifying such Change Order. In the event of any amendment or modification made by the Contractor to a Change Order for which there is no prior approval by the District, in accordance with the provisions of this Article 9.6,

unless otherwise expressly stated in its approval and ratification of such Change Order, any action of the Board of Education to approve and ratify such Change Order shall be deemed to be limited to the Change Order as prepared by the Architect; such approval and ratification of such Change Order shall not be deemed the District's approval and ratification of any unapproved amendment or modification by the Contractor to such Change Order.

9.7 Unilateral Change Orders. A Unilateral Change Order is a Change Order issued by the District, in the sole and exclusive discretion of the District, in the event that the Contractor and District have not agreed on the extent of adjustment of the Contract Time or the Contract Price relating to a Change. The District may, in its sole reasonable discretion, issue a Unilateral Change Order for any Change to the Work authorized by the District when the Contractor and the District have been unable to reach mutual agreement as to the extent of any adjustment to the Contract Price or Contract Time on account of such Change. The Unilateral Change Order shall be based upon the District's good faith determination of the appropriate adjustment of the Contract Price and/or Contract Time. If the District elects to issue a Unilateral Change Order, the District shall forward to the Contractor a copy of the proposed Unilateral Change Order (for the Contractor's information) at least ten (10) days prior to the date of the Board of Education meeting to review and consider approval of the Unilateral Change Order. Any Unilateral Change Order issued hereunder shall be binding upon the District and Contractor only if the District's Board of Education takes action to approve or ratify the Unilateral Change Order. Any and all claims by the Contractor arising out of such Unilateral Change Order, and/or the Change giving rise to such Unilateral Change Order, shall accrue as of the date of the Board of Education's action approving or ratifying a Unilateral Change Order and shall be subject to the claim provisions set forth in Article 16.11. Notwithstanding any provision of the Contract Documents to the contrary, an express condition precedent to the Contractor's exercise of rights and remedies under Article 16.11 relating to a Unilateral Change Order, is the Contractor notification to the District, Architect and Project Manager, if any, in writing of the Contractor's objections to all or any portion of a Unilateral Change Order within ten (10) days after the date of the Board of Education meeting ratifying or approving a Unilateral Change Order; failure of the Contractor to do so is deemed the Contractor's acceptance of the entirety of a Unilateral Change Order, as approved or ratified by the District's Board of Education and an express unequivocal waiver by the Contractor of any right or remedy of the Contractor, under the Contract Documents or the Laws to: (i) object to the Unilateral Change Order or any portion thereof; or (ii) further adjustment of the Contract Time or the Contract Price on account of the Change(s) incorporated into a Unilateral Change Order.

9.8 Contractor Notice of Changes; Claims. If the Contractor should claim that any instruction, request, the Drawings, the Specifications, action, condition, omission, default, or other situation obligates the District to increase the Contract Price or to extend the Contract Time, the Contractor shall notify the Architect, in writing, of such claim within three (3) working days from the date Contractor discovers or reasonably should discover, that an act, error or omission of District, its agents or employees, or action, condition or other situation has occurred that may entitle Contractor to an adjustment of the Contract Price and/or Contract Time (even if Contractor has not been damaged, delayed, or incurred extra cost when Contractor discovers, or reasonably should discover, the act, error, omission, action, condition or situation giving rise to the claim). The District shall consider any such claim of the Contractor only if sufficient Supporting Documentation is submitted with the Contractor's notice to the Architect. Time is of the essence in Contractor's written notice pursuant to the preceding sentence so that the District can promptly investigate and consider alternative measures to the address such instruction, request, Drawings, Specifications, action, condition, omission, default or other situation. Accordingly, Contractor acknowledges that its failure, for any reason, to give written notice (with Supporting Documentation to permit the District's review and evaluation) within three (3) working days of its actual or constructive knowledge of any instruction, request, Drawings,

Specifications, action, condition, omission, default or other situation for which the Contractor believes there should an adjustment of the Contract Time or the Contract Price shall be deemed Contractor's waiver, release, discharge and relinquishment of any right to assert or claim any entitlement to an adjustment of the Contract Time or the Contract Price on account of any such instruction, request, Drawings, Specifications, action, condition, omission, default or other situation. In the event that the District determines that the Contract Price or the Contract Time is subject to adjustment based upon the events, circumstances and Supporting Documentation submitted with the Contractor's written notice under this Article 9.6, any such adjustment shall be determined in accordance with the provisions of Article 9.5. Contractor agrees that strict compliance with the requirements of this Article 9 is an express condition precedent to Contractor's right to arbitrate or litigate a claim. Contractor specifically agrees to assert no claims in arbitration or litigation unless there has been strict compliance with this Article 9.

9.9 Supporting Documentation. As used in this Article 9, "Supporting Documentation" consists of the following:

9.9.1 A detailed description of the act, error, omission, unforeseen condition, event or other condition giving rise to the claim for adjustment of the Contract Price or Contract Time.

9.9.2 A detailed justification for any remedy or relief sought by the claim, including to the extent applicable, the following:

9.9.3 If the claim involves extra work, a detailed cost breakdown of the amounts claimed, including the items specified in this Article 9. The breakdown must be provided even if the costs claimed have not been incurred when the claim is submitted. To the extent costs have been incurred when the claim is submitted, the claim must include actual cost records (including without limitation, payroll records, material and rental invoices and the like) demonstrating that costs claimed have actually been incurred. To the extent costs have not yet been incurred at the time the claim is submitted, actual cost records must be submitted on a current basis not less than once a week during any periods costs are incurred. A cost record will be considered current if submitted within seven (7) days of the date the cost reflected in the record is incurred. At the request of District, claimed extra costs may be subject to further verification procedures (such as having an inspector verify the performance of alleged extra work on a daily basis).

9.9.4 If the claim involves an error or omission in the Contract Documents: (i) an affirmative representation under penalty of perjury by Contractor and any affected subcontractors and suppliers that the error or omission was not discovered prior to submitting a bid for the Contract, and (ii) a detailed statement demonstrating that the error or omission reasonably should not have been discovered, by Contractor, its subcontractors and suppliers, prior to submitting a bid for the Contract.

9.9.5 If the claim involves an extension of the Contract Time, written documentation demonstrating Contractor's entitlement to a time extension under Article 7.4.

9.9.6 If the claim involves an adjustment of the Contract Price for delay, written documentation demonstrating Contractor's entitlement to such an adjustment under Article 7.4 and Article 9, as it may apply.

9.9.7 Contractor shall not be entitled to compensation for escalation of materials costs unless Contractor demonstrates to the satisfaction of the District that such cost escalation is the result of unusual, unforeseeable market conditions, not the fault of the Contractor, and were not reasonably foreseeable at the time of the award of the Contract.

Contractor shall provide indisputable evidence to District of the costs included in the Contract, that such costs were reasonable at the time and that Contractor timely ordered the materials at issue.

9.10 Disputed Changes. If there is any dispute or disagreement between the Contractor and the District regarding the characterization of any item as a Change to the Work or as to the appropriate adjustment of the Contract Price or the Contract Time on account thereof, the Contractor shall promptly proceed with the performance and completion of such item of the Work, subject to a subsequent resolution of such dispute or disagreement in accordance with the terms of the Contract Documents. The Contractor's failure or refusal to so proceed with such Work is the Contractor's default of a material obligation of the Contractor under the Contract Documents.

9.11 Emergencies. In an emergency affecting or threatening the safety of persons, or which affects or threatens the Work, or property, the Contractor, without special instruction or prior authorization from the District, Project Manager or the Architect, is permitted to act at its discretion to prevent such threatened loss or injury. Any compensation claimed by the Contractor on account of such emergency work shall be submitted and determined in accordance with this Article 9.

9.12 Minor Changes in the Work. The Architect may order minor Changes in the Work not involving an adjustment in the Contract Price or the Contract Time and not inconsistent with the intent of the Contract Documents. Such Changes shall be effected by written order and shall be binding on the District and the Contractor. The Contractor shall carry out such orders promptly.

9.13 Unauthorized Changes. Any Work beyond the lines and grades shown on the Contract Documents, or any extra Work performed or provided by the Contractor without notice to the Architect, Project Manager and the Project Inspector in the manner and within the time set forth in Articles 9.2 or 9.7 shall be considered unauthorized and at the sole expense of the Contractor. Work so done will not be measured or paid for, no extension to the Contract Time will be granted on account thereof and any such Work may be ordered removed at the Contractor's sole cost and expense. The failure of the District to direct or order removal of such Work shall not constitute acceptance or approval of such Work nor relieve the Contractor from any liability on account thereof.

ARTICLE 10: SEPARATE CONTRACTORS

10.1 District's Right to Award Separate Contracts. The District reserves the right to perform construction or operations related to the Project with the District's own forces or to award separate contracts in connection with other portions of the Project or other construction or operations at or about the Site. If the Contractor claims that delay or additional cost is involved because of such action by the District, the Contractor shall seek an adjustment to the Contract Price or the Contract Time as provided for in the Contract Documents. Failure of the Contractor to request such an adjustment of the Contract Time or the Contract Price in strict conformity with the provisions of the Contract Documents applicable thereto shall be deemed a waiver of the same.

10.2 District's Coordination of Separate Contractors. The District shall provide for coordination of the activities of the District's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the District in reviewing their respective Construction Schedules when directed to do so. The Contractor shall make any revisions to the Approved Construction Schedule for the Work hereunder deemed necessary after a joint review and mutual agreement.

The Construction Schedules shall then constitute the Construction Schedules to be used by the Contractor, separate contractors and the District until subsequently revised.

10.3 Mutual Responsibility. The Contractor shall afford the District and separate contractors of the District reasonable opportunity for storage of their materials and equipment and performance of their activities at the Site and shall connect and coordinate the Contractor's Work, construction and operations with theirs as required by the Contract Documents.

10.4 Discrepancies or Defects. If part of the Contractor's Work depends for proper execution or results upon construction or operations by the District or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect, Project Manager, if any and the Project Inspector any discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results of the Contractor's Work. Failure of the Contractor to so report shall constitute an acknowledgment that the District's or separate contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then discoverable by the Contractor's reasonable diligence.

ARTICLE 11: TESTS AND INSPECTIONS

11.1 Tests; Inspections; Observations.

11.1.1 Contractor's Notice. If the Contract Documents, the Laws or any public authority with jurisdiction over the Work requires the Work, or any portion thereof, to be specially tested, inspected or approved, the Contractor shall give the Architect, the Project Manager and the Project Inspector written notice of the readiness of such Work for observation, testing or inspection at least two (2) working days prior to the time for the conducting of such test, inspection or observation. The Contractor shall not cover up any portion of the Work subject to tests, inspections or observations prior to the completion and satisfaction of the requirements of such test, inspection or observation. If any portion of the Work subject to tests, inspection or approval is covered up by Contractor prior to completion and satisfaction of the requirements of such tests, inspection or approval, Contractor shall be responsible for the uncovering of such portion of the Work as is necessary for performing such tests, inspection or approval without adjustment of the Contract Price or the Contract Time on account thereof.

11.1.2 Cost of Tests and Inspections. The District will pay for fees, costs and expenses for the initial tests/inspections of materials/equipment which are conducted at the Site or locations within a one hundred (100) mile radius of the Site. All fees, costs or expenses for subsequent tests/inspections or for tests/inspections conducted at a location more than a one hundred (100) mile radius from the Site (including without limitation, travel and travel-related expenses) shall be borne solely and exclusively by the Contractor.

11.1.3 Testing/Inspection Laboratory. The District shall select duly qualified person(s) or testing laboratory(ies) to conduct the tests and inspections to be paid for by the District and required by the Contract Documents. All such tests and inspections shall be in conformity with the Laws, including without limitation, Title 24 of the California Code of Regulations. Where inspection or testing is to be conducted by an independent laboratory or testing agency, materials or samples thereof shall be selected by the laboratory, testing agency, the Project Inspector, the Project Manager or the Architect and not by the Contractor.

11.1.4 Additional Tests, Inspections and Approvals. If the Architect, the Project Manager, the Project Inspector or public authorities having jurisdiction over the Work determine that portions of the Work require additional testing, inspection or approval, the Architect or Project Manager, if any will, upon written authorization from the District, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the District, and the Contractor shall give timely notice

to the Architect, the Project Manager and the Project Inspector of when and where tests and inspections are to be made so the Project Inspector and the Architect may observe such procedures. The District shall bear the costs of such additional tests, inspections or approvals, except to the extent that such additional tests, inspections or approvals reveal any failure of the Work to comply with the requirements of the Contract Documents, in which case the Contractor shall bear all costs made necessary by such failures, including without limitation, the costs of corrections, repeat tests, inspections or approvals and the fees of the Architect, Project Manager, if any, and the Project Inspector in connection therewith. Where required DSA testing of the work identifies a failure rate of ten percent (10%) or greater for any system, scope of work, installation or subtrade that has been specifically targeted, District may, at its sole discretion, order that all such similar systems, installations, scopes of work or subtrade work used in connection with the Project be tested, and the cost to test all such work shall be paid by the Contractor.

11.2 Delivery of Certificates. Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

11.3 Timeliness of Tests, Inspections and Approvals. Tests or inspections required and conducted pursuant to the Contract Documents shall be made or arranged by Contractor to avoid delay in the progress of the Work.

ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

12.1 Inspection of the Work.

12.1.1 Access to the Work. All Work and all materials and equipment forming a part of the Work or incorporated into the Work are subject to inspection by the District, the Project Manager, the Architect and the Project Inspector for conformity with the Contract Documents. The Contractor shall, at its cost and without adjustment to the Contract Price or the Contract Time, furnish any facilities necessary for sufficient and safe access to the Work for purposes of inspection by the District, the Project Manager, the Architect, the Project Inspector, DSA or any other public or quasi-public authority with jurisdiction over the Work or any portion thereof.

12.1.2 Limitations Upon Inspections. Inspections, tests, measurements, or other acts of the Architect and the Project Inspector hereunder are for the sole purpose of assisting them in determining that the Work, materials, equipment, progress of the Work, and quantities generally comply and conform to the requirements of the Contract Documents. These acts or functions shall not relieve the Contractor from performing the Work in full compliance with the Contract Documents. No inspection by the Architect or the Project Inspector shall constitute or imply acceptance of Work inspected. Inspection of the Work hereunder is in addition to, and not in lieu of, any other testing, inspections or approvals of the Work required under the Contract Documents.

12.2 Uncovering of Work. If any portion of the Work is covered contrary to the request of the Architect, the Project Inspector or the requirements of the Contract Documents, it must, if required by the Architect or the Project Inspector, be uncovered for observation by the Architect and the Project Inspector and be replaced at the Contractor's expense without adjustment of the Contract Time or the Contract Price.

12.3 Rejection of Work. Prior to the District's Final Acceptance of the Work, any Work or materials or equipment forming a part of the Work or incorporated into the Work which constitutes Defective or Non-Conforming Work may be rejected by the District, the Project Manager the Architect or the Project Inspector and the Contractor shall correct such rejected Work without any adjustment to the Contract Price or the Contract Time, even if the Work,

materials or equipment have been previously inspected by the Architect or the Project Inspector or even if they failed to observe the Defective or Non-Conforming nature of the Work, materials or equipment.

12.4 Correction of Work. The Contractor shall promptly correct any Defective or Non-Conforming Work whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting Defective or Non-Conforming Work, including additional testing and inspections and compensation for the Architect's services and expenses made necessary thereby. The Contractor shall bear all costs of correcting destroyed or damaged construction, whether completed or partially completed, of the District or separate contractors, caused by the Contractor's correction or removal of Defective or Non-Conforming Work.

12.5 Removal of Non-Conforming or Defective Work. The Contractor shall, at its sole cost and expense, remove from the Site all Defective or Non-Conforming Work which are neither corrected by the Contractor nor accepted by the District.

12.6 Failure of Contractor to Correct Work. If the Contractor fails to commence to correct Defective or Non-Conforming Work within three (3) days of notice of such condition and promptly thereafter complete the same within a reasonable time, the District may correct it in accordance with the Contract Documents. If the Contractor does not proceed with correction of such Defective or Non-Conforming Work within the time fixed herein, the District may remove it and store the salvable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage after written notice, the District may sell such materials or equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including without limitation compensation for the Architect's services, attorney's fees and other expenses made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Price shall be reduced by the deficiency. If payments of the Contract Price then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor and the Surety shall be jointly and severally liable to the District for any such excess amount.

12.7 Acceptance of Defective or Non-Conforming Work. The District may, in its sole and exclusive discretion, elect to accept Defective or Non-Conforming Work in lieu of requiring its removal and correction, in which case the Contract Price shall be reduced as appropriate and equitable. The District's determination of the extent of reduction of the Contract Price on account of Defective or Non-Conforming Work accepted by the District shall be binding, conclusive, dispositive and not subject to appeal or other dispute resolution procedures, unless such determination is manifestly unreasonable.

ARTICLE 13: WARRANTIES

13.1 Workmanship and Materials. The Contractor warrants to the District that: (i) the Work and all materials and equipment incorporated therein conform to requirements of the Contract Documents; (ii) all materials and equipment incorporated into the Work are new, of good quality and of the most suitable grade and quality for the purpose intended, unless otherwise specified in the Contract Documents; and (iii) all Work and workmanship is of good quality, free from faults and defects and in conformity with the requirements of the Contract Documents. If required by the Architect, Project Inspector, Project Manager or the District, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment incorporated into the Work. Any Work or portion thereof not conforming to these requirements, including substitutions or alternatives not properly approved in accordance with the Contract Documents may be deemed Defective or Non-Conforming. Where there is an approved substitution of, or

alternative to, material or equipment specified in the Contract Documents, the Contractor warrants to the District that such installation, construction, material, or equipment will equally perform the function and have the quality of the originally specified material or equipment. The Contractor expressly warrants the merchantability, the fitness for use, and quality of all substitute or alternative items in addition to any warranty given by the manufacturer or supplier of such item. The obligations of the Contractor hereunder are in addition to, and not in lieu of, any other obligations imposed by any special guarantee or warranty required by the Contract Documents, guarantees or warranties provided by any manufacturer of any item or equipment forming a part of, or incorporated into the Work, or otherwise recognized, prescribed or imposed by the Laws.

13.2 Warranty Work. If, within one (1) year after the date of Final Acceptance, or such other time frame set forth elsewhere in the Contract Documents, any of the Work is found to be defective or not in accordance with the requirements of the Contract Documents, or otherwise contrary to the warranties contained in the Contract Documents, the Contractor shall commence all necessary corrective action not more than seven (7) days after receipt of a written notice from the District to do so, and to thereafter diligently complete the same. If the Contractor fails or refuses to commence correction of any such item within said seven (7) day period or to diligently prosecute such corrective actions to completion, the District may, without further notice to Contractor, cause such corrective Work to be performed and completed. In such event, Contractor and Contractor's Performance Bond Surety shall be responsible for all costs in connection with such corrective Work, including without limitation, general administrative overhead costs of the District in securing and overseeing such corrective Work. Nothing contained herein shall be construed to establish a period of limitation with respect to any obligation of the Contractor under the Contract Documents. Neither the District's Final Acceptance, the making of Final Payment, any provision in Contract Documents, nor the use or occupancy of the Work, in whole or in part, by District shall constitute acceptance of Work not in accordance with the Contract Documents nor relieve the Contractor or the Contractor's Performance Bond Surety from liability with respect to any warranties or responsibility for faulty or defective Work or materials, equipment and workmanship incorporated therein.

13.3 Guarantee. Upon completion of the Work, Contractor shall execute and deliver to the District the form of Guarantee (Attachment D to Special Conditions). The Contractor's execution and delivery of the form of Guarantee is an express condition precedent to any obligation of the District to disburse the Final Payment to the Contractor and any right of the Contractor to Final Payment.

13.4 Survival of Warranties; Surety Obligations. The Contractor's warranty obligations hereunder shall survive the Contractor's completion of Work under the Contract Documents, the District's Final Acceptance or the termination of the Contract. The obligations of the Surety issuing the Performance Bond shall include assumption and discharge of the Contractor's warranty obligations if the Contractor fails or refuses to perform its warranty obligations hereunder in strict conformity herewith.

ARTICLE 14: SUSPENSION OF WORK

14.1 District's Right to Suspend Work. The District may, without cause, and without invalidating or terminating the Contract, order the Contractor, in writing, to suspend, delay or interrupt the Work in whole or in part for such period of time as the District may determine. The Contractor shall resume and complete the Work suspended by the District in accordance with the District's directive, whether issued at the time of the directive suspending the Work or subsequent thereto.

14.2 Adjustments to Contract Price and Contract Time. In the event the District shall order suspension of the Work, an adjustment shall be made to the Contract Price for increases in the

direct cost of performance of the Work of the Contract Documents, actually caused by suspension, delay or interruption ordered by the District; provided however that no adjustment of the Contract Price shall be made to the extent: (i) that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible under the Contract Documents; or (ii) that an equitable adjustment is made or denied under another provision of the Contract Documents. The foregoing notwithstanding, any such adjustment of the Contract Price shall not include any adjustment to increase the Contractor's overhead, general administrative costs or profit, all of which will remain as reflected in the Cost Breakdown submitted by the Contractor pursuant to the Contract Documents. In the event of the District's suspension of the Work, the Contract Time shall be equitably adjusted.

ARTICLE 15: TERMINATION

15.1 Termination for Cause.

15.1.1 District's Right to Terminate. The District may terminate the Contract and/or the Contractor's performance of the Contract, in whole or in part, upon the occurrence of any one or more of the following events of the Contractor's default: (i) if the Contractor refuses or fails to prosecute the Work with diligence as will insure Substantial Completion of the Work within the Contract Time, or if the Contractor fails to substantially Complete the Work within the Contract Time; (ii) if the Contractor becomes bankrupt or insolvent, or makes a general assignment for the benefit of creditors, or if the Contractor or a third party files a petition to reorganize or for protection under any bankruptcy or similar laws, or if a trustee or receiver is appointed for the Contractor or for any of the Contractor's property on account of the Contractor's insolvency, and the Contractor or its successor in interest does not provide adequate assurance of future performance in accordance with the Contract Documents within 10 days of receipt of a request for such assurance from the District; (iii) if the Contractor repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment; (iv) if the Contractor repeatedly fails to make prompt payments to any Subcontractor, of any tier, or Material Suppliers or others for labor, materials or equipment; (v) if the Contractor disregards laws, ordinances, rules, codes, regulations, orders applicable to the Work or similar requirements of any public entity having jurisdiction over the Work; (vi) if the Contractor disregards proper directives of the Architect, the Project Inspector or District under the Contract Documents; (vii) if the Contractor performs Work which deviates from the Contract Documents and neglects or refuses to correct such Work; or (viii) if the Contractor otherwise violates in any material way any provisions or requirements of the Contract Documents. Once the District determines that sufficient cause exists to justify the action, the District may terminate the Contract without prejudice to any other right or remedy the District may have, after giving the Contractor and the Surety at least seven (7) days advance written notice of the effective date of termination. The District shall have the sole discretion to permit the Contractor to remedy each cause for the termination without waiving the District's right to terminate the Contract, or otherwise waiving, restricting or limiting any other right or remedy of the District under the Contract Documents or at law.

15.1.2 District's Rights Upon Termination. In the event that the Contract or the Contractor's performance of the Contract is terminated pursuant to this Article 15.1, the District may take over the Work and prosecute it to completion, pursuant to the Contract or otherwise, and may exclude the Contractor from the site. The District may take possession of the Work and of all of the Contractor's tools, appliances, construction equipment, machinery, materials, and plant which may be on the site of the Work, and use the same to the full extent they could be used by the Contractor without liability to the Contractor. In exercising the District's right to prosecute the completion of the Work, the District may also take possession of all materials and equipment stored at the site of the Work or for which the District has paid the Contractor but which are stored elsewhere, and finish the Work as the District deems expedient. In exercising the District's right to

prosecute the completion of the Work, the District shall have the right to exercise its sole discretion as to the manner, methods, and reasonableness of the costs of completing the Work and the District shall not be required to obtain the lowest figure for completion of the Work. In the event that the District takes bids for remedial Work or completion of the Work, the Contractor shall not be eligible for the award of such contract(s).

15.1.3 Completion by the Surety. In the event that the Contract or the Contractor's performance of the Contract is terminated pursuant to this Article 15.1, the District may demand that the Surety take over and complete the Work. The District may require that in so doing, the Surety not utilize the Contractor in performing and completing the Work. Upon the failure or refusal of the Surety to take over and begin completion of the Work within twenty (20) days after demand therefor, the District may take over the Work and prosecute it to completion as provided for above.

15.1.4 Assignment and Assumption of Subcontracts. The District shall, in its sole and exclusive discretion, have the option of requiring any Subcontractor or Material Supplier to perform in accordance with its Subcontract or Purchase Order with the Contractor and assign the Subcontract or Purchase Order to the District or such other person or entity selected by the District to complete the Work.

15.1.5 Costs of Completion. In the event of termination under this Article 15.1, the Contractor shall not be entitled to receive any further payment of the Contract Price until the Work is completed. If the unpaid balance of the Contract Price as of the date of termination exceeds the District's direct and indirect costs and expenses for completing the Work, including without limitation, attorneys' fees, fees for additional professional and consultant services, and the District's administrative costs, such excess shall be used to pay the Contractor for the cost of the Work performed prior to the effective date of termination with a reasonable allowance for overhead and profit. If the District's costs and expenses to complete the Work exceed the unpaid Contract Price, the Contractor and Surety are jointly and severally liable for payment of such difference to the District.

15.1.6 Contractor Responsibility for Damages. The Contractor and the Surety shall be jointly and severally liable for all damage sustained by the District resulting from, in any manner, the termination of Contract under this Article 15.1, including without limitation, attorneys' fees, and for all costs necessary for repair and completion of the Work exceeding the Contract Price.

15.1.7 Conversion to Termination for Convenience. In the event the Contract is terminated under this Article 15.1, and it is determined, for any reason, that the Contractor was not in default under the provisions hereof, the termination shall be deemed a Termination for Convenience of the District and thereupon, the rights and obligations of the District and the Contractor shall be determined in accordance with Article 15.2 hereof.

15.1.8 District's Rights Cumulative. In the event the Contract is terminated pursuant to this Article 15.1, the termination shall not affect or limit any rights or remedies of the District against the Contractor or the Surety. The rights and remedies of the District under this Article 15.1 are in addition to, and not in lieu of, any other rights and remedies provided by the Laws or under the Contract Documents. Any retention or payment of monies to the Contractor by the District shall not be deemed to release the Contractor or the Surety from any liability hereunder.

15.2 Termination for Convenience of the District. The District may at any time, in its sole and exclusive discretion, by written notice to the Contractor, terminate the Contract or the Contractor's performance of the Contract, in whole or in part, when it is in the interest of, or for the convenience of, the District. In such case, the Contractor shall be entitled to payment for: (i) Work actually performed and in place as of the effective date of such termination for convenience of the District, with a reasonable allowance for profit and overhead on such Work, and (ii) reasonable termination expenses for reasonable protection of Work in place and suitable

storage and protection of materials and equipment delivered to the site of the Work but not yet incorporated into the Work, provided that such payments exclusive of termination expenses shall not exceed the total Contract Price as reduced by payments previously made to the Contractor and as further reduced by the value of the Work as not yet completed. The Contractor shall not be entitled to profit and overhead on Work which was not performed as of the effective date of the termination for convenience of the District or for any other damages, direct or indirect, which the Contractor or anyone claiming through the Contractor alleges resulted from the District's election to terminate under this Article 15.2 or where a termination under Article 15.1 has been converted to a termination for convenience under Article 15.1.7. The District may, in its sole discretion, elect to have subcontracts assigned pursuant to Article 15.1.4 above after exercising the right hereunder to terminate for the District's convenience.

ARTICLE 16: MISCELLANEOUS

16.1 Governing Law. This Contract shall be governed by and interpreted in accordance with the laws of the State of California.

16.2 Marginal Headings; Interpretation. The titles of the various Articles of these General Conditions and elsewhere in the Contract Documents are used for convenience of reference only and are not intended to, and shall in no way, enlarge or diminish the rights or obligations of the District or the Contractor and shall have no effect upon the construction or interpretation of the Contract Documents. The Contract Documents shall be construed as a whole in accordance with their fair meaning and not strictly for or against the District or the Contractor.

16.3 Successors and Assigns. Except as otherwise expressly provided in the Contract Documents, all terms, conditions and covenants of the Contract Documents shall be binding upon, and shall inure to the benefit of the District and the Contractor and their respective heirs, representatives, successors-in-interest and assigns.

16.4 Cumulative Rights and Remedies; No Waiver. Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not in lieu of or otherwise a limitation or restriction of duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by the District shall constitute a waiver of a right or remedy afforded it under the Contract Documents or at law nor shall such an action or failure to act constitute approval of or acquiescence in a breach hereunder, except as may be specifically agreed in writing. No course of conduct or act of forbearance on any one or more occasions by the District shall preclude the District from asserting any right or remedy available to it in the future. No course of conduct or act of forbearance on any one or more occasions shall be deemed to be an implied modification of the terms of this Contract. Neither the making of any payment, including final payment, the recordation of a Notice of Completion or any other act or failure to act by the District, the Architect, Project Inspector, the Project Manager or anyone else employed by them, shall relieve the Contractor or the Surety from full and exact compliance with the requirements of the Contract Documents, including the approved plans and specifications or shall serve to exonerate, in whole or in part, any obligation or duty owed to the District by the Contractor or the Surety.

16.5 Severability. If any provision of the Contract Documents is deemed illegal, invalid, unenforceable and/or void, by a court or any other governmental agency of competent jurisdiction, such provision shall be deemed to be severed and deleted from the Contract Documents, but all remaining provisions hereof, shall in all other respects, continue in full force and effect.

16.6 No Assignment by Contractor. The Contractor shall not sublet or assign the Contract, or any portion thereof, or any monies due thereunder, without the express prior written consent

and approval of the District, which approval may be withheld in the sole and exclusive discretion of the District. The District's approval to such assignment shall be upon such terms and conditions as determined by the District in its sole and exclusive discretion.

16.7 Gender and Number. Whenever the context of the Contract Documents so require, the neuter gender shall include the feminine and masculine, the masculine gender shall include the feminine and neuter, the singular number shall include the plural and the plural number shall include the singular.

16.8 Independent Contractor Status. In performing its obligations under the Contract Documents, the Contractor is an independent contractor to the District and not an agent or employee of the District.

16.9 Notices. Except as otherwise expressly provided for in the Contract Documents, all notices which the District or the Contractor may be required, or may desire, to serve on the other, shall be effective only if delivered by personal delivery or by postage prepaid, First Class Certified Return Receipt Requested United States Mail, addressed to the District or the Contractor at their respective address set forth in the Contract Documents, or such other address(es) as either the District or the Contractor may designate from time to time by written notice to the other in conformity with the provisions hereof. In the event of personal delivery, such notices shall be deemed effective upon delivery, provided that such personal delivery requires a signed receipt by the recipient acknowledging delivery of the same. In the event of mailed notices, such notice shall be deemed effective on the third working day after deposit in the mail.

16.10 Disputes; Continuation of Work. Notwithstanding any claim, dispute or other disagreement between the District and the Contractor regarding performance under the Contract Documents, the scope of Work thereunder, or any other matter arising out of or related to, in any manner, the Contract Documents, the Contractor shall proceed diligently with performance of the Work in accordance with the District's written direction, pending any final determination or decision regarding any such claim, dispute or disagreement.

16.11 Dispute Resolution; Arbitration.

16.11.1 Claims Under \$375,000.00. Claims between the District and the Contractor of \$375,000.00 or less shall be resolved in accordance with the procedures established in Part 3, Chapter 1, Article 1.5 of the California Public Contract Code, §§20104 et seq.; provided however that California Public Contract Code §20104.2(a) shall not supersede the requirements of the Contract Documents with respect to the Contractor's notification to the District of such claim or extend the time for the giving of such notice as provided in the Contract Documents. The term "claims" as used herein shall be as defined in California Public Contract Code §20104(b)(2).

16.11.2 Government Code Claim Requirements. Pursuant to Government Code §930.6, any claim, demand, dispute, disagreement or other matter in controversy asserted by the Contractor against the District for money or damages, including, without limitation, a Demand for Arbitration, except for those subject to resolution pursuant to Article 16.11.1, shall be deemed a "suit for money or damages" and shall be subject to the provisions of Government Code §§945.4, 945.6 and 946. Notwithstanding the resolution of disputes pursuant to the arbitration provisions set forth in Article 16.11.3 any claim, demand, dispute, disagreement or other matter in controversy between the Contractor and the District seeking money or damages in excess of \$375,000 shall first be presented to the District and acted upon or deemed rejected by the District in accordance with Government Code § 900, et seq., as an express condition precedent to the Contractor's commencement of arbitration proceedings.

16.11.3 Arbitration. Except as provided in Article 16.11.1, any other claims, disputes, disagreements or other matters in controversy between the District and the Contractor arising out of, or related, in any manner, to the Contract Documents, or the interpretation, clarification or enforcement thereof shall be resolved by binding arbitration conducted before a retired judge in accordance with the arbitration rules of Judicial Arbitration Mediation Services (“JAMS”) in effect as of the date that a Demand for Arbitration is filed, except as expressly modified herein. The locale for any arbitration commenced hereunder shall be the regional office of the JAMS closest to the Site. The award rendered by the Arbitrator(s) shall be final and binding upon the District and the Contractor only if the arbitration award: (i) is supported by substantial evidence; (ii) is based on applicable legal standards in effect at the time the arbitration award is issued; and (iii) includes written findings of fact and conclusions of law in conformity with California Code of Civil Procedure §1296. In connection with any arbitration proceeding commenced hereunder, the discovery rights and procedures provided for in California Code of Civil Procedure §1283.05 shall be applicable, and the same shall be deemed incorporated herein by this reference. A Demand for Arbitration shall be filed and served within a reasonable time after the occurrence of the claim, dispute or other disagreement giving rise to the Demand for Arbitration, but in no event shall a Demand for Arbitration be filed or served after the date when the institution of legal or equitable proceedings based upon such claim, dispute or other disagreement would be barred by the applicable statute of limitations. If more than one Demand for Arbitration is filed by either the District or the Contractor relating to the Work or the Contract Documents, all Demands for Arbitration shall be consolidated into a single arbitration proceeding, unless otherwise agreed to by the District and the Contractor. The Contractor’s Surety, a Subcontractor or Material Supplier to the Contractor and other third parties may be permitted to join in and be bound by an arbitration commenced hereunder if required by the terms of their respective agreements with the Contractor, except to the extent that such joinder would unduly delay or complicate the expeditious resolution of the claim, dispute or other disagreement between the District and the Contractor, in which case an appropriate severance order shall be issued by the Arbitrator(s). The expenses and fees of the Arbitrator(s) shall be divided equally among the parties to the arbitration. Each party to any arbitration commenced hereunder shall be responsible for and shall bear its own attorneys’ fees, witness fees and other costs or expenses incurred in connection with such arbitration. The foregoing notwithstanding, the Arbitrator(s) may award arbitration costs, including Arbitrators’ fees but excluding attorneys’ fees, to the prevailing party. The confirmation, enforcement, vacation or correction of an arbitration award rendered hereunder shall be the Superior Court of the State of California for the county in which the Site is situated. The substantive and procedural rules for such post-award proceedings shall be as set forth in California Code of Civil Procedure §1285 et seq.

16.11.4 Limitation on Arbitrator. Notwithstanding any other provision of this Article 16, the Superior Court for the State of California for the County in which the Project Site is situated shall have sole and exclusive jurisdiction, and an arbitrator shall have no authority, to hear and/or determine a challenge to the institution or maintenance of a proceeding in arbitration of a claim on the grounds that: i) the claim is barred by the applicable statute of limitations; ii) the claim is barred by a provision of the California Government Claims Act; iii) claimant has failed to satisfy any and all conditions precedent to arbitration; iv) the right to compel arbitration has been waived by the petitioner; and/or, v) there is the prospect that a ruling in arbitration would conflict with a ruling in a pending proceeding regarding the Project on a common issue of law or fact.

16.11.5 Inapplicability to Bid Bond. The provisions of this Article 16.11 shall not be applicable to disputes, disagreements or enforcement of rights or obligations under the Bid Bond; all claims, disputes and actions to enforce rights or obligations under the Bid Bond shall be adjudicated only by judicial proceedings commenced in a court of

competent jurisdiction.

16.12 Limitation on Special/Consequential Damages. In the event of the District's breach or default of its obligations under the Contract Documents, the damages, if any, recoverable by the Contractor shall be limited to general damages which are directly caused by the breach or default of the District and shall exclude any and all special or consequential damages, if any. By executing the Agreement, the Contractor expressly acknowledges the foregoing limitation to recovery of only general damages from the District if the District is in breach or default of its obligations under the Contract Documents; the Contractor expressly waives and relinquishes any recovery of special or consequential damages from the District.

16.13 Capitalized Terms. Except as otherwise expressly provided, capitalized terms used in the Contract Documents shall have the meaning and definition for such term as set forth in the Contract Documents.

16.14 No Attorneys' Fees. Except as expressly provided for in the Contract Documents, or authorized by the Laws, neither the District nor the Contractor shall recover from the other any attorney's fees or other costs associated with or arising out of any legal, administrative or other proceedings filed or instituted in connection with or arising out of the Contract Documents or the performance of either the District or the Contractor thereunder.

16.15 No Interest. In accordance with California Public Contract Code §7107, the District is entitled to withhold up to 150% of disputed amounts. Notwithstanding any other provision of law, the District shall not be liable for payment of interest on such disputed amounts pending final adjudication of such disputes.

16.16 Provisions Required by Law Deemed Inserted. Each and every provision of law and clause required by law to be inserted in the Contract Documents is deemed to be inserted herein and the Contract Documents shall be read and enforced as though such provision or clause are included herein, and if through mistake, or otherwise, any such provision or clause is not inserted or if not correctly inserted, then upon application of either party, the Contract Documents shall forthwith be physically amended to make such insertion or correction.

16.17 Prohibited Interests. No employee of the District, who is authorized in such capacity on behalf of the District to negotiate, make, accept or approve, or to take part in negotiating, making, accepting or approving any architectural, engineering, inspection, construction or material supply contract or subcontract in connection with the Work shall become directly or indirectly financially interested in the Work or any part thereof.

16.18 Entire Agreement. The Contract Documents contain the entire agreement and understanding between the District and the Contractor concerning the subject matter hereof, and supersedes and replaces all prior negotiations, proposed agreements or amendments, whether written or oral. No amendment or modification to any provision of the Contract Documents shall be effective or enforceable except by an agreement in writing executed by the District and the Contractor.

[END OF SECTION]

SPECIAL CONDITIONS

1. Application of Special Conditions. These Special Conditions form a part of the Contract Documents for the Work generally described as: **BID NO. 2015/16:7R, Rowland High School Additions.**

2. Drawings and Specifications. The number of sets of the Drawings and Specifications which the District will provide to the Contractor, pursuant to Article 2.1.3 of the General Conditions is three (3) Additional sets of the Drawings and Specifications may be obtained by the Contractor from the District at the cost of reproduction.

3. Insurance.

3.1. Insurance Requirements for Contractor. Pursuant to Article 6 of the General Conditions, the Contractor shall obtain and maintain the following insurance coverage with the following minimum coverage amounts:

Workers Compensation Insurance	In accordance with applicable law
Employers Liability Insurance	<u>\$1,000,000</u>
Commercial General Liability Insurance (including coverage for bodily injury, death, property damage and motor vehicle liability)	
Per Occurrence	<u>\$2,000,000</u>
Aggregate	<u>\$5,000,000</u>

3.2. Subcontractor's Insurance. In accordance with Article 6.5 of the General Conditions, each Subcontractor shall obtain and maintain the following insurance coverages in the following minimum coverage amounts:

Workers Compensation Insurance	In accordance with applicable law
Employers Liability Insurance	<u>\$1,000,000</u>
Commercial General Liability Insurance (including coverage for bodily injury, death, property damage and motor vehicle liability)	
Per Occurrence	<u>\$1,000,000</u>
Aggregate	<u>\$2,000,000</u>

4. Contract Time. The Work at **Rowland High School Additions** shall commence on the date set forth in the Notice to Proceed issued by or on behalf of the District; the Contractor shall achieve Substantial Completion within **1,134 calendar days** and Final Completion within **1,164 calendar days** after the commencement date set forth in the Notice to Proceed.

5. Liquidated Damages: District Withhold of Liquidated Damages; Performance Bond Surety. If the Contractor is subject to assessment of Liquidated Damages for delayed Submittals, delayed Substantial Completion, and/or delayed completion of Punchlist Items, the District may withhold such assessments from the Contract Price then or thereafter due the Contractor. If the assessment of Liquidated Damages exceeds the then remaining balance of the Contract Price, the Contractor and the Surety issuing the Performance Bond shall be jointly and severally liable to the District for such amounts.

- 5.1. Delayed Submittals.** Each and every submittal delayed beyond the time frames listed in the Submittal Schedule and Article 4.7.2.1. of the General Conditions shall be subject to an assessment and withholding of Liquidated Damages in the sum of Five Hundred Dollars **(\$500.00)** per day per Submittal until the required Submittal is submitted.
- 5.2. Delayed Substantial Completion.** The Contractor shall be subject to assessment and withholding of Liquidated Damages for each day of delayed Substantial Completion beyond the Contract Time for Substantial Completion of the Work in the sum of Three Thousand Dollars **(\$3,000.00)** per day.
- 5.3. Delayed Completion of Punchlist Items.** The Contractor shall be subject to assessment and withholding of Liquidated Damages if completion of Punchlist items for the Work are not achieved within the time for Final Completion established pursuant to the Contract Documents, in the sum of Three Thousand Dollars **(\$3,000.00)** per day until all Punchlist items are completed:
- 5.4. Mark-Ups on Changes to the Work.** In the event of Changes to the Work, pursuant to Article 9 of the General Conditions, the mark-up for all overhead (including home and field office overhead), general conditions costs and profit, shall not exceed the percentage of allowable direct actual costs for performance of the Change as set forth below.
- 5.4.1. Subcontractor Performed Changes.** For the portion of any Change performed by Subcontractors of any tier, the percentage of mark-up on allowable actual direct labor and materials costs incurred by all Subcontractors of any tier shall be Ten Percent (10%). In addition, for the portion of any Change performed by a Subcontractor of any tier, the Contractor may add an amount equal to Five Percent (5%) of the allowable actual direct labor and materials costs of Subcontractors performing the Change; the foregoing mark-up shall not be applied to the Subcontractor mark-up.
- 5.4.2. Contractor Performed Changes.** For the portion of any Change performed by the Contractor's own forces, the mark-up on the allowable actual direct labor and materials costs of such portion of a Change shall be Fifteen Percent (15%).
- 5.4.3. Credit for Deleted Work.** Where an entire item or portion of Work is deleted from the Contract, the mark-up on the allowable actual direct labor and materials costs of such Change shall be Five Percent (5%) to account for the Contractor's saved overhead, bonds and insurance.
- 5.4.4. Bond Premium Costs.** In addition to the foregoing mark-ups on the direct costs of labor and materials, a bond premium expense in an amount equal to the lesser of the Contractor's actual bond premium rate or one percent (1%) of the total actual direct costs of labor and materials (before Subcontractor and Contractor mark-ups) will be allowed.
- 5.4.5. Exclusions From Mark-Up of Actual Costs.** Mark-ups on the actual cost of materials/equipment incorporated into a Change or for purchase/rental of Construction Equipment shall not be applied to any portion of such costs which are for sales, use or other taxes arising out of the purchase of materials/equipment and/or for purchase/rental of Construction Equipment.
- 6. Hours/Days of Work at Site.** Work at the site is limited to Mondays through Fridays, except for District holiday days, between the hours of 7:00 a.m. to 4:00 p.m. No Work at the Site is permitted except during such days and hours. Contractor is also expected to adjust their

schedule as required by the school so as not to impact State Testing periods, pursuant to Article 4.9.10.

- 7. **Site Activity Limitations.** The permitted hours and days of Work activities on the Site Work activities are set forth in paragraph 7, above. Limitations set forth above must be incorporated into and reflected in the Construction Schedules prepared by the Contractor pursuant to the Contract Documents. No adjustment of the Contract Time or Contract Price will be allowed due to the limitations/prohibitions on Work activities as set above.
- 8. **Weather Days for Unusually Severe Weather Conditions (“Rain Days”).** For purposes of Article 7.4.1 of the General Conditions, the number of days of weather days for unusually severe weather conditions expected during each calendar month of the Contract Time is set forth below. Construction Schedules prepared pursuant to the Contract Documents shall incorporate the unusually severe weather days set forth below. The Contract Time will not be subject to adjustment for unusually severe weather conditions resulting from rain until the actual number of unusually severe weather conditions in any calendar month during the Contract Time exceeds the number of unusually severe weather days set forth below for such month.

Month	Unusually Severe Weather Days
January	4
February	4
March	4
April	2
May	1
June	0
July	0
August	0
September	0
October	1
November	2
December	3

To be considered an Unusually Severe Weather Day, all of the following conditions must be met: (i) the unusually severe weather conditions must occur on a scheduled workday; (ii) the weather conditions must be the sole cause of the work stoppage for a continuous period of at least three (3) hours; and (iii) the work stopped must be on the critical path of the then current Updated Construction Schedule.

- 9. **Contractor Obtained Permits.** In addition to permits or approvals obtained by the District for the Work, the Contractor shall obtain the following permits, approvals and other authorizations from any public agency with jurisdiction over any portion of the Work. The Contractor shall obtain the permits, approvals and/or authorizations set forth below: (i) without adjustment of the Contract Price, unless otherwise indicated below; and (ii) without adjustment of the Contract Time.

Contractor Obtained Permit, Approval or Authorization	Cost Reimbursement
Deferred Approval Items	No reimbursement to Contractor; cost included in Contract Price.
Offsite Permits	Reimbursement to Contractor at actual costs without mark-up.

10. Utility Services Disruption. If any portion of the Work requires the cessation, limitation or other disruption to utility services (including without limitation, electrical power, voice/data services, water, sewer, storm drain, or gas) serving any portion of the District's campus, the Contractor shall not commence such Work without prior notice to the District of the extent and nature of utility service cessation, limitation or disruption and written approval by the District to proceed with such Work. The District's approval of any cessation, limitation or disruption of utility services may be denied, granted or conditioned in the sole and exclusive discretion of the District. The foregoing may include, without limitation, approval conditioned on the Contractor providing temporary utility services and distribution thereof during the cessation, limitation or disruption of utility services during; any such temporary utility services and distributions thereof shall be at the cost and expense of the Contractor without adjustment of the Contract Price or the Contract Time.

11. Vegetation Removal/Vegetation Trimming. All activities relating to the removal of any existing vegetation in or about the Site shall be coordinated with the District pursuant to such limitations, restrictions or conditions established by the District. Prior to any vegetation removal activities, each Contractor and its Subcontractor performing any portion of the vegetation removal or related activities shall meet and confer with the District to establish the scope of removal/trimming. If a Contractor removes or trims vegetation materials without having engaged in such meet and confer with the District and the District's designation of the scope and extent of removal/trimming, the Contractor shall be responsible for all costs, fees and expenses to replace the removed/trimmed vegetation materials as directed by the District.

12. Existing Improvements/Conditions.

12.1. Verification of Existing Improvements/Conditions. Prior to commencement of any portion of the Work, the Contractor shall review the Contract Documents and the existing improvements/conditions in, on or about the area(s) for such portion of the Work to confirm that the actual existing improvements/conditions are consistent with the existing improvements/conditions depicted in the Contract Documents. If any discrepancies exist between actual existing improvements/conditions and those depicted in the Contract Documents, the Contractor shall, prior to commencement of Work in such area notify the District Representative and the Architect, in writing of such variation; as necessary or appropriate, the Contractor shall obtain clarification or direction from the District Representative and/or the Architect to address such variations.

12.2. Damage or Destruction to Existing Improvements/Conditions. If any portion of the Work results in damage or destruction to any existing improvements or conditions in, on or about the Site, the Contractor shall: (i) notify the District Representative and the Architect in writing within four (4) hours of the occurrence of an event of damage or destruction and (ii) repair, replace or otherwise correct such damage/destruction and restore the existing improvements/conditions to the condition existing immediately prior to such damage or destruction at the sole cost and expense of the Contractor without adjustment of the Contract Price or the Contract Time. The foregoing notwithstanding, the Contractor shall not, and shall not permit others to, backfill or cover-up any damage or destruction to existing improvements/conditions without prior notice by the Contractor to the District of backfilling or covering-up of damage/destruction and the District's authorization to proceed with backfilling or covering-up.

12.3. No Use of Existing Facilities. The personnel of the Contractor, Subcontractors and other performing Work at the Site shall not use any existing facilities, improvements in, on or about the District campus, including without limitation, trash/rubbish bins/dumpsters, restrooms, food service areas, loading/storage areas and other similar areas.

12.4. Vehicular Access. Construction activities which limit or prevent access to existing vehicular roadways or existing parking areas shall be performed only during non-school hours. Performance of Work in such areas during non-school hours shall be without adjustment of the Contract Price or the Contract Time.

12.5. Fire, Police, Emergency Access. Each Contractor shall at all times during the Work provide unimpeded vehicular access for the police, fire and other emergency services in and around the Site and adjacent areas. Each Contractor shall provide the District, Project Manager and any other public agency designated by the District with keys/codes/card keys to all Site perimeter locks.

13. Demolition Materials.

13.1. Demolition Materials Categories. All demolished materials/equipment shall be separated by the Contractor into three (3) categories: (i) concrete and concrete type materials; (ii) steel and other metals; and (iii) general trash.

13.2. Recycling of Demolition Materials. Each Contractor and each of its Subcontractors engaged in any portion of the demolition work shall: (i) recycle concrete/concrete type and steel/metal materials; and (ii) maintain recycling records/submit recycling reports as set forth herein. All concrete/concrete type and steel/metal demolition materials shall be recycled at appropriate recycling centers and/or locations. Each Subcontractor engaged in any portion of the demolition work shall submit a written report to the Contractor upon completion of its demolition activities at the Site. Each report shall include: (i) the name of the Contractor/Subcontractor; (ii) address/telephone of the Contractor/Subcontractor; (iii) date(s) of demolition materials removed; (iv) estimated weight of demolition materials removed from the Site; (v) type(s) of demolition materials removed from the Site; and (vi) the disposal location. Each Contractor shall compile the foregoing reports prepared by its Subcontractor and submit to the District and Project Manager a comprehensive report of demolition materials types, removal and disposition prior to Final Payment. The Contractor's obligations under the preceding sentence are material and each Contractor's submission of the comprehensive report summarizing the reports of its Subcontractors activities relating to demolition materials and the removal, disposal or recycling thereof is an express condition precedent to the District's obligation to disburse the Final Payment and each Contractor's right to receive the Final Payment. The Contractor shall submit to District with each progress payment application a written report or manifest detailing all recycled and demolished materials removed from the Project during the progress payment period.

14. Waste Disposal. No Contractor or any Subcontractors of any tier are permitted to use District dumpsters or waste disposal services for removal of waste and debris resulting from the Work. Each Contractor must, without adjustment of the Contract Price, provide for the removal of waste/debris materials from the Site with its own forces or with its own retained waste/debris removal service.

15. Similar Conditions. The intent of the Contract Documents is to provide a fully functional finished product, complete in every respect. Where a specific detail is not shown, the construction shall be similar to that indicated or noted for similar conditions and cases of construction on this project. References of notes and details to specific conditions and locations shall not limit their applicability. Materials for similar use shall be of the same type and manufacturer, unless otherwise indicated or specifically specified to be different in the Contract Documents. Any deviation must be approved in writing, by the Architect prior to incorporation into the Work.

- 16. Applicable Codes.** All work shall conform to the most recent edition of the California Building Code as adopted and amended DSA and the Laws. All Work shall conform to all applicable requirements set forth in Titles 21 and 24 of the California Code of Regulations. No part of the Contract Documents shall be construed as requiring or permitting Work contrary to the requirements of the Laws.
- 17. Handicap Access Regulations.** The Contractor and all Subcontractors shall comply with Title 24 of the California Code of Regulations relating to Disabled Access Regulations and ADA, Americans With Disabilities Act Regulations whether or not specifically indicated on the Contract Documents. Where existing paths of travel are interrupted due to construction, the Contractor, without adjustment to Contract Price or Contract Time, shall maintain barrier-free paths of travel.
- 18. Locked Door Policy.** In addition to the security requirements set forth elsewhere in the Contract Documents, the Contractor must adhere to a Locked Door Policy. No building room or site gate shall be left unsecured for any period of time when not occupied by the Contractor and/or after the Contractor's daily work hours.
- 19. No Employment of Persons Convicted of Sex Offenses or Controlled Substance Offenses.** California Education Code section 44836 states, in relevant part:
- (a)(1) The governing board of a school district shall not employ or retain in employment persons in public school service who have been convicted, or who have been convicted following a plea of nolo contendere to charges, of any sex offense as defined in Section 44010.
- (2) If a person's conviction of a sex offense as defined in Section 44010 is reversed and the person is acquitted of the offense in a new trial or the charges against him or her are dismissed, this section does not prohibit his or her employment thereafter. If the dismissal was pursuant to Section 1203.4 of the Penal Code and the victim of the sex offense was a minor, this section does prohibit the person's employment.
- (b)(1) The governing board of a school district also shall not employ or retain in employment persons in public school service who have been convicted of any controlled substance offense as defined in Section 44011.
- (2) If a person's conviction for a controlled substance offense as defined in Section 44011 is reversed and the person is acquitted of the offense in a new trial or the charges against him or her are dismissed, this section does not prohibit his or her employment thereafter.
- (c) Notwithstanding subdivision (b), the governing board of a school district may employ a person convicted of a controlled substance offense in a position requiring certification qualifications if that person holds an appropriate credential issued by the Commission on Teacher Credentialing.
- 20. Identification Badges.** Identification badges are required for Site access. Personnel providing or performing any Work at the Site will be permitted access to the Site only if District-issued identification badges are worn.
- 21. Fingerprinting.** The Contractor must have the job superintendent and all employees, consultants, subcontractors of all tiers, and regular delivery persons who may be working on or frequenting the site at any time fingerprinted.

[END OF SECTION]

**ACADEMIC CALENDAR
(Attachment A to Special Conditions)**

ROWLAND UNIFIED SCHOOL DISTRICT (2/10/2016)
2016-2017 Calendar

July				
M	T	W	Th	F
				1
4	5	6	7	8
11	12	13	14	15
18	19	20	21	22
25	26	27	28	29
July 4 Independence Day Observed (legal holiday)				
Instructional Days: 0				

August				
M	T	W	Th	F
	1	2	3	4
8	9	10	11	12
15	16	17	18	19
22	23	24	25	26
29	30	31		
Aug. 2,3,4 New teacher orientation				
Aug.9-11 Certificated orientation				
Aug. 15 First day of school				
Aug. 15 TK-6 trimester begins				
Aug. 15 TK-6 Shortened Days				
Aug. 26 NHS Shortened Day				
Instructional Days: 13				

September				
M	T	W	Th	F
			1	2
5	6	7	8	9
12	13	14	15	16
19	20	21	22	23
26	27	28	29	30
Sept. 5 Labor Day (legal holiday)				
Sept. 9 RHS Shortened Day				
Sept. 19 TK-12 Articulation (Day 1) Shortened Day				
Sept. 23 Grades 9-12 Progress Rpt.				
Instructional Days: 21				

October				
M	T	W	Th	F
	3	4	5	6
10	11	12	13	14
17	18	19	20	21
24	25	26	27	28
31				
Oct. 7 7-8 Quarter Ends				
Oct. 10,11 TK-6 Parent Conference Shortened Days				
Oct. 12 TK-6 Parent Conferences (Student Free)				
Oct. 14,15 TK-6 Parent Conference Shortened Days				
Oct. 13,14 NHS/RHS Shortened Day				
Oct. 20, 21 7-8 Shortened Days				
Oct. 24 TK-12 Articulation (Day 2)				
E-20 Instructional Days: S-21				

November				
M	T	W	Th	F
		1	2	3
7	8	9	10	11
14	15	16	17	18
21	22	23	24	25
28	29	30		
Nov. 4 Grades 9-12 Progress Rpt.				
Nov. 8 TK-6 trimester ends				
Nov. 9 TK-6 2 nd trimester begins				
Nov. 11 Veterans Day (legal holiday)				
Nov. 18 TK-6 Report Card				
Nov. 23-25 Thanksgiving (legal & local holidays)				
Instructional Days: 18				

December				
M	T	W	Th	F
			1	2
5	6	7	8	9
12	13	14	15	16
19	20	21	22	23
26	27	28	29	30
Dec. 15 Grades 7-12 Semester Ends				
Dec.16 Grades 7-12 Planning Day (Student Free)				
Dec. 19-30 Winter break				
Dec. 23 Christmas Eve (local holiday)				
Dec. 26 Christmas Day (legal holiday) Observed				
Dec. 30 New Year's Eve (local holiday) Observed				
E-12 Instructional Days: S-11				

January				
M	T	W	Th	F
	2	3	4	5
9	10	11	12	13
16	17	18	19	20
23	24	25	26	27
30	31			
Jan. 2 New Year's Day (legal holiday) Observed				
Jan. 2-6 Winter break				
Jan. 9 7-12 2 nd Semester Begins				
Jan. 16 Martin Luther King (legal holiday)				
Jan. 23 7-12 Articulation (Day 3) Shortened Day				
Instructional Days: 16				

February				
M	T	W	Th	F
		1	2	3
6	7	8	9	10
13	14	15	16	17
20	21	22	23	24
27	28			
Feb 6-10 TK-6 Shortened Days				
Feb. 20 Presidents Day (legal holiday)				
Feb. 16,17 7-8 Shortened Day				
Feb. 17 Grades 9-12 Progress Rpt.				
Feb. 27 TK-12 Articulation Day (Shortened Day)				
Instructional Days: 19				

March				
M	T	W	Th	F
		1	2	3
6	7	8	9	10
13	14	15	16	17
20	21	22	23	24
27	28	29	30	31
March 1 TK-6 2 nd trimester ends				
March 2 TK-6 3 rd trimester begins				
March 10 NHS/RHS Shortened Day				
March 10 TK-6 Report Cards				
March 17 Grades 7-8 3 rd Quarter Ends				
March 22-24 7-8 shortened Days				
Instructional Days: 23				

April				
M	T	W	Th	F
	3	4	5	6
10	11	12	13	14
17	18	19	20	21
24	25	26	27	28
Apr. 3-7 Spring Break				
Apr. 10 TK-12 Articulation (Day 4)				
Apr. 28 Grades 9-12 Progress Rpt.				
Instructional Days: 15				

May				
M	T	W	Th	F
	1	2	3	4
8	9	10	11	12
15	16	17	18	19
22	23	24	25	26
29	30	31		
May 2 Day of the Teacher				
May 17 Classified Day				
May 29 Memorial Day (legal holiday)				
May 30 Adult School Graduation				
Instructional Days: 22				

June				
M	T	W	Th	F
			1	2
5	6	7	8	9
12	13	14	15	16
19	20	21	22	23
26	27	28	29	30
June 1 TK-6 3 rd trimester ends				
June 1 TK-6 Report Cards				
June 1 Last Day of School - Shortened Day				
June 1 High School Graduation				
June 2 Last Day for Teachers				
Instructional Days: 1				

**Contractor Provided Facilities, Services, Furnishings
and Equipment for Project Inspector
(Attachment B to Special Conditions)**

The Contractor shall provide and furnish the following for use by the Project Inspector for the entire duration of the Work at the Site, until Final Completion is achieved. All costs, fees, expenses or other charges for the following are included within the Contract Price.

Site Office Facility	
Site Office Furnishings	
Site Office Equipment	
Site Office Services	
Site Office Consumable Materials	
Other Items/Services	

NOT USED

WDID No.

***STORM WATER POLLUTION
PREVENTION PLAN
(RL 1 - SWPPP)***

ROWLAND HIGH SCHOOL ADDITION

ROWLAND UNIFIED SCHOOL DISTRICT

CITY OF ROWLAND HEIGHTS, IN LOS ANGELES COUNTY

SUBMITTED BY:

**ROWLAND UNIFIED SCHOOL DISTRICT
1830 NOGALES STREET
ROWLAND HEIGHTS, CA 91748**

**EVEREST
ENVIRONMENTAL**



**STORM WATER POLLUTION PREVENTION PLAN
(SWPPP) (RISK LEVEL 1)**

FOR

**ROWLAND HIGH SCHOOL ADDITION/MODERNIZATION
ROWLAND UNIFIED SCHOOL DISTRICT
IN THE CITY OF ROWLAND HEIGHTS, IN LOS ANGELES COUNTY**

Owner:

Rowland Unified School District
1830 Nogales Street
Rowland Heights, CA 91748
(626) 965-2541 office
(626)712-5796 cell
Marcus Rodriguez

Contractor:

Project Site Location/Address:

2000 Otterbein Avenue
Rowland Heights, CA 91748

Waste Discharge Identification (WDID) No.

_____ pending

Assigned QSP

Meiji Tsutsui, CESSWI, QSP #23678
(760) 900-5780

SWPPP Prepared by:



6297 East Avenue
Rancho Cucamonga, CA 91739
(909) 957-4239
Ryan C. Paris, QSD #00120, CPESC#5722

SWPPP Preparation Date:

April 28, 2016

SECTION 300

PROJECT INFORMATION

300.1 INTRODUCTION AND PROJECT DESCRIPTION

Project Location: The proposed construction is scheduled to occur at the Rowland High School Campus at 2000 Otterbein Avenue, in the City of Rowland Heights, in Los Angeles County. The proposed project will occur over 10 acres, with 9.5 acres being considered as disturbed soil area. All project activities take place within the Rowland High School Campus proper. Site access will occur via stabilized construction roadway off Valencia Street.

Attachment A contains a vicinity map and photograph of the construction site depicting the topography and geographic features including property boundaries of the construction site, surface water bodies, anticipated discharge location(s) and flow direction of site runoff.

Project Features: Project includes the following;

Classroom Building: A two story, 22 classroom building. It will be construction in central campus area and cover over 32,000sf including building and surrounding area.

Performing Arts Center: New complete structure and surrounding areas to include lobby area will serve as a mini art gallery space, instructional spaces in theater arts and music (Band and Choral), band room with large open floor space and high ceilings (3,300 sq. foot, 45' x 74'), choral room with three practice/storage rooms (2,160 sq. foot, 45' x 48'). 650 seat theater with 30' x 80' stage and digital sound system for music, lecture and drama performances. Facility will provide both performance and teaching areas with state-of-the-art stage rigging/lighting, two control booths and an above-house catwalk lighting grid.

Administration & Library Building: This two story building will replace the current office and library and cover 14,800sf. The new office space will be located on the ground floor. The new library will feature a career center, a computer lab, three dividable classroom spaces to accommodate guest lecturers and general instruction.

Multipurpose Room / "Hideout": Located across the breezeway and just to the east of the new office building, the new Multipurpose room / "Hideout". It will provide significantly more space to offer a variety of services for students and faculty.

New Campus Quad: A campus quad will be constructed on the site of the existing Library building. The quad will become the new heart of the campus and will be available for lunch time activities and during intermission breaks from the new performing arts center. The tree lined quad will be flanked by covered lunch shelters and an outdoor stage will be the focal point of the quad's north end.

ASB Building: A one story ASB building will be constructed at the north of the new campus quad. The 3,000 square foot building will house ASB classrooms, instructional space, an activities area, office and storage space.

Special Education Building: A one story Special Education building will be constructed at the

east end of the existing parking lot, near the Tennis Courts. This 4,200 square foot building will include three classrooms, restrooms, storage, and meeting room space.

Parking Lot Renovation: The existing primary parking lot will be completely re-constructed over 178,000sf to include 399 parking stalls

Project phases will occur per the following;

Phase 1

- New Classroom - Install Laydown Area per CMSK - 03
- Phase 1 Utility Lines - Cap Off
- Portables Bldgs P11,P12 - Demo CMSK - 05
- New Classroom Bldg - Site Demo
- New Classroom Bldg - Construction
- Construct Student Access Corridor per CMSK- 04
- Temp Head-In Bldg - Relocate P-27 (allowance item) CMSK 12
- New Classroom Bldg - Low Voltage Switch Over
- Remove and Repair Laydown Area per CMSK - 03
- Temporary Band and Hideout Portables set by RUSD
- New Classroom Bldg - Punch Period (7/3/17 to 7/14/17)
- New Classroom Bldg - Substantial Completion (7/14/17)
- New Classroom Bldg - District Move In Period (7/17/17 to 8/11/17)

Phase 2

- Portable Bldgs P-7 thru P-10 - Demo per CMSK 06
- Set Temp Admin Staff Toilet Trailer - per CMSK 08
- District Moves Library Facility to C Bldg (allowance item) CMSK13
- Portable Bldgs P-1 thru P-6 - Admin TI (allowance item) CMSK 14
- Set Temp Food Service Portable Bldg - per CMSK 07
- (E) Admin, H bldg, Library, Kitchen, JAR Bldg - Dist. Move Out
- Portable Bldgs P-1 thru P-6 - Admin Dept. Move In
- (E) Admin, H bldg, Library, JAR - Fence Off Area - Per CMSK 09A,10
- Admin/Library, Theater/Kitch,ASB,JAR Laydown Area per CMSK 09A
- Phase 2 Utilities - Cap Off
- (E) Admin, Theater/H bldg, Library, JAR - Demo
- New Admin/Library, Theater/Kitchen, JAR, ASB - Construction
- ASB, JAR Bldgs - Punch Period
- ASB, JAR Bldgs - Substantial Completion
- Admin/Library Bldg - Punch Period

- Admin/Library Bldg - Substantial Completion
- Admin/Library Bldg - District Move In
- Student P-Lot - Reconfigure for Site Access - per CMSK 09B
- Portable Bldgs P-1 thru P-6 - Fence Off, Cap (E) Utilities
- Portable Bldgs P-1 thru P-6 - Remove Existing Bldgs
- New Special Ed Bldg - Construction
- Remove, Repair Contactor Yard/Parking - per CMSK 02
- Theater/Kitchen, Special Ed Bldgs - Punch Period
- Theater/Kitchen, Special Ed Bldgs - Substantial Completion

Phase 3

- Portable P-27 Temp Head-in Low Voltage - Demo bldg CMSK 12
- Student P-Lot - Fence Off
- Student P-Lot - Cap Off Existing Utilities
- Student P-Lot - Demo Existing
- Student P-Lot - Construction
- Portable Bldgs P-13 thru P26 - Remove - per CMSK 11
- Phase 3 - Punch Period
- Phase 3 - Substantial Completion

The area currently contains 87.5% impervious and 87.5% pervious (undeveloped). The area topography is generally flat; the site slopes downward to the west at an average gradient of about <1 percent.

Unique Project Features: The project includes no site features with regards to Environmentally Sensitive Areas, or adjacent water bodies. The site currently drains to storm drain systems. This plan will outline a system of BMPs that will reduce and or eliminate the possibility of storm water discharges that will compromise water quality

300.2 CONSTRUCTION SITE RISK DETERMINATION EVALUATION

The Notice of Intent (NOI) Application process includes a risk assessment evaluation determining the projects Risk Level. Via the Waterboards SMARTS Database factors were populated for Rainfall Erosivity, Soil Erodibility, slope length, and slope gradient. A screen shot indicating the Risk Level from the SMARTS website is included in Attachment F. Risk Level 1 compliance details can be found in Attachment M.

Based on the Risk Assessment performed by the QSD;

SITE RISK ASSESMENT FOR THIS PROJECT RESULTS IN:

RISK LEVEL 1

Summary of Sediment Risk

RUSLE Factor	Value	Method for establishing value
R	147	Via EPA Online Calculator
K	0.32	Google Earth Overlay per Guidance
LS	0.23	Hand Calculated from site elevations
Total Predicted Sediment Loss (tons/acre)		10.891
Overall Sediment Risk Low Sediment Risk < 15 tons/ acre Medium Sediment Risk >= 15 and < 75 tons/acre High Sediment Risk >= 75 tons/acre		LOW

Summary of Receiving Water Risk

Receiving Water (RW) Risk Factor Worksheet	Entry	Score
A. Watershed Characteristics	yes/no	
A.1. Does the disturbed area discharge (either directly or indirectly) to a 303(d)-listed waterbody impaired by sediment (For help with impaired waterbodies please visit the link below) or has a USEPA approved TMDL implementation plan for sediment?: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	NO	Low
OR		
A.2. Does the disturbed area discharge to a waterbody with designated beneficial uses of SPAWN & COLD & MIGRATORY? (For help please review the appropriate Regional Board Basin Plan) http://www.waterboards.ca.gov/waterboards_map.shtml		

300.3 CONSTRUCTION SITE ESTIMATES

The following are estimates of the construction site:

Construction site area:	10.0 acres
Area of Soil Disturbance:	9.55 acres
Percentage impervious area before construction:	87.5%
Runoff coefficient before construction ⁽¹⁾ :	0.87
Percentage impervious area after construction:	87.5%
Runoff coefficient after construction ⁽¹⁾ :	0.87
Anticipated storm water flow on to the construction site ⁽²⁾ :	Attachment E
(1) Calculations are shown in Attachment D	
(2) Calculations are shown in Attachment E	

300.4 PROJECT SCHEDULE/WATER POLLUTION CONTROL SCHEDULE

Estimate Construction Start:	June 27, 2016
Estimate Construction Finish:	September 02, 2019
Phase 1:	07/01/2016 to 08/11/2017
Phase 2:	06/26/2017 to 06/01/2019
Phase 3:	06/24/2019 to 08/31/2019
Annual Reporting Due:	September 01, 2017 (2018) (2019)

300.5 CONTACT INFORMATION/LIST OF RESPONSIBLE PARTIES

The Contractor assigned to this project is:

This SWPPP has been prepared by the following QSD:


Ryan C. Paris, CPESC #5722
Cell: (909) 957-4239
6297 East Avenue
Rancho Cucamonga, CA 91739
ryan.paris@everestenvironmental.com

The QSP assigned to this project is:


Meiji Tsutsui, CESSWI, QSP#23678
Cell: (760) 900-5780
6297 East Avenue
Rancho Cucamonga, CA 91739
meiji.tsutsui@everestenvironmental.com

The QSP shall have primary responsibility and significant authority for implementation, maintenance, inspection and amendments to the approved SWPPP. The QSP will be available at all times throughout duration of the project. Duties of the Contractor's QSP include but are not limited to:

- Ensuring full compliance with the SWPPP and the Permit
- Implementing all elements of the SWPPP, including but not limited to
 - Implementation of prompt and effective erosion and sediment control measures
 - Implementing all non-storm water management, and materials and waste management activities such as monitoring discharges (dewatering, diversion devices); general site clean-up; vehicle and equipment cleaning, fueling and maintenance; spill control; ensuring that no materials other than storm water are discharged in quantities which will have an adverse effect on receiving waters or storm drain systems; etc.
- Pre-storm inspections
- Post-storm inspections
- Storm event inspections
- Routine inspections as specified in the Special Provisions or described in the SWPPP
- Updates / Amendments to the SWPPP, as needed
- Ensuring elimination of all unauthorized discharges
- The Contractor's QSP shall be assigned authority by the QSD/QSP/LRP to mobilize crews in order to make immediate repairs to the control measures
- Coordinate with the QSD/QSP/LRP to assure all of the necessary corrections/repairs are made immediately, and that the project complies with the SWPPP, the Permit and approved plans at all times.
- Submitting Notices of Discharge and reports of Illicit Connections or Illegal Discharges.

300.6 TRAINING

Section 300.5 shows the name of the Qualified SWPPP Practitioner (QSP). This person has received the following training:

- CASQA QSD/QSP Training 24-hour
- CESSWI Training Program and recognition

The training log showing formal and informal training of various Contractor personnel is shown in Attachment I.

Other Contractor personnel attending tailgate training will document attendance using the form in Attachment I and will address the following topics:

- Erosion Control BMPS
- Sediment Control BMPs
- Waste Management and Materials Pollution Control BMPs
- Emergency Procedures specific to the construction site storm water management

The SWPPP for this project was developed by a Qualified SWPPP Developer (QSD). Ryan Paris, CPESC developed the SWPPP and meets the qualifications and certification requirements of Section VII, Training Qualifications and Certification Requirements, of the CGP based on:



Ryan C. Paris, CPESC #5722

The QSD has received the following training.

- CASQA QSD/P & Trainer of Record 24-hour Course
- 8-Hour NPDES Training Course
- 8-Hour NPDES SWPPP Preparation Course
- 8-Hour NPDES Regulatory Course
- 4-Hour SAP Class (Caltrans Class Instructor for AEI-CASC)
- 24-Hour Caltrans SWPPP Training by GENI
- 24-Hour Caltrans SWPPP Training by AEI-CASC
- 24-Hour Caltrans Training (Class Instructor)
- 10 week State Hydrology Course
- 10 week State Soils Course
- Mr. Paris has prepared over 400 site specific water pollution control documents

SECTION 500

BODY OF SWPPP

500.1 OBJECTIVE

This Storm Water Pollution Prevention Plan (SWPPP) has six main objectives:

- *Identify all pollutant sources including sources of sediment that may affect the quality of storm water discharges associated with construction activity (storm water discharges) from the construction site, and*
- *Identify non-storm water discharges and*
- *Identify, construct, implement in accordance with a time schedule, and maintain Best Management Practices (BMPs) to reduce or eliminate pollutants in storm water discharges and authorized non-storm water discharges from the construction site during construction, and*
- *Develop a maintenance schedule for BMPs installed during construction designed to reduce or eliminate pollutants after construction is completed (post-construction BMPs).*
- *Identify a sampling and analysis strategy and sampling schedule for discharges from construction activity which discharges directly into water bodies listed in Attachment 3 of the Permit (Clean Water Act Section 303(d) Water Bodies Listed as Impaired for Sedimentation.*
- *For all construction activity, identify a sampling and analysis strategy and sampling schedule for discharges that have been discovered through visual monitoring to be potentially contaminated by pollutants not visually detectable in the runoff.*

This SWPPP conforms with the required elements of the General Permit CAS000002 issued by the State of California, State Water Resources Control Board (SWRCB). This SWPPP will be modified and amended to reflect any amendments to the Permits, or any changes in construction or operations that may affect the discharge of pollutants from the construction site to surface waters, groundwaters, or the municipal separate storm sewer system (MS4). The SWPPP will also be amended if it is in violation of any condition of the Permit or has not achieved the general objective of reducing pollutants in storm water discharges. The SWPPP will be readily available on-site for the duration of the project.

500.2 VICINITY MAP

The construction project vicinity map showing the project location, surface water boundaries, geographic features, construction site perimeter, and general topography, is located in attachment A.

500.3 POLLUTANT SOURCE IDENTIFICATION AND BMP SELECTION

500.3.1 Inventory of Materials and Activities that may Pollute Storm Water

The following is a list of construction materials that may be used and activities that may be performed that may have the potential to contribute pollutants other than sediment, to storm water runoff. Control practices for each activity are identified in the Water Pollution Control Drawings (WPCDs) and/or in Sections 500.3.4 through 500.3.9. For sampling requirements for non-visible pollutants associated with construction activity please refer to Section 600. For a full and complete list of onsite pollutants, refer to the Material Safety Data Sheets (MSDS), which are retained onsite at the construction trailer.

- waste materials associated with demolition activities (e.g. asbestos, wood debris; Freon; aluminum, zinc, masonry block rubble, and PCC rubble),
- materials and waste associated with roadway paving operations (e.g. hot asphalt, asphalt emulsion, liquid asphalt, any type of asphalt concrete, cold mix, crumb rubber, acidity, alkalinity, and sawcutting slurries),
- materials and waste associated with hardscape improvements such as drainage structures, median barriers, and bridge construction (e.g. Portland cement, masonry blocks, sealants, steel slag, metals, foundry sand, fly ash, mortar, treated wood, and rinse water),
- base, subbase, and stockpiled materials associated with hardscape and underground improvements (e.g. cement bound granular mixtures, hydraulic road binder bound mixtures, soil cement, and soil treated by hydraulic road binder),
- joint and curing compounds (e.g. patching compounds, levelers, drywall joint compounds, polymeric compounds, water reducing admixtures, sealants, and waterproofing coatings),
- concrete curing compounds (e.g. floor hardners, methacrylate, and epoxy resin products),
- painting products (e.g. paint, dyes, stripping pigments, sanding residue, paint strippers, acetone, methyl ethyl ketone, resins, sealants, solvents, thinners, lacquers, varnish, enamels, gum spirit, and turpentine),
- vehicle and equipment fluids (e.g. total petroleum hydrocarbons and fuels, oils and grease, coolants/antifreeze, solvents, sealers, acids, benzene and derivatives, lubricants, and discharge from batteries),
- portable toilet waste products (e.g. bacteria, BOD, pathogens, and sanitary wastes), and
- general litter (e.g. plastic, paper, cigarettes, other dry garbage, wood products, steel, and packaging).

Construction activities that have the potential to contribute sediment to storm water discharges include:

- Excavation

- Grading
- Saw-cutting

Implementation and location of BMPs are shown on the WPCD in Attachment B. Narrative descriptions of BMPs to be used during the project are listed by category in each of the following SWPPP sections. Attachment Q includes a copy or a list of all the BMPs selected for this project.

500.3.2 Existing (pre-construction) Control Measures

The following are existing (pre-construction) control measures encountered within the project site:

- Hardened and engineered storm drainage conveyances
- Landscaping and irrigation systems

500.3.3 Nature of fill material and existing data describing the soil

Fill Material

Fill material is not expected to be necessary in order to complete the Project Scope of Work.

Soil Characteristics

Topsoil encountered on the site consists of 60% sand, 30% silty sand, and 10% clay.

Existing Pollutant Sources

No significant materials are known to have been spilled, leaked, or otherwise accidentally released in significant quantities onto the construction site. This determination is based on historical data and site review. No "significant materials and quantities" includes no toxic chemicals, listed in Code of Federal Regulations (40 CFR 372), requiring reporting on the EPA Form R; and no oil or hazardous substances in excess of reportable quantities, as specified in 40 CFR 110, 117, and 302 .

500.3.4 Erosion Control (Soil Stabilization)

Soil stabilization, also referred to as erosion control, consists of source control measures that are designed to prevent soil particles from detaching and becoming transported in storm water runoff. Soil stabilization BMPs protect the soil surface by covering and/or binding soil particles. This project will incorporate minimum temporary soil stabilization requirements and other measures selected by the Contractor. This project will implement the following practices for effective temporary and final soil stabilization during construction:

- (1.) Preserve and maintain existing vegetation where required and when feasible.
- (2.) Stabilize non-active areas within 14 days of cessation of construction activities.
- (3.) At completion of construction, install permanent erosion control, landscaping, to all remaining disturbed soil areas as required in the project specifications.

The Contractor shall limit the use of plastic materials when more sustainable, environmentally friendly alternatives exist. Where plastic materials are deemed necessary, the discharger shall consider the use of plastic materials resistant to solar degradation.

Implementation and locations of temporary soil stabilization BMPs are shown on the Water Pollution Control Drawing (WPCD) in Attachment B and/or described in this section. The BMP Consideration Checklist in Attachment C indicates the BMPs that will be implemented to control erosion on the construction site; these are:

- **EC-1, Scheduling**

Contractor shall reduce the discharge of pollutants to storm drain facilities or water courses caused by construction activities by scheduling said activities in a manner that will limit exposure of disturbed soil to wind, rain, and storm water run-on and run-off. AC and PCC applications shall not occur within 48 hours of a forecast rain event.

- **EC-2, Preservation of Existing Vegetation**

Contractor shall protect and preserve ANY existing vegetation adjacent to work areas as long as practicable before disturbing them. Contractor shall also preserve and protect existing vegetation adjacent to work areas. The protection and preservation of such vegetation will serve to control erosion and filter out sediment. This may include mowing of natural grasses and weeds and preservation of large trees.

- **EC-3, Hydraulic Mulch**

Contractor will apply hydraulic mulch to slopes as a means of erosion control for any disturbed soil areas which lay idle in excess of 14 days. This BMP may be used in conjunction with BMP EC-7.

- **EC-7, Geotextiles & Mats**

Contractor shall implement one or more of these measures to stabilize disturbed soil areas (stockpiles, slopes, embankments, conveyances, etc.) and protect these soils from erosion by rain, wind or storm water run-on and run-off. Primarily, plastic sheeting will be used to cover stockpiles prior to a forecast rain or wind event. If disturbed soil areas become idle for 14 days or more, or a rain event of 50% or greater is forecast, the contractor will utilize this BMP to stabilize these areas

Implementation of Soil Stabilization BMPs

BMPs will be deployed in a sequence to follow the progress of grading and construction. As the locations of soil disturbance change, erosion and sedimentation controls will be adjusted accordingly to control storm water runoff at the downgrade perimeter and drain inlets. BMPs will be mobilized as follows:

Year-round:

- The Qualified SWPPP Practitioner will monitor weather using National Weather Service reports to track conditions and alert crews to the onset of rainfall events.
- Disturbed areas will be stabilized with temporary soil stabilization or with permanent erosion control as soon as possible after grading or construction is complete.
- Disturbed areas will be stabilized with temporary or permanent soil stabilization (erosion control) before rain events.
- Prior to forecast storm events, temporary soil stabilization BMPs will be deployed and inspected.
- The project schedule will sequence construction activities with the installation of both soil stabilization and sediment control measures. The construction schedule will be arranged as much as practicable to leave existing vegetation undisturbed until immediately prior to grading.

500.3.5 Sediment Control

Sediment controls are structural measures that are intended to complement and enhance the selected erosion control measures and reduce sediment discharges from active construction areas. Sediment controls are designed to intercept and settle out soil particles that have been detached and transported by the force of water. This project will incorporate temporary sediment control required by the contract documents, and other measures selected by the LRP/QSD, QSP.

Temporary sediment control materials will be maintained on-site throughout the duration of the project, to allow implementation of temporary sediment controls in the event of predicted rain, and for rapid response to failures or emergencies, in conformance with other Permit requirements and as described in this SWPPP. This includes implementation requirements for active areas and non-active areas before the onset of rain.

Implementation of Temporary Sediment Controls:

- Temporary sediment controls will be implemented at the draining perimeter of disturbed soil areas, at storm drain inlets and at outfall areas at all times.

Implementation and locations of temporary sediment control BMPs are shown on the Water Pollution Control Drawing (WPCD) in Attachment B. The BMP Consideration Checklist in Attachment C indicates all the BMPs that will be implemented to control sediment on the construction site; these are:

- **SE-1, Silt Fence; SE-5, Fiber Rolls; SE-6, Gravel Bag Berm**

Linear barriers for sediment control protection will be applied throughout the construction zone but primarily located at the project perimeter, as well as, around any material, or spoil stockpiling areas. The installation of linear barriers will serve as sediment control for exposed soil areas. Linear barriers shall be maintained to provide adequate sediment holding capacity. Sediment shall be removed when it reaches approximately 1/3 of the barrier height. The Contractor may use a combination of the above BMPs.

- **SE-4, Check Dams**

The Contractor will implement gravel bag check dams at concentrated flow areas where erosion potential is high. With the onset of soil disturbing activities gravel bag check dams shall be placed per BMP specifications in Attachment Q. The area behind the gravel bags will collect and hold runoff in order to allow suspended sediment to settle out. The Contractor will remove this sediment periodically during the rainy season, and especially after heavy rains. Gravel bags, which become clogged with sediment, will be replaced as necessary to ensure the free flow of water.

- **SE-7, Sediment Sweeping and Vacuuming**

Sediment sweeping and vacuuming will be provided year-round for all points of ingress and egress to the project site where vehicles and/or equipment may track sediment onto public and/or private roads. The objective of the sediment tracking

control is to limit the amount of sediment from public or private roads that may be transported to storm drains or watercourses. During soil hauling (export operations) the Contractor shall run a mechanical sweeper daily.

- **SE-10, Storm Drain Inlet Protection**

New and existing inlets shown on the WPCDs will be protected, as necessary, from sediment using a gravel bag barrier. The area behind the gravel bags will collect and hold runoff in order to allow suspended sediment to settle out. The Contractor will remove this sediment periodically during the rainy season, and especially after heavy rains. Gravel bags, which become clogged with sediment, will be replaced as necessary to ensure the free flow of water.

During the non-winter season, existing inlets will need to be protected from any grinding, sandblasting, and demolition operations. Any air-borne debris from these operations can settle into any surrounding inlets. Therefore, these inlets need to be protected with sandbags or with a plastic medium.

500.3.6 Tracking Control

The following BMPs have been selected to reduce sediment tracking from the construction site onto private or public roads:

- **TR-1, Stabilized Construction Entrance/Exit**

Stabilized construction entrances/exits have been located. See project WPCDs in Attachment B for locations with the Main Parking Area.

The site entrance/exit will be stabilized to reduce tracking of sediment as a result of construction traffic. The entrance will be designated and graded to prevent runoff from leaving the site. The entrance will be flared where it meets the existing road to provide an adequate turning radius.

Sediment tracking control BMPs shall be considered for all points of ingress and egress to the project site where vehicles and/or equipment may track sediment onto public or private roads. The objective of the sediment tracking control is to prevent tracking of sediment onto public or private roads

- **SE-7 Sediment Sweeping and Vacuuming**

Sediment sweeping and vacuuming will be provided year-round for all points of ingress and egress to the project site where vehicles and/or equipment may track sediment onto public and/or private roads. The objective of the sediment tracking control is to limit the amount of sediment from public or private roads that may be transported to storm drains or watercourses. During construction Contractor shall run a mechanical sweeper weekly as needed.

500.3.7 Wind Erosion Control

The following BMP has been selected to control dust from the construction site:

- **EC-2, Preservation of Existing Vegetation**

Contractor shall preserve and protect existing vegetation adjacent to work areas. The protection and preservation of such vegetation will serve to control erosion and filter out sediment.

- **EC-3, Hydraulic Mulch**

Contractor will apply hydraulic mulch to slopes as a means of erosion control for any disturbed soil areas which lay idle in excess of 14 days. This BMP may be used in conjunction with BMP EC-7.

- **EC-7, Geotextiles & Mats**

Contractor shall implement one or more of these measures to stabilize disturbed soil areas (stockpiles, slopes, embankments, conveyances, etc.) and protect these soils from erosion by rain, wind or storm water run-on and run-off. Primarily, plastic sheeting will be used to cover stockpiles prior to a forecast rain or wind event. If disturbed soil areas become idle for 14 days or more, or a rain event of 50% or greater is forecast, the contractor will utilize this BMP to stabilize these areas

- **WE-1, Wind Erosion Control**

Contractor shall apply water to active disturbed soil areas.

Dust Control

During windy conditions (forecast or actual wind conditions of approximately 25 mph or greater), dust control will be applied to DSAs to adequately control wind erosion.

500.3.8 Non Storm Water Control

An inventory of construction activities and potential non-storm water discharges is provided in Section 500.3.1. The BMP Consideration Checklist in Attachment C and the following list indicates the BMPs that have been selected to control non-storm water pollution on the construction site. Implementation and locations of some non-storm water control BMPs are shown on the Water Pollution Control Drawing (WPCD) in Attachment B. A narrative description of each BMP follows.

- **NS-1, Water Conservation Practices**

The Contractor shall use water in a manner which will not cause erosion or transport pollutants off-site.

- **NS-3, Paving and Grinding Operations**

The Contractor will implement the BMP listed above during paving operations including any AC or PCC removal, saw-cutting and resurfacing operations.

BMP NS-3, Paving and Grinding Operations, will be implemented to prevent paving materials from being discharged off-site. Covers will be placed over each inlet adjacent to paving operations. The covers may consist of plastic covers placed over, and tucked under, each inlet grate. Following paving operations, the area will be swept, inlet covers will be removed, and the inlets will be inspected for paving materials.

This project may require saw-cutting operations, periodically throughout the project. BMP WM-8, Concrete Waste Management, will be implemented to contain and dispose of saw-cutting slurries. Sand bags will be used to contain the slurry and prevent discharges to the storm drain system. The slurry will be vacuumed and discharged to the concrete washout facility described below. Dried and cured concrete wastes will be disposed off-site during concrete washout maintenance activities.

- **NS-6, Illicit Connection/Discharge**

The Contractor will implement BMP NS-6, Illicit Connection/Discharge throughout the duration of the project.

Accidental discharges will be cleaned up immediately. Illicit discharges by the Contractor's operation will not be allowed. Illicit discharges by others will be reported to the appropriate authorities (i.e. City Hall or the local police).

- **NS-7, Potable Water/Irrigation**

Contractor shall implement this BMP whenever there is a possibility for discharge of potential pollutants from potable water or irrigation systems at or entering the site. These systems that generate such discharges include irrigation lines, lawn and garden watering, planned or unplanned discharges from potable water sources, water line flushing, and hydrant flushing.

- **NS-9, Vehicle and Equipment Fueling; NS-10, Vehicle and Equipment Maintenance**

Several types of vehicles and equipment will be used on-site throughout the project, including loaders, paving equipment, rollers, trucks and trailers, backhoes, forklifts, generators, compressors, and traffic control equipment. BMPs NS-9, Vehicle and Equipment Fueling, and NS-10, Vehicle and Equipment Maintenance will be utilized to prevent discharges of fuel and other vehicle fluids. Except for concrete washout, which is addressed in Section 500.3.8, vehicle cleaning is not scheduled to be performed on-site.

Fuel trucks, each equipped with absorbent spill clean-up materials, will be used for all on-site fueling. All vehicle maintenance and mobile fueling operations will be conducted at least 50 ft away from operational inlets and drainage facilities and on a level graded area. Drip pans will be used for all mobile fueling.

- **NS-12, Concrete Curing**

The Contractor will utilize this BMP in the handling and application of concrete curing compounds. Furthermore, the Contractor will strictly use only pigmented curing compound in order to alleviate any question with regards to sampling for non-visible pollutants inherent in curing compounds.

- **NS-12, Concrete Finishing**

The Contractor will utilize this BMP in the finishing of concrete surfaces. Furthermore, the Contractor will ensure that blasting and other concrete finishing materials are not to be swept or otherwise settled into new or existing inlets.

500.3.9 Waste Management and Materials Pollution Controls

An inventory of construction activities, materials, and wastes is provided in Section 5.3.1. The BMP Consideration Checklist in Attachment C and the following list indicates the BMPs that have been selected to handle materials and control construction site wastes. A narrative description of each BMP follows:

- **WM-1, Material Delivery and Storage; WM-2, Material Use**

Material loading, unloading, and storage areas will be conducted on impervious surfaces. The Contractor will field locate a stabilized area to prevent potential spills or unnecessary tracking of sediment. The Contractor will utilize this BMP for construction material loading, unloading, and storage areas.

In general, BMPs WM-1 and WM-2 will be implemented to help prevent discharges of construction materials during delivery, storage, and use. The general material storage area will be located in the Contractor's yard.

- **WM-3, Stockpile Management**

If temporary stockpiles become necessary, the Contractor will place any stockpiles with-in the work area and show location(s) on the WPCDs. Stockpiles shall be covered with visqueen or other plastic medium if left idle for 14 days or more.

Visqueen or plastic medium shall be weighted with sandbags or gravel bags and keyed in as required.

- **WM-4, Spill Prevention and Control**

The Contractor shall implement this BMP when any chemical and/or hazardous substance is used or stored on site to control, clean-up and prevent spills and discharges to storm drain systems. Spill prevention is also discussed above in Material Delivery, Storage, and below in the following waste management and equipment maintenance sections.

Implement spill and leak prevention procedures for chemicals and hazardous substances stored at the job site. If you spill or leak chemicals or hazardous substances at the job site, you are responsible for all associated cleanup costs and related liability.

As soon as it is safe, contain and clean up spills of petroleum products, sanitary and septic waste substances listed under CFR Title 40, Parts 110, 117, and 302.

Minor Spill

Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.

Clean up minor spills using the following procedures:

1. Contain the spread of the spill
2. Recover the spilled material by absorption
3. Clean the contaminated area
4. Dispose of the contaminated material promptly and properly

Semi-significant Spills

Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.

Clean up semi-significant spills immediately by the following procedures:

1. Contain the spread of the spill
2. Recover the spilled material using absorption whenever a spill occurs on a paved surface or an impermeable surface
3. Contain the spill with an earthen dike and dig up the contaminated soil for disposal whenever a spill occurs on soil
4. If the spill occurs during precipitation, cover the spill with plastic or other material to prevent contaminated runoff
5. Dispose of the contaminated material promptly and properly

Significant or Hazardous Spills

Immediately notify qualified personnel of significant or hazardous spills. Do not let construction personnel attempt to clean up the spill until qualified staff have arrived. Do the following:

1. Notify the LRP/QSD/QSP and follow up with a written report

2. Obtain the services of a spills contractor or hazardous material team immediately
3. Notify ARCC (424) 646-5292
4. Notify the local emergency response team by dialing 911 and county officials at the emergency phone numbers kept at the job site
5. Notify the Governor's Office of Emergency Services Warning Center at (805) 852-7550
6. Notify the National Response Center at (800) 424-8802 regarding spills of Federal reportable quantities under CFR Title 40, Parts 110, 119, and 302
7. Notify other agencies as appropriate, including:
 - Fire Department
 - Public Works Department
 - City Police or County Sheriff Department
 - Department of Toxic Substances
 - California Division of Oil and Gas
 - Cal OSHA
 - Regional Water Resources Control Board

Report minor, semi-significant, and significant spills to the QSP. The QSP must oversee and enforce proper spill prevention and control measures. Prevent spills from entering storm water runoff before and during cleanup. Do not bury spills or wash spills with water.

Keep material or waste storage areas clean, well organized, and equipped with enough cleanup supplies for the material being stored.

Maintain proper spill kit material on equipment which utilizes hydraulic equipment, within the yard area, on trucks able to mobilize clean-up effort.

- **WM-5, Solid Waste Management; WM-6, Hazardous Waste Management**

The Contractor shall implement this BMP whenever wastes are generated, stockpiled or removed from the site. Implementation of this BMP minimizes or eliminates the discharge of pollutants to the drainage system or watercourses.

BMP WM-5, Solid Waste Management, and BMP WM-6, Hazardous Waste Management will be implemented to minimize storm water contact with waste materials and prevent waste discharges. When on-site storage is necessary, solid wastes will be stored in watertight dumpsters in the general storage area of the contractors yard. Dumpster locations will be located throughout the project site. Solid waste, including rubble stockpiles, will be removed and disposed off-site at least weekly.

Hazardous wastes, if any, will be stored in the shipping containers or covered containment area discussed above for materials storage. Hazardous wastes will be appropriate and clearly marked containers and segregated from other non-waste materials

- **WM-8, Concrete Waste Management**

BMP WM-8, Concrete Waste Management, will be implemented in above grade portable concrete washout facilities to be constructed and maintained at concrete waste washout area located with-in the Contractors Yard area shown on the WPCDs. All excess concrete and concrete washout slurries will be discharged to the washout facility for drying. BMP maintenance, waste disposal, and BMP removal will be conducted as described in WM-8.

- **WM-9 – Sanitary/Septic Waste Management**

The Contractor shall minimize or eliminate the discharge of construction sanitary/septic wastes by implementing this BMP. This BMP is applicable to temporary and portable sanitary/septic systems on construction sites and associated areas. Portable toilets will be located and maintained on-site for the duration of the project. Maintenance will be provided as necessary and wastes will be disposed off-site.

500.3.10 Cost Breakdown for Water Pollution Control

A spreadsheet for Water Pollution Control Cost's has been provided in Attachment O. The Contractor may choose to utilize this form as a means of internally tracking BMP cost at his/her discretion.

500.4 *WATER POLLUTION CONTROL DRAWING (WPCD)*

The Water Pollution Control Drawing can be found in Attachment B.

500.5 *CONSTRUCTION BMP MAINTENANCE, INSPECTION AND REPAIR*

Inspections will be conducted as follows:

- Weekly
- Prior to a forecast storm
- After a rain event that causes runoff from the construction site
- At 24-Hour intervals during extended rain events

Copies of the completed checklists will be kept in the SWPPP in Attachment H.

A tracking or follow-up procedure shall follow any inspection that identifies deficiencies in BMPs. A program for Maintenance, Inspection, and Repair is shown in Attachment G.

500.6 *POST CONSTRUCTION STORM WATER MANAGEMENT*

500.6.1 *Post Construction Control Practices*

The following are the post-construction BMPs that are to be used at this construction site after all construction is complete:

- Los Angeles County Lid and MS4 Compliance including retention/infiltration of the Designed Capture Volume

500.6.2 *Operation/Maintenance after Project Completion*

The post-construction BMPs that are described above will be funded and maintained as follows:

- Rowland School District

500.7 *LIST OF SUBCONTRACTORS*

All Contractors and Subcontractors will be notified of the requirement for storm water management measures during the project. A list of Contractors will be maintained and included in the SWPPP. If Subcontractors change during the project, the list will be updated accordingly. The Subcontractor notification letter and log is included in the SWPPP as Attachment J.

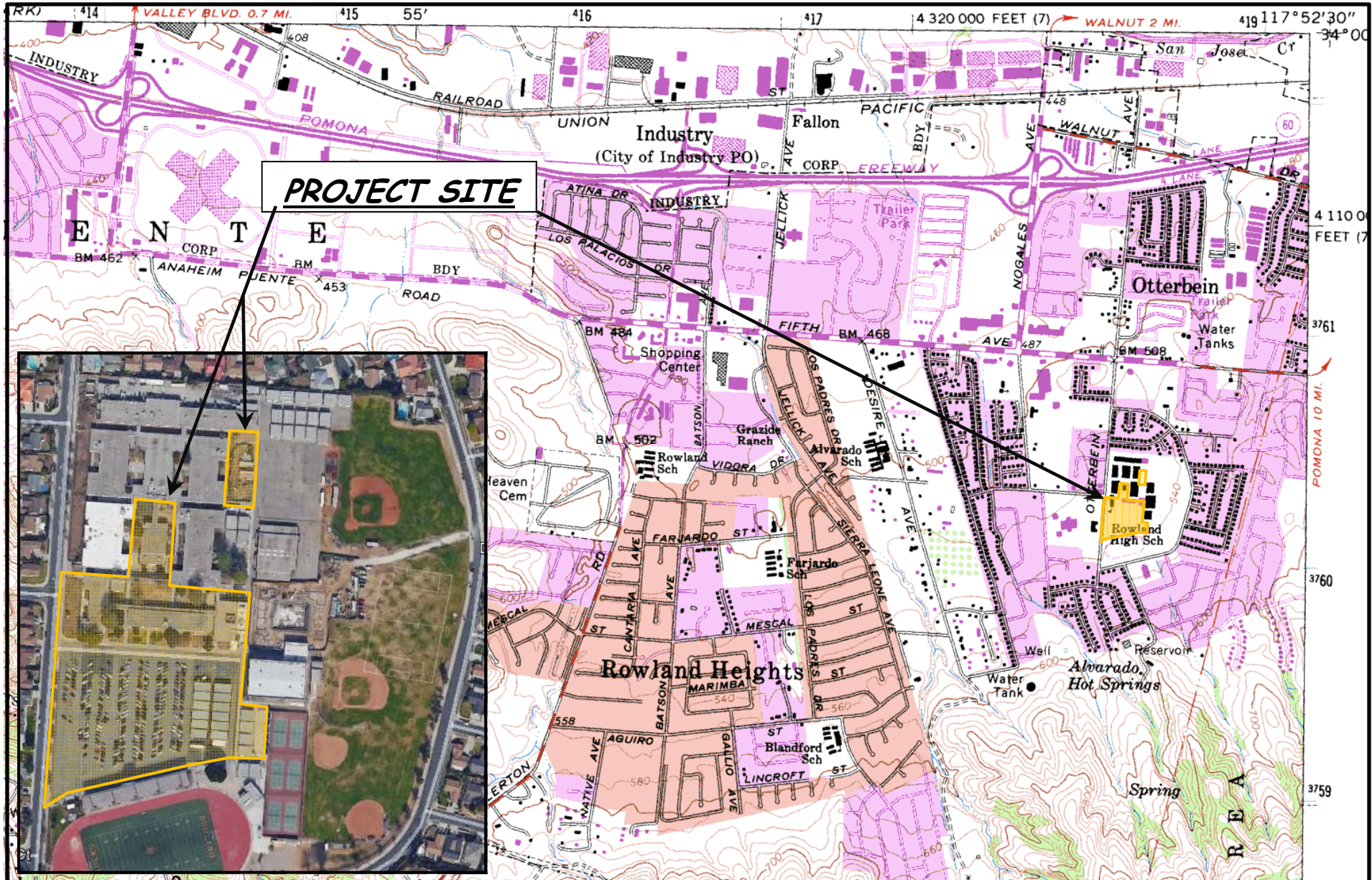
500.8 *Other Plans/Permits*

Attachment N includes copies of other local, state, and federal plans and permits. Following is a list of the plans and permits included in Attachment N:

- State Water Resources Control Board (SWRCB) Order No. 2009-0009-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002 (“General Permit”), Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity.
- State Water Resources Control Board (SWRCB) Order No. 2010-0014-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002 (“General Permit”), Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity.

ATTACHMENT A

Vicinity Map



PREPARED BY:



PREPARED FOR:

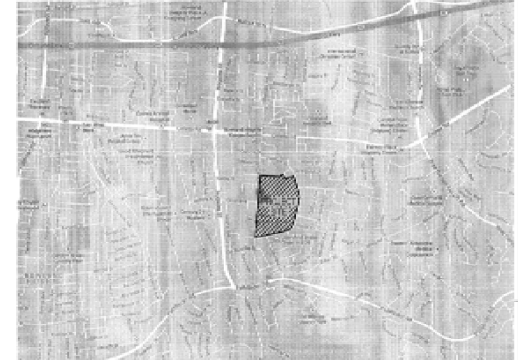
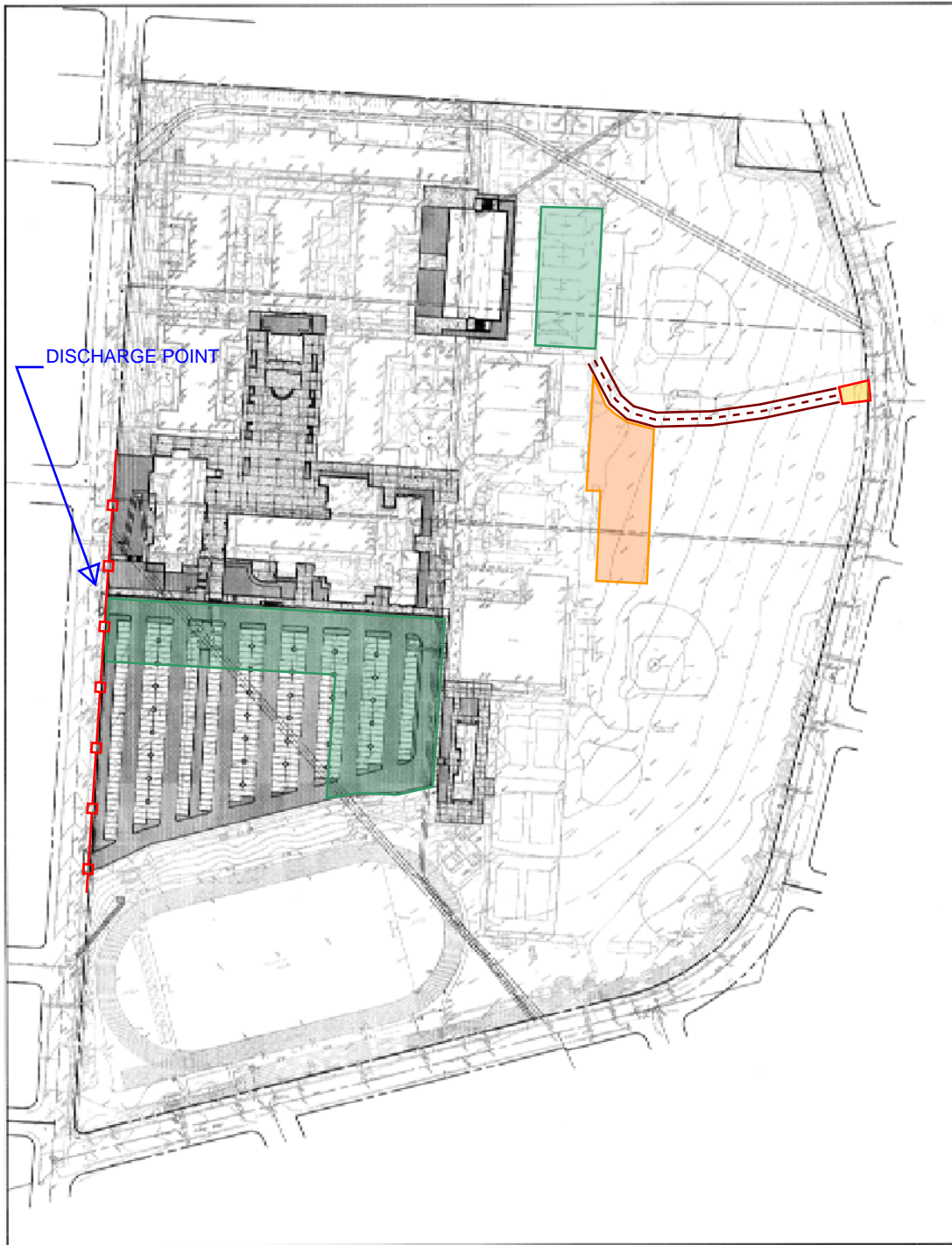
LMCCI
 9441 Haven Ave.
 Rancho Cucamonga, CA 91730
 (909) 476-0590

**Rowland HS Addition
 Rowland Heights CA**

VICINITY MAP





ATTACHMENT B

Water Pollution Control Drawings (WPCDs)



VICINITY MAP
NOT TO SCALE

NOTES

-  CONSTRUCTION TRAILER AND PARKING AREA
-  MATERIAL AND EQUIPMENT STORAGE AREAS
-  STABILIZED CONSTRUCTION ENTRANCE/EXIT
-  INSTALL LINEAR BARRIER PER SE-01 PRIOR TO CREATION OF DISTURBED SOIL IN THESE PHASES

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REVISION SCHEDULE		
NO.	DATE	DESCRIPTION
01/10/14	01/10/14	INITIAL DESIGN DEVELOPMENT
02/02/14	02/02/14	REVISED PROGRESS
03/20/14	03/20/14	DSA SUBMITTAL
04/02/15	04/02/15	DSA BACK CHECK

DRAWN: CEI CHKD: CEI
 DATE: 04/28/2015 SCALE: AS SHOWN
 PROJECT NUMBER: 1316130

TITLE SHEET

DRAWING NUMBER: **C0.01**

**CMSK 01
Construction Access
and Haul Road**

Valencia Street

Construction access
and haul road

Contractor job trailer
and parking yard

Contractor shall perform the following:

1. Provide SC-07, Sediment Sweeping and Vacuuming at Valencia Avenue, adjacent access areas, and any are where tracked sediment becomes evident.
2. BMPs active within the Contractor's Yard include but may not be limited to; WM-1, WM-2, WM-3, WM-4, WM-5, WM-6, WM-8, WM-9, NS-1, NS-6, NS-9, NS-10, SE-1, TC-1, WE-1
3. The sites LMCCI assigned QSP shall update on site WPCDs on a bimonthly basis in order to reflect current active conditions.
4. new and existing inlets on site, and within Valencia Avenue, shall be protected via SE-10.

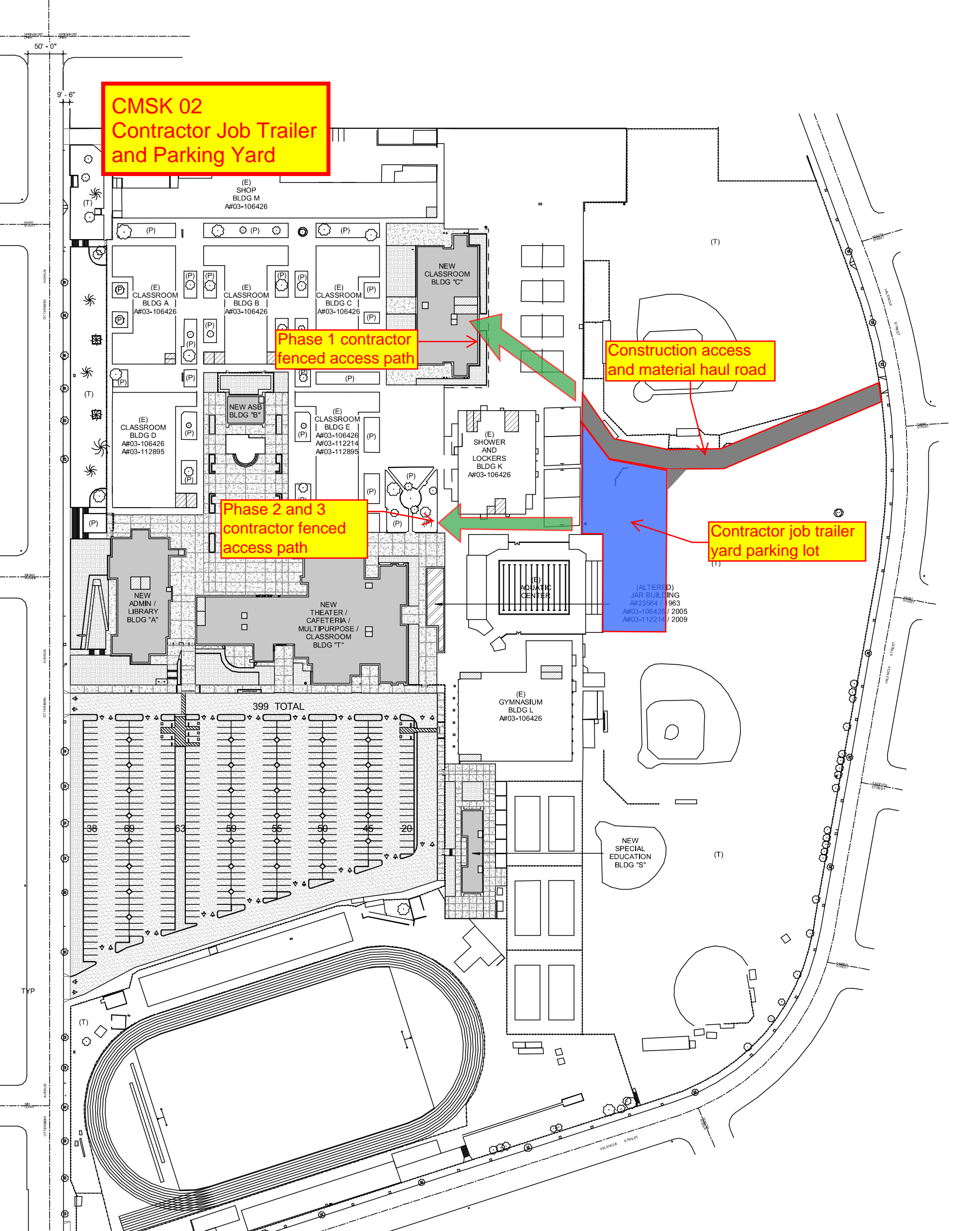
**CMSK 02
Contractor Job Trailer
and Parking Yard**

**Phase 1 contractor
fenced access path**

**Construction access
and material haul road**

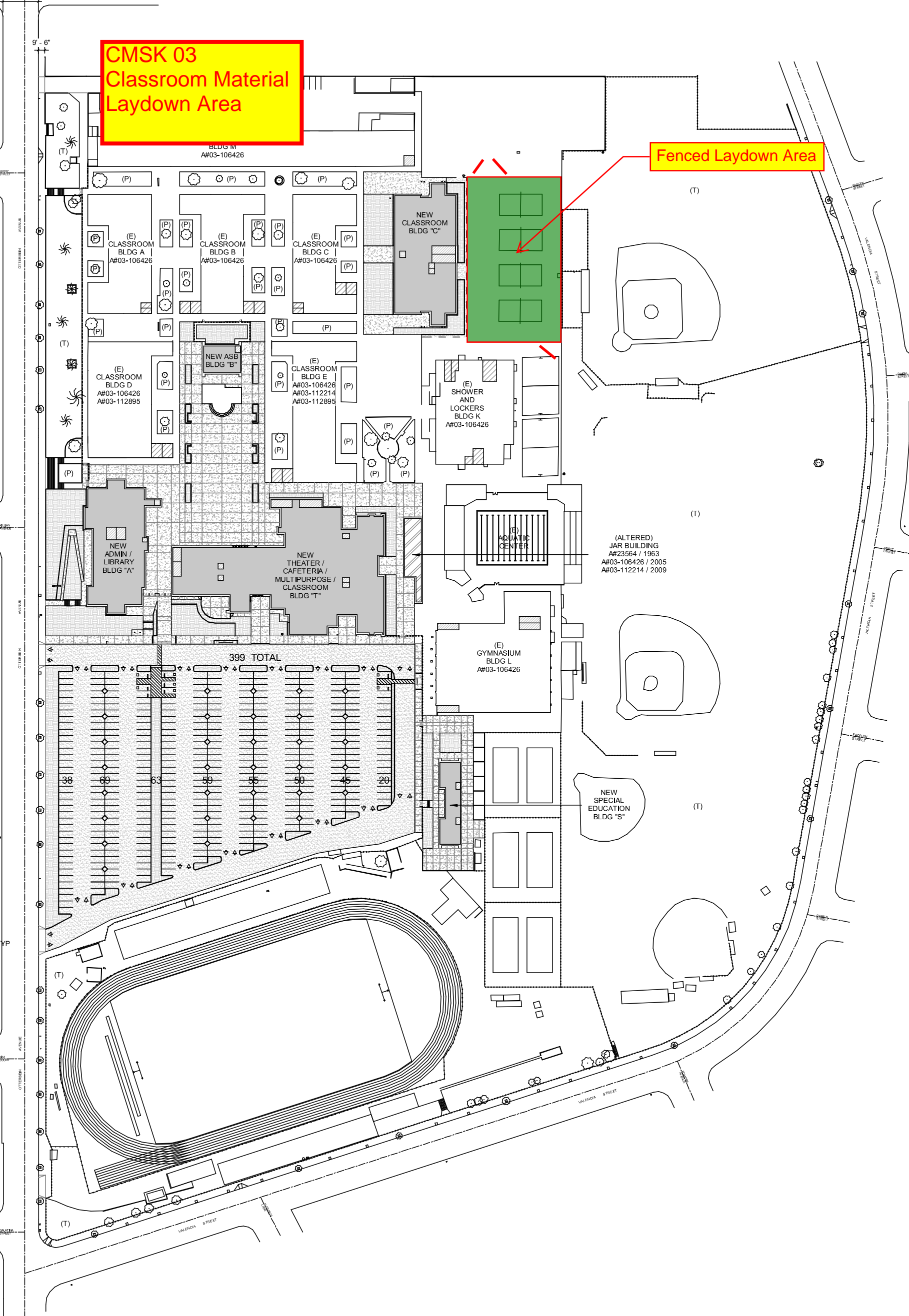
**Phase 2 and 3
contractor fenced
access path**

**Contractor job trailer
yard parking lot**



**CMSK 03
Classroom Material
Laydown Area**

Fenced Laydown Area



**CMSK - 09A
Phase 2 Material
Laydown Area**

SHOP
BLDG M
A#03-106426

(E)
CLASSROOM
BLDG A
A#03-106426

(E)
CLASSROOM
BLDG B
A#03-106426

(E)
CLASSROOM
BLDG C
A#03-106426

NEW
CLASSROOM
BLDG "C"

(E)
CLASSROOM
BLDG D
A#03-106426
A#03-112895

NEW ASB
BLDG "B"

(E)
CLASSROOM
BLDG E
A#03-106426
A#03-112214
A#03-112895

(E)
SHOWER
AND
LOCKERS
BLDG K
A#03-106426

NEW
ADMIN /
LIBRARY
BLDG "A"

NEW
THEATER /
CAFETERIA /
MULTIPURPOSE /
CLASSROOM
BLDG "T"

(E)
AQUATIC
CENTER

(ALTERED)
JAR BUILDING
A#23584 / 1963
A#03-106426 / 2005
A#03-112214 / 2009

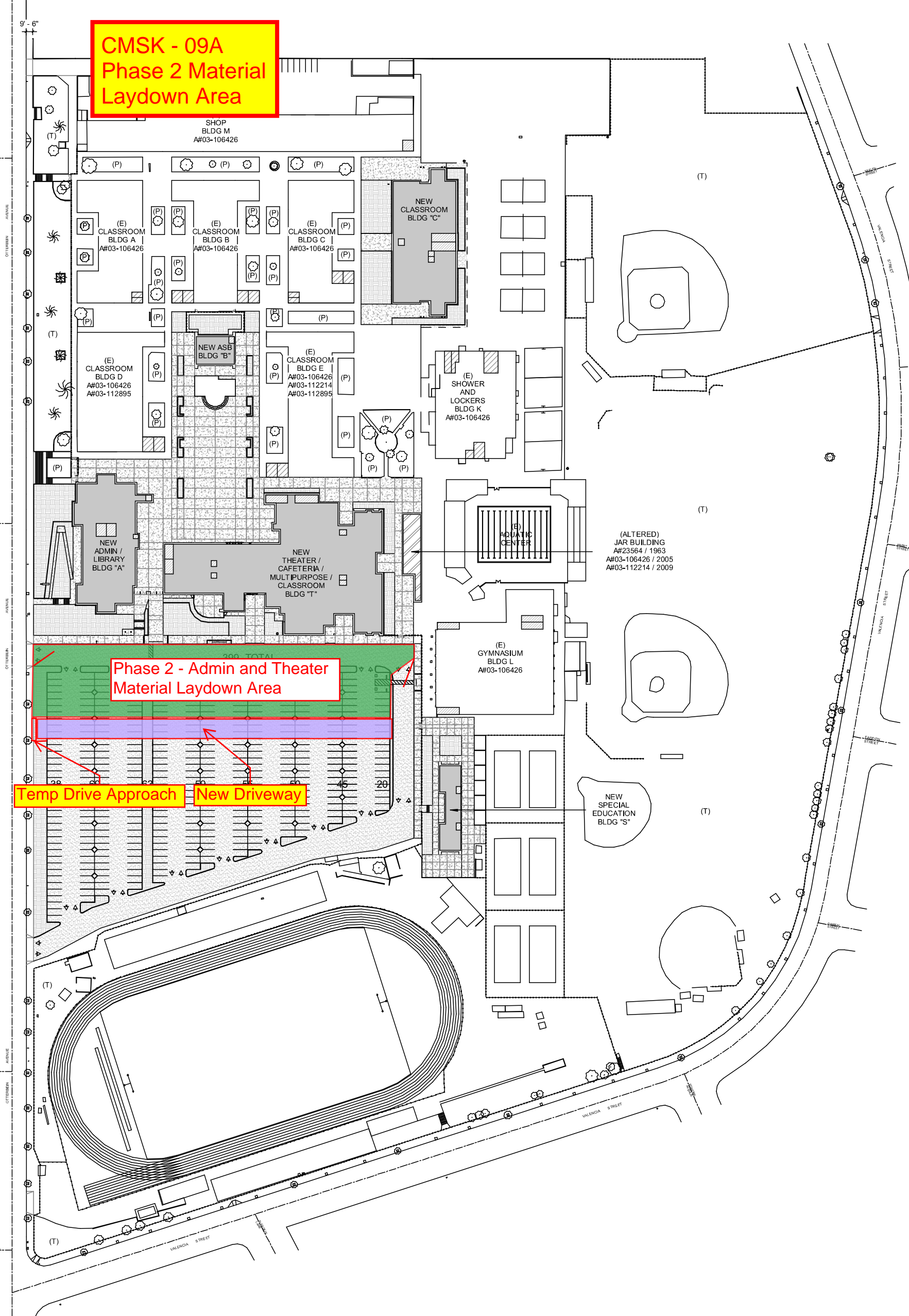
**Phase 2 - Admin and Theater
Material Laydown Area**

(E)
GYMNASIUM
BLDG L
A#03-106426

NEW
SPECIAL
EDUCATION
BLDG "S"

Temp Drive Approach

New Driveway



**CMSK 10
Overall Fencing Plan**

Student Access Corridor

**Phase 1
Fence Around P-11 Panel**

Phase 1

Haul Road

**Contractor
Yard**

Phase 2

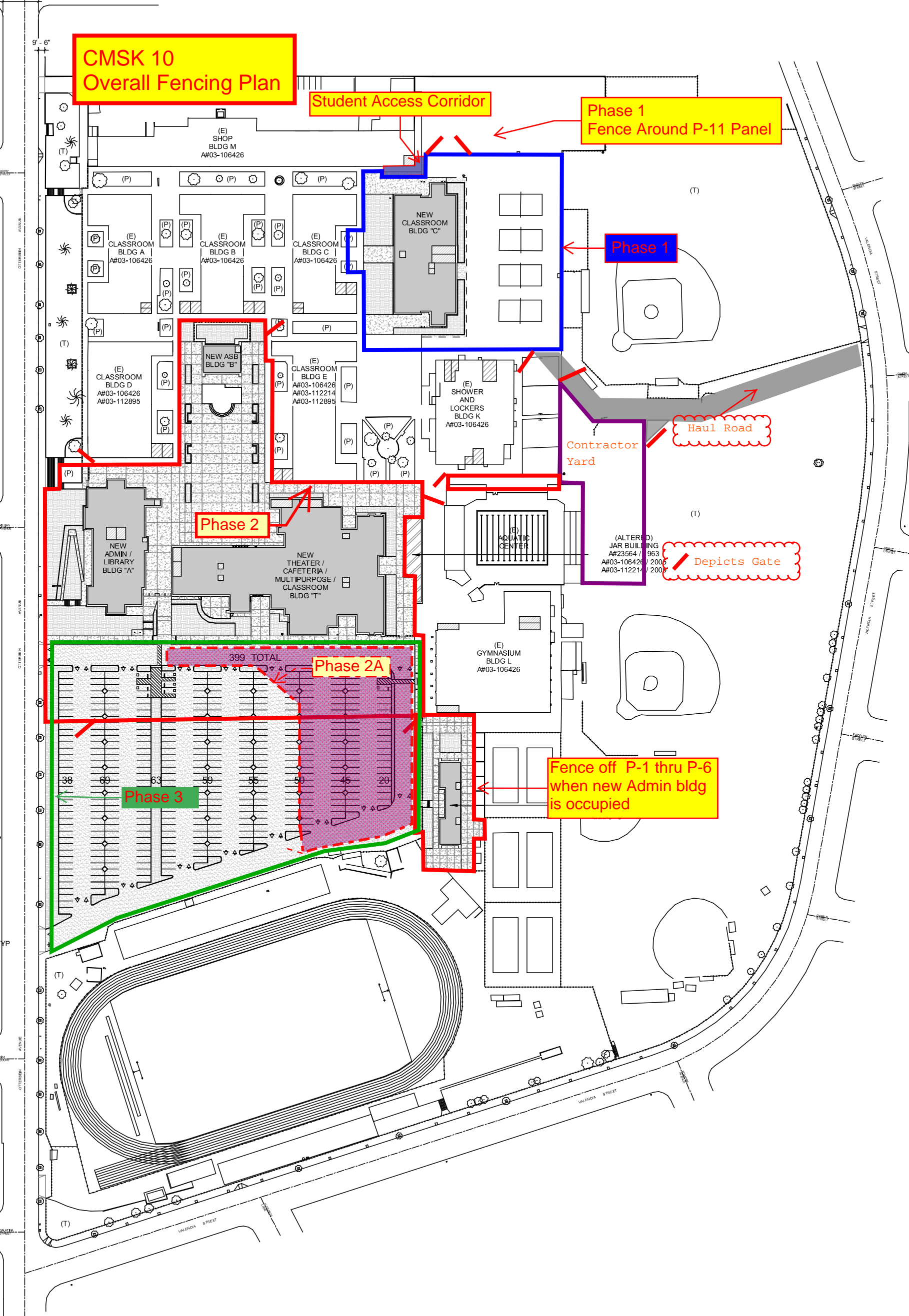
Depicts Gate

Phase 2A

399 TOTAL

**Fence off P-1 thru P-6
when new Admin bldg
is occupied**

Phase 3



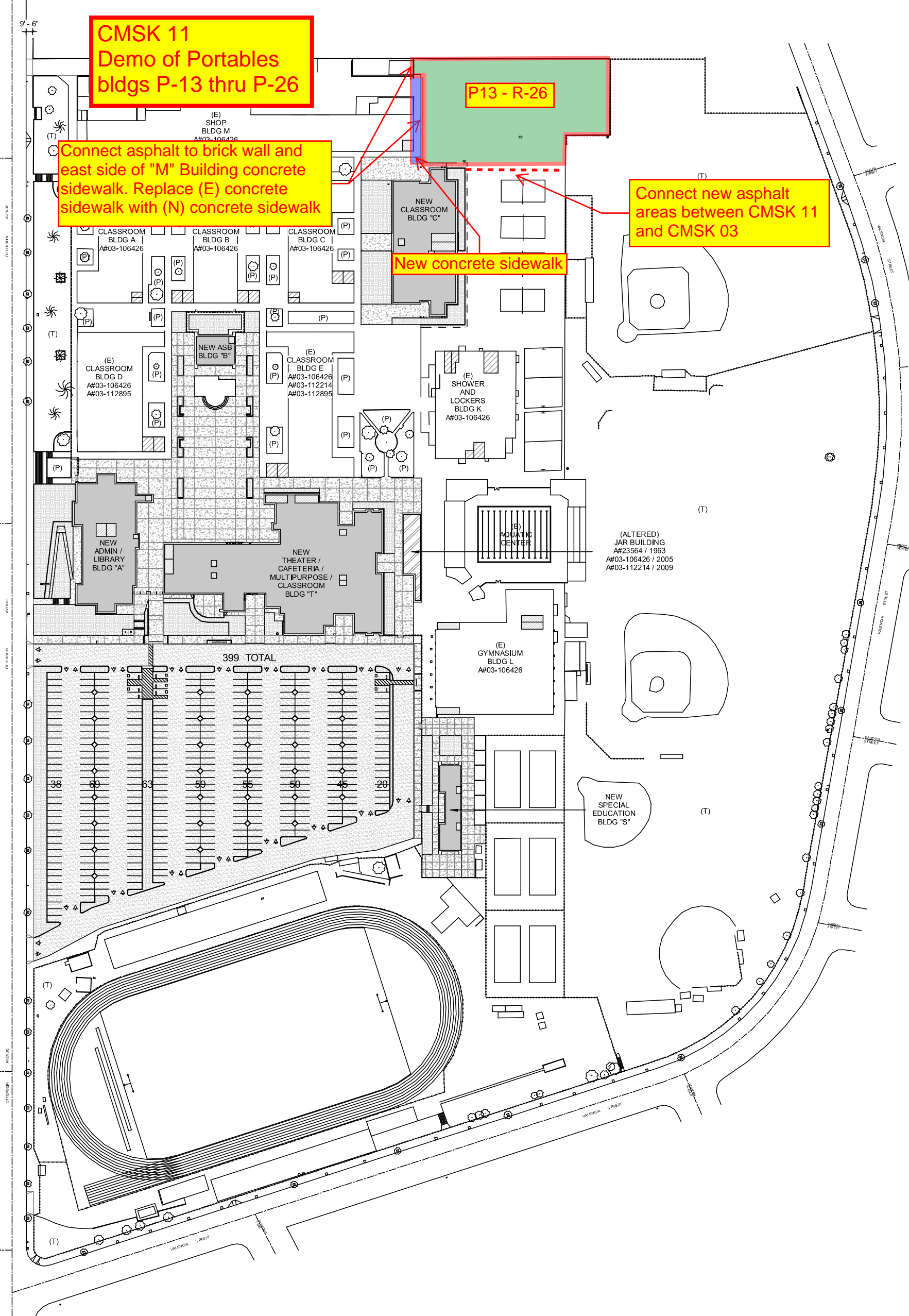
CMSK 11
Demo of Portables
bdgs P-13 thru P-26

P13 - R-26

Connect asphalt to brick wall and east side of "M" Building concrete sidewalk. Replace (E) concrete sidewalk with (N) concrete sidewalk

Connect new asphalt areas between CMSK 11 and CMSK 03

New concrete sidewalk



ATTACHMENT C

BMP Consideration Checklist

CONSTRUCTION SITE BMPs CONSIDERATION CHECKLIST					
The BMPs listed here should be considered for every project. Those BMPs that are not included in the SWPPP must be checked as "Not Used" with a brief statement describing why it is not being used.					
EROSION CONTROL BMPs					
BMP No.	BMP	CONSIDERED FOR PROJECT	CHECK IF USED	CHECK IF NOT USED	IF NOT USED, STATE REASON
EC-1	Scheduling	✓	✓		
EC-2	Preservation of Existing Vegetation	✓	✓		
EC-3	Hydraulic Mulch	✓	✓		
EC-4	Hydroseeding	✓		✓	Utilizing Others
EC-5	Soil Binders	✓		✓	Utilizing Others
EC-6	Straw Mulch	✓		✓	Utilizing Others
EC-7	Geotextiles & Mats	✓	✓		
EC-8	Wood Mulching	✓		✓	Utilizing Others
EC-9	Earth Dikes & Drainage Swales	✓	✓		
EC-10	Velocity Dissipation Devices	✓		✓	Not Applicable
EC-11	Slope Drains	✓		✓	Not Applicable
EC-12	Streambank Stabilization			✓	Not Applicable
EC-13	Polyacrylamide			✓	Not in Use

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

ROWLAND HIGH SCHOOL ADDITION

ROWLAND UNIFIED SCHOOL DISTRICT

**CONSTRUCTION SITE BMPs
CONSIDERATION CHECKLIST**

The BMPs listed here should be considered for every project. Those BMPs that are not included in the SWPPP must be checked as "Not Used" with a brief statement describing why it is not being used.

SEDIMENT CONTROL BMPs

BMP No.	BMP	CONSIDERED FOR PROJECT	CHECK IF USED	CHECK IF NOT USED	IF NOT USED, STATE REASON
SE-1	Silt Fence	✓	✓		
SE-2	Sediment Basin			✓	No Reasonable Room
SE-3	Sediment Trap			✓	No Reasonable Room
SE-4	Check Dam	✓	✓		
SE-5	Fiber Rolls	✓	✓		
SE-6	Gravel Bag Berm	✓	✓		
SE-7	Street Sweeping and Vacuuming	✓	✓		
SE-8	Sand Bag Barrier	✓		✓	Utilizing SE-6
SE-9	Straw Bale Barrier	✓		✓	Utilizing SE-6
SE-10	Storm Drain Inlet Protection	✓	✓		
SE-11	Chemical Treatment			✓	Not Selected

WIND EROSION CONTROL BMPs

WE-1	Wind Erosion Control	✓	✓		
------	----------------------	---	---	--	--

TRACKING CONTROL BMPs

TR-1	Stabilized Construction Entrance/Exit	✓	✓		
TR-2	Stabilized Construction Roadway			✓	Not Applicable
TR-3	Entrance/Outlet Tire Wash	✓		✓	Not Applicable

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

ROWLAND HIGH SCHOOL ADDITION

ROWLAND UNIFIED SCHOOL DISTRICT

**CONSTRUCTION SITE BMPs
CONSIDERATION CHECKLIST**

The BMPs listed here should be considered for every project. Those BMPs that are not included in the SWPPP must be checked as "Not Used" with a brief statement describing why it is not being used.

NON-STORM WATER MANAGEMENT BMPs

BMP No.	BMP	CONSIDERED FOR PROJECT	CHECK IF USED	CHECK IF NOT USED	IF NOT USED, STATE REASON
NS-1	Water Conservation Practices	✓	✓		
NS-2	Dewatering Operations	✓		✓	Not Anticipated
NS-3	Paving and Grinding Operations	✓	✓		
NS-4	Temporary Stream Crossing			✓	Not Applicable
NS-5	Clear Water Diversion			✓	Not Applicable
NS-6	Illicit Connection/ Discharge	✓	✓		
NS-7	Potable Water/Irrigation	✓	✓		Not Anticipated
NS-8	Vehicle and Equipment Cleaning	✓		✓	Will Not Occur
NS-9	Vehicle and Equipment Fueling	✓	✓		
NS-10	Vehicle and Equipment Maintenance	✓	✓		
NS-11	Pile Driving Operations			✓	Not Applicable
NS-12	Concrete Curing	✓	✓		
NS-13	Concrete Finishing	✓	✓		
NS-14	Material and Equipment Use Over Water			✓	Will Not Occur
NS-15	Demolition Adjacent to Water			✓	Not Applicable

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

ROWLAND HIGH SCHOOL ADDITION

ROWLAND UNIFIED SCHOOL DISTRICT

**CONSTRUCTION SITE BMPs
CONSIDERATION CHECKLIST**

The BMPs listed here should be considered for every project. Those BMPs that are not included in the SWPPP must be checked as "Not Used" with a brief statement describing why it is not being used.

WASTE MANAGEMENT AND MATERIALS POLLUTION CONTROL BMPs

BMP No.	BMP	CONSIDERED FOR PROJECT	CHECK IF USED	CHECK IF NOT USED	IF NOT USED, STATE REASON
WM-1	Material Delivery and Storage	✓	✓		
WM-2	Material Use	✓	✓		
WM-3	Stockpile Management	✓	✓		
WM-4	Spill Prevention and Control	✓	✓		
WM-5	Solid Waste Management	✓	✓		
WM-6	Hazardous Waste Management	✓	✓		
WM-7	Contaminated Soil Management	✓		✓	Not Applicable
WM-8	Concrete Waste Management	✓	✓		
WM-9	Sanitary/Septic Waste Management	✓	✓		
WM-10	Liquid Waste Management	✓		✓	Not Applicable

ATTACHMENT D

Computation Sheet for Determining Runoff Coefficients

$$\text{Total Site Area} = \underline{\hspace{2cm} 10.0 \text{ acres} \hspace{2cm}} \quad (\text{A})$$

EXISTING SITE CONDITIONS

$$\text{Impervious Site Area}^1 = \underline{\hspace{2cm} 8.75 \text{ acre} \hspace{2cm}} \quad (\text{B})$$

$$\text{Impervious Site Area Runoff Coefficient}^{2,4} = \underline{\hspace{2cm} .95 \hspace{2cm}} \quad (\text{C})$$

$$\text{Pervious Site Area}^3 = \underline{\hspace{2cm} 1.25 \text{ acres} \hspace{2cm}} \quad (\text{D})$$

$$\text{Pervious Site Area Runoff Coefficient}^4 = \underline{\hspace{2cm} .32 \hspace{2cm}} \quad (\text{E})$$

$$\text{Existing Site Area Runoff Coefficient} \quad \frac{(\text{B} \times \text{C}) + (\text{D} \times \text{E})}{(\text{A})} = \underline{\hspace{2cm} .87 \hspace{2cm}} \quad (\text{F})$$

PROPOSED SITE CONDITIONS (AFTER CONSTRUCTION)

$$\text{Impervious Site Area}^1 = \underline{\hspace{2cm} 8.75 \text{ acres} \hspace{2cm}} \quad (\text{G})$$

$$\text{Impervious Site Area Runoff Coefficient}^{2,4} = \underline{\hspace{2cm} .95 \hspace{2cm}} \quad (\text{H})$$

$$\text{Pervious Site Area}^3 = \underline{\hspace{2cm} 1.25 \text{ acre} \hspace{2cm}} \quad (\text{I})$$

$$\text{Pervious Site Area Runoff Coefficient}^4 = \underline{\hspace{2cm} .32 \hspace{2cm}} \quad (\text{J})$$

$$\text{Proposed Site Area Runoff Coefficient} \quad \frac{(\text{G} \times \text{H}) + (\text{I} \times \text{J})}{(\text{A})} = \underline{\hspace{2cm} .87 \hspace{2cm}} \quad (\text{K})$$

1. Includes paved areas, areas covered by buildings, and other impervious surfaces.
2. Use 0.95 unless lower or higher runoff coefficient can be verified.
3. Includes areas of vegetation, most unpaved or uncovered soil surfaces, and other pervious areas.
4. Refer to local Hydrology Manual for typical C values.

ATTACHMENT D

Table D-1				
Runoff Coefficients for Undeveloped Areas				
Watershed Types				
	Extreme	High	Normal	Low
Relief	0.28 – 0.35 Steep, rugged terrain with average slopes above 30%	0.20 – 0.28 Hilly, with average slopes of 10 to 30%	0.14 – 0.20 Rolling, with average slopes of 5 to 10%	0.08 – 0.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	0.12 – 0.16 No effective soil cover, either rock or thin soil mantle of negligible infiltration capacity	0.08 – 0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity, imperfectly or poorly drained	0.06 – 0.08 Normal; well drained light or medium textured soils, sandy loam's, silt and silt loam's	0.04 – 0.06 High; deep sand or other soil that takes up water readily, very light well drained soils
Vegetal Cover	0.12 – 0.16 No effective plant cover, bare or very sparse cover	0.08 – 0.12 Poor to fair; clean cultivation crops, or poor natural cover, less than 20% of drainage area over good cover	0.06 – 0.08 Fair to good; about 50% of area in good grassland or woodland, nor more than 50% of area in cultivated crops	0.04 – 0.06 Good to excellent; about 90% of drainage area in good grassland, woodland or equivalent cover
Surface Storage	0.10 – 0.12 Negligible surface depression few and shallow; drainage-ways steep and small, no marshes	0.08 – 0.10 Low; well defined system of small drainage ways; no ponds or marshes	0.06 – 0.08 Normal; considerable surface depression storage; lakes and pond marshes	0.04 – 0.06 High; surface storage, high; drainage system not sharply defined; large flood plain storage or large number of ponds or marshes
<p>Given An undeveloped watershed consisting of;</p> <ol style="list-style-type: none"> 1) Rolling 2) Sandy Loams 3) Good cover 4) Normal <p>Find The runoff coefficient, C, for the above watershed.</p>		<p>Solution:</p> <p>Relief 0.14</p> <p>Soil Infiltration 0.06</p> <p>Vegetal Cover 0.06</p> <p>Surface Storage <u>0.06</u></p> <p align="center">C = 0.32</p>		

ATTACHMENT E

Computation Sheet for Determining Run-on Discharges

The potential for run-on flows exist from the existing school facilities adjacent to the work areas. Although the possibility run-on exists it is difficult to determine accurate flow calculations due to several unknown variables such as impervious/pervious rations, micro-hydrology on each area (i.e. landscaping and existing of drainage structures).

ATTACHMENT F

Risk Assessment and Notice of Intent (NOI/WDID)

- WDID Receipt Letter shall be added once received

	A	B	C
1	Sediment Risk Factor Worksheet		Entry
2	A) R Factor		
3	Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to the link below to determine the R factor for the project site.		
4	http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm		
5	R Factor Value		147
6	B) K Factor (weighted average, by area, for all site soils)		
7	The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Use Site-specific data must be submitted.		
8	Site-specific K factor guidance		
9	K Factor Value		0.32
10	C) LS Factor (weighted average, by area, for all slopes)		
11	The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use the LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction.		
12	LS Table		
13	LS Factor Value		0.23
14			
15	Watershed Erosion Estimate (=RxKxLS) in tons/acre		10.891
16	Site Sediment Risk Factor		Low
17	Low Sediment Risk: < 15 tons/acre		
18	Medium Sediment Risk: >=15 and <75 tons/acre		
19	High Sediment Risk: >= 75 tons/acre		
20			

Water: Stormwater

You are here: [Water](#) » [Pollution Prevention & Control](#) » [Permitting \(NPDES\)](#) » [Stormwater](#) » LEW Results

LEW Results

Rainfall Erosivity Factor Calculator for Small Construction Sites

Facility Information

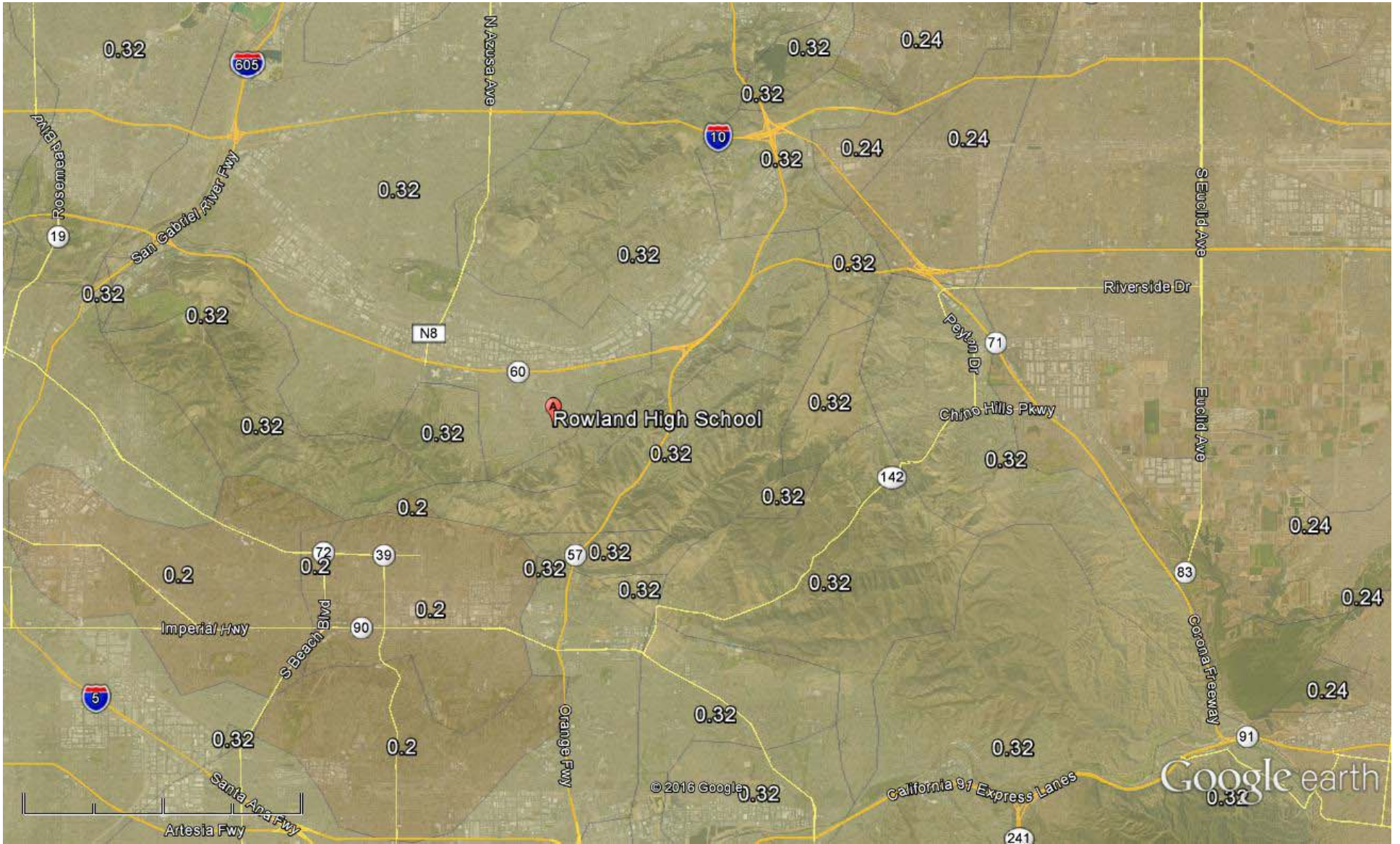
Start Date:	06/27/2016
End Date:	09/02/2019
Latitude:	33.9822
Longitude:	-117.8825

Erosivity Index Calculator Results

AN EROSIIVITY INDEX VALUE OF **147** HAS BEEN DETERMINED FOR THE CONSTRUCTION PERIOD OF **06/27/2016 - 09/02/2019**

A rainfall erosivity factor of 5.0 or greater has been calculated for your site and period of construction. **You do NOT qualify for a waiver from NPDES permitting requirements.**

[Start Over](#)



Google earth





Google earth

feet
meters



PROJECT LS ASSESSMENT:

SLOPE = RISE/ RUN
 RISE = 547'-537' = 10'
 SLOPE = 10'/1,500' = .67% slope
 LS Chart indicates 0.23

Sheet Flow Length (ft)	Average Watershed Slope (%)											
	0.2	0.5	0.7	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0	12.0
<3	0.05	0.07	0.08	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.35	0.36
6	0.05	0.07	0.08	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.37	0.41
9	0.05	0.07	0.08	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.38	0.45
12	0.05	0.07	0.08	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.39	0.47
15	0.05	0.07	0.08	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.40	0.49
25	0.05	0.07	0.08	0.10	0.16	0.21	0.26	0.31	0.36	0.45	0.57	0.71
50	0.05	0.08	0.11	0.13	0.21	0.30	0.38	0.46	0.54	0.70	0.91	1.15
75	0.05	0.08	0.11	0.14	0.25	0.36	0.47	0.58	0.69	0.91	1.20	1.54
100	0.05	0.09	0.12	0.15	0.28	0.41	0.55	0.68	0.82	1.10	1.46	1.88
150	0.05	0.09	0.13	0.17	0.33	0.50	0.68	0.86	1.05	1.43	1.92	2.51
200	0.06	0.10	0.14	0.18	0.37	0.57	0.79	1.02	1.25	1.72	2.34	3.07
250	0.06	0.10	0.14	0.19	0.40	0.64	0.89	1.16	1.43	1.99	2.72	3.60
300	0.06	0.10	0.15	0.20	0.43	0.69	0.98	1.28	1.60	2.24	3.09	4.09
400	0.06	0.11	0.16	0.22	0.48	0.80	1.14	1.51	1.90	2.70	3.75	5.01
600	0.06	0.12	0.18	0.24	0.56	0.96	1.42	1.91	2.43	3.52	4.95	6.67
800	0.06	0.12	0.19	0.26	0.63	1.10	1.65	2.25	2.89	4.24	6.03	8.17
1000	0.06	0.13	0.20	0.27	0.69	1.23	1.86	2.55	3.30	4.91	7.02	9.57
1500	0.06	0.15	0.23	0.32	0.80	1.46						

LS Factors for Construction Sites. *Table from Renard et. al., 1997.*

Receiving Water (RW) Risk Factor Worksheet	Entry	Score
A. Watershed Characteristics	yes/no	
<p>A.1. Does the disturbed area discharge (either directly or indirectly) to a 303(d)-listed waterbody impaired by sediment (For help with impaired waterbodies please visit the link below) or has a USEPA approved TMDL implementation plan for sediment?:</p> <p>http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml</p> <p style="text-align: center;">OR</p>	NO	Low
<p>A.2. Does the disturbed area discharge to a waterbody with designated beneficial uses of SPAWN & COLD & MIGRATORY? (For help please review the appropriate Regional Board Basin Plan)</p> <p>http://www.waterboards.ca.gov/waterboards_map.shtml</p>		
<p>Region 1 Basin Plan</p> <p>Region 2 Basin Plan</p> <p>Region 3 Basin Plan</p> <p>Region 4 Basin Plan</p> <p>Region 5 Basin Plan</p> <p>Region 6 Basin Plan</p> <p>Region 7 Basin Plan</p> <p>Region 8 Basin Plan</p> <p>Region 9 Basin Plan</p>		

Combined Risk Level Matrix

		<u>Sediment Risk</u>		
		Low	Medium	High
<u>Receiving Water Risk</u>	Low	Level 1	Level 2	
	High	Level 2		Level 3

Project Sediment Risk: **Low**

Project RW Risk: **Low**

Project Combined Risk: **Level 1**

ATTACHMENT G

Program for Maintenance, Inspection, and Repair of Construction Site BMPs

<i>SWPPP Inspection, Maintenance, and Repair Program</i>		
<i>Best Management Practices (BMPs)</i>	<i>INSPECTION FREQUENCY</i>	<i>MAINTENANCE/REPAIR PROGRAM</i>
<i>TEMPORARY SOIL STABILIZATION BMPs</i>		
EC-3, Hydraulic Mulch EC-7 Geotextiles, Mats/Plastic Covers & Erosion Control Blankets EC-9, Earth Dikes and Drainage Swales	Weekly Visual inspections will serve as the following: Prior to a forecast storm After a rain event that causes runoff from the construction site At 24-hour intervals during extended rain events	<ul style="list-style-type: none"> ▪ Verify protective measures are in place. Repair damaged protections immediately ▪ Replace and dispose torn or missing sections of plastic covers. Replace or supplement anchors as necessary to keep covers in place ▪ Ensure drainage swales liner is intact and complete.

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

ROWLAND HIGH SCHOOL ADDITION

ROWLAND UNIFIED SCHOOL DISTRICT

<i>BMPs</i>	<i>INSPECTION FREQUENCY</i>	<i>MAINTENANCE/REPAIR PROGRAM</i>
TEMPORARY SEDIMENT CONTROL BMPs		
SE-1 Silt Fence SE-4 Check Dams SE-5 Fiber Rolls SE-6 Gravel Bag Berm SE-10 Storm Drain Inlet Protection	Weekly Visual inspections will serve as the following: Prior to a forecast storm After a rain event that causes runoff from the construction site At 24-hour intervals during extended rain events	<ul style="list-style-type: none"> ▪ Ensure accumulated sediment has not compromised holding capacity if so remove sediment ▪ Remove, dispose, and replace damaged, deteriorated, or otherwise unsuitable BMPs ▪ Replace torn section of silt fences ▪ Remove retained sediment before they reach $\frac{1}{3}$ of the barrier height or $\frac{1}{2}$ of the sediment holding capacity ▪ Clean and dispose of accumulated sediment deposited in check dams ▪ Remove BMPs when no longer needed, as directed by the Engineer. Repair slope/surfaces damaged by BMP removal. ▪ Remove and accumulation at inlet protection
SC-7 Street Sweeping and Vacuuming	Daily	<ul style="list-style-type: none"> ▪ Inspect site access points during construction activities ▪ Sweep tracked sediment
WIND EROSION CONTROL BMPs		
WE-1, Wind Erosion Control	Weekly	<ul style="list-style-type: none"> ▪ Verify water has left a crust on soil, reapply as necessary

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

ROWLAND HIGH SCHOOL ADDITION

ROWLAND UNIFIED SCHOOL DISTRICT

BMPs	INSPECTION FREQUENCY	MAINTENANCE/REPAIR PROGRAM
TRACKING CONTROLS BMPs		
TC-1 Stabilized Construction Entrance/Exit SC-7 Street Sweeping and Vacuuming	Daily Visual inspections will serve as the following: Prior to a forecast storm After a rain event that causes runoff from the construction site At 24-hour intervals during extended rain events	<ul style="list-style-type: none"> ▪ Remove any tracked soil ▪ Sweep surrounding areas
NON-STORM WATER MANAGEMENT BMPs		
NS-3 Paving and Grinding Operations NS-6 Illicit Connection/Illegal Discharge Detection and Reporting NS-9 Vehicle and Equipment Fueling NS-10 Vehicle and Equipment Maintenance	Weekly	<ul style="list-style-type: none"> ▪ Inspect site during project execution for evidence of illicit discharges or illegal dumping ▪ Observe site perimeter for evidence or potential of illicitly discharged or illegally dumped material which may enter the job site ▪ Notify the QSP of any illicit discharges or illegal dumping incidents at time of discovery ▪ Remove vehicles and/or equipment that leaks ▪ Remove BMPs when no longer needed, as directed by the Engineer ▪ Repair slope/surfaces damaged by BMP removal ▪ Ensure that all Concrete Curing Compounds are stored in a watertight condition ▪ Immediately clean and dispose of any curing compound spills and/or leaks

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

ROWLAND HIGH SCHOOL ADDITION

ROWLAND UNIFIED SCHOOL DISTRICT

<i>BMPs</i>	<i>INSPECTION FREQUENCY</i>	<i>MAINTENANCE/REPAIR PROGRAM</i>
WASTE MANAGEMENT AND MATERIALS POLLUTION CONTROL BMPs		
WM-1, Material Delivery and Storage WM-2 Material Use WM-3 Stockpile Management WM-4 Spill Prevention and Control WM-5 Solid Waste Management WM-6 Hazardous Waste Management WM-9 Sanitary Septic Waste Management	Weekly Visual inspections will serve as the following: Prior to a forecast storm After a rain event that causes runoff from the construction site At 24-hour intervals during extended rain events	<ul style="list-style-type: none"> ▪ Keep storage areas clean, well organized, and supplies as appropriate for the materials stored ▪ Repair or replace perimeter controls, containment structures, covers and linear as needed to maintain proper function and protection ▪ Properly remove and dispose accumulated rainwater from containment facilities ▪ Cover any stockpiles with appropriate mats or covers ▪ Maintain waste fluid containers in leak proof condition ▪ Repair or replace dumpster that leak ▪ Schedule refuse contractor to pick up waste containers
WM-8 Concrete Waste Management	Weekly	<ul style="list-style-type: none"> ▪ Remove accumulated debris from concrete washouts ▪ Replace containment devices as necessary

ATTACHMENT I

Trained Contractor Personnel Log

Insert any documentation of training here.

Date	Training Type (ex. Formal class, tailgate session, video)	Training Duration	Attendees

Note: Attach copies of sign-in sheets or other documentation of training (certificates, materials presented, agenda, etc.)

Storm Water Pollution Prevention “Tailgate Talks”

Requirements

General Permit CAS000002 requires that all Individuals responsible for SWPPP preparation, implementation, and permit compliance shall be appropriately trained, and the SWPPP shall document all training. This includes those personnel responsible for installation, inspection, maintenance, and repair of BMPs. According to the permit training should be both formal and informal and occur on an ongoing basis when it is appropriate and convenient.

This “tailgate talk” will serve as informal training for on-site personnel and will include date, time, location and duration of informal training, and documentation of who attended.

Discussion Topics

The Contractor will select a BMP(s) from Attachment O that relates to current or upcoming operations and discuss application, limitations, specifications, and maintenance for the selected BMP(s). See below for discussion topic checklist.

Place a Check next to the BMP(s) Discussed:

Temporary Soil Stabilization (Erosion Control)

- EC-1 Scheduling
- EC-2 Preservation of Existing Vegetation
- EC-3 Hydraulic Mulch
- EC-4 Hydroseeding
- EC-5 Soil Binders
- EC-6 Straw Mulch
- EC-7 Geotextiles, Plastic Covers & Erosion Control Blankets/Mats
- EC-8 Wood Mulch
- EC-9 Earth Dikes/Drainage Swales & Lined Ditches
- EC-10 Outlet Protection/Velocity Dissipation Devices
- EC-11 Slope Drains

Temporary Sediment Control

- SE-1 Silt Fence
- SE-2 Desilting Basin
- SE-3 Sediment Traps
- SE-4 Check Dams
- SE-5 Fiber Rolls
- SE-6 Gravel Bag Berms
- SE-7 Street Sweeping and Vacuuming
- SE-8 Sand Bag Barrier
- SE-9 Straw Bale Barrier
- SE-10 Storm Drain Inlet Protection

Wind Erosion Control

- WE-1 Wind Erosion Control

Tracking Controls

- TC-1 Stabilized Construction Entrance/Exit
- TC-2 Stabilized Construction Roadway
- TC-3 Entrance/Outlet Tire Wash

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

ROWLAND HIGH SCHOOL ADDITION

ROWLAND UNIFIED SCHOOL DISTRICT

Non-Storm Water Management

- NS-1 Water Conservation Practices
- NS-2 Dewatering Operations
- NS-3 Paving and Grinding Operations
- NS-4 Temporary Stream Crossing
- NS-5 Clear Water Diversion
- NS-6 Illicit Connection/Illegal Discharge Detection and Reporting
- NS-7 Potable Water/Irrigation
- NS-8 Vehicle and Equipment Cleaning
- NS-9 Vehicle and Equipment Fueling
- NS-10 Vehicle and Equipment Maintenance

Waste Management and Materials Pollution Control

- WM-1 Material Delivery and Storage
- WM-2 Material Use
- WM-3 Stockpile Management
- WM-4 Spill Prevention and Control
- WM-5 Solid Waste Management
- WM-6 Hazardous Waste Management
- WM-7 Contaminated Soil Management
- WM-8 Concrete Waste Management
- WM-9 Sanitary/Septic Waste Management
- WM-10 Liquid Waste Management

Meeting Conducted by:

Print Name: _____

Signature: _____

Date: _____

Location: _____

Meeting Attended By:

ATTACHMENT J

Subcontractor Notification Letter and Log

Project Name: Rowland High School Addition

Owner: Rowland Unified School District

The list shall include all Subcontractor names, responsible individuals, telephone numbers, addresses, specific areas of responsibility, and emergency contact numbers.

SUBCONTRACTOR NAME/AREA OF RESPONSIBILITY	CONTACT NAME	ADDRESS	PHONE NUMBER	PAGER/FIELD EMERGENCY PHONE NUMBER	DATE NOTIFICATION LETTER SENT
TO BE COMPLETED UPON CONTRACTOR SELECTION					

ATTACHMENT J

Memorandum to Employees

(May Be Attached Periodically to Paychecks)

TO ALL EMPLOYEES:

Rowland Unified School District & _____
support the protection of our environment and has developed a program for this project to reduce pollutants from entering the local waterways.

You will be expected to do your part to comply with this program while you are working on this project by:

- Disposing of trash, rubbish, and construction debris properly.
- Reporting, to the General Contractor, leaky vehicles or equipment or other pollution sources.
- Covering materials, which may be exposed to the rain.
- Encouraging your co-workers to do the same.

Remember, you and your family are the ones who drink, shower, fish, and enjoy the recreation that is provided by these waters.

A copy of the storm water pollution plan developed for this site is available for your review at the construction office.

Sample Subcontractor Notification Letter

SWPPP Notification

Company
Address
City, State, ZIP

Dear Sir/Madam,

Please be advised that the California State Water Resources Control Board has adopted the General Permit (General Permit) for Storm Water Discharges Associated with Construction Activity (CAS000002). The goal of these permits is prevent the discharge of pollutants associated with construction activity from entering the storm drain system, ground and surface waters.

Rowland Unified School District & _____
have developed a Storm Water Pollution Prevention Plan (SWPPP) in order to implement the requirements of the Permits.

As a subcontractor, you are required to comply with the SWPPP and the Permits for any work that you perform on site. Any person or group who violates any condition of the Permits may be subject to substantial penalties in accordance with state and federal law. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP and the Permits. A copy of the Permits and the SWPPP are available for your review at the construction office. Please contact me if you have further questions.

Sincerely,

Name
Title

ATTACHMENT M

Risk Level 1 Requirements

ATTACHMENT C RISK LEVEL 1 REQUIREMENTS

A. Effluent Standards

[These requirements are the same as those in the General Permit order.]

1. Narrative – Risk Level 1 dischargers shall comply with the narrative effluent standards listed below:
 - a. Storm water discharges and authorized non-storm water discharges regulated by this General Permit shall not contain a hazardous substance equal to or in excess of reportable quantities established in 40 C.F.R. §§ 117.3 and 302.4, unless a separate NPDES Permit has been issued to regulate those discharges.
 - b. Dischargers shall minimize or prevent pollutants in storm water discharges and authorized non-storm water discharges through the use of controls, structures, and management practices that achieve BAT for toxic and non-conventional pollutants and BCT for conventional pollutants.
2. Numeric – Risk Level 1 dischargers are not subject to a numeric effluent standard.

B. Good Site Management "Housekeeping"

1. Risk Level 1 dischargers shall implement good site management (i.e., "housekeeping") measures for construction materials that could potentially be a threat to water quality if discharged. At a minimum, Risk Level 1 dischargers shall implement the following good housekeeping measures:
 - a. Conduct an inventory of the products used and/or expected to be used and the end products that are produced and/or expected to be produced. This does not include materials and equipment that are designed to be outdoors and exposed to environmental conditions (i.e. poles, equipment pads, cabinets, conductors, insulators, bricks, etc.).
 - b. Cover and berm loose stockpiled construction materials that are not actively being used (i.e. soil, spoils, aggregate, fly-ash, stucco, hydrated lime, etc.).

- c. Store chemicals in watertight containers (with appropriate secondary containment to prevent any spillage or leakage) or in a storage shed (completely enclosed).
 - d. Minimize exposure of construction materials to precipitation. This does not include materials and equipment that are designed to be outdoors and exposed to environmental conditions (i.e. poles, equipment pads, cabinets, conductors, insulators, bricks, etc.).
 - e. Implement BMPs to prevent the off-site tracking of loose construction and landscape materials.
2. Risk Level 1 dischargers shall implement good housekeeping measures for waste management, which, at a minimum, shall consist of the following:
- a. Prevent disposal of any rinse or wash waters or materials on impervious or pervious site surfaces or into the storm drain system.
 - b. Ensure the containment of sanitation facilities (e.g., portable toilets) to prevent discharges of pollutants to the storm water drainage system or receiving water.
 - c. Clean or replace sanitation facilities and inspecting them regularly for leaks and spills.
 - d. Cover waste disposal containers at the end of every business day and during a rain event.
 - e. Prevent discharges from waste disposal containers to the storm water drainage system or receiving water.
 - f. Contain and securely protect stockpiled waste material from wind and rain at all times unless actively being used.
 - g. Implement procedures that effectively address hazardous and non-hazardous spills.
 - h. Develop a spill response and implementation element of the SWPPP prior to commencement of construction activities. The SWPPP shall require that:
 - i. Equipment and materials for cleanup of spills shall be available on site and that spills and leaks shall be cleaned up immediately and disposed of properly; and

- ii. Appropriate spill response personnel are assigned and trained.
 - i. Ensure the containment of concrete washout areas and other washout areas that may contain additional pollutants so there is no discharge into the underlying soil and onto the surrounding areas.
3. Risk Level 1 dischargers shall implement good housekeeping for vehicle storage and maintenance, which, at a minimum, shall consist of the following:
- a. Prevent oil, grease, or fuel to leak in to the ground, storm drains or surface waters.
 - b. Place all equipment or vehicles, which are to be fueled, maintained and stored in a designated area fitted with appropriate BMPs.
 - c. Clean leaks immediately and disposing of leaked materials properly.
4. Risk Level 1 dischargers shall implement good housekeeping for landscape materials, which, at a minimum, shall consist of the following:
- a. Contain stockpiled materials such as mulches and topsoil when they are not actively being used.
 - b. Contain fertilizers and other landscape materials when they are not actively being used.
 - c. Discontinue the application of any erodible landscape material within 2 days before a forecasted rain event or during periods of precipitation.
 - d. Apply erodible landscape material at quantities and application rates according to manufacture recommendations or based on written specifications by knowledgeable and experienced field personnel.
 - e. Stack erodible landscape material on pallets and covering or storing such materials when not being used or applied.
5. Risk Level 1 dischargers shall conduct an assessment and create a list of potential pollutant sources and identify any areas of the site where additional BMPs are necessary to reduce or prevent pollutants in storm water discharges and authorized non-storm water discharges. This potential pollutant list shall be kept with the SWPPP and shall identify

all non-visible pollutants which are known, or should be known, to occur on the construction site. At a minimum, when developing BMPs, Risk Level 1 dischargers shall do the following:

- a. Consider the quantity, physical characteristics (e.g., liquid, powder, solid), and locations of each potential pollutant source handled, produced, stored, recycled, or disposed of at the site.
 - b. Consider the degree to which pollutants associated with those materials may be exposed to and mobilized by contact with storm water.
 - c. Consider the direct and indirect pathways that pollutants may be exposed to storm water or authorized non-storm water discharges. This shall include an assessment of past spills or leaks, non-storm water discharges, and discharges from adjoining areas.
 - d. Ensure retention of sampling, visual observation, and inspection records.
 - e. Ensure effectiveness of existing BMPs to reduce or prevent pollutants in storm water discharges and authorized non-storm water discharges.
6. Risk Level 1 dischargers shall implement good housekeeping measures on the construction site to control the air deposition of site materials and from site operations. Such particulates can include, but are not limited to, sediment, nutrients, trash, metals, bacteria, oil and grease and organics.

C. Non-Storm Water Management

1. Risk Level 1 dischargers shall implement measures to control all non-storm water discharges during construction.
2. Risk Level 1 dischargers shall wash vehicles in such a manner as to prevent non-storm water discharges to surface waters or MS4 drainage systems.
3. Risk Level 1 dischargers shall clean streets in such a manner as to prevent unauthorized non-storm water discharges from reaching surface water or MS4 drainage systems.

D. Erosion Control

1. Risk Level 1 dischargers shall implement effective wind erosion control.
2. Risk Level 1 dischargers shall provide effective soil cover for inactive¹ areas and all finished slopes, open space, utility backfill, and completed lots.
3. Risk Level 1 dischargers shall limit the use of plastic materials when more sustainable, environmentally friendly alternatives exist. Where plastic materials are deemed necessary, the discharger shall consider the use of plastic materials resistant to solar degradation.

E. Sediment Controls

1. Risk Level 1 dischargers shall establish and maintain effective perimeter controls and stabilize all construction entrances and exits to sufficiently control erosion and sediment discharges from the site.
2. On sites where sediment basins are to be used, Risk Level 1 dischargers shall, at minimum, design sediment basins according to the method provided in CASQA's Construction BMP Guidance Handbook.

F. Run-on and Runoff Controls

Risk Level 1 dischargers shall effectively manage all run-on, all runoff within the site and all runoff that discharges off the site. Run-on from off site shall be directed away from all disturbed areas or shall collectively be in compliance with the effluent limitations in this General Permit.

G. Inspection, Maintenance and Repair

1. Risk Level 1 dischargers shall ensure that all inspection, maintenance repair and sampling activities at the project location shall be performed or supervised by a Qualified SWPPP Practitioner (QSP) representing the discharger. The QSP may delegate any or all of these activities to an employee trained to do the task(s) appropriately, but shall ensure adequate deployment.
2. Risk Level 1 dischargers shall perform weekly inspections and observations, and at least once each 24-hour period during extended

¹ Inactive areas of construction are areas of construction activity that have been disturbed and are not scheduled to be re-disturbed for at least 14 days.

storm events, to identify and record BMPs that need maintenance to operate effectively, that have failed, or that could fail to operate as intended. Inspectors shall be the QSP or be trained by the QSP.

3. Upon identifying failures or other shortcomings, as directed by the QSP, Risk Level 1 dischargers shall begin implementing repairs or design changes to BMPs within 72 hours of identification and complete the changes as soon as possible.
4. For each inspection required, Risk Level 1 dischargers shall complete an inspection checklist, using a form provided by the State Water Board or Regional Water Board or in an alternative format.
5. Risk Level 1 dischargers shall ensure that checklists shall remain onsite with the SWPPP and at a minimum, shall include:
 - a. Inspection date and date the inspection report was written.
 - b. Weather information, including presence or absence of precipitation, estimate of beginning of qualifying storm event, duration of event, time elapsed since last storm, and approximate amount of rainfall in inches.
 - c. Site information, including stage of construction, activities completed, and approximate area of the site exposed.
 - d. A description of any BMPs evaluated and any deficiencies noted.
 - e. If the construction site is safely accessible during inclement weather, list the observations of all BMPs: erosion controls, sediment controls, chemical and waste controls, and non-storm water controls. Otherwise, list the results of visual inspections at all relevant outfalls, discharge points, downstream locations and any projected maintenance activities.
 - f. Report the presence of noticeable odors or of any visible sheen on the surface of any discharges.
 - g. Any corrective actions required, including any necessary changes to the SWPPP and the associated implementation dates.
 - h. Photographs taken during the inspection, if any.
 - i. Inspector's name, title, and signature.

H. Rain Event Action Plan

Not required for Risk Level 1 dischargers.

I. Risk Level 1 Monitoring and Reporting Requirements

Table 1- Summary of Monitoring Requirements

Risk Level	Visual Inspections					Sample Collection	
	Quarterly Non-storm Water Discharge	Pre-storm Event		Daily Storm BMP	Post Storm	Storm Water Discharge	Receiving Water
		Baseline	REAP				
1	X	X		X	X		

1. Construction Site Monitoring Program Requirements

- a. Pursuant to Water Code Sections 13383 and 13267, all dischargers subject to this General Permit shall develop and implement a written site-specific Construction Site Monitoring Program (CSMP) in accordance with the requirements of this Section. The CSMP shall include all monitoring procedures and instructions, location maps, forms, and checklists as required in this section. The CSMP shall be developed prior to the commencement of construction activities, and revised as necessary to reflect project revisions. The CSMP shall be a part of the Storm Water Pollution Prevention Plan (SWPPP), included as an appendix or separate SWPPP chapter.
- b. Existing dischargers registered under the State Water Board Order No. 99-08-DWQ shall make and implement necessary revisions to their Monitoring Programs to reflect the changes in this General Permit in a timely manner, but no later than July 1, 2010. Existing dischargers shall continue to implement their existing Monitoring Programs in compliance with State Water Board Order No. 99-08-DWQ until the necessary revisions are completed according to the schedule above.
- c. When a change of ownership occurs for all or any portion of the construction site prior to completion or final stabilization, the new discharger shall comply with these requirements as of the date the ownership change occurs.

2. Objectives

The CSMP shall be developed and implemented to address the following objectives:

- a. To demonstrate that the site is in compliance with the Discharge Prohibitions;

- b. To determine whether non-visible pollutants are present at the construction site and are causing or contributing to exceedances of water quality objectives;
 - c. To determine whether immediate corrective actions, additional Best Management Practice (BMP) implementation, or SWPPP revisions are necessary to reduce pollutants in storm water discharges and authorized non-storm water discharges; and
 - d. To determine whether BMPs included in the SWPPP are effective in preventing or reducing pollutants in storm water discharges and authorized non-storm water discharges.
- 3. Risk Level 1 - Visual Monitoring (Inspection) Requirements for Qualifying Rain Events**
- a. Risk Level 1 dischargers shall visually observe (inspect) storm water discharges at all discharge locations within two business days (48 hours) after each qualifying rain event.
 - b. Risk Level 1 dischargers shall visually observe (inspect) the discharge of stored or contained storm water that is derived from and discharged subsequent to a qualifying rain event producing precipitation of $\frac{1}{2}$ inch or more at the time of discharge. Stored or contained storm water that will likely discharge after operating hours due to anticipated precipitation shall be observed prior to the discharge during operating hours.
 - c. Risk Level 1 dischargers shall conduct visual observations (inspections) during business hours only.
 - d. Risk Level 1 dischargers shall record the time, date and rain gauge reading of all qualifying rain events.
 - e. Within 2 business days (48 hours) prior to each qualifying rain event, Risk Level 1 dischargers shall visually observe (inspect):
 - i. All storm water drainage areas to identify any spills, leaks, or uncontrolled pollutant sources. If needed, the discharger shall implement appropriate corrective actions.
 - ii. All BMPs to identify whether they have been properly implemented in accordance with the SWPPP. If needed, the discharger shall implement appropriate corrective actions.

- iii. Any storm water storage and containment areas to detect leaks and ensure maintenance of adequate freeboard.
- f. For the visual observations (inspections) described in e.i and e.iii above, Risk Level 1 dischargers shall observe the presence or absence of floating and suspended materials, a sheen on the surface, discolorations, turbidity, odors, and source(s) of any observed pollutants.
- g. Within two business days (48 hours) after each qualifying rain event, Risk Level 1 dischargers shall conduct post rain event visual observations (inspections) to (1) identify whether BMPs were adequately designed, implemented, and effective, and (2) identify additional BMPs and revise the SWPPP accordingly.
- h. Risk Level 1 dischargers shall maintain on-site records of all visual observations (inspections), personnel performing the observations, observation dates, weather conditions, locations observed, and corrective actions taken in response to the observations.

4. Risk Level 1 – Visual Observation Exemptions

- a. Risk Level 1 dischargers shall be prepared to conduct visual observation (inspections) until the minimum requirements of Section I.3 above are completed. Risk Level 1 dischargers are not required to conduct visual observation (inspections) under the following conditions:
 - i. During dangerous weather conditions such as flooding and electrical storms.
 - ii. Outside of scheduled site business hours.
- b. If no required visual observations (inspections) are collected due to these exceptions, Risk Level 1 dischargers shall include an explanation in their SWPPP and in the Annual Report documenting why the visual observations (inspections) were not conducted.

5. Risk Level 1 – Monitoring Methods

Risk Level 1 dischargers shall include a description of the visual observation locations, visual observation procedures, and visual observation follow-up and tracking procedures in the CSMP.

6. Risk Level 1 – Non-Storm Water Discharge Monitoring Requirements

- a. Visual Monitoring Requirements:
 - i. Risk Level 1 dischargers shall visually observe (inspect) each drainage area for the presence of (or indications of prior) unauthorized and authorized non-storm water discharges and their sources.
 - ii. Risk Level 1 dischargers shall conduct one visual observation (inspection) quarterly in each of the following periods: January-March, April-June, July-September, and October-December. Visual observation (inspections) are only required during daylight hours (sunrise to sunset).
 - iii. Risk Level 1 dischargers shall ensure that visual observations (inspections) document the presence or evidence of any non-storm water discharge (authorized or unauthorized), pollutant characteristics (floating and suspended material, sheen, discoloration, turbidity, odor, etc.), and source. Risk Level 1 dischargers shall maintain on-site records indicating the personnel performing the visual observation (inspections), the dates and approximate time each drainage area and non-storm water discharge was observed, and the response taken to eliminate unauthorized non-storm water discharges and to reduce or prevent pollutants from contacting non-storm water discharges.

7. Risk Level 1 – Non-Visible Pollutant Monitoring Requirements

- a. Risk Level 1 dischargers shall collect one or more samples during any breach, malfunction, leakage, or spill observed during a visual inspection which could result in the discharge of pollutants to surface waters that would not be visually detectable in storm water.
- b. Risk Level 1 dischargers shall ensure that water samples are large enough to characterize the site conditions.
- c. Risk Level 1 dischargers shall collect samples at all discharge locations that can be safely accessed.
- d. Risk Level 1 dischargers shall collect samples during the first two hours of discharge from rain events that occur during business hours and which generate runoff.
- e. Risk Level 1 dischargers shall analyze samples for all non-visible pollutant parameters (if applicable) - parameters indicating the

presence of pollutants identified in the pollutant source assessment required (Risk Level 1 dischargers shall modify their CSMPs to address these additional parameters in accordance with any updated SWPPP pollutant source assessment).

- f. Risk Level 1 dischargers shall collect a sample of storm water that has not come in contact with the disturbed soil or the materials stored or used on-site (uncontaminated sample) for comparison with the discharge sample.
- g. Risk Level 1 dischargers shall compare the uncontaminated sample to the samples of discharge using field analysis or through laboratory analysis.²
- h. Risk Level 1 dischargers shall keep all field /or analytical data in the SWPPP document.

8. Risk Level 1 – Particle Size Analysis for Project Risk Justification

Risk Level 1 dischargers justifying an alternative project risk shall report a soil particle size analysis used to determine the RUSLE K-Factor. ASTM D-422 (Standard Test Method for Particle-Size Analysis of Soils), as revised, shall be used to determine the percentages of sand, very fine sand, silt, and clay on the site.

9. Risk Level 1 – Records

Risk Level 1 dischargers shall retain records of all storm water monitoring information and copies of all reports (including Annual Reports) for a period of at least three years. Risk Level 1 dischargers shall retain all records on-site while construction is ongoing. These records include:

- a. The date, place, time of facility inspections, sampling, visual observation (inspections), and/or measurements, including precipitation.
- b. The individual(s) who performed the facility inspections, sampling, visual observation (inspections), and or measurements.
- c. The date and approximate time of analyses.
- d. The individual(s) who performed the analyses.

² For laboratory analysis, all sampling, sample preservation, and analyses must be conducted according to test procedures under 40 CFR Part 136. Field discharge samples shall be collected and analyzed according to the specifications of the manufacturer of the sampling devices employed.

- e. A summary of all analytical results from the last three years, the method detection limits and reporting units, and the analytical techniques or methods used.
- f. Rain gauge readings from site inspections.
- g. Quality assurance/quality control records and results.
- h. Non-storm water discharge inspections and visual observation (inspections) and storm water discharge visual observation records (see Sections I.3 and I.6 above).
- i. Visual observation and sample collection exception records (see Section I.4 above).
- j. The records of any corrective actions and follow-up activities that resulted from analytical results, visual observation (inspections), or inspections.

ATTACHMENT Q

Applicable BMP's

The following BMPs have been referenced in this document;

- *EC-1, Scheduling*
- *EC-2, Preservation of Existing Vegetation*
- *EC-3, Hydraulic Mulch*
- *EC-7, Geotextiles & Mats*
- *SE-1, Silt Fence*
- *SE-4, Check Dams*
- *SE-5, Fiber Rolls*
- *SE-6, Gravel Bag Berm*
- *SE-7, Street Sweeping and Vacuuming*
- *SE-10, Storm Drain Inlet Protection*
- *WE-1, Wind Erosion Control*
- *TC-1, Stabilized Construction Entrance*
- *NS-1, Water Conservation Practices*
- *NS-3 Paving and Grinding Operations*
- *NS-6, Illicit Connection/Discharge*
- *NS-7, Potable Water Irrigation*
- *NS-9, Vehicle and Equipment Fueling*
- *NS-10, Vehicle and Equipment Maintenance*
- *NS-12, Concrete Curing Compound*
- *NS-14, Concrete Finishing*
- *WM-1, Material Delivery and Storage*
- *WM-2, Material Use*
- *WM-3, Stockpile Management*
- *WM-4, Spill Prevention and Control*
- *WM-5, Solid Waste Management*
- *WM-8, Concrete Waste Management*
- *WM-9, Sanitary/Septic Waste Management*

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DIVISION 24 - RESERVED

NOT USED

DIVISION 25 - INTEGRATED AUTOMATION

NOT USED

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DIVISION 29 - RESERVED

NOT USED

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NOT USED

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DIVISION 34 - TRANSPORTATION

NOT USED

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NOT USED

DIVISION 36 TO 39 - RESERVED

NOT USED

**SPECIFICATIONS GROUP
PROCESS EQUIPMENT SUBGROUP**

DIVISION 40 - PROCESS INTEGRATION

NOT USED

DIVISION 41 - MATERIAL PROCESSING AND HANDLING EQUIPMENT

NOT USED

DIVISION 42 - PROCESS HEATING, COOLING, AND DRYING EQUIPMENT

NOT USED

DIVISION 43 - PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE

NOT USED

DIVISION 44 - POLLUTION CONTROL EQUIPMENT

NOT USED

DIVISION 45 - INDUSTRY-SPECIFIC MANUFACTURING EQUIPMENT

NOT USED

DIVISION 46 - INDUSTRY-SPECIFIC MANUFACTURING EQUIPMENT

NOT USED

DIVISION 47 - INDUSTRY-SPECIFIC MANUFACTURING EQUIPMENT

NOT USED

DIVISION 48 - ELECTRICAL POWER GENERATION

NOT USED

DIVISION 49 - RESERVED

NOT USED

SECTION 06 10 00

ROUGH CARPENTRY

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Floor, wall sheathing.
- B. Wood furring, backing and grounds.
- C. Preservative treatment of wood.

1.2 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations Title 24, Part 2.
- B. ANSI/AF & PA NDS-12 - National Design Specifications for Wood Construction.
- C. MS MIL-L-19140 - Fire Retardant Wood Preservative Chemicals.
- D. National Bureau of Standards - Product Standard PS-1-09 for Construction and Industrial Plywood.
- E. WCLIB - West Coast Lumber Inspection Bureau: Standard Grading Rules for West Coast Lumber.
- F. WWPA - Western Wood Products Association.

1.3 QUALITY ASSURANCE

- A. Lumber Grading Agency: Certified by ALSC.
- B. Plywood Grading Agency: Certified by APA.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 23.
- B. Allowable stress design values shall be in compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 2306, ANSI/AF & PA NDS-12 - National Design Specifications for Wood Construction, and ANSI/SDPWS - Special Design Provisions for Wind and Seismic.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect products under provisions of Section 01 61 00.
- B. Deliver materials free from pest infestation. Protect materials on site to prevent termite, beetle or other wood boring insect attacks.
- C. Stack lumber flat, off grade, with spacers between each bundle to promote air circulation. Provide for air circulation around and under coverings.

2. PART 2 PRODUCTS

2.1 LUMBER MATERIALS

- A. Lumber Grading Rules: WCLIB and WWPA. Lumber shall bear WCLIB grade stamp.
- B. Non-structural Light Framing Studs, Plate and Blocking: Douglas Fir species, construction grade.
- C. Plank and Decking: Douglas Fir species, Com Dex.

2.2 MOISTURE CONTENT

- A. 2x and 3x material, 19 percent moisture content, S-Dry. Structural and non structural framing, beam, rafters, joists, studs, plates and blocking.
- B. 4x and 6x material, 19 percent moisture content at time of application of Architectural finishes. 22 percent maximum moisture content at time of delivery to project site. Materials to be air dried as required to achieve 22 percent moisture content prior to delivery to site. Structural and non structural framing, beam, rafters, joists, studs, plates and blocking.
- C. Lumber materials with a moisture content above 19 percent and less than 22 percent at the time of installation shall be tested for moisture content prior to covering with Architectural finishes. Moisture tests shall be performed under the provisions of Section 01 45 29.
- D. No lumber shall be covered with an Architectural finish until the moisture content of the lumber is 19 percent or below.

2.3 PLYWOOD MATERIALS

- A. Floor Sheathing: APA Structural I, Grade C-D, Exterior grade. Minimum 5-ply construction, meeting Product Standard PS-1-09.
- B. Telephone and Electrical Panel Boards: APA Grade C-D with exterior glue, minimum 5 ply, 3/4 inch thick, meeting PS-1-09.

2.4 ACCESSORIES

- A. Fasteners: Hot-dipped galvanized steel for exterior, high humidity, and treated wood locations; plain finish elsewhere; size and type to suit condition.
- B. Connectors: As indicated.

2.5 WOOD TREATMENT

- A. Preservative Treatment: Where lumber or plywood is indicated as treated or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood).
- B. Pressure treat all lumber in contact with ground. After treatment kiln-dry lumber to a maximum moisture content of 19 percent.
- C. Pressure treat above ground items as indicated. After treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated items and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
 - 2. Horizontal wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.
 - 3. Horizontal wood framing members less than 18 inches above grade.
 - 4. Wood floor plates installed over concrete slabs directly in contact with earth.
- D. Complete fabrication of treated items prior to treatment, where possible. If cut or drilled after treatment, coat cut or drilled surfaces with heavy brush coat of same chemical used for treatment and to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.6 FIRE RETARDANT TREATMENT

- A. Fire retardant wood to have a flame spread of less than 25 when tested in an extended 30-minute tunnel test according to ASTM E84.

- B. Dimensional lumber to be kiln dried to a maximum moisture content of 19 percent after treatment.
- C. Plywood to be kiln dried to a maximum moisture content of 15 percent after treatment.
- D. Fire retardant wood to comply with AWPA Standard C20 for lumber and C27 for plywood.
- E. Fire retardant chemicals to comply with FR-1 of AWPA Standard P-17 and shall be free of halogens, sulfates and ammonium phosphate.
- F. Carbon steel, galvanized steel, aluminum, copper, and red brass in contact with fire retardant wood shall exhibit corrosion rates less than one mil per year when tested in accordance with FS MIL-L-19140, Paragraph 4.6.5.2.
- G. Fire retardant chemicals must be registered for use as a wood preservative buy the U.S. Environmental Protection Agency.

3. PART 3 EXECUTION

3.1 FRAMING

- A. Erect wood framing members level and plumb.
- B. Place horizontal members laid flat, crown side-up.
- C. Construct framing members full length without splices.
- D. Double members at openings over 1 sq ft. Space short studs over and under opening to stud spacing.
- E. Construct double joist headers at floor and ceiling openings. Frame rigidly into joists.
- F. Construct double joists under wall studding.
- G. Bridge joists in excess of 8 feet span at mid-span members. Fit solid blocking at ends of members.

3.2 FURRING, BLOCKING AND GROUNDS

- A. Provide wherever shown and where required for attachment of other work. Coordinate with work of other sections.
- B. Item locations include but are not limited to toilet accessories, toilet partitions, door frames, window frames, hardware, access doors and ladders, cabinetry, miscellaneous equipment locations and mechanical, plumbing and electrical item locations and all other locations of wall mounted items.
- C. Install plywood backboards for telephone, data and other electrical equipment.
- D. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- E. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.
- F. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- G. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finished work.
- H. Firestop all concealed spaces of wood stud walls, ceilings and floor levels at 10 foot intervals both vertically and horizontally.
- I. Firestop all concealed vertical and horizontal spaces as occur at soffits, vents, stair stringers, pipes and similar openings in compliance with CBC, (CCR) Title 24, Part 2, Section 717.

- J. Firestopping shall consist of closely fitted wood blocks of 2 inch nominal thickness lumber of same width as framing members.

3.3 TOLERANCES

- A. Framing Members: 1/4 inch maximum from true position.
- B. Surface Flatness of Floor: 1/4 inch in 10 feet maximum.

END OF SECTION

SECTION 08 14 00

WOOD DOORS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Flush faced wood doors fire rated and non-rated.
- B. Door louvers.

1.2 REFERENCES

- A. ANSI/WDMA - Wood Door Manufacturers Association I.S. 1-A-04-Architectural Wood Flush Doors.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- C. NFPA 80 - Fire Doors and Windows.
- D. NWWDA I.S.1 - Industry Standard For Wood Flush Doors (Includes Standards I.S.1.1 through I.S.1.7).
- E. FSC - Forest Stewardship Council.
- F. UL 10C - Fire Tests of Door Assemblies.
- G. WI - Woodwork Institute: Architectural Woodwork Standards.

1.3 QUALITY ASSURANCE

- A. Conform to requirements of The WI Architectural Woodwork Standards, Section 9 Custom Grade except where otherwise indicated.
- B. All wood doors and the installation of wood doors shall be monitored for compliance under the scope of the WI Certified Compliance Program (CCP).
- C. Issue a WI Certified Compliance Certificate prior to delivery of doors certifying that doors meet all requirements of WI Grade specified.
- D. After completion issue a WI Certified Compliance Certificate for Installation..

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC - California Building Code, for fire rated doors and Transom Panels.
- B. Fire Door and Transom Panel Construction: Conform to UL 10C, Category A.
- C. Installed Doors and Transom Panels: Conform to NFPA 80 for fire rated class indicated.

1.5 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00. Shop drawings shall bear the WI Certified Compliance Label on the first page of each set.
- B. Indicate door elevations, stile and rail reinforcement, internal blocking for hardware attachment, and cutouts for glazing and louvers.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 12 x 12 inch in size illustrating each species and finish.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Protect products under provisions of Section 01 61 00.
- B. Package, deliver, and store doors in accordance with WI requirements as set forth in Section 2 and Appendix B of The Architectural Woodwork Standards.

1.7 WARRANTY

- A. Provide manufacturer's standard lifetime warranty for interior doors under provisions of Section 01 77 00 for solid core doors.
- B. Provide 1 year manufacturer's warranty under provisions of Section 01 77 00 for Stile and Rail Doors.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS, FLUSH FACED DOORS

- A. Algoma Hardwoods, www.algomahardwoods.com.
- B. Door America-American Building Supply, Inc., www.dooramerican.com.
- C. Eggers Industries, www.eggersindustries.com.
- D. Haley Architectural Doors, www.haleybros.com.
- E. Oshkosh Door Co., www.oshkoshdoor.com.
- F. Marshfield Door Systems, Inc., www.marshfielddoors.com.
- G. V.T. Industries, www.vtindustries.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.2 ACCEPTABLE MANUFACTURERS, STILE AND RAIL DOORS

- A. Door America-American Building Supply, Inc., www.dooramerican.com.
- B. Eggers Industries, www.eggersindustries.com.
- C. Pinecrest, www.pinecrestinc.com.
- D. Simpson Door Co., www.simpsondoor.com.
- E. Sun-Dor-Co., www.sundorco.com.
- F. The Maiman Co., www.maiman.com.
- G. Marshfield Door Systems, Inc., www.marshfielddoors.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.3 DOOR AND TRANSOM PANEL CONSTRUCTION

- A. Lumber Materials: FSC - Forest Stewardship Council certified sustainable harvested wood.
- B. Solid Non-rated Core: Solid wood block, framed block glued, or solid particleboard.
- C. Hollow Core: NWWDA I.S.1; mesh or cellular core including lock blocks, vertical edge bands, and top and bottom rails.

- D. Solid, Special Function Core: Labeled fire performance type, UL 10C, Category A. Intumescent seals concealed by outer stile in matching veneer.
- E. Construction: WI, Custom grade, ANSI/WDMA extra heavy duty, 5 ply, manufactured as an edge bonded, sanded core assembly, laminated in a one-step, hot pressed operation. Cold-press method is not acceptable.
- F. Flush Interior Door Veneer: White Birch species; plain sliced with book matched grain, for transparent stain finish. Satin sheen. Medium density overlay face veneer for opaque paint finish. Factory finish. Color as selected.
- G. Flush Exterior Door Veneer: Medium density overlay face veneer for opaque paint finish. Site finish.

2.4 ADHESIVES

- A. Exterior Doors: WI Type I.
- B. Interior Doors: WI Type I.

2.5 ACCESSORIES

- A. Louvers: Roll formed 20 gage galvanized steel; factory primed; inverted 'Y' blade; sightproof.
- B. Glass Stops: Rolled metal to conform to UL requirements.

2.6 FABRICATION

- A. Fabricate non-rated wood doors to requirements of The WI Architectural Woodwork Standards, Section 9, in the WI Grade specified.
- B. Fabricate fire rated doors per manufacturer's standard construction, and labeling agency requirements.
- C. Premachine doors for finish hardware.
- D. For fire rated doors with mineral cores, provide solid wood blocks for hardware reinforcement at lock edge and at top of door for closer.
- E. For fire rated doors with mineral cores, provide solid wood blocking for thru-bolted hardware.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install doors in accordance with The WI Architectural Woodwork Standards Section 9 and Appendix B.
- B. Conform to WI and NFPA requirements for fit tolerances.
- C. Coordinate installation of glass and glazing.
- D. Install door louvers.
- E. Adjust doors for smooth and balanced movements.
- F. Install fire doors in accordance with NFPA 80.

3.2 INSTALLATION TOLERANCES

- A. Edge clearance for swinging doors shall not exceed the following as required by WI and NFPA 80:
 - 1. Between door and frame at head and jamb 1/8 inch
 - 2. Between edge of pair of doors 1/8 inch

- | | | |
|----|--|----------|
| 3. | Diagonal distortion | 1/8 inch |
| 4. | At door sill with threshold. (From bottom of door to top of threshold) | 3/8 inch |
| 5. | At door sill with no threshold | 1/2 inch |
| 6. | At door bottom and rigid floor covering per NFPA 80 | 1/2 inch |
| 7. | At door bottom and nominal floor covering per NFPA 80 | 5/8 inch |

END OF SECTION

SECTION 09 30 16

QUARRY TILE FLOOR FINISHING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Quarry tile floor finish using the thinset application method.
- B. Quarry tile base.

1.2 REFERENCES

- A. ANSI/TCA A108.6 - Ceramic Tile Installed with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.
- B. ANSI/TCA A118.1 - Dry-Set Portland Cement Mortar.
- C. ANSI/TCA A118.3 - Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.
- D. ANSI/TCA A118.4 - Latex-Portland Cement Mortar.
- E. ANSI/TCA A118.12 - Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
- F. ANSI/TCA A137.1 - Specifications for Ceramic Tile.
- G. ASTM A185 - Welded Steel Wire Fabric.
- H. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

- A. Submit samples under provisions of Section 01 33 00.
- B. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- C. Submit manufacturer's certificate under provisions of Section 01 33 00 that products meet or exceed ANSI/TCA A137.1.
- D. Submit maintenance data under provisions of Section 01 77 00.
- E. Include recommended cleaning and stain removal methods, cleaning materials.

1.4 QUALITY ASSURANCE

- A. Conform to ANSI/TCA A137.1 for tile materials.
- B. Conform to ANSI/TCA A137.1 DCOF AcuTest for coefficient of friction.
- C. Conform to ANSI/TCA Standards and TCA Handbook for tile installation.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum five years documented experience.
- B. Installer: Company specializing in applying the work of this Section with minimum five years documented experience.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain 50 degrees F during installation of mortar materials.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS - TILE

- A. American Olean Tile Co., Inc., www.aotile.com.
B. DSA (Buchtal), www.dsa-ceramics.com.
C. Dal-Tile Corp., www.daltile.com.
D. Florida Tile Industries, Inc., www.floridatile.com.
E. Interceramic, www.interceramic.com.
F. Metropolitan Ceramics, www.metroceramics.com.
G. Shaw Commercial, www.shawinc.com.
H. Summitville Tile, Inc., www.summitville.com.
I. Substitutions: Under provisions of Section 01 25 13.

2.2 TILE MATERIALS

- A. Quarry Tile: ANSI/TCA A137.1, conforming to the following:

Table with 2 columns: Property and Requirement. Rows include Manufacturer and Pattern, Moisture Absorption, Size, Edge, Surface Finish, Color, and Coefficient of Friction.

- B. Base: Match quarry tile for moisture absorption, surface finish, and color, conforming to the following:

Table with 2 columns: Property and Requirement. Rows include Length, Height, Top Edge, and Internal Corner.

2.3 MANUFACTURERS - MORTAR AND GROUT

- A. American Olean Tile Co., Inc., www.aotile.com.
B. C-Cure, www.c-cure.com.
C. Custom Building Products, www.custombuildingproducts.com.
D. Dal-Tile Corp., www.doltile.com.
E. H.B. Fuller Co., www.hbfuller.com.

- F. Hydromet, www.bostikfindley-usa.com.
- G. Laticrete International, Inc., www.laticrete.com.
- H. MAPEI, www.mapei.com.
- I. W.R. Bonsal Company, www.bonsal.com.
- J. Substitutions: Under provisions of Section 01 25 13.

2.4 MORTAR MATERIALS

- A. Chemical Resistant Epoxy Mortar for Bond Coat: ANSI/TCA A118.3, water cleanable. Material shall have a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and shall meet South Coast Air Quality Management District (SCAQMD) Rule 1168.

2.5 GROUT MATERIALS

- A. Grout: Chemical resistant type, consisting of epoxy resin and hardener, conforming to ANSI/TCA A118.3 of color selected. Material shall have a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and shall meet South Coast Air Quality Management District (SCAQMD) Rule 1168.

2.6 ACCESSORIES

- A. Thin Load Bearing Direct Bond Membrane: Chlorinated polyethylene elastomer sheet material laminated with fabric on both sides meeting requirements of ANSI A118.12.
 - 1. Dal-Tile Corp., Dal Seal TS, www.daltile.com.
 - 2. Compotite Corp., Composeal Gold, www.compotite.com.
 - 3. NAC Products, Inc., ECB Membrane, www.nac-anti-fracture.com.
 - 4. Noble Company, Noble Seal TS, www.noblecompany.com.
 - 5. Pasco Manufacturing, Inc., Baseline, www.pascoespecialty.com.
 - 6. Substitutions: Under provisions of Section 01 25 13.
- B. Reinforcing Mesh: ASTM A185, 2 x 2 inch size, of WO.3/WO.3 wire size; welded fabric, galvanized.
- C. Sealant: Type specified in Section 07 92 00.

2.7 MORTAR MIX AND GROUT MIX

- A. Mix and proportion pre-mix setting bed, bond coat and grout materials in accordance with manufacturer's instructions and referenced standards.

2.8 SEALER

- A. Tile and Grout Sealer: Aqua Mix Penetrating Sealer manufactured by Aqua Mix, Inc., www.aquamix.com.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means installer accepts condition of existing surfaces.

3.2 PREPARATION

- A. Protect surrounding work from damage or disfiguration.
- B. Vacuum clean existing surfaces and damp clean.
- C. Seal substrate surface cracks with filler.

3.3 INSTALLATION THINSET METHOD

- A. Install mortar, tile and grout in accordance with ANSI/TCA 108.6 and applicable tile installation standards of the TCA Handbook.
- B. Apply bond coat.
- C. Install thin load bearing direct bond membrane with bond coat.
- D. Lay tile to pattern indicated on drawings, or if not indicated, request tile pattern from Architect. Do not interrupt tile pattern through openings.
- E. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align floor, base, and wall joints.
- F. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Provide control joints, vertical and horizontal at not-to-exceed 20'-0" oc. Keep control joints free of mortar or grout. Install joints in accordance with TCA Handbook. Apply sealant to joints.
- I. Allow tile to set for a minimum of 48 hours prior to grouting.
- J. Grout tile joints.
- K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.4 CLEANING

- A. Clean work under provisions of Section 01 77 00.
- B. Clean tile surfaces.

3.5 SEALING

- A. Install sealer in accordance with manufacturer's recommendations.

3.6 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Do not permit traffic over finished floor surface for a minimum of 48 hours. After 48 hours and until 72 hours, cover area with 3/8 inch plywood panels if traffic required.

END OF SECTION

SECTION 27 05 26

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Grounding conductors.
 - 2. Grounding connectors.
 - 3. Grounding busbars.
 - 4. Grounding rods.
 - 5. Grounding labeling.

1.3 DEFINITIONS

- A. BCT: Bonding conductor for telecommunications.
- B. EMT: Electrical metallic tubing.
- C. TGB: Telecommunications grounding busbar.
- D. TMGB: Telecommunications main grounding busbar.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. Shop Drawings: For communications equipment room signal reference grid. Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:
 - 1. Ground rods.
 - 2. Ground and roof rings.
 - 3. BCT, TMGB, TGBs, and routing of their bonding conductors.
- B. Qualification Data: For installation supervisor, and field inspector.

- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Result of the ground-resistance test, measured at the point of BCT connection.
 - b. Result of the bonding-resistance test at each TGB and its nearest grounding electrode.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Installation Supervision: Installation shall be under the direct supervision of ITS **Installer 2**, who shall be present at all times when Work of this Section is performed at Project site.
 - 2. Field Inspector: Currently registered by BICSI as a **registered communications distribution designer** to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

- A. Comply with J-STD-607-A.

2.2 CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Harger Lightning & Grounding.
 - 2. Panduit Corp.
 - 3. TE Connectivity Ltd.
- B. Comply with UL 486A-486B.
- C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
 - 1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
- D. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.

4. Bonding Cable: 28 kcmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, and 1/4 inch (6.3 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Burndy; Part of Hubbell Electrical Systems.
 2. Harger Lightning & Grounding.
 3. Panduit Corp.
- B. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
- C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.
1. Electroplated tinned copper, C and H shaped.
- D. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.
- E. Busbar Connectors: Cast silicon bronze, solderless **compression**-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.
- F. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING BUSBARS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Chatsworth Products, Inc.
 2. Harger Lightning & Grounding.
 3. Panduit Corp.
- B. TMGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as TMGB and shall comply with J-STD-607-A.
1. Predrilling shall be with holes for use with lugs specified in this Section.
 2. Mounting Hardware: Stand-off brackets that provide a 4-inch (100-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- C. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-A. Predrilling shall be with holes for use with lugs specified in this Section.
1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.

2. Rack-Mounted Horizontal Busbar: Designed for mounting in 19- or 23-inch (483- or 584-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
3. Rack-Mounted Vertical Busbar: 72 or 36 inches (1827 or 914 mm) long, with stainless-steel or copper-plated hardware for attachment to the rack.

2.5 GROUND RODS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Harger Lightning & Grounding.
 2. TE Connectivity Ltd.
- B. Ground Rods: [**Copper-clad**] [**Zinc-coated**] [**Stainless-**] steel[, **sectional type**]; [3/4 inch by 10 feet (19 mm by 3 m)] [5/8 by 96 inches (16 by 2400 mm)] in diameter.

2.6 LABELING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Brother International Corporation.
 2. HellermannTyton.
 3. Panduit Corp.
- B. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.
- B. Inspect the test results of the ac grounding system measured at the point of BCT connection.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.
- B. Comply with NECA 1.

- C. Comply with J-STD-607-A.

3.3 APPLICATION

- A. Conductors: Install solid conductor for [No. 8] <Insert number> AWG and smaller and stranded conductors for [No. 6] <Insert number> AWG and larger unless otherwise indicated.
 - 1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than [No. 6] <Insert number> AWG.
 - 2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than [No. 6] <Insert number> AWG.
- B. Underground Grounding Conductors: Install bare copper conductor, **No. 3/0**AWG minimum.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.
- D. Conductor Support:
 - 1. Secure grounding and bonding conductors at intervals of not less than 36 inches (900 mm).
- E. Grounding and Bonding Conductors:
 - 1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
 - 2. Install without splices.
 - 3. Support at not more than 36-inch (900-mm) intervals.
 - 4. Install grounding and bonding conductors in 3/4-inch (21-mm) PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.
 - a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 270528 "Pathways for Communications Systems," and bond both ends of the conduit to a TGB.

3.4 GROUNDING ELECTRODE SYSTEM

- A. The BCT between the TMGB and the ac service equipment ground shall not be smaller than **No. 3/0** AWG.

3.5 GROUNDING BUSBARS

- A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 12 inches (300 mm) above finished floor unless otherwise indicated.
- B. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

3.6 CONNECTIONS

- A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than **No. 6 AWG**.
- B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
 - 1. Use crimping tool and the die specific to the connector.
 - 2. Pretwist the conductor.
 - 3. Apply an antioxidant compound to all bolted and compression connections.
- D. Primary Protector: Bond to the TMGB with insulated bonding conductor.
- E. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot (1 sq. mm/linear meter) of conductor length, up to a maximum size of No. 3/0 AWG [**168 kcmils (85 sq. mm)**] unless otherwise indicated.
- F. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install **vertically mounted** rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.
- G. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.
- H. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each TGB to the ground bar of the panelboard.
- I. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.
- J. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.
- K. Access Floors: Bond all metal parts of access floors to the TGB.
- L. Equipment Room Signal Reference Grid: Provide a low-impedance path between telecommunications cabinets, equipment racks, and the reference grid, using **No. 6 AWG** bonding conductors.
 - 1. Install the conductors in grid pattern on 4-foot (1200-mm) centers, allowing bonding of one pedestal from each access floor tile.
 - 2. Bond the TGB of the equipment room to the reference grid at two or more locations.
 - 3. Bond all conduits and piping entering the equipment room to the TGB at the perimeter of the room.

3.7 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.
- B. Comply with IEEE C2 grounding requirements.

- C. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) extends above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

- D.
- E. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect grounding conductors to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

3.8 IDENTIFICATION

- A. Labels shall be preprinted or computer-printed type.
 - 1. Label TMGB(s) with "fs-TMGB," where "fs" is the telecommunications space identifier for the space containing the TMGB.
 - 2. Label TGB(s) with "fs-TGB," where "fs" is the telecommunications space identifier for the space containing the TGB.
 - 3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.
 - a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.
 - 3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
 - a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB. Maximum acceptable ac current level is 1 A.
- D. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.
- E. Grounding system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION

SECTION 27 05 28

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Nonmetallic wireways and auxiliary gutters.
6. Surface pathways.
7. Boxes, enclosures, and cabinets.
8. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
3. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.3 DEFINITIONS

ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
- C. Samples: For **wireways, nonmetallic wireways, and surface pathways** and for each color and texture specified, 12 inches (300 mm) long.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
1. Structural members in paths of pathway groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For pathway racks, enclosures, cabinets, equipment racks and their mounting provisions, including those for internal components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
 4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. O-Z/Gedney; a brand of Emerson Industrial Automation.
 2. Southwire Company.
 3. Thomas & Betts Corporation; A Member of the ABB Group.
- B. General Requirements for Metal Conduits and Fittings:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. PVC-Coated Steel Conduit: PVC-coated [**rigid steel conduit**] [**IMC**].
1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- G. EMT: Comply with ANSI C80.3 and UL 797.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.

2. Fittings for EMT:
 - a. Material: **die cast**.
 - b. Type: **compression**.
 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems; a part of Atkore International.
 2. Carlton; a brand of Thomas & Betts Corporation.
 3. Thomas & Betts Corporation; A Member of the ABB Group.
- B. General Requirements for Nonmetallic Conduits and Fittings:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. RNC: **Type EPC-40-PVC**, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Rigid HDPE: Comply with UL 651A.
- E. Continuous HDPE: Comply with UL 651B.
- F. RTRC: Comply with UL 1684A and NEMA TC 14.
- G. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- H. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carlton; a brand of Thomas & Betts Corporation.
 2. Dura-Line.
 3. IPEX USA LLC.
- B. Description: Comply with UL 2024; flexible-type pathway, approved for **plenum or general-use** installation unless otherwise indicated.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. B-line, an Eaton business.
 2. Hoffman; a brand of Pentair Equipment Protection.
 3. Square D; by Schneider Electric.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, **Type 3R** or **Type 4** unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: **Flanged-and-gasketed type** unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allied Moulded Products, Inc.
 2. Carlton; a brand of Thomas & Betts Corporation.
 3. Hoffman; a brand of Pentair Equipment Protection.
- B. General Requirements for Nonmetallic Wireways and Auxiliary Gutters:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- F. Solvents and Adhesives: As recommended by conduit manufacturer.

2.6 SURFACE PATHWAYS

- A. General Requirements for Surface Pathways:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.

B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. **Manufacturer's standard enamel finish in color selected by Architect.**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MonoSystems, Inc.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.

C. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from [**manufacturer's standard**] [**custom**] colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton; a brand of Thomas & Betts Corporation.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.

D. Tele-Power Poles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MonoSystems, Inc.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.
2. Material: [**Galvanized steel with ivory baked-enamel finish**] [**Aluminum with clear anodized finish**].
3. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carlton; a brand of Thomas & Betts Corporation.
2. Crouse-Hinds, an Eaton business.
3. O-Z/Gedney; a brand of Emerson Industrial Automation.

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, **ferrous alloy**, Type FD, with gasketed cover.

E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

F. Metal Floor Boxes:

1. Material: **Cast metal or sheet metal.**
2. Type: **Fully adjustable.**

3. Shape: Rectangular.
 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Nonmetallic Floor Boxes: Nonadjustable, **rectangular**.
1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, **galvanized, cast iron** with gasketed cover.
- J. Device Box Dimensions: **4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep)]** .
- K. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, **Type 1** or **Type 3R** with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Nonmetallic Enclosures:
 - a. Material: **Plastic**.
 - b. Finished inside with radio-frequency-resistant paint.
 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- M. Cabinets:
1. NEMA 250, **Type 1** or **Type 3R**, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.
 5. Accessory feet where required for freestanding equipment.
 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING

- A. General Requirements for Handholes and Boxes:
1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. Comply with TIA-569-B.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.

- c. Quazite: Hubbell Power Systems, Inc.
- 2. Standard: Comply with SCTE 77.
- 3. Configuration: Designed for flush burial with **integral closed** bottom unless otherwise indicated.
- 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
- 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- 6. Cover Legend: Molded lettering, "**COMMUNICATIONS.**".
- 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- 8. Handholes **12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long)** and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.9 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: **IMC**.
 - 2. Concealed Conduit, Aboveground: **EMT**.
 - 3. Underground Conduit: RNC, **Type EPC-40-PVC** or **Type EPC-80-PVC**.
 - 4. Boxes and Enclosures, Aboveground: NEMA 250, **Type 3R**.
- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: **EMT**.
 - 2. Exposed, Not Subject to Severe Physical Damage: **EMT**.
 - 3. Exposed and Subject to Severe Physical Damage: **IMC**. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums
 - 4. Concealed in Ceilings and Interior Walls and Partitions: **EMT**.
 - 5. Damp or Wet Locations: **IMC**.
 - 6. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: **EMT**.
 - 7. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: **EMT**.
 - 8. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: **EMT**.
 - 9. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 **stainless steel** in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: 3/4-inch (21-mm) trade size. Minimum size for optical-fiber cables is 1 inch (27 mm).

- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 3. EMT: Use **compression** fittings. Comply with NEMA FB 2.10.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface pathways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

- A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- I. Pathways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
 - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange pathways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from ENT to **IMC** before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits of 2-inch (53-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb ((90-kg))tensile strength. Leave at least 12 inches ((300 mm))of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- R. Surface Pathways:
 - 1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
 - 2. Install surface pathway with a minimum 2-inch (50-mm) radius control at bend points.
 - 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- S. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
 - 1. 3/4-Inch (21-mm) Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15 m).
 - 2. 1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- T. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

- U. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.

- V. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

- W. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to **bottom** of box unless otherwise indicated.

- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

- AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

- BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

- CC. Set metal floor boxes level and flush with finished floor surface.

- DD. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, but a minimum of 6 inches (150 mm) below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes with bottom below frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 27 05 44

SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for pathway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized-steel sheet.
2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Pipeline Seal and Insulator, Inc.
 - c. Proco Products, Inc.
2. Sealing Elements: **EPDM** rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: **Plastic**.
4. Connecting Bolts and Nuts: **Carbon steel, with corrosion-resistant coating**, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. HOLDRITE.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and pathway or cable unless sleeve seal is to be installed **or unless seismic criteria require different clearance.**
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors **2 inches (50 mm)** above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using **cast-iron** pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building.

- B. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 27 11 00

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Grounding.

B. Related Requirements:

1. Section 271300 "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
2. Section 271500 "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.
3. Section 280513 "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. LAN: Local area network.
- C. RCDD: Registered Communications Distribution Designer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Seismic Qualification Certificates: For equipment frames from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of **Commercial Installer, Level 2**.
 2. Installation Supervision: Installation shall be under the direct supervision of **Level 2 Installer**, who shall be present at all times when Work of this Section is performed at Project site.
 3. Field Inspector: Currently registered by **Commercial Installer, Level 2** to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Equipment frames shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.
 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event.**"

2.2 BACKBOARDS

- A. Backboards: Plywood, **fire-retardant treated**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).

2.3 EQUIPMENT FRAMES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. B-line, an Eaton business.
 2. Hubbell Premise Wiring.

3. Leviton Manufacturing Co., Inc.

B. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310-D standard, 19-inch (480-mm) panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, **aluminum** construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, **and a power strip**.
2. Baked-polyester powder coat finish.

D. Modular Freestanding Cabinets:

1. Removable and lockable side panels.
2. Hinged and lockable front and rear doors.
3. Adjustable feet for leveling.
4. Screened ventilation openings in the roof and rear door.
5. Cable access provisions in the roof and base.
6. Grounding bus bar.
7. **Rack-mounted, 550-cfm (260-L/s) fan with filter.**
8. Power strip.
9. Baked-polyester powder coat finish.
10. All cabinets keyed alike.

E. Modular Wall Cabinets:

1. Wall mounting.
2. **Aluminum** construction.
3. Treated to resist corrosion.
4. Lockable front **and rear** doors.
5. Louvered side panels.
6. Cable access provisions top and bottom.
7. Grounding lug.
8. **Rack]-mounted, 250-cfm (118-L/s) fan.**
9. Power strip.
10. All cabinets keyed alike.

F. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Rack mounting.
3. **Six 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R** receptacles.
4. LED indicator lights for power and protection status.
5. LED indicator lights for reverse polarity and open outlet ground.

6. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
7. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
8. **Close-coupled, direct plug-in** line cord.
9. Rocker-type on-off switch, illuminated when in on position.
10. Peak Single-Impulse Surge Current Rating: **33 kA** per phase.
11. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than **330 V**.

2.5 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless **compression**-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with J-STD-607-A.

2.6 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Comply with requirements in Section 270528 "Pathways for Communications Systems" for materials and installation requirements for **underground** pathways.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 2. Record agreements reached in meetings and distribute them to other participants.
 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
 - 1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
- B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for **Class 2** level of administration **including optional identification requirements of this standard.**

D. Labels shall be preprinted or computer-printed type.

END OF SECTION

SECTION 27 13 00

COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cable.
3. **62.5/125**-micrometer, optical fiber cabling.
4. Coaxial cable.
5. Cable connecting hardware, patch panels, and cross-connects.
6. Cabling identification products.

B. Related Sections:

1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. LAN: Local area network.
- F. RCDD: Registered Communications Distribution Designer.
- G. UTP: Unshielded twisted pair.

1.4 BACKBONE CABLING DESCRIPTION

- A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

- 1. For coaxial cable, include the following installation data for each type used:

- a. Nominal OD.
- b. Minimum bending radius.
- c. Maximum pulling tension.

- B. Shop Drawings:

- 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
- 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
- 3. Cabling administration drawings and printouts.
- 4. Wiring diagrams to show typical wiring schematics including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
- 5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
- 6. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
 - a. Vertical and horizontal offsets and transitions.
 - b. Clearances for access above and to side of cable trays.
 - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
 - d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.
- D. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.8 CLOSEOUT SUBMITTALS

- A. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Patch-Panel Units: **One** of each type.
 2. Connecting Blocks: **One** of each type.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings **Cabling Administration Drawings, and field testing program development** by an RCDD.
 2. Installation Supervision: Installation shall be under the direct supervision of **Registered Technician or Level 2 Installer**, who shall be present at all times when Work of this Section is performed at Project site.
 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Testing Agency Qualifications: An NRTL.
1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: **25** or less.
 2. Smoke-Developed Index: **50** or less.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- F. Grounding: Comply with ANSI-J-STD-607-A.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
1. Test optical fiber cable to determine the continuity of the strand end to end. Use **optical fiber flashlight or optical loss test set**.
 2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
 3. Test each pair of UTP cable for open and short circuits.

1.12 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.13 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

1.14 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for **two** years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within **two** years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide **30** days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
- C. Conduit and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

- A. Backboards: Plywood, **fire-retardant treated**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Section 061000 "Rough Carpentry" for plywood backing panels.

2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 2. General Cable; General Cable Corporation.
 - 3. Optical Cable Corporation.

- B. Description: 100-ohm, **100-pair** UTP, formed into 25-pair binder groups covered with a **gray** thermoplastic jacket **and overall metallic shield**.
1. Comply with ICEA S-90-661 for mechanical properties.
 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 3. Comply with TIA/EIA-568-B.2, **Category 5e** for existing and **Category 6** for new.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX.
 - e. Multipurpose: Type MP or MPG.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 2. Berk-Tek Leviton; a Nexans/Leviton alliance.
 3. Hubbell Premise Wiring.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: **110-style IDC for Category 5e** for existing/remodel and **110-style IDC for Category 6** for new. Provide blocks for the number of cables terminated on the block, plus **25** percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
1. Number of Terminals per Field: **One** for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
1. Number of Jacks per Field: **One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.**
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made, 4-pair cables in **48-inch/1200-mm** lengths; terminated with 8-position modular plug at each end.
1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 2. Patch cords shall have color-coded boots for circuit identification.

2.5 OPTICAL FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMP NETCONNECT; a TE Connectivity Ltd. company.
2. General Cable; General Cable Corporation.
3. Optical Cable Corporation.

B. Description: Multimode, **62.5/125**-micrometer, **24** -fiber, **nonconductive**, tight buffer, optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA/EIA-568-B.3 for performance specifications.
3. Comply with **TIA/EIA-492AAAA-B & TIA/EIA-492AAAA-A** for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or OFNG.
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC or OFCG.
 - e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.
5. Conductive cable shall be **aluminum** armored type.
6. Maximum Attenuation: **3.50** dB/km at 850 nm; **1.5** dB/km at 1300 nm.
7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

C. Jacket:

1. Jacket Color: **Orange for 62.5/125-micrometer cable.**
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Technology Systems Industries, Inc.
2. Hubbell Premise Wiring.
3. Optical Cable Corporation.

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: **One** for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

C. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.

D. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
2. Quick-connect, simplex and duplex, **Type SC** connectors. Insertion loss not more than 0.75 dB.
3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Networking Division/NORDX.

2. Coleman Cable, Inc.
 3. Draka USA.
- B. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- C. RG-11/U: NFPA 70, Type CATV.
1. No. **14** AWG, solid, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 4. Jacketed with sunlight-resistant, black PVC or PE.
 5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- D. RG59/U: NFPA 70, Type CATVR.
1. No. **20** AWG, solid, silver-plated, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
 4. Color-coded PVC jacket.
- E. RG-6/U: NFPA 70, Type CATV or CM.
1. No. **16** AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 3. Jacketed with black PVC or PE.
 4. Suitable for indoor installations.
- F. RG59/U: NFPA 70, Type CATV.
1. No. **20** AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
 3. PVC jacket.
- G. RG59/U (Plenum Rated): NFPA 70, Type CMP.
1. No. **20** AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
 3. Copolymer jacket.
- H. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
1. CATV Cable: Type CATV, or **CATVP** or **CATVR**.
 2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 3. CATV Riser Rated: Type CATVR; or **CATVP**, **CATVR**, or **CATV**, complying with UL 1666.
 4. CATV Limited Rating: Type CATVX.

2.8 COAXIAL CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aim Electronics.
 2. Leviton Manufacturing Co., Inc.

3. Siemon Co. (The).

- B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.9 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.10 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.11 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
- E. Cable will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard when entering room from overhead.
 - 4. Extend conduits 3 inches (76 mm) above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
 - 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - 10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 - 11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
 2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- D. Optical Fiber Cable Installation:
1. Comply with TIA/EIA-568-B.3.
 2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
- E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than **60 inches (1524 mm)** apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- F. Outdoor Coaxial Cable Installation:
1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
- G. Group connecting hardware for cables into separate logical fields.
- H. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.5 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Administration Class: 1.
 - 2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for **Class 2** level of administration **including optional identification requirements of this standard**.
- D. Comply with requirements in Section 271500 "Communications Horizontal Cabling" for cable and asset management software.
- E. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, **backbone pathways and cables**, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- G. Cable and Wire Identification:
 - 1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
 - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

- a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:
- 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
- 1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 4. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- F. End-to-end cabling will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

END OF SECTION

SECTION 27 15 00

COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. UTP cabling.
2. **62.5/125**-micrometer, optical fiber cabling.
3. Coaxial cable.
4. Multiuser telecommunications outlet assemblies.
5. Cable connecting hardware, patch panels, and cross-connects.
6. Telecommunications outlet/connectors.
7. Cabling system identification products.
8. Cable management system.

B. Related Requirements:

1. Section 271300 "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
2. Section 280513 "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- D. EMI: Electromagnetic interference.
- E. IDC: Insulation displacement connector.
- F. LAN: Local area network.
- G. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.
- H. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

- I. RCDD: Registered Communications Distribution Designer.
 - J. UTP: Unshielded twisted pair.
- 1.4 ADMINISTRATIVE REQUIREMENTS
- A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.
 - B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.
- 1.5 ACTION SUBMITTALS
- A. Product Data: For each type of product.
 - 1. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
 - B. Shop Drawings:
 - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - 3. Cabling administration drawings and printouts.
 - 4. Wiring diagrams to show typical wiring schematics, including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
 - 5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
 - C. Samples: For workstation outlets, jacks, jack assemblies, **[in specified finish, one for each size and outlet configuration] [and faceplates for color selection and evaluation of technical features]**.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
 - B. Source quality-control reports.
 - C. Field quality-control reports.
- 1.7 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For splices and connectors to include in maintenance manuals.
 - B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Patch-Panel Units: **One** of each type.
 2. Connecting Blocks: **One** of each type.
 3. Device Plates: **One** of each type.
 4. Multiuser Telecommunications Outlet Assemblies: **One** of each type.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings **Cabling Administration Drawings, and field testing program development** by an RCDD.
 2. Installation Supervision: Installation shall be under the direct supervision of **Registered Technician or Level 2 Installer**, who shall be present at all times when Work of this Section is performed at Project site.
 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Testing Agency Qualifications: An NRTL.
1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
1. Test optical fiber cables to determine the continuity of the strand end to end. Use **optical fiber flashlight or optical loss test set**.
 2. Test optical fiber cables while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; including the loss value of each. Retain test data and include the record in maintenance data.
 3. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.

2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.
4. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: **25** or less.
2. Smoke-Developed Index: **50** or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Grounding: Comply with J-STD-607-A.

2.3 BACKBOARDS

A. Backboards: Plywood, **fire-retardant treated**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Section 061000 "Rough Carpentry" for plywood backing panels.

2.4 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMP NETCONNECT; a TE Connectivity Ltd. company.
2. General Cable; General Cable Corporation.
3. Optical Cable Corporation.

B. Description: 100-ohm, four-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. <Double click to insert sustainable design text for lead content.>
4. Comply with TIA/EIA-568-B.2, **Category 5e & Category 6**.
5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX.
 - e. Multipurpose: Type MP or MPG.

- f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
- g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.5 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 2. Hubbell Premise Wiring.
 - 3. Panduit Corp.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: **110-style IDC for Category 5e & 110-style IDC for Category 6**. Provide blocks for the number of cables terminated on the block, plus **25** percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 - 1. Number of Terminals per Field: **One** for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 - 1. Number of Jacks per Field: **One** for each four-pair **conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.**
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made, four-pair cables in **48-inch** 1200-mm lengths; terminated with eight-position modular plug at each end.
 - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 - 2. Patch cords shall have color-coded boots for circuit identification.

2.6 OPTICAL FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 2. Berk-Tek Leviton; a Nexans/Leviton alliance.
 - 3. General Cable; General Cable Corporation.
- B. Description: Multimode, **62.5/125**-micrometer, **24**-fiber, **nonconductive**, tight buffer, optical fiber cable.
 - 1. Comply with ICEA S-83-596 for mechanical properties.
 - 2. Comply with TIA/EIA-568-B.3 for performance specifications.
 - 3. Comply with **TIA-492AAAB & TIA-492AAAA-A** for detailed specifications.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or OFNG.

- b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC or OFCG.
 - e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.
- 5. Conductive cable shall be **aluminum** armored type.
 - 6. Maximum Attenuation: **3.50** dB/km at 850 nm.
 - 7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
- C. Jacket:
- 1. Jacket Color: **Orange for 62.5/125-micrometer cable.**
 - 2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
 - 3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.7 OPTICAL FIBER CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. American Technology Systems Industries, Inc.
 - 2. Hubbell Premise Wiring.
 - 3. Optical Cable Corporation.
- B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
- 1. Number of Connectors per Field: **One** for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
- C. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.
- D. Cable Connecting Hardware:
- 1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 - 2. Quick-connect, simplex and duplex, **Type SC** connectors. Insertion loss not more than 0.75 dB.
 - 3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.8 COAXIAL CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Belden CDT Networking Division/NORDX.
 - 2. CommScope, Inc.
 - 3. Draka USA.
- B. General Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- C. RG-11/U: NFPA 70, Type CATV.
- 1. **No. 14** AWG, solid, copper-covered steel conductor.
 - 2. Gas-injected, foam-PE insulation.
 - 3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 - 4. Jacketed with sunlight-resistant, black PVC or PE.

5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- D. RG59/U: NFPA 70, Type CATVR.
1. **No. 20** AWG, solid, silver-plated, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
 4. Color-coded PVC jacket.
- E. RG-6/U: NFPA 70, Type CATV or CM.
1. **No. 16** AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 3. Jacketed with black PVC or PE.
 4. Suitable for indoor installations.
- F. RG59/U: NFPA 70, Type CATV.
1. **No. 20** AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
 3. PVC jacket.
- G. RG59/U (Plenum Rated): NFPA 70, Type CMP.
1. **No. 20** AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
 3. Copolymer jacket.
- H. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
1. CATV Cable: Type CATV or CATVP or CATVR.
 2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 3. CATV Riser Rated: Type CATVR; or CATVP, CATVR, or CATV, complying with UL 1666.
 4. CATV Limited Rating: Type CATVX.

2.9 COAXIAL CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Emerson Network Power Connectivity Solutions.
 2. Leviton Manufacturing Co., Inc.
 3. Siemon Co. (The).
- B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.10 CONSOLIDATION POINTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Belden CDT Networking Division/NORDX.
 2. Hubbell Premise Wiring.
 3. Panduit Corp.

- B. Description: Consolidation points shall comply with requirements for cable connecting hardware.
 - 1. Number of Terminals per Field: **One** for each conductor in assigned cables.
 - 2. Number of Connectors per Field:
 - a. **One** for each four-pair UTP cable indicated.
 - b. **One** for each four-pair conductor group of indicated cables, plus **25** percent spare positions.
 - 3. Mounting: **Recessed in ceiling or Wall**.
 - 4. NRTL listed as complying with UL 50 and UL 1863.
 - 5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.11 MULTIUSER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Belden CDT Networking Division/NORDX.
 - 2. Hubbell Premise Wiring.
 - 3. Panduit Corp.
- B. Description: MUTOAs shall meet the requirements for cable connecting hardware.
 - 1. Number of Terminals per Field: **One** for each conductor in assigned cables.
 - 2. Number of Connectors per Field:
 - a. **One** for each four-pair UTP cable indicated.
 - b. **One** for each four-pair conductor group of indicated cables, plus **25** percent spare positions.
 - 3. Mounting: **[Recessed in ceiling or Wall]** .
 - 4. NRTL listed as complying with UL 50 and UL 1863.
 - 5. Label shall include maximum length of work area cords, based on TIA/EIA-568-B.1.
 - 6. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.12 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets: **Four-port-connector** assemblies mounted in **single** faceplate.
 - 1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
 - 2. Metal Faceplate: **Stainless steel**, complying with requirements in Section 262726 "Wiring Devices."
 - 3. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
 - a. Flush mounting jacks, positioning the cord at a 45-degree angle.
 - 4. Legend: Factory labeled by silk-screening or engraving **for stainless steel faceplates**.
 - 5. Legend: Machine printed, in the field, using adhesive-tape label.
 - 6. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.13 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

- B. Comply with J-STD-607-A.

2.14 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.15 CABLE MANAGEMENT SYSTEM

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. iTRACS Corporation.
 - 2. Telsoft Solutions.
- B. Description: Computer-based cable management system, with integrated database capabilities.
- C. Document physical characteristics by recording the network, TIA/EIA details, and connections between equipment and cable.
- D. Information shall be presented in database view, **schematic plans, or technical drawings.**
 - 1. **AutoCAD** drawing software shall be used as drawing and schematic plans software.
- E. System shall interface with the following testing and recording devices:
 - 1. Direct upload tests from circuit testing instrument into the personal computer.
 - 2. Direct download circuit labeling into labeling printer.

2.16 SOURCE QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to evaluate cables.
- B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.
- E. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- F. Cable will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters. Conceal pathways and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements in Section 270528 "Pathways for Communications Systems."
- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
 - 2. Install lacing bars and distribution spools.
 - 3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. MUTOA shall not be used as a cross-connect point.
 - 5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for UTP at least 49 feet (15 m) from communications equipment room.
 - 6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - 10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 12. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
1. Comply with TIA/EIA-568-B.2.
 2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- D. Optical Fiber Cable Installation:
1. Comply with TIA/EIA-568-B.3.
 2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
- E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than [60 inches (1524 mm)] <Insert dimension> apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- F. Outdoor Coaxial Cable Installation:
1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
- G. Group connecting hardware for cables into separate logical fields.
- H. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 1. Administration Class: 1.
 2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
- C. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- D. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for **Class 2** level of administration[, **including optional identification requirements of this standard.**
- E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, **backbone pathways and cables**, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

G. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.

H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections **with the assistance of a factory-authorized service representative**:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually confirm **Category 5e**, & **Category 6**, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
5. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

- b. Link End-to-End Attenuation Tests:
 - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

- 6. UTP Performance Tests:
 - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.
 - 10) Delay skew.

- 7. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.3.
- 8. Coaxial Cable Tests: Conduct tests according to Section 274133 "Master Antenna Television System."
- 9. Final Verification Tests: Perform verification tests for UTP[**and optical fiber**] systems after the complete communications cabling and workstation outlet/connectors are installed.
 - a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
 - b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

- D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

- F. Prepare test and inspection reports.

- 3.8 SOFTWARE SERVICE AGREEMENT
 - A. Technical Support: Beginning with Substantial Completion, provide software support for **two** years.
 - B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within **two** years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide **30** days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets. **Include training in cabling administration software.**

END OF SECTION

SECTION 27 41 33

MASTER ANTENNA TELEVISION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. MATV equipment using **CCTV cameras and video recorders** as the signal source.
2. Off-air antennas.
3. MATV head-end components.
4. Distribution components.

B. Related Sections:

1. Section 271300 "Communications Backbone Cabling" for coaxial, UTP, and fiber-optic cables and connectors.
2. Section 271500 "Communications Horizontal Cabling" for coaxial, UTP, and fiber-optic cables and connectors.
3. Section 282300 "Video Surveillance" for cameras, monitors, computers, and cabling for video surveillance systems.

1.3 DEFINITIONS

- A. Agile Receiver: A broadband receiver that can be tuned to any desired channel.
- B. A/V: Audio/Visual.
- C. Broadband: For the purposes of this Section, wide bandwidth equipment or systems that can carry signals occupying in the frequency range of 54 to 1002 MHz. A broadband communication system can simultaneously accommodate television, voice, data, and many other services.
- D. Carrier: A pure-frequency signal that is modulated to carry information. In the process of modulation, the signal is spread out over a wider band. The carrier frequency is the center frequency on any television channel.
- E. CATV: Community antenna television. A communication system that simultaneously distributes several different channels of broadcast programs and other information to customers via a coaxial cable.
- F. CCTV: Closed-circuit television.
- G. CEA: Consumer Electronics Association.
- H. dBmV: Decibels relative to 1 mV across 75 ohms. Zero dBmV is defined as 1 mV across 75 ohms. $\text{dBmV} = 20 \log_{10}(V_1/V_2)$ where V_1 is the measurement of voltage at a point having identical impedance to V_2 (0.001 V across 75 ohms).

- I. Headend: The control center of the MATV system, where incoming signals are amplified, converted, processed, and combined into a common cable along with any locally originated television signals, for transmission to user-interface points. It is also called the "central retransmission facility."
- J. I/O: Input/Output.
- K. MATV: Master antenna television. A small television antenna distribution system usually restricted to one or two buildings.
- L. RF: Radio frequency.
- M. User Interface: End point of Contractor's responsibility for Work of this Section. User interfaces are the **terminal blocks to which the end user may connect coaxial cabling.**

1.4 SYSTEM DESCRIPTION

- A. System shall consist of **CCTV cameras and video recorders** and a coaxial cable distribution system.
 - 1. Headend equipment shall consist of receiving antennas, satellites, and associated signal distribution amplification and equalization.
 - 2. Distribution of direct broadcast satellite-service signals, which includes coordinating with Owner's selected service provider for installation of its dish-type antennas and processing the signals as needed to provide specified services combined into a single-feed point ready for connection into the distribution system. Obtain signal levels and noise and distortion characteristics from service provider as the point of departure for system layout and final equipment selection.
 - 3. Distribution of cable television service signals, which includes coordinating with Owner's selected service provider for installation of cable to the service point ready for connection into the distribution system. Obtain signal levels and noise and distortion characteristics from service provider as the point of departure for system layout and final equipment selection.
 - 4. Cable distribution system consisting of coaxial cables, user interfaces, signal taps and splitters, RF amplifiers, signal equalizers, power supplies, and required hardware, complying with CEA-310-E and CEA-2032 and resulting in performance parameters specified in this Section. System shall be capable of distributing television channels according to CEA-542-B.
- B. Hardware Requirements: Use plug-in, modular, solid-state electronic components. Mount amplifiers and other powered equipment in standard 19-inch (483-mm) cabinet complying with CEA-310-E.
- C. Off-Air Stations: Install antennas for the reception and distribution of selected stations.

1.5 PERFORMANCE REQUIREMENTS

- A. Minimum acceptable performance of distribution system at all user-interface points shall be as follows:
 - 1. RF Video-Carrier Level: Between 3 and 12 dBmV.
 - 2. Relative Video-Carrier Level: Within 3 dB to adjacent channel.
 - 3. Carrier Level Stability, Short Term: Level shall not change more than 0.5 dB during a 60-minute period.
 - 4. Carrier Level Stability, Long Term: Level shall not change more than 2 dB during a 24-hour period.
 - 5. Channel Frequency Response: Across any 6-MHz channel in the 54- to 220-MHz frequency range, referenced to video; signal amplitude shall be plus or minus 1 dB, maximum.
 - 6. Carrier-to-Noise Ratio: 45 dB or more.
 - 7. RF Visual Signal-to-Noise Ratio: 43 dB or more.
 - 8. Antenna Combiner Insertion Loss: 40 dB maximum.
 - 9. Signal Power Splitter and Isolation Tap Return Loss: 17 dB maximum.
 - 10. Cable Connectors Attenuation: Less than 0.1 dB.
 - 11. Cross Modulation: Less than minus 50 dB.
 - 12. Carrier-to-Echo Ratio: More than 40 dB.
 - 13. Composite Triple Beat: Less than minus 53 dB.

14. Second Order Beat: Less than minus 60 dB.
15. Terminal Isolation from Television to Television: 25 dB, minimum.
16. Terminal Isolation between Television and FM: 35 dB, minimum.
17. Hum Modulation: 2 percent, maximum.
18. RF FM Carrier Level: 13 to 17 dB below video-carrier level.
19. FM Frequency Response: More than in the 88- to 108-MHz frequency range; signal amplitude is plus or minus 0.75 dB, maximum.
20. FM Carrier-to-Noise Ratio: More than 24 dB.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For headend and distribution system. Include plans, elevations, sections, details, and attachments to other work.
 1. Show fabrication and installation details for television equipment.
 2. Functional Block Diagram: Show single-line interconnections between components for headend and distribution system to user-interface points. Show cable types and sizes.
 3. Dimensioned Plan and Elevations of Headend Equipment: Show access and workspace requirements.
 4. Wiring Diagrams: For power, signal, and control wiring. For UTP or fiber-optic cable, include cross connects, patch panels, and patch cords.
- C. Samples: Full size for each outlet device plate in required colors and textures.
- D. Design Calculations: Calculate signal attenuation budget and show calculated line and equipment losses for the system based on the functional block diagram, to show that proposed system layout can be expected to perform up to specification. Calculate signal strength from sources to headend input points for each antenna, satellite dish, and CATV grouping. Allowable losses between components and user interface shall be used to determine size and type of coaxial cable.

1.7 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Include dimensioned plan and elevation views of components and enclosures. Show access and workspace requirements.
- B. Equipment List: Include each piece of equipment and include model number, manufacturer, serial number, location, and date of original installation. Insert testing record of each piece of adjustable equipment, listing name of person testing, date of test, and description of as-left set points.
- C. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For headend and distribution system to include in emergency, operation, and maintenance manuals.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Provide no fewer than one of each item listed below. Deliver extra materials to Owner.
 1. Fuses: One for every 10 of each type and rating.

2. Splitters: One for every **10** installed.
3. MATV Distribution Power Amplifiers: One for every **10** of each type installed.
4. MATV Signal Traps: **One** for every **10** of each type used.
5. MATV Attenuators: **One** for every **10** of each type used.
6. Cable: 100 feet (30 m) of each type used.

1.10 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.11 PROJECT CONDITIONS

- A. Environmental Limitations: System components shall be equipped and rated for the environments in which they are installed.
- B. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 1. Interior, Controlled Environment: System components, except central-station control unit, installed in **air-conditioned** interior environments shall be rated for continuous operation in ambient conditions of [36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 2. Interior, Uncontrolled Environment: System components installed in non-**temperature-controlled** interior environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.

1.12 COORDINATION

- A. Coordinate size and location of raceway system and provisions for electrical power to equipment specified in this Section.
- B. Coordinate Work of this Section with requirements of **CCTV cameras and video recorders** service provider.
- C. Coordinate sizes and locations of concrete bases with actual equipment provided.
- D. Coordinate installation of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.13 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide **12 months'** full maintenance by skilled employees of MATV system Installer. Include quarterly adjusting as required for optimum system performance. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.
- B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 SYSTEMS REQUIREMENTS

- A. Components: Plug-in, modular, heavy-duty, industrial- or commercial-grade units.
- B. Equipment: Silicon-based, solid-state, integrated circuit devices.
- C. Power Supply Characteristics: Devices shall be within specified parameters for ac supply voltages within the range of 105 to 130 V.
- D. Protect signal cables and connected components against transient-voltage surges by suppressors and absorbers designed specifically for that purpose. Comply with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
- E. Provide ac-powered equipment with integral surge suppressors complying with UL 1449.
- F. RF and Video Impedance Matching: Signal-handling components, including connecting cable, shall have end-to-end impedance-matched signal paths. Match and balance devices used at connections where it is impossible to avoid impedance mismatch or mismatch of balanced circuits to unbalanced circuits.

2.2 MATV EQUIPMENT

- A. Description: Signal-source components, signal-processing and amplifying equipment, distribution components, and interconnecting wiring. System shall receive, amplify, process, and distribute signals to outlets for receiving sets. Equipment shall translate UHF channels to VHF channels before distribution to outlets.
- B. Coordinate first paragraph below with Drawings. Clear descriptions of signal sources used and programs distributed are critical to obtaining meaningful Contractor response to MATV system requirements.
- C. MATV System Qualitative and Quantitative Performance Requirements: Reception quality of color-television program transmissions at each system outlet from each service and source shall be equal to or superior than that obtained with performance checks specified in "Field Quality Control" Article, using standard, commercial, cable-ready, multiple A/V input color-television receivers.

2.3 OFF-AIR ANTENNAS

- A. Antennas shall be tested, marked, and packaged, according to CEA-774-A, CEA-2028, and CEA-2032. Antennas shall be labeled according to CEA antenna mapping program.
- B. Off-Air, Mast-Mounted Antennas: Weatherproof single-channel or broadband type, constructed of high-strength anodized aluminum and rated to survive in a 100-mph (160-km/h) wind, minimum.
 - 1. Elements: Internally dampened against mechanical vibration that may occur in service.
 - 2. Ends of Crossarms and Elements: Sealed.
 - 3. Mounting and Connecting Hardware: Corrosion proof.
 - 4. Frequency Range: Matched to source frequencies.
 - 5. Retain first subparagraph below if reception patterns are not scheduled on Drawings. See Editing Instruction No. 3 in the Evaluations for discussion of CEA antenna reception patterns and scheduling.
 - 6. FM Antenna: Separate from the broadband antenna and the **directional** antenna, with 2-dB minimum gain.
- C. Antenna-Supporting Structures: Prefabricated, hot-dip galvanized-steel units.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Channel Master.
 - b. Winegard Company.
2. Strength of Structure and Attachments: Adequate to withstand 100-mph (160-km/h) winds while supporting installed antennas.
3. Comply with 47 CFR 17 and TIA 222-G.
4. Comply with FAA AC 70/7460-1K.

2.4 MATV HEADEND COMPONENTS

- A. Headend Equipment: **Combining networks** for receiving off-air television and FM signals and outputting the signals to cable distribution system. Equip coaxial down-leads of the off-air antennas with preamplifiers to send signals at strength required by headend. Headend component performance specified in this article is minimum acceptable; better performance may be required to comply with minimum acceptable system performance standard in "Performance Requirements" Article.
 1. House units in standard 19-inch (483-mm) electronic equipment cabinet complying with EIA 310.
- B. Antenna Combiner: Directional coupler design network, combining up to eight antenna signals into a single output. Frequency response of the device shall be 5 to 400 MHz, and the insertion loss between input ports shall be not less than 40 dB.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATX Networks Inc.
 - b. Blonder Tongue Laboratories, Inc.
- C. Down-Lead Preamplifiers: Antenna mast-mounted preamplifier, designed to boost antenna signal and contained in weatherproof housing; single-channel or broadband type. Install power supplies indoors at headend equipment, connected through power inserters to provide power to preamplifiers through the coaxial down-lead cable.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Blonder Tongue Laboratories, Inc.
 - b. Channel Master.
 - c. Leviton Manufacturing Co., Inc.
 2. Frequency Response: Plus or minus 0.75 dB.
 3. Minimum Input: Minus 20 dBmV.
 4. Return Loss: 14 dB.
 5. I/O Impedance: 75 ohms.
- D. Channel Mixers: Use for nonadjacent channels only.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATX Networks Inc.
 - b. Blonder Tongue Laboratories, Inc.
 - c. Leviton Manufacturing Co., Inc.
 2. Insertion Loss (Maximum 54 to 216 MHz): 2.5 dB.
 3. Return Loss: 14 dB.
 4. Out-of-Band Rejection: 12 dB.

5. I/O Impedance: 75 ohms.
- E. Processors: One for each channel to be translated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATX Networks Inc.
 - b. Blonder Tongue Laboratories, Inc.
 - c. Cisco Systems, Inc.
 2. Bandwidth: 6 MHz.
 3. Return Loss: 16 dB, within the 6-MHz bandwidth.
 4. Noise: Not more than 10 dB at maximum gain.
 5. Input Level Range, VHF: Minus 20 to plus 30 dBmV.
 6. Input Level Range, UHF: Minus 20 to plus 25 dBmV.
 7. Output Level Range: 50 to 60 dBmV.
 8. Carrier-to-Noise Ratio: Minus 57 dB at plus 10-dBmV input.
 9. Automatic Gain Control: Plus or minus 1-dB output variation for rated input level range variation.
 10. Frequency Stability: Plus or minus 10 kHz over the operational temperature range.
 11. Spurious Output: 60 dB below the video carrier with video-carrier output level at plus 60 dBmV and audio-carrier level at plus 45 dBmV.
 12. Adjacent Channel Rejection: Not less than 60 dB.
 13. I/O Impedance: 75 ohms.
- F. Broadband Amplifier:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATX Networks Inc.
 - b. Blonder Tongue Laboratories, Inc.
 - c. Leviton Manufacturing Co., Inc.
 2. Frequency Range: **54 to 220** MHz.
 3. Frequency Response: Plus or minus 1.0 dB across passband.
 4. Maximum Noise: 10 dB.
 5. Minimum Return Loss: 16 dB.
 6. I/O Impedance: 75 ohms.
- G. Single-Channel Amplifiers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Blonder Tongue Laboratories, Inc.
 - b. Cisco Systems, Inc.
 - c. Leviton Manufacturing Co., Inc.
 2. Frequency: 6 MHz for specified channel.
 3. Frequency Response: Plus or minus 0.5 dB.
 4. Maximum Noise: 10 dB.
 5. Minimum Return Loss: 14 dB.
 6. Automatic Gain Control: Plus or minus 1-dB output variation for rated input level range variation.
 7. Skirt Rejection: Minus 26 dB at plus or minus 5 MHz from channel center.
 8. Sound Trap: Adjustable to 10 VdB of attenuation of the sound carrier.
 9. I/O Impedance: 75 ohms.
- H. FM Module: One RF processor module for each station listed.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Blonder Tongue Laboratories, Inc.
 - b. Cisco Systems, Inc.
 - c. Leviton Manufacturing Co., Inc.
 2. Frequency Range: Between 88 and 108 MHz.
 3. Output Level: 52 dBmV.
 4. Output Level Control: Plus or minus 10 dB.
 5. Stability: 0.005 percent, crystal controlled.
 6. Sensitivity: 3 mV for 30-dB quieting.
 7. Input Level: 60 mV, stereo.
 8. Image Rejection: 901 dB.
 9. Passband: 200 kHz.
 10. Selectivity: Plus or minus 150 kHz or less, at 30 dB down. Plus or minus 250 kHz or less, at 50 dB down.
- I. Combining Network (Mixer): Combines the off-air television [FM] [CCTV] [and] [CATV] signals into a single-broadband output. An output test point, a 75-ohm television jack, a mixer output step attenuator dual-pilot insertion network, and a removable mixer-to-trunk jumper are included.
1. Passband: As required by system performance.
 2. Distortion: Not more than plus or minus 0.1 dB over any 6-MHz segment.
 3. Distortion: Not more than plus or minus 0.5 dB over the 54- to 216-MHz frequency range.
 4. Nominal Insertion Loss:
 - a. 15 dB maximum, channel input to single-system output.
 - b. 13 dB maximum, channel input to mixer output.
 - c. 20 dB maximum at test point, e.g., loss from trunk output.
 5. Isolation between any Two Inputs: 30 dB.
 6. I/O Impedance: 70 ohms.

2.5 DISTRIBUTION COMPONENTS

- A. Signal Power Splitters and Isolation Taps: Metal-enclosed directional couplers with brass connector parts. Where installed in signal circuits used to supply cable-powered amplifiers, power throughput capacity shall exceed load by at least 25 percent.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATX Networks Inc.
 - b. Leviton Manufacturing Co., Inc.
 2. Return Loss: 17 dB.
 3. RFI Shielding: 100 dB.
 4. Isolation: 25 dB.
 5. I/O Impedance: 75 ohms.
- B. Distribution System Amplifiers: Powered by coaxial cable system and equipped with surge protection device and external test points to allow convenient signal monitoring.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ARRIS.
 - b. ATX Networks Inc.

- c. Leviton Manufacturing Co., Inc.
 - C. Cable System Power Supplies: Plug-in, modular construction, with surge, short-circuit, and overload protection.
 - D. Signal Traps: Packaged filters tuned to interference frequencies encountered in Project.
 - E. Attenuators: Passive, of fixed value, and used to balance signal levels.
 - F. Terminating Resistors: Enclosed units rated 0.5 W and matched for coaxial impedance.
 - G. User-Interface Device: Flush, female-type outlets, designed to mimic power duplex outlet; for mounting in standard outlet box; with metallic parts of anodized brass, beryllium copper, or phosphor bronze. Cable connector mounting shall be semirecessed so its protrusion is flush with the plane of device plate. [**Feed-through-type cable connection shall not be used**] [except in area housing a single tenant] [except within a single-dwelling unit].
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATX Networks Inc.
 - b. Cisco Systems, Inc.
 - c. Leviton Manufacturing Co., Inc.
 - 2. Cable Connector: Female, Type F.
 - 3. Wall Plates: Match materials and finish of power outlets in same space.
 - 4. Attenuation: Less than 0.1 dB.
 - 5. Voltage Standing-Wave Ratio: Less than 1.15 to 1.
- 2.6 ENCLOSURES
- A. Enclosures for Interior, Controlled Environments: NEMA 250, Type 1.
 - B. Enclosures for Interior, Uncontrolled Environments: NEMA 250, **Type 4**.
 - C. Enclosures for Exterior Environments: NEMA 250, **Type 3R** or **Type 4X**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for antenna to verify actual locations of cable connections before antenna installation.
- B. Examine walls, floors, roofs, equipment bases, and roof supports for suitable conditions where television equipment is to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install signal line surge suppressors on coaxial cables entering headend equipment space and at antenna-mounted amplifiers. Comply with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."

- B. Install antenna towers, masts, and mountings on concrete bases. Comply with requirements for concrete bases specified in **Section 033000 "Cast-in-Place Concrete."**
 - 1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.3 ANTENNA AND HEADEND INSTALLATION

- A. Mount headend equipment in electronic-equipment cabinets recommended by manufacturer. Group related items in methodical sequence.
- B. Arrange equipment to facilitate access for maintenance and to preserve headroom and passage space. Parts that require periodic service or maintenance shall be readily accessible. Headend components that require tuning adjustments shall be accessible from the front of equipment cabinets.
- C. Align antenna elements to achieve maximum signal level and quality.
- D. Antenna-Supporting Structure: Increase antenna height as required to obtain signal strength needed for specified system performance.
 - 1. Attachment to Building: Use 0.375-inch- (10-mm-) minimum expansion anchors for masonry, and place anchors clear of grout or mortar joints.
 - 2. Attachment to Building: Use 0.375-inch- (10-mm-) minimum lag bolts for attachment to wood.
 - 3. Lightning Protection: Comply with requirements in Section 264113 "Lightning Protection for Structures."
- E. Antenna Cable Entrance: Use weatherproof entrance fittings, and seal at penetrations of the building envelope.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
- D. Tests and Inspections:
 - 1. Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements.
 - 2. Replace malfunctioning or damaged items.
 - 3. Retest until satisfactory performance and conditions are achieved.
 - 4. Prepare television equipment for acceptance and operational testing.

5. Use an agile receiver and signal strength meter or spectrum analyzer for testing.
6. Off-Air, Mast-Mounted Antenna Sources: Connect receiver to the down-lead of a 10-element, single-channel antenna, tuned and oriented to optimize reception for the channel and placed at system antenna's location. Alternatively, connect receiver to a single-channel video amplifier connected to the down-lead of the above single-channel antenna.
7. CATV Sources: Connect receiver to an agile demodulator or CATV set-top converter at CATV service entrance to the facility.
8. Satellite Earth-Station System Sources: Adapt receiver to the output of satellite-television receiver.
9. CCTV Sources: Connect receiver to the output of each CCTV signal source or the distribution amplifier associated with it.
10. Test Schedule: Schedule tests after pretesting has successfully been completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
11. Operational Tests: Perform tests of operational system to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
12. Distribution System Acceptance Tests:
 - a. Field-Strength Instrument: Rated for minus 40-dBmV measuring sensitivity and a frequency range of 54 to 812 MHz, minimum. Provide documentation of recent calibration against recognized standards.
 - b. Signal Level and Picture Quality: Use a field-strength meter or spectrum analyzer, and a standard television receiver to measure signal levels and check picture quality at **all** user-interface outlets.
 - 1) Test the signal strength in dBmV at 55[, 151, 547,] and 750 MHz.
 - 2) Minimum acceptable signal level is 0 dBmV (1000 mV).
 - 3) Maximum acceptable signal level over the entire bandwidth is 15 dBmV.
 - 4) Television receiver shall show no evidence of cross-channel intermodulation, ghost images, or beat interference.
13. Signal-to-Noise-Ratio Test: Use a field-strength meter to make a sequence of measurements at the output of the last distribution amplifier or of another agreed-on location in system. With system operating at normal levels, tune meter to the picture carrier frequency of each of the designated channels in turn and record the level. With signal removed and input to corresponding headend amplifier terminated at 75 ohms, measure the level of noise at same tuning settings. With meter correction factor added to last readings, differences from first set must not be less than 45 dB.
14. Qualitative and Quantitative Performance Tests: Demonstrate reception quality of color-television program transmissions at each user interface from each designated channel and source. Quality shall be equal to or superior than that obtained with performance checks specified below, using a standard, commercial, cable-ready, color-television receiver. Level and quality of signal at each outlet and from each service and source shall comply with the following Specifications when tested according to 47 CFR 76:
 - a. RF video-carrier level.
 - b. Relative video-carrier level.
 - c. Carrier level stability, during 60-minute and 24-hour periods.
 - d. Broadband frequency response.
 - e. Channel frequency response.
 - f. Carrier-to-noise ratio.
 - g. RF visual signal-to-noise ratio.
 - h. Antenna combiner insertion loss.
 - i. Signal power splitter loss.
 - j. Cable connector attenuation.
 - k. Cross modulation.
 - l. Carrier-to-echo ratio.
 - m. Composite triple beat.
 - n. Second order beat.
 - o. Terminal isolation.
 - p. Terminal isolation between television and FM.
 - q. Hum modulation.

- r. RF FM carrier level.
- s. FM frequency response.
- t. FM carrier-to-noise ratio.

- E. Headend and distribution system will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. For fiber-optic- and UTP-cable performance test, see Section 271500 "Communications Horizontal Cabling."
- H. Cap all unused connectors and seal weathertight.

3.6 DEMONSTRATION

- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain MATV equipment.
 - 1. Train Owner's maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment.
 - 2. Demonstrate methods of determining optimum alignment and adjustment of components and settings for system controls.
 - 3. Demonstrate programming and tuning of satellite receivers.

END OF SECTION

SECTION 27 51 16

PUBLIC ADDRESS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Preamplifiers.
 - 2. Power amplifiers.
 - 3. Transfer to standby amplifier.
 - 4. Microphones.
 - 5. Volume limiter/compressors.
 - 6. Control console.
 - 7. Equipment cabinet.
 - 8. Equipment rack.
 - 9. Telephone paging adapters.
 - 10. Tone generator.
 - 11. Monitor panel.
 - 12. Loudspeakers.
 - 13. Noise-operated gain controllers.
 - 14. Microphone and headphone outlets.
 - 15. Battery backup power unit.
 - 16. Conductors and cables.
 - 17. Pathways.

1.3 DEFINITIONS

- A. Channels: Separate parallel signal paths, from sources to loudspeakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.
- B. VU: Volume unit.
- C. Zone: Separate group of loudspeakers and associated supply wiring that may be arranged for selective switching between different channels.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Power, signal, and control wiring.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.

3. Console layouts.
4. Control panels.
5. Rack arrangements.
6. Calculations: For sizing backup battery.
7. Wiring Diagrams: For power, signal, and control wiring.

- a. Identify terminals to facilitate installation, operation, and maintenance.
- b. Single-line diagram showing interconnection of components.
- c. Cabling diagram showing cable routing.

C. Delegated-Design Submittal: For supports and seismic restraints for control consoles, equipment cabinets and racks, and components indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of supports and seismic restraints for control consoles, equipment cabinets and racks, and components.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.

B. Qualification Data: For **Installer & testing agency**.

C. Seismic Qualification Certificates: For control consoles, equipment cabinets and racks, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Include qualification data for testing agency.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For public address systems to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017700 "Closeout Procedures" and Section 017823 "Operation and Maintenance Data," include the following:
 - a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
 - b. Operating instructions laminated and mounted adjacent to operating console location.
 - c. Training plan.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Microphone: **One**
2. Microphone Desk Stand(s): **One**.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
 1. Personnel certified by NICET as Audio Systems Level II Technician.
- B. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated.
 1. Testing Agency's Field Supervisor: Currently certified by NICET at Level III to supervise on-site testing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Atlas Sound LP.
 2. Bogen Communications, Inc.
 3. Edwards Signaling; UTC Fire & Security.
- B. Source Limitations: Obtain public address system from single source from single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. System Functions:
 1. Selectively connect any zone to any available signal channel.
 2. Selectively control sound from microphone outlets and other inputs.
 3. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.
 4. Telephone paging adapter shall allow paging by dialing an extension from any local telephone instrument and speaking into the telephone.
 5. Produce a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
 6. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of nonuniform coverage of amplified sound.

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports and seismic restraints for control consoles, equipment cabinets and racks, and components, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Seismic Performance: Supports and seismic restraints for control consoles, equipment cabinets and racks, and components shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event.**"

2.4 SYSTEM DESCRIPTION

- A. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
- C. Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch (483-mm) housing complying with EIA/ECA-310-E.
- D. Weather-Resistant Equipment: Listed and labeled by a qualified testing agency for duty outdoors or in damp locations.

2.5 PREAMPLIFIERS

- A. Preamp: Separately mounted.
- B. Preamp: Integral to power amplifier.
- C. Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.
- D. Total Harmonic Distortion: Less than 1 percent.
- E. Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.
- F. Input Jacks: Minimum of three. One matched for low-impedance microphone; one USB port; and the other matchable to DVD or CD player, or radio tuner signals without external adapters.
- G. Minimum Noise Level: Minus 55 dB below rated output.
- H. Controls: On-off, input levels, and master gain.

2.6 POWER AMPLIFIERS

- A. Mounting: **Console**.
- B. Output Power: 70-V balanced line. **80 percent of the sum of wattage settings of connected** for each station and speaker connected in all-call mode of operation, plus a **25 percent** allowance for future stations.
- C. Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.
- D. Minimum Signal-to-Noise Ratio: 80 dB, at rated output.
- E. Frequency Response: Within plus or minus 3 dB from 20 to 12,000 Hz.

- F. Output Regulation: Less than 2 dB from full to no load.
- G. Controls: On-off, input levels, and low-cut filter.
- H. Input Sensitivity: Matched to preamplifier and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.

2.7 TRANSFER TO STANDBY AMPLIFIER

- A. Monitoring Circuit and Sensing Relay: Detect reduction in output of power amplifier of 40 percent or more and, in such event, transfer load and signal automatically to standby amplifier.

2.8 MICROPHONES

- A. Paging Microphone:
 1. Type: Dynamic, with **omnidirectional** polar characteristic.
 2. Impedance: **250** ohms.
 3. Frequency Response: Uniform, 50 to 15,000 Hz.
 4. Sensitivity: Minus 70 dB.
 5. Output Level: Minus 58 dB, minimum.
 6. Cable: Braided shield cable with **Amphenol** XLR connectors. Coordinate impedance with microphone impedance.
 7. Mounting: Desk stand with integral-locking, press-to-talk switch.

2.9 VOLUME LIMITER/COMPRESSOR

- A. Minimum Performance Requirements:
 1. Frequency Response: 45 to 15,000 Hz, plus or minus 1 dB minimum.
 2. Reduction Ratio: Automatically vary compression ratio, and attack and release times for voice and music inputs.
 - a. Compression Ratio Range: 3:1 to 10:1 minimum.
 - b. Averaging Compressor Attack Time: Up to 500 milliseconds.
 - c. Signal Fast Compression Attack Time: Less than 10 milliseconds.
 - d. Release time: Up to 500 milliseconds.
 3. Distortion: 0.5 percent, maximum.
 4. Rated Output: Minimum of plus 14 dB.
 5. Inputs: Minimum of two inputs with variable front-panel gain controls and VU or decibel meter for input adjustment.
 6. Rack mounted.

2.10 CONTROL CONSOLE

- A. Cabinet: Modular, **desk style**; complying with EIA/ECA-310-E.
- B. Housing: Steel, 0.0478 inch (1.2 mm) minimum, with removable front and rear panels. Side panels are removable for interconnecting side-by-side mounting.
- C. Panel for Equipment and Controls: Rack mounted.
- D. Controls:

1. Switching devices to select signal sources for distribution channels.
 2. Program selector switch to select source for each program channel.
 3. Switching devices to select zones for paging.
 4. All-call selector switch.
- E. Indicators: A visual annunciation for each distribution channel to indicate source being used.
- F. Self-Contained Power and Control Unit: A single assembly of basic control, electronics, and power supply necessary to accomplish specified functions.
- G. Spare Positions: 20 percent spare zone control and annunciation positions on console.
- H. Microphone jack.
- 2.11 EQUIPMENT CABINET
- A. Comply with EIA/ECA-310-E.
 - B. House amplifiers and auxiliary equipment at each location.
 - C. Cabinet Housing:
 1. Constructed of 0.0478-inch (1.2-mm) steel, minimum, with front- and rear-locking doors and standard EIA/ECA-310-E-compliant, 19-inch (483-mm) racks.
 2. Arranged for floor or wall mounting as indicated.
 3. Sized to house all equipment indicated, plus spare capacity.
 4. Include **20** percent minimum spare capacity for future equipment in addition to space required for **future** DVD or CD player.
 - D. Power Provisions: A single switch in cabinet shall disconnect cabinet power distribution system and electrical outlets, which shall be uniformly spaced to accommodate ac-power cords for each item of equipment.
 - E. Ventilation: A low-noise fan for forced-air cabinet ventilation. Fan shall be equipped with a filtered input vent and shall be connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switched; arranged to be powered when main cabinet power switch is on.
- 2.12 EQUIPMENT RACK
- A. Racks: 19 inches (483 mm) standard, complying with EIA/ECA-310-E.
 - B. Power-Supply Connections: Compatible plugs and receptacles.
 - C. Enclosure Panels: Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.
 - D. Finish: Uniform, baked-enamel factory finish over rust-inhibiting primer.
 - E. Power-Control Panel: On front of equipment housing, with master power on-off switch and pilot light; and with cartridge fuse protection for rack equipment power.
 - F. Service Light: At top rear of rack with an adjacent control switch.
 - G. Vertical Plug Strip: Grounded receptacles, 12 inches (300 mm) o.c.; the full height of rack for public address system equipment use only.

- H. Maintenance Receptacles: Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.
 - I. Spare Capacity: **20** percent in rack for future equipment.
- 2.13 TELEPHONE PAGING ADAPTER
- A. Adapters shall accept voice signals from telephone extension dialing access and automatically provide amplifier input and program override for preselected zones.
 1. Minimum Frequency Response: Flat, 200 to 2500 Hz.
 2. Impedance Matching: Adapter matches telephone line to public address equipment input.
 3. **Cabinet** mounted.
- 2.14 TONE GENERATOR
- A. Tone generator shall provide clock and program interface with public address system.
 - B. Signals: Minimum of seven distinct, audible signal types including wail, warble, high/low, alarm, repeating and single-stroke chimes, and tone.
 - C. Pitch Control: Chimes and tone.
 - D. Volume Control: All outputs.
 - E. Activation-Switch Network: Establishes priority and hierarchy of output signals produced by different activation setups.
 - F. Mounting: **Cabinet**.
- 2.15 MONITOR PANEL
- A. Monitor power amplifiers.
 - B. Components: VU or dB meter, speaker with volume control, and multiple-position rotary selector switch.
 - C. Selector Switch and Volume Control: Selective monitoring of output of each separate power amplifier via VU or dB meter and speaker.
 - D. Mounting: **Cabinet**.
- 2.16 LOUDSPEAKERS
- A. Cone-Type Loudspeakers:
 1. Minimum Axial Sensitivity: 91 dB at 1 m, with 1-W input.
 2. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
 3. Size: **6 inches**150 mm with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.
 4. Rated Output Level: **10 W**.
 5. Minimum Dispersion Angle: 100 degrees.
 6. Matching Transformer: Full-power rated with four taps. Maximum insertion loss of 0.5 dB.
 7. Surface-Mounted Units: Ceiling, wall, or pendant mounted, as indicated, in steel back boxes, acoustically dampened. Front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and shop primed for field painting.

8. Flush-Ceiling-Mounted Units: In steel back boxes, acoustically dampened. Metal ceiling grille with **white** baked enamel.

B. Horn-Type Loudspeakers:

1. Type: Single-horn units, double-reentrant design, with minimum full-range power rating of 15 W.
2. Matching Transformer: Full-power rated with four standard taps. Maximum insertion loss of 0.5 dB.
3. Frequency Response: Within plus or minus 3 dB from 250 to 12,000 Hz.
4. Dispersion Angle: 130 by 110 degrees.
5. Mounting: Integral bracket.
6. Units in Damp, Wet, or Outdoor Locations: Listed and labeled for environment in which they are located.
7. Units in Hazardous (Classified) Locations: Listed and labeled for environment in which they are located. Provide any accessories required to maintain listing.

2.17 NOISE-OPERATED GAIN CONTROLLER

- A. Gain controller shall be designed to continuously sense space noise level and automatically adjust signal level to local speakers.
- B. Frequency Response: 20 to 20,000 Hz, plus or minus 1 dB.
- C. Level Adjustment Range: 30 dB minimum.
- D. Maximum Distortion: 0.5 percent.
- E. Control: Permits adjustment of sensing level of device.

2.18 OUTLETS

- A. Volume Attenuator Station: Wall-plate-mounted autotransformer type with paging priority feature.
 1. Wattage Rating: 10 W unless otherwise indicated.
 2. Attenuation per Step: 3 dB, with positive off position.
 3. Insertion Loss: 0.4 dB maximum.
 4. Attenuation Bypass Relay: SPDT. Connected to operate and bypass attenuation when all-call, paging, program signal, or prerecorded message features are used. Relay returns to normal position at end of priority transmission.
 5. Label: "PA Volume."
- B. Microphone Outlet: Three-pole, polarized, locking-type, microphone receptacles in single-gang boxes. Equip wall outlets with brushed stainless-steel device plates. Equip floor outlets with gray tapered rubber or plastic cable nozzles and fixed outlet covers.
- C. Headphone Outlet (for the Hearing Impaired): Microphone receptacles in single-gang boxes. Equip wall outlets with brushed stainless-steel device plates. Equip floor outlets with gray tapered rubber or plastic cable nozzles and fixed-outlet covers.

2.19 BATTERY BACKUP POWER UNIT

- A. Unit shall be rack mounted, consisting of time-delay relay, sealed lead-calcium battery, battery charger, on-off switch, "normal" and "emergency" indicating lights, and adequate capacity to supply maximum equipment power requirements for one hour of continuous full operation.
- B. Unit shall supply public address equipment with 12- to 15-V dc power automatically during an outage of normal 120-V ac power.

- C. Battery shall be on float charge when not supplying system and able to transfer automatically to supply system after three to five seconds of continuous outage of normal power, as sensed by time-delay relay.
- D. Unit shall automatically retransfer system to normal supply when normal power has been reestablished for three to five seconds continuously.

2.20 CONDUCTORS AND CABLES

- A. Jacketed, twisted pair and twisted multipair, untinned solid copper.
 - 1. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
 - 2. Microphone Cables: Neoprene jacketed, not less than 2/64 inch (0.8 mm) thick, over shield with filled interstices. Shield No. 34 AWG, tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.
 - 3. Plenum Cable: Listed and labeled for plenum installation.

2.21 PATHWAYS

- A. Conduit and Boxes: Comply with Section 270528 "Pathways for Communications Systems."
 - 1. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method: Install cables in pathways except within consoles, cabinets, desks, and counters. Conceal pathway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for pathways and boxes specified in Section 270528 "Pathways for Communications Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF PATHWAYS

- A. Comply with requirements in Section 270528 "Pathways for Communications Systems." for installation of conduits and wireways.
- B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Cable Installation Requirements:

1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
3. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceiling by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate pathways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other communication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

A. Coordinate layout and installation of system components and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

C. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

D. Equipment Cabinets and Racks:

1. Group items of same function together, either vertically or side by side, and arrange controls symmetrically. Mount monitor panel above the amplifiers.
2. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
3. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.

E. Volume Limiter/Compressor: Equip each zone with a volume limiter/compressor. Install in central equipment cabinet. Arrange to provide a constant input to power amplifiers.

F. Wall-Mounted Outlets: Flush mounted.

G. Floor-Mounted Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.

- H. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.
- I. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
- J. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.
- K. Connect wiring according to Section 271500 "Communications Horizontal Cabling" and Section 280513 "Conductors and Cables for Electronic Safety and Security."

3.5 GROUNDING

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
- C. Install grounding electrodes as specified in Section 270526 "Grounding and Bonding for Communications Systems."

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Schedule tests with at least seven days' advance notice of test performance.
 - 2. After installing public address system and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
 - 4. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
 - a. Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.
 - b. Repeat test for each separately controlled zone of loudspeakers.
 - c. Minimum acceptance ratio is 50 dB.
 - 5. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For

each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.

6. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
 7. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
 8. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Section 270526 "Grounding and Bonding for Communications Systems."
- E. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
- F. Public address system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
1. Include a record of final speaker-line matching transformer-tap settings and signal ground-resistance measurement certified by Installer.
- 3.7 STARTUP SERVICE
- A. **Engage a factory-authorized service representative to perform** startup service.
1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
 2. Complete installation and startup checks according to manufacturer's written instructions.
- 3.8 ADJUSTING
- A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.
- B. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.
- 3.9 DEMONSTRATION
- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain the public address system and equipment. Refer to Section 017900 "Demonstration and Training."

END OF SECTION

SECTION 27 51 19

SOUND MASKING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Electronic noise generators.
 - 2. Amplifiers.
 - 3. Wiring.
 - 4. Masking speaker assemblies.
 - 5. Controls.
 - 6. Component mounting racks.

1.3 DEFINITIONS

- A. Covered Spaces: Spaces above which masking speakers are installed.

1.4 SYSTEM DESCRIPTION

- A. Zones: **Multiple**-zone coverage.
- B. Channels: Single channel of masking sound to each zone.
- C. Channels: Separate channel of masking sound to each of **three** groups of speakers in each zone.
- D. Signal Levels: Individually adjustable for each of 14 one-third octave bands centered at 200 through 4000 Hz, for sound-masking noise channels.
- E. Sound-Power Level Produced by System: Match **NC 40** contour between **400 and 2000 Hz**, with smooth roll-off above and below those frequencies.
 - 1. Initial Level: **40 dB**, A-weighted.
 - 2. Final Adjusted Level: **40 to 50 dB**, A-weighted. Determine final level for each space individually by measurement as specified in Part 3.
 - 3. Measurements: Made under calibration conditions.
- F. Maximum Local Variance of Sound-Power Level: **6 dB** for the 500-Hz octave band and **3 dB** for the 1000-, 2000-, and 4000-Hz octave bands for 75 percent of the locations in covered spaces.
- G. Maximum Average Range of Sound-Power-Level Deviation: **2 dB** in the 250-, 2000-, and 4000-Hz octave bands and **1.5 dB** for the 500- and 1000-Hz octave bands for all locations.

- H. Directional Effect: People in covered spaces under calibration conditions cannot determine source of masking sound.
- I. Uniformity with Respect to Time: One-minute time-averaged sound-pressure level of any octave band of masking sound from **250 to 8000 Hz** remains constant in any space to within a standard deviation of **2 dB** when measured over a 30-minute period.
- J. Sound Quality: No audible hum or noise from this system in covered spaces when noise generators are off and power amplifiers are on with input volume controls set at **50** percent.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include nationally recognized testing laboratory listing data.
- B. Shop Drawings: Dimensioned plans and elevations showing minimum clearances and installed features and devices for system components. Show types and locations of masking speakers and their wiring connections, channel assignments, and axis orientations. Show ducts, beams, and other significant sound-reflecting and -absorbing elements in ceiling space and show locations of partitions below ceiling. Include a diagram showing interconnection of major system components for each zone and channel and indicating grounding connections.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified **manufacturer and testing agency**.
- B. Product Certificates: For sound-masking equipment and components, signed by product manufacturer.
- C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sound-masking equipment and components to include in emergency, operation, and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sound-Masking Speaker Assemblies: **One** for each 10 of each type used, but no fewer than one.
 - 2. Fuses: **One** for each type used, but no fewer than one.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer trained and approved by manufacturer of sound-masking equipment.
- B. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing of sound-masking systems according to ASTM E 1130. Required experience includes having

tested a minimum of five different systems within the last five years, each system similar in size and complexity to Project system.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.
- E. Comply with UL 813 unless a more stringent standard is specified in Part 2.

1.10 COORDINATION

- A. Coordinate quantity and arrangement of speaker assemblies with ceiling space configuration and with components occupying ceiling space, including structural members, pipes, air-distribution components, raceways, cable trays, recessed lighting fixtures, and other items.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Sound Masking, LLC.
 - 2. Atlas Sound LP.
 - 3. GE Security, Sound and Communications.

2.2 GENERAL REQUIREMENTS FOR SOUND-MASKING EQUIPMENT

- A. Components: Modular plug-in, heavy-duty, industrial-grade integrated circuit devices.
- B. AC Supply Voltage Tolerance: 105 to 130 V with no degradation of system performance.
- C. Protection from Power Line Surges: Integral surge protection devices listed in UL 1449; with the following features:
 - 1. Suppression Level: 300 V.
 - 2. Maximum Response Time: 5 nanoseconds.
 - 3. Circuit: Multistage, using inductors and silicon-avalanche zener diodes or equivalent.
 - 4. Indicator Lamp: Neon or light-emitting diode located on control panel and arranged to extinguish on failure of protection.
 - 5. Fuses: Externally accessible.
- D. Component Housings: Suitable for mounting in standard 19-inch (480-mm) relay racks, with connections at rear and controls either on rear panel or protected by a screw-fastened security cover.

2.3 NOISE GENERATOR AND FILTER UNITS

- A. Digital Masking Generator Spectra: Pink, white, and superwhite.
- B. Pink Noise Generator: Output octave bands from 30 to 4000 Hz.
- C. Filters for One-Third Octave Bands: Adjustable from 10 dB of boost to 10 dB of cut at each center frequency.

- D. Mixer Inputs: Two high level and one microphone level.
- E. High-Pass Filter: Approximate range of cutoff adjustment is 37 to 400 Hz.
- F. Low-Pass Filter: Adjustable roll-off frequency 100 Hz to 10 kHz.
- G. High-Cut Filter: Approximate range of cutoff adjustment is 180 to 9000 Hz with slope varying to 12 dB per octave.
- H. Auxiliary Inputs: Able to accept two, high-level, auxiliary signals such as music and telephone paging as well as general paging.
- I. Mounting: Shelf or rack 3-1/2 inches (90 mm) high.

2.4 PROGRAMMABLE AUDIO-LEVEL CONTROL UNIT

- A. Automatic Sound-Power-Level Changes: Six system channel changes, four times per day, and capable of different time settings for each day of week.
- B. Level Changes: Programmable from front panel of unit, and automatically incremented over a period long enough for sound-level variations to be imperceptible to occupants of covered spaces.
- C. Muting: Control unit shall be programmed to permit muting for emergency paging.
- D. Built-in zone-level control shall drive other amplifiers and provide minimum 7-position level control.
- E. Program Memory: Nonvolatile for at least one year without power. When re-energized after a power outage, control starts at zero level and automatically advances system sound level at same rate used for programmed level changes.

2.5 POWER AMPLIFIERS

- A. Power Amplifiers: Comply with CEA-426, and have the following minimum features:
 - 1. Mounting: Rack mounted.
 - 2. Output Regulation: Less than 2 dB from zero to full load.
 - 3. Total Harmonic Distortion: Less than 3 percent, at rated power output from 50 to 12,000 Hz.
 - 4. Signal-to-Noise Ratio: 60 dB or greater, at rated output.
 - 5. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.
 - 6. Input: From internal masking or mixer board, or from an exterior source such as an automatic level control or other mixer.

2.6 MASKING SPEAKER ASSEMBLIES

- A. Speakers: Cone type, with the following minimum features:
 - 1. Minimum Axial Sensitivity: 45 dB.
 - 2. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
 - 3. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (142-g) ceramic magnet unless otherwise indicated.
 - 4. Dispersion Angle: 100 degrees.
 - 5. Rated Output Level: 10 W.
- B. Configuration: Dual 8-inch (200-mm) and dual 5-inch (125-mm) units mounted on metal baffles and arranged for optimum, multidirectional, angular sound distribution. Arrange units for suspension from the building structure above the ceiling.

- C. Matching Transformers: Full-power rated with 4 standard taps, and a maximum insertion loss of 0.5 dB.
- D. Assemblies installed in air-handling spaces shall comply with NFPA 70 requirements for rate of heat-release and rate of smoke-release characteristics. Tests for these requirements shall be according to UL 2043.

2.7 WIRE

- A. Speaker Wire: UTP cable complying with manufacturer's requirements; listed and labeled for environmental air plenums where cable is indicated in plenum spaces and is not indicated to be in raceway. Comply with requirements in Section 271500 "Communications Horizontal Cabling."

2.8 COMPONENT MOUNTING RACKS

- A. Configuration: Comply with CEA-310-E. Factory-fabricated units designed for interchangeable mounting, forced or convection air cooling, wiring connection, and enclosure of standard 19-inch (482-mm) relay rack modules.
- B. Mounting Provisions: Equipped for freestanding floor mounting.
- C. Cabinet: Factory-finished steel with component mounting rails and prewired plug strips for component power connections. Full front and rear doors with continuous hinges, handles, and cylindrical keyed locks.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Speaker Assemblies: Suspend with chains from building structure above ceilings so bottom of assembly is 6 to 8 inches (150 to 200 mm) above upper plane of finished ceiling material. Use eyebolts on speaker assemblies for attachment. Suspend independently of supports for components of other building systems.
- B. Install seismic restraints on speakers. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Speaker Connections: For two- or three-channel systems, connect speaker assemblies alternatively so masking sound is redundant throughout zones of coverage.
- D. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and unless otherwise indicated.
 - 1. Except raceways are not required in accessible indoor ceiling spaces and attics.
 - 2. Except raceways are not required in hollow gypsum board partitions.
 - 3. Conceal raceways and wiring except in unfinished spaces.
- E. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements specified in Section 271500 "Communications Horizontal Cabling" for cable trays
 - 3. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
 - 4. Comply with requirements in Section 271500 "Communications Horizontal Cabling."
- F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

- G. Exposed Cable: Install parallel to building lines, follow surface contours, and support as recommended by manufacturer.
- H. Grounding: As recommended by manufacturers unless more stringent requirements are indicated. Ground equipment and conductors to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments with a maximum of 5-ohm to ground at main equipment location. Measure, record, and report ground resistance.
- I. Impedance Matching: For system components, including connecting cable, provide end-to-end level and impedance-matched signal paths. Use matching networks and balancing devices at connections where necessary to avoid mismatches.
- J. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.2 IDENTIFICATION

- A. Use color-coded conductors and apply wire and cable marking tape to designate wires and cables so media are identified in coordination with system wiring diagrams. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Label speaker assemblies as to channel, zone, and address.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Operational Test: Start system to confirm proper operation. Remove malfunctioning units, replace with new units, and retest. Make initial sound-spectrum and -level adjustments for each zone.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
 - 4. Pretesting: Tune, align, and adjust system and pretest components, wiring, and functions to verify they comply with specified material, installation, and performance requirements. Correct deficiencies and retest until satisfactory performance and conditions are achieved.
 - 5. Masking Sound-Power-Level Adjustments: Adjust independently for each space to minimum level between 40 and 50 dB that will provide speech privacy between adjacent workstations while complying with other system requirements.
- E. Final Acceptance Testing: Provide a minimum of 10 days' notice of acceptance test performance schedule. Schedule tests after pretesting has been successfully completed.
 - 1. Tests and Calibration Conditions: Spaces shall be completely furnished but unoccupied; lights and HVAC systems shall be on; HVAC system testing and balancing shall be completed; and electronic ballasts, lighting relay panels, and low voltage transformers shall be in place.

2. Test Conditions: Complying with ASTM E 1130 and calculated according to ANSI S3.5.
 3. Instrumentation: Use a professional-quality, sound-level meter with octave-band filters and documentation of recent calibration against recognized standards.
 4. Record test observations, readings, and corrective actions.
 5. System Tests: Include the following for each system zone:
 - a. Speaker Circuit Impedance Test: Measure impedance at 1000 Hz with amplifier disconnected, using a professional impedance meter or bridge. Locate and correct faults denoted by abnormal readings.
 - b. Ambient Sound-Level Tests: With system off, measure ambient sound level in one-third octave bands. Also measure ambient sound level as a single, wide-band, A-weighted reading.
 - c. Amplifier Noise Test: Check for performance specified in "System Description" Article with masking noise generator off and amplifiers on.
 - d. System Noise Test: With masking noise signal on and amplifiers adjusted at a working level 10 dB above ambient sound level, check for hum, buzz, rattle, or other operating deficiencies.
 - e. Spatial Uniformity Test: Measure sound level at locations no greater than 15 feet (4.6 m) o.c. throughout covered spaces to determine compliance with specified performance level.
 - f. Frequency Response Adjustment and Test: Adjust one-third octave frequency bands and other unit filters to provide response. Adjust to meet requirement of space speech intelligibility and quality of background sound. Comply with ANSI S3.2, CEA 426, and ASTM E 1110.
 6. Adjust level of masking sound for each space so one-third octave band centered at 500 Hz has final selected sound-power level for that space. Measure deviation from listed values in one-third octave bands from 100 to 1000 Hz. Measured values must not deviate from those listed by more than 4 dB for open plan areas and 8 dB for enclosed offices. The total of individual band deviations in eight bands must not exceed 16 dB for open plan areas and 30 dB for enclosed offices.
 7. Walk-through Test: People in covered spaces cannot discern speaker locations.
 8. Temporal Stability Test: Check for uniformity of time by measuring sound level in each of 14 octave bands at one-minute intervals over a 30-minute test period. Deviations must not exceed limits specified in "System Description" Article.
 9. Where required, space shall meet the Health Insurance Portability and Accountability Act for privacy and the Gramm-Leach Bliley Act to protect consumer personal and financial information in open office layouts.
- F. Retest: Correct deficiencies identified by tests and observations and retest until meeting specified requirements.
- G. Recording Control Settings and System Adjustments: Record final control settings and programming, and final tap setting of speaker matching transformers. Record final sound-level measurements and observations.
- 3.4 ADJUSTING
- A. Occupancy Adjustments: When requested within [12] <Insert number> months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to [two] <Insert number> visits to Project during other-than-normal occupancy hours for this purpose.
- 3.5 DEMONSTRATION
- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain services.

END OF SECTION

SECTION 27 51 23

INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: **Microprocessor-switched** intercommunications and program systems with the following components:

1. Master stations.
2. Speaker-microphone stations.
3. Call-switch unit.
4. All-call amplifier.
5. Intercommunication amplifier.
6. Paging amplifier.
7. Loudspeakers/speaker microphones.
8. Conductors and cables.
9. Raceways.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For intercommunications and program systems. Include plans, elevations, sections, details, and attachments to other work.
 1. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Include scaled drawings for master station that detail built-in equipment.
 3. Wiring Diagrams: For power, signal, and control wiring.
 - a. Identify terminals to facilitate installation, operation, and maintenance.
 - b. Single-line diagram showing interconnection of components.
 - c. Cabling diagram showing cable routing.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from Installers of the items involved.
- B. Qualification Data: For qualified **testing agency**.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For intercommunications and program systems to include in operation and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. A record of Owner's equipment-programming option decisions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated.
 - 1. Testing Agency's Field Supervisor: Certified by NICET as Audio Systems **Level II** Technician.
 - 2. Testing Agency's Field Supervisor.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted speaker microphones with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aiphone Corporation.
 - 2. Alpha Communications.
 - 3. Federal Signal Corporation.

2.2 FUNCTIONAL DESCRIPTION OF MANUALLY SWITCHED SYSTEMS

- A. Master Station:
 - 1. Communicating selectively with other master and speaker-microphone stations by actuating selector switches.
 - 2. Communicating simultaneously with all other stations by actuating a single all-call switch.
 - 3. Communicating with individual stations in privacy.
 - 4. Including other master-station connections in a multiple-station conference call.
 - 5. Accessing separate paging speakers or groups of paging speakers by actuating selector switches.
 - 6. Overriding any conversation by a designated master station.
- B. Speaker-Microphone Station:

1. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
2. Communicating hands free.
3. Calling master station by actuating call switch.
4. Returning a busy signal to indicate that station is already in use.
5. Being free of noise and distortion during operation and when in standby mode.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.3 FUNCTIONAL DESCRIPTION OF MICROPROCESSOR-SWITCHED SYSTEMS

A. Master Station:

1. Communicating selectively with other master and speaker-microphone stations by dialing station's number on a 12-digit keypad.
2. Communicating simultaneously with all other stations by dialing a designated number on a 12-digit keypad.
3. Communicating with individual stations in privacy.
4. Including other master-station connections in a multiple-station conference call.
5. Accessing separate paging speakers or groups of paging speakers by dialing designated numbers on a 12-digit keypad.
6. Overriding any conversation by a designated master station.
7. Displaying selected station.

B. Speaker-Microphone Station:

1. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
2. Communicating hands free.
3. Calling master station by actuating call switch.
4. Returning a busy signal to indicate that station is already in use.
5. Being free of noise and distortion during operation and when in standby mode.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.4 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

- A. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Expansion Capability: Increase number of stations in the future by **25** percent above those indicated without adding any internal or external components or main trunk cable conductors.
- C. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
- D. Weather-Resistant Equipment: Listed and labeled by an NRTL for duty outdoors or in damp locations.

2.5 MASTER STATION FOR MANUALLY SWITCHED SYSTEMS

- A. Station-Selector and Talk-Listen Switches: Heavy-duty type with gold-plated contacts rated for five million operations.
- B. Volume Control: Regulates incoming-call volume.

- C. LED Annunciation: Identifies calling stations and stations in use. LED remains on until call is answered.
- D. Tone Annunciation: Momentary audible tone signal announces incoming calls.
- E. Speaker Microphone: Transmits and receives calls.
- F. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.
- G. Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and auxiliary equipment.

2.6 MASTER STATION FOR MICROPROCESSOR-SWITCHED SYSTEMS

- A. 12-Digit Keypad Selector: Transmits calls to other stations and initiates commands for programming and operation.
- B. Volume Control: Regulates incoming-call volume.
- C. LED Annunciation: Identifies calling stations and stations in use. LED remains on until call is answered.
- D. Tone Annunciation: Momentary audible tone signal announces incoming calls.
- E. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.
- F. Reset Control: Cancels call and resets system for next call.
- G. Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions.

2.7 SPEAKER-MICROPHONE STATIONS

- A. Mounting: Flush unless otherwise indicated, and suitable for mounting conditions indicated.
- B. Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.
- C. Back Box: Two-gang galvanized steel with 2-1/2-inch (64-mm) minimum depth.
- D. Speaker: 3 inches (76 mm), 2.3 oz. (65 g) minimum; permanent magnet.
- E. Tone Annunciation: Recurring momentary tone indicates incoming calls.
- F. Call Switch: Mount on faceplate. Permits calls to master station.
- G. Privacy Switch: Mount on faceplate. When in on position, switch prevents transmission of sound from remote station to system; when in off position, without further switch manipulation, response can be made to incoming calls.
- H. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.

2.8 CALL-SWITCH UNIT

- A. Enclosure: Single-gang box with stainless-steel faceplate.
- B. Call Switch: Momentary contact signals system that a call has been placed.
- C. Privacy Switch: Prevents transmission of sound signals from station to system.
- D. Volume Control: Operated by screwdriver blade through a hole in faceplate to adjust output level of associated speaker.
- E. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.

2.9 ALL-CALL AMPLIFIER

- A. Output Power: 70-V balanced line. **80 percent of the sum of wattage settings of connected** for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.
- B. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to quantity of stations connected in all-call mode of operation.
- C. Minimum Signal-to-Noise Ratio: 45 dB, at rated output.
- D. Frequency Response: Within plus or minus 3 dB from 70 to 12,000 Hz.
- E. Output Regulation: Maintains output level within 2 dB from full to no load.
- F. Input Sensitivity: Compatible with master stations and central equipment so amplifier delivers full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on master stations, speaker microphones, or handset transmitters.
- G. Amplifier Protection: Prevents damage from shorted or open output.

2.10 INTERCOMMUNICATION AMPLIFIER

- A. Minimum Output Power: **2 W** adequate for all functions.
- B. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to one station connected to output terminals.
- C. Minimum Signal-to-Noise Ratio: 45 dB, at rated output.
- D. Frequency Response: Within plus or minus 3 dB from 70 to 10,000 Hz.
- E. Output Regulation: Maintains output level within 2 dB from full to no load.
- F. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on master stations, speaker microphones, or handset transmitters.
- G. Amplifier Protection: Prevents damage from shorted or open output.

2.11 PAGING AMPLIFIER

- A. Input Voltage: 120-V ac, 60 Hz.

- B. Frequency Response: Within plus or minus 3 dB from 60 to 10,000 Hz.
- C. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
- D. Total Harmonic Distortion: Less than 3 percent at rated power output from 70 to 12,000 Hz.
- E. Output Regulation: Less than 2 dB from full to no load.
- F. Controls: On-off, input levels, and low-cut filter.
- G. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphones or handset transmitters.
- H. Amplifier Protection: Prevents damage from shorted or open output.
- I. Output Circuit: 70-V line.

2.12 CONE-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES

- A. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
- B. Frequency Response: Within plus or minus 3 dB from 70 to 15,000 Hz.
- C. Minimum Dispersion Angle: 100 degrees.
- D. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.
- E. Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and factory primed; complete with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; with relief of back pressure.
- F. Baffle: For flush speakers, minimum thickness of 0.032-inch (0.8-mm) aluminum **with textured white finish**.
- G. Vandal-Proof, High-Strength Baffle: For **flush** and **surface-mounted** speakers, self-aging cast aluminum with tensile strength of 44,000 psi (303 MN/sq. m), 0.025-inch (0.65-mm) minimum thickness; countersunk heat-treated alloy mounting screws; and textured white epoxy finish.
- H. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.

2.13 HORN-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES

- A. Speakers shall be all-metal, weatherproof construction; complete with universal mounting brackets.
- B. Frequency Response: Within plus or minus 3 dB from 275 to 14,000 Hz.
- C. Minimum Power Rating of Driver: 15 W, continuous.
- D. Minimum Dispersion Angle: 110 degrees.
- E. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.

2.14 HORN-TYPE EXPLOSION-PROOF LOUDSPEAKERS

- A. Speakers shall be all-metal construction; complete with universal mounting brackets.
- B. Units in Hazardous (Classified) Locations: Listed and labeled for environment in which they are located.
- C. Frequency Response: Within plus or minus 3 dB from 300 to 12,000 Hz.
- D. Minimum Power Rating of Driver: **60 W**, continuous.
- E. Minimum Dispersion Angle: **60 by 120** degrees.
- F. Line Transformer: Internally mounted and factory installed, power rating equal to speaker's, and at least four level taps.

2.15 CONDUCTORS AND CABLES

- A. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.
- B. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
- C. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.
 - 1. Minimum Shielding Coverage on Conductors: 60 percent.
- D. Plenum Cable: Listed and labeled for plenum installation.

2.16 RACEWAYS

- A. Intercommunication and Program System Raceways and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems."
- B. Intercommunication and Program System Raceways and Boxes: Same as required for electrical branch circuits specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- C. Intercommunication and Program System Raceways and Boxes: **EMT**.
- D. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- E. Flexible metal conduit is prohibited.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."

- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF RACEWAYS

- A. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements:
 1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
 2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
 3. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
 5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
- C. Open-Cable Installation:
 1. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
 2. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceiling by cable supports not more than 60 inches (1524 mm) apart.
 3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
- D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

- A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.
- C. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.

- D. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.
 - E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- 3.5 GROUNDING
- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
 - B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
 - C. Install grounding electrodes as specified in Section 270526 "Grounding and Bonding for Communications Systems."
- 3.6 SYSTEM PROGRAMMING
- A. Programming: Fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.
- 3.7 FIELD QUALITY CONTROL
- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
 - B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
 - C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - D. Tests and Inspections:
 - 1. Schedule tests with at least seven days' advance notice of test performance.
 - 2. After installing intercommunications and program systems and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: Test originating station-to-station, **all-call, and page** messages at each intercommunication station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.
 - 4. Frequency Response Test: Determine frequency response of two transmission paths, **including all-call and paging**, by transmitting and recording audio tones. Minimum acceptable performance is within 3 dB from 150 to 2500 Hz.
 - 5. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
 - a. Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio at **paging** speakers.
 - b. Repeat test for four speaker microphones **and for each separately controlled zone of paging loudspeakers**.
 - c. Minimum acceptable ratio is 35 dB.

6. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into **each paging and all-call amplifier, and** a minimum of two selected intercommunication amplifiers. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.
 7. **Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at three locations in each paging zone. Maximum permissible variation in level is plus or minus 3 dB; in levels between adjacent zones, plus or minus 5 dB.**
 8. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 150, 1000, and 2500 Hz. Maximum variation in power output at these frequencies is plus or minus 3 dB.
 9. Signal Ground Test: Measure and report ground resistance at system signal ground. Comply with testing requirements in Section 270526 "Grounding and Bonding for Communications Systems."
- E. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
 - F. Intercommunications and program systems will be considered defective if they do not pass tests and inspections.
 - G. Prepare test and inspection reports.
- 3.8 STARTUP SERVICE
- A. **Engage a factory-authorized service representative to perform startup service and initial system programming.**
 1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
 2. Complete installation and startup checks according to manufacturer's written instructions.
- 3.9 ADJUSTING
- A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.
 - B. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.
- 3.10 DEMONSTRATION
- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain the intercommunications and program systems.
 1. Train Owner's maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining the system and equipment.

END OF SECTION

SECTION 27 51 23 .50

EDUCATIONAL INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: **Microprocessor-switched telephone/intercommunications]** and program systems with the following components:

1. Master stations.
2. Call control console.
3. Speaker-microphone stations.
4. Call-switch unit.
5. All-call amplifier.
6. Intercommunication amplifier.
7. Paging amplifier.
8. Loudspeakers/speaker microphones.
9. Conductors and cables.
10. Raceways.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For educational intercommunications and program systems. Include plans, elevations, sections, details, and attachments to other work.
 1. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Include scaled drawings for station arrangement of built-in equipment.
 3. Wiring Diagrams: For power, signal, and control wiring.
 - a. Identify terminals to facilitate installation, operation, and maintenance.
 - b. Single-line diagram showing interconnection of components.
 - c. Cabling diagram showing cable routing.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.
- B. Qualification Data: For qualified **testing agency**.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For educational intercommunications and program systems to include in operation and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. A record of final matching transformer-tap settings and signal ground-resistance measurement certified by Installer.
 2. A record of Owner's equipment-programming option decisions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated.
1. Testing Agency's Field Supervisor: Certified by NICET as Audio Systems **Level II** Technician.
 2. Testing Agency's Field Supervisor.
- C. Source Limitations: Obtain educational intercommunications and program systems from single source from single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for location and application.
- E. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted speaker microphones and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bogen Communications, Inc.
 2. Rauland-Borg Corporation.
 3. Valcom, Inc.

2.2 FUNCTIONAL DESCRIPTION OF MANUALLY SWITCHED SYSTEMS

- A. Master Station:
1. Communicating selectively with other master and speaker-microphone stations by actuating selector switches.
 2. Communicating simultaneously with all other stations by actuating a single all-call switch.
 3. Communicating with individual stations in privacy.

4. Including other master-station connections in a multiple-station conference call.
5. Accessing separate paging speakers or groups of paging speakers by actuating selector switches.
6. Overriding any conversation by a designated master station.

B. Speaker-Microphone Station:

1. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
2. Communicating hands free.
3. Calling master station by actuating call switch.
4. Returning a busy signal to indicate that station is already in use.
5. Being free of noise and distortion during operation and when in standby mode.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.3 FUNCTIONAL DESCRIPTION OF MICROPROCESSOR-SWITCHED SYSTEMS

A. Master Station:

1. Communicating selectively with other master and speaker-microphone stations by dialing station's number on a 12-digit keypad.
2. Communicating with individual stations in privacy.
3. Communicating on a minimum of three voice channels with up to two simultaneous conversations between master stations and one conversation between a master station and a speaker-microphone station.
4. Increasing the number of conversation channels by adding a module in central-control cabinet.
5. Including up to three other station connections in a conference call.
6. Accessing separate paging speakers or groups of paging speakers by dialing designated numbers on a 12-digit keypad.
7. Overriding any conversation by a designated master station.
8. Displaying selected station.
9. Communicating simultaneously with all other stations by dialing a designated number on a 12-digit keypad.
10. Automatically controlling gain to ensure constant intercom speech level.
11. Controlling the simultaneous distribution of program material to various combinations of speaker-microphone stations or groups over two program channels by using keypad to control sources and distribute programs.
12. Operating and correcting secondary clocks and controlling class-change signals to speakers and bells by using keypad.
13. User-programmable features include the following:
 - a. Station calling by room number.
 - b. Room station call-in priority levels.
 - c. Clock signal schedule functions.
 - d. Schedule characteristics of audible signals.
 - e. Call-in tone characteristic.
 - f. Precedence among master stations as destinations for incoming calls from room stations.
 - g. Grouping of rooms and speakers into zones for paging and program distribution purposes.

B. Speaker-Microphone Station:

1. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
2. Communicating hands free.
3. Calling master station by actuating call switch.
4. Returning a busy signal to indicate that station is already in use.

- C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.4 FUNCTIONAL DESCRIPTION OF TELEPHONE/INTERCOMMUNICATION SYSTEMS

A. Integrated central system with the following:

1. Direct-dial, full duplex private telephone communications between all locations equipped with telephones. Call initiation among master stations and between master and remote stations by dialing station's number on a 12-digit keypad.
2. **16** channels for unrestricted simultaneous communications.
3. Initial system operation with master and remote stations, expandable to 360 stations.
4. Direct-dial, two-way amplified voice intercommunication between master telephones and remote stations without use of press-to-talk or talk-listen switches.
5. Automatic queuing for intercommunication channels, with automatic call waiting.
6. Call transfer among master stations.
7. Display of selected station and answering calling station by pressing a single "response button."
8. Simultaneous communication with other stations on system by dialing a designated number on a 12-digit keypad.
9. Automatic gain control to ensure constant intercom speech level.
10. Simultaneous distribution of emergency announcements to all locations equipped with speakers by dialing a predetermined code number.
11. User-selectable facility for providing selected telephones with dial tone.
12. User-selectable facility for permitting linkage of selected stations to media retrieval center and for permitting on- and off-premise computer linkage.
13. Assignment of speaker locations within any one or more of eight zones for zone paging or time signal reception.
14. Digital readout displays on which up to three incoming calls are displayed with additional calls stored for subsequent display.
15. Off-site diagnostics through a serial data port on central-control station.
16. Control of simultaneous distribution of program material to various combinations of remote stations or groups by using keypad to control sources and distribute programs.
17. Operation and correction of secondary clocks and control of class-change signals to speakers and bells by using keypad.
18. User-programmable features include the following:
 - a. Station calling by room number.
 - b. Room station call-in priority levels.
 - c. Clock signal schedule functions.
 - d. Schedule characteristics of audible signals.
 - e. Call-in tone characteristic.
 - f. Precedence among master stations as destinations for incoming calls from room stations.
 - g. Grouping rooms and speakers into zones for paging and program distribution purposes.
19. Telephone interconnect features include the following:
 - a. Direct connection to central office trunk lines with initial system wiring for trunk lines.
 - b. Routing of outside trunk lines for "attendant answer incoming" and "direct inward line" functions.
 - c. Station programming for access to outside trunk lines to be any of the following:
 - 1) Totally unrestricted access.
 - 2) Restricted access.
 - 3) No access.
 - d. System programming to allow or disallow local prefixes, and to authorize access for as many as three area codes.
 - e. Discriminating ringing for identifying internal and outside calls.
 - f. Circular hunting for outside trunks to prevent excess usage of any one trunk.
 - g. Direct connection of a single trunk to designated telephone with transfer to attendant if unanswered.

- h. Call parking allowing paged party to remotely pick up outside call from any master station.
- i. Night-answer mode to allow one or all of the following:
 - 1) Incoming call transferred to predetermined extension.
 - 2) Tone transmitted to speakers to notify key personnel to answer telephone.
 - 3) Dial tone to remote stations to allow answering call from all locations.
- j. Call control console to do as follows:
 - 1) Identify, answer, and route incoming outside calls, with reminder and recall features.
 - 2) Directly access outside trunk lines.
 - 3) Hold, park, and transfer calls.
 - 4) Screen outside calls.

B. Remote Stations:

1. Speaker-Microphone Station:

- a. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
- b. Communicating hands free.
- c. Calling master station by actuating call switch.
- d. Returning a busy signal to indicate that station is already in use.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.5 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

- A. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Expansion Capability: Increase number of stations in the future by [25] <Insert number> percent above those indicated without adding any internal or external components or main trunk cable conductors.
- C. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz. Comply with UL 813.
- D. Weather-Resistant Equipment: Listed and labeled by an NRTL for duty outdoors or in damp locations.

2.6 MASTER STATION FOR MANUALLY SWITCHED SYSTEMS

- A. Station-Selector and Talk-Listen Switches: Heavy-duty type with gold-plated contacts rated for five million operations.
- B. Volume Control: Regulates incoming-call volume.
- C. LED Annunciation: Identifies calling stations and stations in use. LED remains on until call is answered.
- D. Tone Annunciation: Momentary audible tone signal announces incoming calls.
- E. Speaker Microphone: Transmits and receives calls.
 - 1. Minimum Speaker Sensitivity: 91 dB at one meter, with 1-W input.

- F. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.
- G. Central-Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and auxiliary equipment.

2.7 MASTER STATION FOR MICROPROCESSOR-SWITCHED SYSTEMS

- A. 12-Digit Keypad Selector: Transmits calls to other stations and initiates commands for programming and operation.
- B. Volume Control: Regulates incoming-call volume.
- C. Tone Annunciation: Momentary audible tone signal announces incoming calls.
- D. Lamp Annunciation: Identifies calling stations and stations in use. Lamp remains on until call is answered.
- E. Speaker Microphone: Transmits intercom voice signals when used via a voice-operated switch.
 - 1. Minimum Speaker Sensitivity: 91 dB at one meter, with 1-W input.
- F. Link Button: To transfer calls.
- G. Reset Control: Cancels call and resets system for next call.
- H. Digital Display: 16-digit alphanumeric LCD readout to register up to four three-digit station numbers.
- I. Central-Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions.

2.8 CALL CONTROL CONSOLE

- A. Microprocessor-based instrument to process outside and internal calls with a 12-digit keypad selector.
- B. 20-character alphanumeric display for the following:
 - 1. Simultaneous display of up to three calling stations plus last station dialed.
 - 2. Display of calls in order received with emergency calls taking precedence on the display.
 - 3. Review of calls stored in groups of four.
 - 4. Display of prompt messages to assist in system operation.
- C. Programmable Keys: Minimum of 20 with LED indicators for ringing/busy status; programmable for trunk and operator functions.
- D. Transfer Button: Calls to busy extensions and unanswered calls automatically returned to call control console.
- E. Hold Button: With reminder feature every 30 seconds for parked calls or calls placed on hold.
- F. Release Button: For use with parked calls or calls placed on hold.
- G. Page Button: For engaging system paging functions.
- H. Programmable for night answer, remote answer, and remote pickup features.

- I. Programmable for distribution of emergency announcements, all-page announcements, zone-page announcements, and emergency/evacuation alert.
- J. Central-Control Cabinet Equipment: Central switching equipment, central office adapter module, line link modules, power supplies, chassis adapters, and other switching and control devices required for trunk and internal conversation channels and control functions.

2.9 SPEAKER-MICROPHONE STATIONS

- A. Mounting: Flush unless otherwise indicated, and suitable for mounting conditions indicated.
- B. Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.
- C. Back Box: Two-gang galvanized steel with 2-1/2-inch (64-mm) minimum depth.
- D. Speaker: Minimum axial sensitivity shall be 91 dB at one meter, with 1-W input. Voice coil shall be not less than 3 inches (76 mm), 2.3 oz. (65 g) minimum; permanent magnet.
- E. Tone Annunciation: Recurring momentary tone indicates incoming calls.
- F. Call Switch: Mount on faceplate. Permits calls to master station.
- G. Privacy Switch: Mount on faceplate. When in on position, switch prevents transmission of sound from remote station to system; when in off position, without further switch manipulation, response can be made to incoming calls.

2.10 CALL-SWITCH UNIT

- A. Enclosure: Single-gang box with stainless-steel faceplate.
- B. Call Switch: Momentary contact signals system that a call has been placed.
- C. Privacy Switch: Prevents transmission of sound signals from station to system.
- D. Volume Control: Operated by screwdriver blade through a hole in faceplate to adjust output level of associated speaker.

2.11 ALL-CALL AMPLIFIER

- A. Output Power: 70-V balanced line. **80 percent of the sum of wattage settings of connected** for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.
- B. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to quantity of stations connected in all-call mode of operation.
- C. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
- D. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.
- E. Output Regulation: Maintains output level within 2 dB from full to no load.
- F. Input Sensitivity: Compatible with master stations and central equipment so amplifier delivers full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on master stations, speaker microphones, or handset transmitters.

- G. Amplifier Protection: Prevents damage from shorted or open output.

2.12 INTERCOMMUNICATION AMPLIFIER

- A. Minimum Output Power: 15 W; adequate for all functions.
- B. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to one station connected to output terminals.
- C. Minimum Signal-to-Noise Ratio: 50 dB, at rated output.
- D. Frequency Response: Within plus or minus 3 dB from 70 to 10,000 Hz.
- E. Output Regulation: Maintains output level within 2 dB from full to no load.
- F. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on microphones in master stations, speaker microphones, or handset transmitters.
- G. Amplifier Protection: Prevents damage from shorted or open output.

2.13 PAGING AMPLIFIER

- A. Input Voltage: 120-V ac, 60 Hz.
- B. Frequency Response: Within plus or minus 3 dB from 60 to 10,000 Hz.
- C. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
- D. Total Harmonic Distortion: Less than 3 percent at rated output power from 70 to 12,000 Hz.
- E. Output Regulation: Less than 2 dB from full to no load.
- F. Controls: On-off, input levels, and low-cut filter.
- G. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphones or handset transmitters.
- H. Amplifier Protection: Prevents damage from shorted or open output.

2.14 CONE-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES

- A. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
- B. Frequency Response: Within plus or minus 3 dB from 70 to 15,000 Hz.
- C. Minimum Dispersion Angle: 100 degrees.
- D. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.
- E. Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and factory primed; complete with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; with relief of back pressure.

- F. Baffle: For flush speakers, minimum thickness of 0.032-inch (0.8-mm) aluminum **with textured white finish]** <Insert finish>.
- G. Vandal-Proof, High-Strength Baffle: For **flush & surface**-mounted speakers, self-aging cast aluminum with tensile strength of 44,000 psi (303 MN/sq. m), 0.025-inch (0.65-mm) minimum thickness; countersunk heat-treated alloy mounting screws; and textured white epoxy finish.
- H. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.

2.15 HORN-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES

- A. Speakers shall be all-metal, weatherproof construction; complete with universal mounting brackets.
- B. Frequency Response: Within plus or minus 3 dB from 275 to 14,000 Hz.
- C. Minimum Power Rating of Driver: 15 W, continuous.
- D. Minimum Dispersion Angle: 110 degrees.
- E. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.

2.16 CONDUCTORS AND CABLES

- A. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.
- B. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
- C. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.
 - 1. Minimum Shielding Coverage on Conductors: 60 percent.
- D. Plenum Cable: Listed and labeled for plenum installation.

2.17 RACEWAYS

- A. Educational Intercommunication and Program System Raceways and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems."
- B. Educational Intercommunication and Program System Raceways and Boxes: Same as required for electrical branch circuits specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- C. Educational Intercommunication and Program System Raceways and Boxes: **EMT**.
- D. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- E. Flexible metal conduit is prohibited.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF RACEWAYS

- A. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements:
 - 1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
 - 2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
 - 3. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
 - 5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
- C. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
 - 2. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceiling by cable supports not more than 60 inches (1524 mm) apart.
 - 3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
- D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

- A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.
- C. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 GROUNDING

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
- C. Install grounding electrodes as specified in Section 270526 "Grounding and Bonding for Communications Systems."

3.6 SYSTEM PROGRAMMING

- A. Programming: Fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Schedule tests with at least seven days' advance notice of test performance.
 - 2. After installing educational intercommunications and program systems and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: Test originating station-to-station, **all-call**, and **page** messages at each intercommunication station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.
 - 4. Frequency Response Test: Determine frequency response of two transmission paths, **including all-call and paging**, by transmitting and recording audio tones. Minimum acceptable performance is within 3 dB from 150 to 2500 Hz.
 - 5. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

- a. Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio at **paging** speakers.
 - b. Repeat test for three speaker microphones, **and** one master station microphone, **and for each separately controlled zone of paging loudspeakers.**
 - c. Minimum acceptable ratio is 45 dB.
- 6. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into each intercom[, **paging, and all-call amplifier**]. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.
 - 7. **Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each paging zone. Maximum permissible variation in level is plus or minus 3 dB; in levels between adjacent zones, plus or minus 5 dB.**
 - 8. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 150, 1000, and 2500 Hz. Maximum variation in power output at these frequencies is plus or minus 3 dB.
 - 9. Signal Ground Test: Measure and report ground resistance at system signal ground. Comply with testing requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
- E. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging and independent room speaker-line matching transformers.
 - F. Educational intercommunications and program systems will be considered defective if they do not pass tests and inspections.
 - G. Prepare test and inspection reports.

3.8 STARTUP SERVICE

- A. **Engage a factory-authorized service representative to perform startup service and initial system programming.**
 - 1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
 - 2. Complete installation and startup checks according to manufacturer's written instructions.

3.9 ADJUSTING

- A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.
- B. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.

3.10 DEMONSTRATION

- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain the educational intercommunications and program systems.
 - 1. Train Owner's maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining the system and equipment.

END OF SECTION

SECTION 27 53 13

CLOCK SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Master clock **and program** control unit.
 - 2. Secondary indicating clocks.
 - 3. Program signal devices.
 - 4. Clock circuit power boosters.
 - 5. Interface with **public-address** system.
 - 6. System wire and cable.

1.3 DEFINITIONS

- A. NIST: The National Institute of Science and Technology.
- B. PC: Personal computer.
- C. UTC: Universal time coordinated. The precisely measured time at zero degrees longitude; a worldwide standard for time synchronization.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Master clock and housing shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event.**"

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes (including available colors) for each product indicated and describe features and operating sequences, both automatic and manual, for the following:
 - 1. Master unit.
 - 2. Indicating clocks.
 - 3. Signal equipment.
 - 4. Equipment enclosures and back boxes.

5. Accessory components.
- B. Shop Drawings: For clock systems. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring and correction circuits.
 - a. Identify terminals and wiring color codes to facilitate installation, operation, and maintenance.
 - b. Indicate recommended wire types and sizes, and circuiting arrangements for field-installed system wiring. Show protection from overcurrent, static discharge, and voltage surge.
 2. Details of seismic restraints including mounting, anchoring, and fastening devices for the following system components:
 - a. Surface-mounted and semi recessed secondary indicating clocks.
 - b. Master clock **mounting racks**.
 - c. Clock circuit power boosters.
 3. Details of seismic strengthening of master clock **mounting racks**.
 4. Dimensioned Outline Drawings of the Mounting Rack for the Master Clock: Show internal seismic bracing, and locate center of gravity of fully equipped and assembled unit. Locate and describe mounting and anchorage provisions.
- C. Samples for Initial Selection:
1. Manufacturer's color photographs or color chips showing the full range of colors available for clocks, signal equipment, and control panels.
 2. Representative operating models of clock type.
- D. Delegated-Design Submittal: For the master clock and housing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of the master clock and housing.
 2. Design Calculations: Calculate requirements for selecting seismic restraints.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Seismic Qualification Certificates: For the master clock, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.
- 1.7 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For clock and program control to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MASTER AND SECONDARY CLOCK SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Dukane Communication Systems.
 - 2. Rauland-Borg Corporation.
 - 3. SimplexGrinnell LP.
- B. System Functions and Features:
 - 1. Supply power to remote indicating clocks.
 - 2. Maintain correct synchronized time and transmit time-correction signals over dedicated system wiring from a master clock to any [one] [two] <Insert number> type(s) of secondary indicating clocks, including the following:
 - a. Analog Synchronous Clocks: Correct for minute- and second-hand synchronization at least once each hour and for hour-hand synchronization at least once each day.
 - b. Digital Clocks: Test clocks automatically for synchronization with master time control at least once every hour and automatically correct those not synchronized with the time reference unit. **Automatically correct clocks immediately when power is restored after an outage of power to the master clock.**
 - 3. Initiate and execute programs for scheduled automatic operation of remote devices. Include **audible signal devices and visual signal devices**.
 - 4. Provide for manual control of programmed signal and equipment-switching circuits.
 - 5. Communicate with remote PC **for access to UTC time base and to permit programming from remote location**.
 - 6. Maintain system access security with a minimum of **three levels** of user-access control to restrict use of system controls to authorized personnel. **Levels of access apply to both local access and access from a remote computer**. Access to user programming and control functions is accomplished by entering a minimum three-digit code. Access levels include the following:
 - a. Access to review existing programs only.
 - b. Access to normal system operating controls.
 - c. Access to all user-programming and control functions.
 - 7. Regulate system timing functions using power-line frequency, backed up for power outages by an internal battery-powered, crystal-controlled oscillator.
 - 8. Regulate system timing functions using power-line frequency, backed up for power outages by an internal battery-powered, crystal-controlled oscillator, and automated periodic reference to NIST or UTC time signals via **internal modem and network or microcomputer Internet access**. Reference time signals shall be automatically accessed at programmable intervals.
 - 9. Provide for programming multiple independent event schedules into memory and running them simultaneously for different output circuits.
 - a. Quantity of Programmable Schedules: **250**, minimum.
 - b. Number of Weekly Events That Can Be Programmed for Each Schedule: **2500**, minimum.
 - c. Simultaneous operation of independent schedules shall be limited only by the number of signal-device and equipment-switching output circuits.

- d. Advance Programming for Automatic Holiday Schedule Changes: Number of schedule changes that can be programmed to suit holidays and vacations shall be **100**, and each change may be programmed up to a year in advance to occur on any day of the calendar year.
- 10. Automatically check functioning of LEDs, switches, input keys, central processor, read-only memory, random access memory, and output circuits. A display on the control panel **or a remote computer with the proper access code** shall indicate failure by identifying faulty component or circuit and shall recommend corrective action.
- 11. Provide **programming for automatic** daylight savings time correction.
- 12. Provide for adjustments to master clock output signals. Duration of momentary signal shall be individually programmable for each signal and equipment-control output circuit from 1 to 99 seconds. Signals shall be programmable for either on or off switching to suit equipment-operation scheduling.

2.2 MASTER CLOCK

- A. Description: Microprocessor-based, software-controlled unit complying with Class A device requirements in 47 CFR 15.
 - 1. Programming and control switches.
 - 2. Informational Display: LED or backlit LCD type.
 - a. Normally shows current time, **date, and day of week** display.
 - b. Provides programming cues when system is being programmed.
 - 3. Output Circuits for Power and Correction of Secondary Indicating Clocks:
 - a. Wired Synchronous Clock Power-and-Correction Circuits: For **digital** clocks; a minimum of **two** required. Relay controlled.
 - b. Wired Synchronous Digital Clock Power-and-Correction Circuits: **One** required.
 - 4. Data Output Port for **Digital** Secondary Clock Correction Circuit: RS485 or similar circuit for scheduled periodic correction signals.
 - 5. Modem and PC interface software suitable for **remote programming and automatic NIST or UTC synchronization**.
 - 6. Circuits for Audible **and Visual** Signal Devices: Relay controlled, manually switchable, using controls on the master clock. Rated 120-V ac, **10 A** minimum. A minimum of **eight** circuits.
 - 7. Circuits for Programmable Switching of Remote Equipment and Circuits: Relay controlled, manually switchable, using controls on the master clock. Rated 120-V ac, **10 A** minimum. A minimum of **eight** circuits.
 - 8. Power Supplies: Capacity for internal loads and power-and correction circuits of connected clocks.
 - 9. Enclosure: Metal cabinet with locking front panel. When cabinet is locked, display indication shall be visible on or through front panel face. Arrange cabinet for surface, semirecessed, or flush mounting as indicated.
 - 10. Housing: Rack-mounting metal enclosure with display indication visible on front panel face.
 - a. Reinforce mounting and attachment capable of resisting seismic forces described in Section 260548.16 "Seismic Controls for Electrical Systems."
 - 11. Battery Backup for Time Base: Lithium battery to maintain the timekeeping function and retain the programs in memory during outage of normal ac power supply for up to 10 years.
 - 12. Electrostatic Discharge Resistance: Master clock **and secondary indicating clocks** shall be tested and certified according to IEC 61000-4-2 in both human-discharge and direct-injection modes.

2.3 SECONDARY INDICATING CLOCKS

- A. Analog Clock: Equipped with a sweep second hand. Movement shall be driven by self-starting, permanently lubricated, sealed synchronous motor equipped with a correcting solenoid actuator, or be a microprocessor-based, second impulse unit, compatible with the master clock.
- B. Digital Clock: Microprocessor-controlled unit complying with Class A device requirements in 47 CFR 15, with red LED digital time display of hours , **minutes, and seconds**.
1. Display Height: 2-1/2-Inch (64-mm) Clock: Hour and minute numerals readable at 50 feet (15 m).
 2. Display Height: 4-Inch (102-mm) Clock: Hour and minute numerals readable at 100 feet (30 m).
 3. Display Format: Selectable between 12-hour with "PM" LED display and 24-hour formats.
 4. Connections for Power and Correction:
 - a. Wired synchronous connection to the master clock for both operating power and correction.
 - 1) Time-Base Backup: Internal alkaline battery shall back up internal time base to maintain timekeeping during power outages of up to six days' duration.
 - 2) Time-Base Backup: Internal capacitor shall back up internal time base to maintain timekeeping during power outages of up to 12 hours' duration.
 - b. Correction by RS485, Ethernet, or similar data line with operating power supplied over a separate connection.
 - c. Power Connection for Secondary Indicating Clocks: **Plug connector**.
- C. Interval-Timer Clock: Digital microprocessor-controlled, 4-inch (102-mm) unit with 2-1/2-inch (64-mm), red LED digital display for hours and minutes and 1-5/16-inch (33-mm) display for seconds; a separately mounted, mode-control switch; and the following features:
1. Display Visibility: Hour and minute numerals readable at **30 feet (10 m)** in normal ambient light.
 2. Operating Modes:
 - a. Normal: Clock operates as a regular secondary system clock, displaying corrected time in normal display configuration, selectable between 12- and 24-hour formats, with "PM" digital display for 12-hour format.
 - b. Count-Down or Count-Up Timer: Selected by mode-control switch count-up and count-down positions, and capable of being preset at the mode-control station.
 3. Mode-Selector Switch: Push-button or rotary, multiposition type, flush mounted; with start, stop, and reset capability in both count-up and count-down modes.
 4. Audible tone signal: Housed in clock or mode-selector-switch box. Sounds at end of preset up or down count.
- D. Provision for Modular Panel Installation: Equip designated clock for panel mounting. Mount flush or semi recessed with arrangement and trim as indicated. Coordinate wiring with other modular panel components, including **room lighting switches, intercom devices, convenience outlets, data outlets, speaker** and other similar devices.
- E. Provision for Time-Tone-Unit Installation: Equip indicated clocks for housing or mounting in an acoustically treated and baffled speaker compartment specified in Section 275116 "Public Address and Mass Notification Systems."
- F. Secondary Indicating Clock Characteristics:
1. Clock Type: **Digital**.
 2. Face Configuration: **Double**.
 3. Mounting: **Recessed, Semi recessed, Pendant or Surface**.
 4. Casing Finish: white.
 5. Special Environmental Conditions: **damp, or dry locations**.
 6. Face Color: white.

7. Seconds Display: **Yes**.
8. Digital Clock Lens: Antiglare acrylic material.
9. Battery Backup: **Yes**.
10. Interval-Timer Display: **Yes**.

2.4 PROGRAM SIGNAL DEVICES

- A. Bells: Heavy-duty, modular, vibrating type with the following sound-output ratings measured at 10 feet (3 m):
 1. 4-Inch (100-mm) Bell: 90 dB.
 2. 6-Inch (150-mm) Bell: 95 dB.
 3. 10-Inch (250-mm) Bell: 104 dB.
- B. Chimes: Heavy-duty, modular, vibrating chimes with polished-chrome tone bar and enamel-finished housing. Minimum sound-output rating measured at 10 feet (3 m) shall be 75 dB.
- C. Clock Buzzers: Adjustable output signal device designed for mounting within clock housing or outlet box.
 1. Sound-Output Rating Measured at 3 Feet (1 m): 75 dB.
 2. Audible Tone Frequency: Manufacturer's standard between 120 Hz and 2 kHz.
- D. Horns: Modular, adjustable-output, vibrating type with minimum full-intensity-rated sound output of 103 dB measured at 10 feet (3 m).
- E. Projector Horns: Adjustable-output, vibrating type with **[single]** **[double]** projector arranged to channel sound in the direction of the projector axis, and with minimum full-intensity-rated sound output of 104 dB measured at 10 feet (3 m).
- F. Loudspeakers for Audible Tones: See Section 275116 "Public Address and Mass Notification Systems."
- G. Visible Signal Devices: Strobe lights with **blue** polycarbonate lens and xenon flash tube, with lens mounted on an aluminum faceplate and the word "Program" engraved in letters at least 1 inch (25 mm) high on lens. Lamp unit shall have a minimum rated light output of 75 candela.
- H. Combination Audible and Visible Signal Devices: Factory-integrated horn and strobe light in a single mounting assembly.
- I. Outdoor Signal Equipment: Weatherproof models listed for outdoor use.
- J. Mounting Arrangement for Signal Devices: Designed for attachment with screws on the mounting plate of a flush-mounted back box unless otherwise indicated.
- K. Enclosures for Flush-Mounting Bells and Horns: Enclosure, mounting plate, and grille assembly shall be furnished by device manufacturer to match features of the device to be mounted. Enclosure shall be recessed in wall, completely enclosing the device, with grille mounting over the open side of the enclosure and flush with the wall.
- L. Connection Provision for Signal-Indicating Devices: **Plug connector**.

2.5 CLOCK CIRCUIT POWER BOOSTER

- A. Description: Transformer power supply, mounted in steel cabinet with hinged door, and having fuse-protected input and output circuits.

2.6 BACK BOXES FOR SECONDARY INDICATING CLOCKS AND PROGRAM DEVICES

- A. Description: Box and cover-plate assembly shall be furnished by device manufacturer and be suitable for device to be mounted. Back boxes shall be equipped with knockouts and hanger straps or mounting adapters arranged for flush mounting the device unless otherwise indicated.

2.7 GUARDS

- A. Description: Formed-steel wire, shaped to fit around guarded device, with 1-inch (25-mm) maximum clearance.
 - 1. Mounting Provisions: Fixed tabs, welded to guard and arranged for screw attachment to mounting surface.
 - 2. Finish for Indoor Devices: **Clear** epoxy lacquer over zinc plating.
 - 3. Finish for Outdoor Devices: **Black** powder coat over zinc plating and primer.

2.8 RACK-MOUNTING PROVISION FOR MASTER CLOCK

- A. Equipment Cabinet: **Floor**-mounted, rack type. Comply with EIA-310-D and the following:
 - 1. Cabinet Housing: Constructed of steel, with front **and rear** doors; with manufacturer's standard tumbler locks, keyed alike.
 - a. Front door shall have a clear panel in front of the master clock display.
 - b. Housing shall enclose master clock and auxiliary clock system components, plus a minimum of **20** percent spare capacity for future equipment.
 - 2. Forced Ventilation: Internal low-noise fan with a filtered intake vent, connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switchable and arranged to be powered when main cabinet power switch is on.
 - 3. Natural Ventilation: Ventilated rear and sides with louvers and solid top.
 - 4. Arrange inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
 - 5. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by equipment or panels.
 - 6. Finish: Uniform, baked-enamel, **manufacturer's standard color** finish over rust-inhibiting primer.
 - 7. Power-Control Panel: On front of equipment housing; with master power on-off switch and pilot light, and socket for a 5-A, indicating, cartridge fuse for rack equipment power.
 - 8. Vertical Plug Strip: Grounded receptacles, 12 inches (300 mm) o.c. the full height of rack, to supply rack-mounting equipment.
 - 9. Maintenance Receptacles: Duplex convenience outlet with supply terminals separate from equipment plug strip and located in front of rack.

2.9 CONDUCTORS AND CABLES

- A. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but not smaller than No. 22 AWG. Voltage drop for signal, control, and clock correction circuits shall not exceed 10 percent under peak load conditions. Comply with requirements in Section 271500 "Communications Horizontal Cabling."
- B. 120-V AC and Class 1 Signal and Control Circuits: Stranded, single conductors of size and type recommended by system manufacturer. Materials and installation requirements are specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 2 and Class 3 Signal and Control Circuits: Single conductor or twisted-pair cable, unshielded, unless manufacturer recommends shielded cable.

- D. Data Circuits: Category 6 minimum, unshielded, twisted-pair cable, unless manufacturer recommends shielded cable.
- E. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
- F. Plenum Cable: Listed and labeled for plenum installation.
- G. Conductor Color-Coding: Uniformly identified and coordinated with wiring diagrams.
- H. Shielding: For speaker-microphone leads and at other locations recommended by manufacturer; No. 34 AWG tinned, soft-copper strands formed into a braid or equivalent foil.
 - 1. Minimum Shielding Coverage on Conductors: 60 percent.

2.10 PATHWAYS

- A. Intercommunication and Program System Raceways and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems."
- B. Intercommunication and Program System Raceways and Boxes: Same as required for electrical branch circuits specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- C. Intercommunication and Program System Raceways and Boxes: **Metal wire ways.**
- D. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- E. Flexible metal conduit is prohibited.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount system components with fastening methods and devices designed to resist the seismic forces indicated in Section 260548.16 "Seismic Controls for Electrical Systems."

3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- D. Support cables not enclosed in raceways on J-Hooks. Install, size, and space J-Hooks to comply with TIA/EIA-568-B.

3.3 ELECTRICAL CONNECTIONS

- A. Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- B. Use **plug connectors** for connections to clocks and signal devices.
- C. Ground clocks, programming equipment, and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.4 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Color-code wires, and apply wire and cable marking tape to designate wires and cables so they are uniformly identified and coordinated with wiring diagrams throughout the system.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installation, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Perform operational-system tests to verify compliance with the Specifications and make adjustments to bring system into compliance. Include operation of all modes of clock correction and all programming and manually programmed signal and relay operating functions.
 - 2. Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
- D. Clock system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Program system according to Owner's requirements. Set system so signal devices operate on Owner-required schedules and are activated for durations selected by Owner. Program equipment-control output circuits to suit Owner's operating schedule for equipment controlled.
- B. Adjust sound-output level of adjustable signal devices to suit Owner's requirements.
- C. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain clock-and-program-control system components.

END OF SECTION

SECTION 28 05 13

CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. UTP cabling.
 - 2. **62.5/125**-micrometer, multimode optical-fiber cabling.
 - 3. Coaxial cabling.
 - 4. RS-232 cabling.
 - 5. RS-485 cabling.
 - 6. Control-voltage cabling.
 - 7. Control-circuit conductors.
 - 8. Fire alarm wire and cable.
 - 9. Identification products.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. IDC: Insulation displacement connector.
- C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- D. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- E. RCDD: Registered Communications Distribution Designer.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of electronic safety and security cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Installation data for UTP and optical-fiber cables as specified in TIA 569-C-1.
2. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.
4. Wiring diagrams to show typical wiring schematics, including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL.
 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 1. Test optical-fiber cable to determine the continuity of the strand, end to end. Use **optical-fiber flashlight or optical loss test set**.
 2. Test optical-fiber cable on reels. Use an optical time domain reflectometer to verify the cable length, and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
 3. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: **25** or less.
 2. Smoke-Developed Index: **50** or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 BACKBOARDS

- A. Backboards: Plywood, **fire-retardant treated**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Section 061000 "Rough Carpentry."

2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 2. General Cable Technologies Corporation.
 3. Hubbell Incorporated.
- B. Description: 100-ohm, four-pair UTP, covered with a blue thermoplastic jacket.
1. Comply with ICEA S-90-661 for mechanical properties.
 2. Comply with TIA-568-C.1 for performance specifications.
 3. Comply with TIA-568-C.2, **Category 5e & Category 6**.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or Type CMG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX.
 - e. Multipurpose: Type MP or Type MPG.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 2. Leviton Manufacturing Co., Inc.
 3. Panduit Corp.
- B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

- C. Connecting Blocks: [110-style for Category 5e] [110-style for Category 6] [66-style for Category 5e]. Provide blocks for the number of cables terminated on the block, plus [25] <Insert number> percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL-FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. Berk-Tek Leviton; a Nexans/Leviton alliance.
3. General Cable Technologies Corporation.

- B. Description: Multimode, **62.5/125**-micrometer, **24**-fiber, [**nonconductive**,]tight buffer, optical-fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with **TIA-492AAAB & TIA-492-B** for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or Type OFNG.
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC or Type OFCG.
 - e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.
5. Conductive cable shall be **aluminum** armored type.
6. Maximum Attenuation: **3.50** db/km at 850 nm; **1.5** db/km at 1300 nm.
7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

- C. Jacket:

1. Jacket Color: **Orange for 62.5/125-micrometer cable.**
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL-FIBER CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMP NETCONNECT; a TE Connectivity Ltd. company.
2. Belden Inc.
3. Leviton Manufacturing Co., Inc.

- B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: **One** for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

- C. Patch Cords: Factory-made, dual-fiber cables in **36-inch (915-mm)** lengths.

- D. Cable Connecting Hardware: Comply with the Fiber Optic Connector Intermateability Standard (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA-604-12. Comply with TIA-568-C.3.

1. Quick-connect, simplex and duplex, **Type SC** connectors. Insertion loss not more than 0.75 db.

2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 COAXIAL CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 2. General Cable Technologies Corporation.
 3. West Penn Wire.
- B. General Coaxial-Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data-transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 db maximum from 7 to 806 MHz.
- C. RG-11/U: NFPA 70, Type CATV.
1. **No. 14** AWG, solid, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 4. Jacketed with sunlight-resistant, black PVC or PE.
 5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- D. RG-6/U: NFPA 70, Type CATV or CM.
1. **No. 18** AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 3. Jacketed with PVC or PE.
 4. Suitable for indoor installations.
- E. RG-6/U (Plenum Rated): NFPA 70, Type CMP.
1. **No. 18** AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 3. Jacketed with PE.
- F. NFPA and UL Compliance: Coaxial cables shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, Article 820 "Radio and Television Equipment" and Article 830 "Community Antenna Television and Radio Distribution Systems." Types are as follows:
1. CATV Cable: Type CATV.
 2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 3. CATV Riser Rated: Type CATVR, complying with UL 1666.
 4. CATV Limited Rating: Type CATVX.

2.8 COAXIAL-CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 2. Leviton Manufacturing Co., Inc.
 3. West Penn Wire.
- B. Coaxial-Cable Connectors:
1. Type BNC, 75 ohms, crimp on style.

2. Type F compression style for RG-6/U cables.

2.9 RS-232 CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. General Cable Technologies Corporation.
3. Genesis Cable Products; Honeywell International, Inc.

B. Standard Cable: NFPA 70, Type CM.

1. **Three**, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Polypropylene insulation.
3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
4. PVC jacket.
5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with UL 1581.

C. Plenum-Rated Cable: NFPA 70, Type CMP.

1. **Three**, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PE insulation.
3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
4. Fluorinated ethylene propylene jacket.
5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.10 RS-485 CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. General Cable Technologies Corporation.
3. Southwire Company.

B. Standard Cable: NFPA 70, Type CM[or Type CMG].

1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

C. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.11 CONTROL-VOLTAGE CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. General Cable Technologies Corporation.
3. Southwire Company.

B. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, [**No. 16 AWG, stranded (19x29)**] [and] [**No. 18 AWG, stranded (19x30)**] tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

C. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, [**No. 16 AWG, stranded (19x29)**] [and] [**No. 18 AWG, stranded (19x30)**] tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.12 CONTROL-CIRCUIT CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. General Cable Technologies Corporation.
3. Southwire Company.

B. Class 1 Control Circuits: Stranded copper, **Type THHN-THWN, complying with UL 83, in pathway.**

C. Class 2 Control Circuits: Stranded copper, **Type THHN-THWN, complying with UL 83, in pathway.**

D. Class 3 Remote-Control and Signal Circuits: **Stranded copper, Type TW or TF in pathway, complying with UL 83.**

2.13 FIRE ALARM WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Wire & Cable Inc.
2. Genesis Cable Products; Honeywell International, Inc.
3. West Penn Wire.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, **not less than No. 18 AWG AWG & as recommended by system manufacturer].**

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
 2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor[**with outer jacket**] with red identifier stripe, NRTL listed for fire alarm and cable tray installation, plenum rated.

2.14 CONSOLIDATION POINTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Belden CDT Networking Division/NORDX.
 2. Hubbell Premise Wiring.
 3. Panduit Corp.
- B. Description: Consolidation points shall comply with requirements for cable connecting hardware.
1. Number of Terminals per Field: **[One]** <Insert number> for each conductor in assigned cables.
 2. Number of Connectors per Field:
 - a. **One** for each four-pair UTP cable indicated.
 - b. **One** for each four-pair conductor group of indicated cables, plus **25** percent spare positions.
 3. Mounting: **Recessed in ceiling** or wall.
 4. NRTL listed as complying with UL 50 and UL 1863.
 5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.15 IDENTIFICATION PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
 2. HellermannTyton.
 3. Panduit Corp.
- B. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.16 CABLE MANAGEMENT SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Chatsworth Products, Inc.
 2. Telsoft Solutions.
 3. Total Wire Software Company, Inc.
- B. Description: Computer-based cable management system, with integrated database[**and graphic**] capabilities.
- C. Document physical characteristics by recording the network, TIA details, and connections between equipment and cable.

- D. Information shall be presented in database view **technical drawings**.
 - 1. **AutoCAD** drawing software shall be used as drawing and schematic plans software.
- E. System shall interface with the following testing and recording devices:
 - 1. Direct upload tests from circuit-testing instrument into the personal computer.
 - 2. Direct download circuit labeling into labeling printer.

2.17 SOURCE QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to evaluate cables.
- B. Factory test UTP and optical-fiber cables on reels according to TIA-568-C.1.
- C. Factory test UTP cables according to TIA-568-C.2.
- D. Factory test multimode optical fiber cables according to TIA-526.14-B and TIA-568-C.3.
- E. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results. Structural Return Loss shall be less than 20 db.
- F. Cable will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

3.2 WIRING METHOD

- A. Install wiring in metal pathways and wireways.
 - 1. Minimum conduit size shall be **3/4 inch (21 mm)**. Control and data-transmission wiring shall not share conduits with other building wiring systems.
 - 2. Comply with requirements in Section 280528 "Pathways for Electronic Safety and Security."
 - 3. Comply with requirements in Section 260536 "Cable Trays for Electrical Systems."
 - 4. Comply with requirements in Section 270536 "Cable Trays for Communications Systems."
- B. Install cable, concealed in accessible ceilings, walls, and floors when possible.
- C. Wiring on Racks and within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSM's "Cabling Termination Practices" chapter. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered.
 - 2. Install lacing bars and distribution spools.

3. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
4. Install conductors parallel with or at right angles to sides and back of enclosure.
5. Connect conductors associated with intrusion system that are terminated, spliced, or interrupted in any enclosure onto terminal blocks.
6. Mark each terminal according to system's wiring diagrams.
7. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1 and NFPA 70.
- B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.
- C. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.
- D. Install UTP, optical-fiber, and coaxial cables and connecting materials after spaces are complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- E. General Requirements for Cabling:
 1. Comply with TIA-568-C.1.
 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels. Leave a minimum of 6 inches (150 mm) of slack at outlet terminations and coil loosely into box after termination on outlet fitting.
 4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 5. Maintain minimum cable bending radius during installation and termination of cables.
 6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions. Do not exceed manufacturer's rated cable-pulling tension.
 9. Riser Cable: Riser cable support intervals shall be in accordance with manufacturer's recommendations.
 10. Comply with Section 280544 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."
- F. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with **Category 5e & Category 6** rating of components and that ensure **Category 5e & Category 6** performance of completed and linked signal paths, end to end.
 1. Comply with TIA-568-C.2.
 2. Install 110-style IDC termination hardware unless otherwise indicated.
 3. Do not untwist UTP cables more than 1/2 inch (12 mm) from point of termination to maintain cable geometry.
- G. Optical-Fiber Cable Installation:
 1. Comply with TIA-568-C.3.
 2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
- H. Coaxial-Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
3. Install indoor cables in pathway.

I. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than [60 inches (1525 mm)] <Insert dimension> apart. Cable supports shall be fastened to structural members or floor slabs in accordance with Section 260529 "Hangers and Supports for Electrical Systems."
3. Cable shall not be run in contact with pipes, ducts, or other potentially damaging items. Cables shall not be run through structural members or use structural members, pipes, ducts, or equipment as a support.

J. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (300 mm) in diameter below each feed point.

K. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-C recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communication cables or cables in nonmetallic pathways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
3. Separation between communication cables in grounded metallic pathways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between cables in grounded metallic pathways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or hp and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.

- B. Wiring Method: Install wiring in metal pathway according to Section 280528 "Pathways for Electronic Safety and Security."
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated pathway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
 - 1. Cables and pathways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
 - 2. Fire-Rated Cables: Use of two-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is[**not**] permitted.
 - 3. Signaling Line Circuits: Power-limited fire alarm cables **shall not** be installed in the same cable or pathway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and another for supervisory circuits. Color code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- H. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS

- A. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
- B. Minimum Conductor Sizes:
 - 1. Class 1 remote-control and signal circuits, No. 14 AWG.
 - 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
 - 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.6 CONNECTIONS

- A. Comply with requirements in Section 281643 "Perimeter Security Systems" for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Section 281600 "Intrusion Detection" for connecting, terminating, and identifying wires and cables.

- C. Comply with requirements in Section 281300 "Access Control" for connecting, terminating, and identifying wires and cables.
 - D. Comply with requirements in Section 282300 "Video Surveillance" for connecting, terminating, and identifying wires and cables.
 - E. Comply with requirements in Section 284619 "PLC Electronic Detention Monitoring and Control Systems" for connecting, terminating, and identifying wires and cables.
 - F. Comply with requirements in **Section 283111 "Digital, Addressable Fire-Alarm System"** for connecting, terminating, and identifying wires and cables.
 - G. Comply with requirements in Section 283500 "Refrigerant Detection and Alarm" for connecting, terminating, and identifying wires and cables.
- 3.7 FIRESTOPPING
- A. Comply with requirements in Section 078413 "Penetration Firestopping."
 - B. Comply with TIA-569-C, "Firestopping" Annex A.
 - C. Comply with BICSI TDMM, "Firestopping Systems" Article.
- 3.8 GROUNDING
- A. For communication wiring, comply with J-STD-607-A and with BICSI TDMM's "Grounding, Bonding, and Electrical Protection" chapter.
 - B. For low-voltage wiring and cabling, comply with requirements in Section 280526 "Grounding and Bonding for Electronic Safety and Security."
- 3.9 IDENTIFICATION
- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- 3.10 FIELD QUALITY CONTROL
- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
 - B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
 - C. Perform the following tests and inspections **with the assistance of a factory-authorized service representative**:
 1. Visually inspect UTP and optical-fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.

- a. Test instruments shall comply with or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Optical-Fiber Cable Tests:
- a. Test instruments shall comply with or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA-526-14-B, Method B, One Reference Jumper.
 - 2) Attenuation test results for links shall be less than 2.0 db. Attenuation test results shall be less than that calculated according to equation in TIA-568-C.1.
5. Coaxial-Cable Tests:
- a. Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements.
 - b. Replace malfunctioning or damaged items.
 - c. Retest until satisfactory performance and conditions are achieved.
 - d. Use an agile receiver and signal strength meter or spectrum analyzer for testing.
 - e. CCTV Sources: Connect receiver to the output of each CCTV signal source or the distribution amplifier associated with it.
 - f. Test Schedule: Schedule tests after pretesting has successfully been completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
 - g. Operational Tests: Perform tests of operational system to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
 - h. Distribution System Acceptance Tests:
 - 1) Field-Strength Instrument: Rated for minus 40-db mV measuring sensitivity and a frequency range of 54 to 812 MHz, minimum. Provide documentation of recent calibration against recognized standards.
 - 2) Signal Level and Picture Quality: Use a field-strength meter or spectrum analyzer, as well as a standard television receiver, to measure signal levels and check picture quality at [all] [25 percent of] <Insert number or percentage> user-interface outlets.
 - a) Test the signal strength in db mV at 55[, 151, 547,] and 750 MHz.
 - b) Minimum acceptable signal level is zero db mV (1000 mV).
 - c) Maximum acceptable signal level over the entire bandwidth is 15 db mV.
 - d) Television receiver shall show no evidence of cross-channel intermodulation, ghost images, or beat interference.
 - i. Signal-to-Noise-Ratio Test: Use a field-strength meter to make a sequence of measurements at the output of the last distribution amplifier or of another agreed-on location in system. With system operating at normal levels, tune meter to the picture carrier frequency of each of the designated channels in turn, and record the level. With signal removed and input to corresponding headend amplifier terminated at 75 ohms, measure the level of noise at same tuning settings. With meter correction factor added to last readings, differences from first set shall not be less than 45 db.
 - j. Qualitative and Quantitative Performance Tests: Demonstrate reception quality of color-television program transmissions at each user interface from each designated channel and source. Quality shall be equal or superior to that obtained with performance checks specified below, using a standard, commercial, cable-ready, color-television receiver. Level

and quality of signal at each outlet and from each service and source shall comply with the following Specifications when tested according to 47 604-12 76:

- 1) RF video-carrier level.
- 2) Relative video-carrier level.
- 3) Carrier-level stability, during 60-minute and 24-hour periods.
- 4) Broadband frequency response.
- 5) Channel frequency response.
- 6) Carrier-to-noise ratio.
- 7) RF visual signal-to-noise ratio.
- 8) Antenna combiner insertion loss.
- 9) Signal power splitter loss.
- 10) Cable connector attenuation.
- 11) Cross modulation.
- 12) Carrier-to-echo ratio.
- 13) Composite triple beat.
- 14) Second order beat.
- 15) Terminal isolation.
- 16) Terminal isolation between television and FM.
- 17) Hum modulation.
- 18) RF FM carrier level.
- 19) FM frequency response.
- 20) FM carrier-to-noise ratio.

- D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION

SECTION 28 05 26

GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Grounding conductors.
 - 2. Grounding connectors.
 - 3. Grounding busbars.

1.3 DEFINITIONS

- A. Signal Ground: The ground reference point designated by manufacturer of the system that is considered to have zero voltage.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. Harger Lightning & Grounding.
 - 3. Panduit Corp.
- B. Comply with UL 486A-486B.
- C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
 - 1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
- D. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, and 1/4 inch (6.3 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

- A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Burndy: Part of Hubbell Electrical Systems.
 2. Harger Lightning & Grounding.
 3. Panduit Corp.
- C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.
 1. Electroplated tinned copper, C and H shaped.
- D. Busbar Connectors: Cast silicon bronze, solderless **compression or exothermic**-type mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.
- E. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING BUSBARS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Chatsworth Products, Inc.
 2. Harger Lightning & Grounding.
 3. Panduit Corp.
- B. Grounding Busbars: Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 2 inches (6.3 by 50 mm) in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-A.
 1. Predrilling shall be with holes for use with lugs specified in this Section.
 2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch (50-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.)
 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600 V switchboards, impulse tested at 5000 V.
- C. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-A. Predrilling shall be with holes for use with lugs specified in this Section.
 1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
 2. Rack-Mounted Horizontal Busbar: Designed for mounting in 19- or 23-inch (483- or 584-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.

3. Rack-Mounted Vertical Busbar: 72 or 36 inches (1827 or 914 mm long, with)stainless-steel or copper-plated hardware for attachment to the rack.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."
 1. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
 2. Bond shields and drain conductors to ground at only one point in each circuit.
- B. Signal Ground:
 1. For each system, establish the signal ground and label that location as such.
 2. Bond the signal ground to the alternating-current (ac) power system service by connecting to one of the following listed locations, using insulated **No. 6 AWG**, stranded, Type THHN wire:
 - a. Grounding bar in an electrical power panelboard if located in the same room or space as the signal ground.
 - b. Telecommunications grounding busbar.
- C. Comply with NECA 1.

3.2 APPLICATION

- A. Conductors: Install solid conductor for **No. 8 AWG** and smaller and stranded conductors for **No. 6 AWG** and larger unless otherwise indicated.
- B. Grounding and Bonding Conductors:
 1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
 2. Install without splices.
 3. Support at not more than 36-inch (900-mm) intervals.

3.3 CONNECTIONS

- A. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- B. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
 1. Use crimping tool and the die specific to the connector.
 2. Pretwist the conductor.
 3. Apply an antioxidant compound to all bolted and compression connections.
- C. Shielded Cable: Bond the shield of shielded cable to the signal ground. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.
- D. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the

power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 28 05 28

PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetallic conduits, tubing, and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Nonmetallic wireways and auxiliary gutters.
6. Surface pathways.
7. Boxes, enclosures, and cabinets.
8. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
3. Section 270528 "Pathways for Communications Systems" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving communications systems.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
- C. Samples: For **wireway and surface pathways** and for each color and texture specified, 12 inches (300 mm) long.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of pathway groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For pathway racks, enclosures, cabinets, and equipment racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 3. Thomas & Betts Corporation; A Member of the ABB Group.
- B. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with TIA-569-B.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. PVC-Coated Steel Conduit: PVC-coated **IMC**.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- G. EMT: Comply with ANSI C80.3 and UL 797.
- H. FMC: Comply with UL 1; **zinc-coated steel**.
- I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

- J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: **Steel or die cast.**
 - b. Type: **compression.**
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 467, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- K. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems; a part of Atkore International.
 - 2. Allied Tube & Conduit; a part of Atkore International.
 - 3. Thomas & Betts Corporation; A Member of the ABB Group.
- B. General Requirements for Nonmetallic Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with TIA-569-B.
- C. ENT: Comply with NEMA TC 13 and UL 1653.
- D. RNC: **Type EPC-40-PVC**, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. LFNC: Comply with UL 1660.
- F. Rigid HDPE: Comply with UL 651A.
- G. Continuous HDPE: Comply with UL 651B.
- H. RTRC: Comply with UL 1684A and NEMA TC 14.
- I. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- J. Fittings for LFNC: Comply with UL 514B.
- K. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire.
 - 2. Arco Corporation.
 - 3. Endot Industries Inc.

- B. Description: Comply with UL 2024; flexible-type pathway, approved for [plenum] [riser] [or] [general-use] installation unless otherwise indicated.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. B-line, an Eaton business.
 2. Hoffman; a brand of Pentair Equipment Protection.
 3. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, **Type 3R** unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: **Flanged-and-gasketed type** unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allied Moulded Products, Inc.
 2. Hoffman; a brand of Pentair Equipment Protection.
 3. Lamson & Sessions.
- B. General Requirements for Nonmetallic Wireways and Auxiliary Gutters:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- F. Solvents and Adhesives: As recommended by conduit manufacturer.

2.6 SURFACE PATHWAYS

A. General Requirements for Surface Pathways:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. **Manufacturer's standard enamel finish in color selected by Architect.**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MonoSystems, Inc.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.

C. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from **custom** colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lamson & Sessions.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.

D. Tele-Power Poles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MonoSystems, Inc.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.
2. **Material: Galvanized steel with ivory baked-enamel finish.**
3. **Fittings and Accessories:** Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Crouse-Hinds, an Eaton business.
2. Hoffman; a brand of Pentair Equipment Protection.
3. Lamson & Sessions.

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, **ferrous alloy**, Type FD, with gasketed cover.

- E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- F. Metal Floor Boxes:
 - 1. Material: **Cast metal**.
 - 2. Type: **Fully adjustable**.
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Nonmetallic Floor Boxes: Nonadjustable, **rectangular**.
 - 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, **galvanized, cast iron** with gasketed cover.
- J. Device Box Dimensions: **4-inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep)**.
- K. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, **Type 3R** with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures:
 - a. Material: **Plastic**.
 - b. Finished inside with radio-frequency-resistant paint.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- M. Cabinets:
 - 1. NEMA 250, **Type 3R**, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING

- A. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. Comply with TIA-569-B.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Quazite: Hubbell Power Systems, Inc.
2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with **integral closed** bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "**ELECTRIC.**".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes **12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long)** and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.9 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed Conduit: **IMC**.
 2. Concealed Conduit, Aboveground: **EMT**.
 3. Underground Conduit: RNC, **Type EPC-40-PVC**.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): **LFMC**.
 5. Boxes and Enclosures, Aboveground: NEMA 250, **Type 3R** or **Type 4**.
- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: **EMT**.
 2. Exposed, Not Subject to Severe Physical Damage: **EMT**.
 3. Exposed and Subject to Severe Physical Damage: **IMC**. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums
 4. Concealed in Ceilings and Interior Walls and Partitions: **EMT**.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric-Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: **IMC**.
 7. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: **EMT**.
 8. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: **EMT**.
 9. Pathways for Concealed General Purpose Distribution of Optical-Fiber or Communications Cable: **EMT**.
 10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 **stainless steel** in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: [1/2-inch (16-mm)] [3/4-inch (21-mm)] trade size. Minimum size for optical-fiber cables is 1 inch (27 mm).
- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use **compression cast-metal** fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface pathways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds **120 deg F (49 deg C)**.

3.2 INSTALLATION

- A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications wiring conduits for which only two 90-degree bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- I. Pathways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
 3. Arrange pathways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 5. Change from ENT to **IMC** before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for pathways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to conduit assembly to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits of 2-inch (53-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- R. Surface Pathways:
1. Install surface pathway for surface electrical outlet boxes only where indicated on Drawings.
 2. Install surface pathway with a minimum 2-inch (50-mm) radius control at bend points.
 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- S. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch (21-mm) Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15 m).
 2. 1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- T. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

- U. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.

- V. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

- W. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC[**and EMT**] conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: **125 deg F (70 deg C)** temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: **155 deg F (86 deg C)** temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: **125 deg F (70 deg C)** temperature change.
 - d. Attics: **135 deg F (75 deg C)** temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.00078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

- X. Flexible Conduit Connections: Comply with NEMA RV 3. Use maximum of 72 inches (1830 mm) of flexible conduit for **recessed and semirecessed luminaires**, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

- Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to **bottom** of box unless otherwise indicated.

- Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

- AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

- DD. Set metal floor boxes level and flush with finished floor surface.
- EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, but a minimum of 6 inches (150 mm) below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes with bottom below frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

- F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 28 16 00

INTRUSION DETECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Intrusion detection with communication links to perform monitoring, alarm, and control functions.
2. Integration of other electronic and electrical systems and equipment.

B. Related Sections:

1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for cabling between master control units and field-mounted devices and control units.
2. Section 281643 "Perimeter Security Systems" for outdoor intrusion detection devices, including lighting and communications associated with chain-link fence gates.
3. Section 282300 "Video Surveillance" for CCTV cameras that are used as devices for video motion detection.

1.3 DEFINITIONS

- A. CCTV: Closed-circuit television.
- B. PIR: Passive infrared.
- C. RFI: Radio-frequency interference.
- D. UPS: Uninterruptible power supply.
- E. Control Unit: System component that monitors inputs and controls outputs through various circuits.
- F. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.
- G. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.
- H. Protected Zone: A protected premises or an area within a protected premises that is provided with means to prevent an unwanted event.
- I. Standard Intruder: A person who weighs 100 lb (45 kg) or less and whose height is 60 inches (1525 mm) or less; dressed in a long-sleeved shirt, slacks, and shoes **unless environmental conditions at the site require protective clothing.**

- J. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.
- K. Systems Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.
- L. Zone. A defined area within a protected premises. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

1.4 ACTION SUBMITTALS

- A. Product Data: Components for sensing, detecting, **systems integration**, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.
 - 1. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate methods used to achieve systems integration. Indicate control, signal, and data communication paths and identify **networks and** control interface devices and media to be used. Describe characteristics of network and other data communication lines.
 - a. Indicate methods used to achieve systems integration.
 - b. Indicate control, signal, and data communication paths and identify PLCs, networks, control interface devices, and media to be used.
 - c. Describe characteristics of network and other data communication lines.
 - d. Describe methods used to protect against power outages and transient voltages including types and ratings of isolation and surge suppression devices used in data, communication, signal, control, and ac and dc power circuits.
 - 2. Raceway Riser Diagrams: Detail raceway runs required for intrusion detection **and for systems integration**. Include designation of devices connected by raceway, raceway type and size, and type and size of wire and cable fill for each raceway run.
 - 3. UPS: Sizing calculations.
 - 4. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building. **Include room layout for master control-unit console, terminal cabinet, racks, and UPS.**
 - 5. Master Control-Unit Console Layout: Show required artwork and device identification.
 - 6. Device Address List: Coordinate with final system programming.
 - 7. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
 - 8. Details of surge-protection devices and their installation.
 - 9. Sensor detection patterns and adjustment ranges.
- C. Equipment and System Operation Description: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification: For each type of exposed finish required.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **intrusion detection systems integrator** and **testing agency**.
- B. Field quality-control reports.
- C. Warranty: Sample of special warranty.
- D. Other Information Submittals:
 - 1. Test Plan and Schedule: Test plan defining all tests required to ensure that system meets technical, operational, and performance specifications within **60 days** of date of Contract award.
 - 2. Examination reports documenting inspections of substrates, areas, and conditions.
 - 3. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For intrusion detection system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Data for each type of product, including features and operating sequences, both automatic and manual.
 - 2. Master control-unit hardware and software data.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Intrusion Detection Devices: Furnish quantity equal to **[five]** <Insert number> percent of the number of units of each type installed, but no fewer than one of each type.
 - 2. Fuses: **Three** of each kind and size.
 - 3. Tool Kit: Provide **six** sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.
 - 4. Security Fasteners: Furnish no fewer than **1 box for every 50** boxes or fraction thereof, of each type and size of security fastener installed.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. An employer of workers, at least one of whom is a technician certified by the National Burglar & Fire Alarm Association.
 - 2. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Intrusion Detection Systems Integrator Qualifications: An experienced intrusion detection equipment supplier **and Installer** who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Control Units, Devices, and Communications with Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.
- F. FM Global Compliance: FM-Approved and -labeled intrusion detection devices and equipment.
- G. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

- A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 1. Altitude: Sea level to **4000 feet (1220 m)**.
 2. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
 3. Interior, Controlled Environment: System components, except master control unit, installed in **air-conditioned** interior environments shall be rated for continuous operation in ambients of **36 to 122 deg F (2 to 50 deg C)** dry bulb and 20 to 90 percent relative humidity, noncondensing.
 4. Interior, Uncontrolled Environment: System components installed in **non-air-conditioned, non-temperature-controlled** interior environments shall be rated for continuous operation in ambients of **[0 to 122 deg F (minus 18 to plus 50 deg C)** dry bulb and 20 to 90 percent relative humidity, noncondensing.
 5. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambients of **minus 30 to plus 122 deg F (minus 34 to plus 50 deg C)** dry bulb and 20 to 90 percent relative humidity, condensing. Comply with UL 294 and UL 639 for outdoor-use equipment. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to **85 mph (137 km/h)**.
 6. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flying shall be rated, listed, and installed according to NFPA 70.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: **Two** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Description: **Multiplexed**, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.
- B. Supervision: System components shall be continuously monitored for normal, alarm, **supervisory**, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.
 1. Alarm Signal: Display at master control unit and actuate audible and visual alarm devices.

2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or control-unit failure.
 3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or control unit.
- C. System Control: Master control unit shall directly monitor intrusion detection units and connecting wiring.
- D. System Control: Master control unit shall directly monitor intrusion detection devices, **control units associated with perimeter detection units**, and connecting wiring in a multiplexed distributed control system or as part of a network.
- E. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.
- F. Operator Commands:
1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.
 2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
 3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
 4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
 5. Protected Zone Test: Initiate operational test of a specific protected zone.
 6. System Test: Initiate system-wide operational test.
 7. Print reports.
- G. Timed Control at Master Control Unit: Allow automatically timed "secure" and "access" functions of selected protected zones.
- H. Automatic Control of Related Systems: Alarm or supervisory signals from certain intrusion detection devices control the following functions in related systems:
1. Switch selected lights.
 2. Shift elevator control to a different mode.
 3. Open a signal path between certain intercommunication stations.
 4. Shift sound system to "listening mode" and open a signal path to certain system speakers.
 5. Switch signal to selected monitor from CCTV camera in vicinity of sensor signaling an alarm.
- I. Printed Record of Events: Print a record of alarm, supervisory, and trouble events on system printer. Sort and report by protected zone, device, and function. When master control unit receives a signal, print a report of alarm, supervisory, or trouble condition. Report type of signal (alarm, supervisory, or trouble), protected zone description, date, and time of occurrence. Differentiate alarm signals from other indications. When system is reset, report reset event with the same information concerning device, location, date, and time. Commands shall initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.
- J. Response Time: **Two** seconds between actuation of any alarm and its indication at master control unit.
- K. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from master control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at master control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.
- L. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.

- M. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

2.2 SYSTEM COMPONENT REQUIREMENTS

- A. Compatibility: Detection devices and their communication features, connecting wiring, and master control unit shall be selected and configured with accessories for full compatibility with the following equipment:
 - 1. Door hardware specified in Section 087100 "Door Hardware."
 - 2. Door hardware specified in Section 087111 "Door Hardware (Descriptive Specification)."
 - 3. Elevators specified in Section 142100 "Electric Traction Elevators."
 - 4. Elevators specified in Section 142400 "Hydraulic Elevators."
 - 5. Lighting controls specified in Section 260923 "Lighting Control Devices."
 - 6. Lighting controls specified in Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."
 - 7. Intercom and program systems specified in Section 275123 "Intercommunications and Program Systems."
 - 8. Public address and mass notification systems specified in Section 275116 "Public Address and Mass Notification Systems."
 - 9. Access control system specified in Section 281300 "Access Control."
 - 10. Fire alarm system specified in Section 283111 "Digital, Addressable Fire-Alarm System."
 - 11. Perimeter security system specified in Section 281643 "Perimeter Security Systems."
 - 12. Video surveillance system specified in Section 282300 "Video Surveillance."
- B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.
 - 1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
 - 2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Listed and labeled by a qualified testing agency for compliance with NFPA 731.
- C. Intrusion Detection Units: Listed and labeled by a qualified testing agency for compliance with UL 639.
- D. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V rms injected into power supply lines at 10 to 10,000 MHz.
- E. Tamper Protection: Tamper switches on detection devices, control units, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected. Master control-unit alarm display shall identify tamper alarms and indicate locations.
- F. Self-Testing Devices: Automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Devices transmit test failure to master control unit.
- G. Antimasking Devices: Automatically check operation continuously or at intervals of a minute or less, and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational dysfunction. Devices transmit detection of operational dysfunction to master control unit as an alarm signal.
- H. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to master control unit.
- I. Remote-Controlled Devices: Individually and remotely adjustable for sensitivity and individually monitored at master control unit for calibration, sensitivity, and alarm condition.

2.3 ENCLOSURES

- A. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping noncorrosive liquids.
- B. Interior Electronics: NEMA 250, Type 12.
- C. Exterior Electronics: NEMA 250, Type 4X, **stainless steel**.
- D. Corrosion Resistant: NEMA 250, Type 4X, **stainless steel**.
- E. Screw Covers: Where enclosures are readily accessible, secure with security fasteners of type appropriate for enclosure.

2.4 SECURE AND ACCESS DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Digital Security Controls Ltd.
 - 2. Edwards Signaling; UTC Fire & Security.
 - 3. Honeywell International Inc.
- B. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.
- C. Key-Operated Switch: Change protected zone between secure and access conditions.

2.5 DOOR AND WINDOW SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. GE Security, Inc.
 - 2. Honeywell International Inc.
 - 3. Honeywell Security Products- Americas.
- B. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral overcurrent device to limit current to 80 percent of switch capacity. Bias magnet and minimum of **[two]** **[three]** encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.
- C. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.
- D. Overhead Door Switch: Balanced-magnetic type, listed for outdoor locations, and having door-mounted magnet and floor-mounted switch unit.
- E. Remote Test: Simulate movement of actuating magnet from master control unit.

2.6 PIR SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Digital Security Controls Ltd.
 - 2. GE Security, Inc.
 - 3. Honeywell International Inc.
- B. Listed and labeled by a qualified testing agency for compliance with SIA PIR-01.

- C. Description: Sensors detect intrusion by monitoring infrared wavelengths emitted from a human body within their protected zone and by being insensitive to general thermal variations.
1. Wall-Mounted Unit Maximum Detection Range: 125 percent of indicated distance for individual units and not less than 50 feet (15 m). **Provide adjustable coverage pattern as indicated.**
 2. Ceiling-Mounted Unit Spot-Detection Pattern: Full 360-degree conical.
 3. Ceiling-Mounted Unit Pattern Size: 84-inch (2135-mm) diameter at floor level for units mounted 96 inches (2440 mm) above floor; 18-foot (5.5-m) diameter at floor level for units mounted 25 feet (7.6 m) above floor.
- D. Device Performance:
1. Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F (1 deg C) or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s) across two adjacent segments of detector's field of view.
 2. Test Indicator: LED test indicator that is not visible during normal operation. When visible, indicator shall light when sensor detects an intruder. Locate test enabling switch under sensor housing cover.
 3. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

2.7 MICROWAVE INTRUSION DETECTORS (INTERIOR)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Digital Security Controls Ltd.
 2. GE Security, Inc.
 3. Visonic Inc.
- B. Device Performance: Microwave transmitter establishes an electromagnetic field in an adjustable detection pattern and detects intrusion by monitoring changes in that pattern.
1. Sensitivity: Adjustable, able to detect standard-intruder movement within sensor's detection pattern at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s). Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.
 2. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test-enabling switch under sensor housing cover.
 3. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

2.8 ACOUSTIC-TYPE, GLASS-BREAK SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Digital Security Controls Ltd.
 2. GE Security, Inc.
 3. Honeywell International Inc.
- B. Listed and labeled by a qualified testing agency for compliance with SIA GB-01.
- C. Device Performance: Detect unique, airborne acoustic energy spectrum caused by breaking glass.
1. Sensor Element: Microprocessor-based, digital device to detect breakage of plate, laminate, tempered, and wired glass while rejecting common causes of false alarms. Detection pattern shall be at least a 20-foot (6-m) range.
 2. Hookup Cable: Factory installed, not less than 72 inches (1830 mm).
 3. Activation Indicator: LED on sensor housing that lights when responding to vibrations, remaining on until manually reset at sensor control unit[**or at master control unit**].

4. Control Unit: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.
5. Glass-Break Simulator: A device to induce frequencies into protected glass pane that simulate breaking glass without causing damage to glass.

2.9 PIEZOELECTRIC-TYPE, GLASS-BREAK SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [GE Security, Inc.](#)
2. [Honeywell International Inc.](#)
3. [Potter Electric Signal Company, LLC.](#)

B. Listed and labeled by a qualified testing agency for compliance with SIA GB-01.

C. Device Performance: Detect unique, high-frequency vibrations caused by breaking glass.

1. Sensor Element: Piezoelectric crystals in a housing designed to mount directly to glass surface with adhesive provided by element manufacturer. Circular detection pattern, with at least a 60-inch (1525-mm) radius on a continuous glass pane. Sensor element shall not be larger than 4 sq. in. (25.80 sq. cm).
2. Hookup Cable: Factory installed, not less than 72 inches (1830 mm).
3. Activation Indicator: LED on sensor housing that lights when responding to vibrations, remaining on until manually reset at sensor control unit[or at master control unit].
4. Control Unit: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.
5. Glass-Break Simulator: A device to induce frequencies into protected glass pane that simulate breaking glass without causing damage to glass.

2.10 VIBRATION SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [GE Security, Inc.](#)
2. [Honeywell International Inc.](#)
3. [Potter Electric Signal Company, LLC.](#)

B. Listed and labeled by a qualified testing agency for compliance with SIA GB-01.

C. Description: A sensor control unit and piezoelectric crystal sensor elements that are designed to be rigidly mounted to structure being protected.

D. Device Performance: Detects high-frequency vibrations generated by use of such tools as oxyacetylene torches, oxygen lances, high-speed drills and saws, and explosives that penetrate a structure while not responding to any other mechanical vibration.

1. Circular detection pattern, with at least a 72-inch (1830-mm) radius on protected structure.
2. Hookup Cable: Factory installed, not less than 72 inches (1830 mm).
3. Control Unit: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.
4. Glass-Break Simulator: A device to induce frequencies to protected glass pane that simulate breaking glass without causing damage to glass.

2.11 PHOTOELECTRIC SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [GE Security, Inc.](#)
2. [Honeywell International Inc.](#)
3. [Potter Electric Signal Company, LLC.](#)

B. Device Performance: Detect an interruption of a pulsed, infrared, light beam that links transmitter and receiver.

1. Sensitivity: Detect standard-intruder movement within sensor's detection patterns at any speed of less than 7.5 fps (2.3 m/s) through the beam. Allow installation of multiple sensors within same protected zone that will not interfere with each other.
2. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test enabling switch under sensor housing cover.
3. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

2.12 MICROWAVE-PIR DUAL-TECHNOLOGY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [Aleph America Corporation.](#)
2. [GE Security, Inc.](#)
3. [Honeywell International Inc.](#)

B. Description: Single unit combining a sensor that detects changes in microwave signals and a PIR sensor that detects changes in ambient level of infrared emissions caused by standard-intruder movement within detection pattern.

C. Listed and labeled by a qualified testing agency for compliance with SIA PIR-01.

D. Device Performance: An alarm is transmitted when either sensor detects a standard intruder within a period of three to eight seconds from when the other sensor detects a standard intruder.

1. Minimum Detection Pattern: A room 20 by 30 feet (6 by 9 m).
2. PIR Sensor Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F (1 deg C) or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s) across two adjacent segments of detector's field of view.
3. Microwave Sensor Sensitivity: Adjustable, able to detect standard-intruder movement within sensor's detection pattern at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s). Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.
4. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test enabling switch under sensor housing cover.
5. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

2.13 DURESS-ALARM SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [GE Security, Inc.](#)
2. [Honeywell International Inc.](#)
3. [Visonic Inc.](#)

B. Description: A switch with a shroud over the activating lever that allows an individual to covertly send a duress signal to master control unit, with no visible or audible indication when activated. Switch shall lock in activated position until reset with a key.

1. Minimum Switch Rating: 50,000 operations.

2. Foot Rail: Foot activated, floor mounting.
3. Push Button: Finger activated, suitable for mounting on horizontal or vertical surface.

2.14 VIDEO MOTION SENSORS (INTERIOR)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aleph America Corporation.
 2. GE Security, Inc.
 3. Visonic Inc.
- B. Device Performance: Detect changes in video signal within a user-defined protected zone. Provide an alarm output for each video input.
1. Detect movement within protected zone of standard intruders wearing clothing with a reflectivity that differs from that of background scene by a factor of 2. Reject all other changes in video signal.
 2. Modular design that allows for expansion or modification of number of inputs.
 3. Controls:
 - a. Number of detection zones.
 - b. Size of detection zones.
 - c. Sensitivity of detection of each protected zone.
 4. Mounting: Standard 19-inch (480-mm) rack as described in EIA/ECA 310-E.

2.15 MASTER CONTROL UNIT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Digital Security Controls Ltd.
 2. GE Security, Inc.
 3. Honeywell Security Products- Americas.
- B. Description: Supervise sensors and detection subsystems and their connecting communication links, status control (secure or access) of sensors and detector subsystems, activation of alarms and supervisory and trouble signals, and other indicated functions.
1. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 2. Include a real-time clock for time annotation of events on the event recorder and printer.
 3. Addressable initiation devices that communicate device identity and status.
 4. Control circuits for operation of mechanical equipment in response to an alarm.
- C. Construction: **Freestanding equipment rack**, modular, with separate and independent alarm and supervisory system modules. **Alarm-initiating protected zone boards shall be plug-in cards.** Arrangements that require removal of field wiring for module replacement are unacceptable.
- D. Comply with **UL 609.**
- E. Console Controls and Displays: Arranged for interface between human operator at master control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: LCD, **three** line(s) of **80** characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

3. Control-Unit Network: Automatic communication of alarm, status changes, commands, and other communications required for system operation. Communication shall return to normal after partial or total network interruption such as power loss or transient event. Total or partial signaling network failures shall identify the failure and record the failure at the annunciator display and at the system printer.
 4. Field Device Network: Communicate between the control unit and field devices of the system. Communications shall consist of alarm, network status, and status and control of field-mounted processors. Each field-mounted device shall be interrogated during each interrogation cycle.
 5. Operator Controls: Manual switches and push-to-test buttons that do not require a key to operate. Prevent resetting of alarm, supervisory, or trouble signals while alarm or trouble condition persists. Include the following:
 - a. Acknowledge alarm.
 - b. Silence alarm.
 - c. System reset.
 - d. LED test.
 6. Timing Unit: Solid state, programmable, 365 days.
 7. Confirmation: Relays, contactors, and other control devices shall have auxiliary contacts that provide confirmation signals to system for their on or off status. Software shall interpret such signals, display equipment status, and initiate failure signals.
 8. Alarm Indication: Audible signal sounds and an LED lights at master control unit identifying the **addressable detector** originating the alarm. **Annunciator panel displays a common alarm light and sounds an audible tone.**
 9. Alarm Indication: Audible signal sounds and a plain-language identification of the **addressable detector** originating the alarm appears on LED display at master control unit. **Annunciator panel displays a common alarm light and sounds an audible tone.**
 10. Alarm Indication: Audible signal sounds and a plain-language identification of the **addressable detector** originating the alarm appears on LED display at master control unit. **Annunciator panel alarm light and audible tone identify protected zone signaling an alarm.**
 11. Alarm activation sounds a **bell or siren and strobe.**
- F. Protected Zones: Quantity of alarm and supervisory zones as indicated, with capacity for expanding number of protected zones by a minimum of 25 percent.
- G. Power Supply Circuits: Master control units shall provide power for remote power-consuming detection devices. Circuit capacity shall be adequate for at least a [25] <Insert number> percent increase in load.
- H. UPS: Comply with Section 263353 "Static Uninterruptible Power Supply." UPS shall be sized to provide a minimum of six hours of master control-unit operation.
- I. Cabinet: Lockable, steel enclosure arranged so operations required for testing, normal operation, and maintenance are performed from front of enclosure. If more than a single cabinet is required to form a complete control unit, provide exactly matching modular enclosures. Accommodate all components and allow ample gutter space for field wiring. Identify each enclosure by an engraved, laminated, phenolic-resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch (25 mm) high. Identify, with permanent labels, individual components and modules within cabinets.
- J. Transmission to Monitoring Station: A communications device to automatically transmit alarm, supervisory, and trouble signals to the monitoring station, operating over a standard voice grade telephone leased line. Comply with UL 1635.
- K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

2.16 AUDIBLE AND VISUAL ALARM DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Edwards Signaling; UTC Fire & Security.
 2. Honeywell International Inc.
 3. Wheelock; a brand of Eaton.
- B. Bell: 10 inches (254 mm) in diameter, rated to produce a minimum sound output of 84 dB at 10 feet (3 m) from master control unit.
1. Enclosure: Weather-resistant steel box equipped with tamper switches on cover and on back of box.
- C. Klaxon Weatherproof Motor-Driven Hooter: UL listed, rated to produce a minimum sound output of 120 dB at 3 feet (1 m), plus or minus 3 dB, at a frequency of 470 Hz. Rated for intermittent use: two minutes on and five minutes off.
1. Designed for use in industrial areas and in high-noise, severe-weather marine environments.
- D. Siren: 30-W speaker with siren driver, rated to produce a minimum sound output of 103 dB at 10 feet (3 m) from master control unit.
1. Enclosure: Weather-resistant steel box with tamper switches on cover and on back of box.
- E. Strobe: Xenon light complying with UL 1638, with a clear polycarbonate lens.
1. Light Output: 115 cd, minimum.
 2. Flash Rate: 60 per minute.

2.17 SECURITY FASTENERS

- A. Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive system type, head style, material, and protective coating as required for assembly, installation, and strength.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Acument Global Technologies; Acument Intellectual Properties, LLC.
 2. Safety Socket LLC.
 3. Tamper-Pruf Screws.
- C. Drive System Types: **pinned hex (Allen).**
- D. Socket Flat Countersunk Head Fasteners:
1. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 2. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
- E. Socket Button Head Fasteners:
1. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 2. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
- F. Socket Head Cap Fasteners:
1. Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
 2. Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.

- G. Protective Coatings for Heat-Treated Alloy Steel:
 - 1. Zinc chromate, ASTM F 1135, Grade 3 or Grade 4, for exterior applications and interior applications where indicated.
 - 2. Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of intrusion detection.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before intrusion detection installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of intrusion detection.
- D. Inspect built-in and cast-in anchor installations, before installing intrusion detection, to verify that anchor installations comply with requirements. Prepare inspection reports.
 - 1. Remove and replace anchors where inspections indicate that they do not comply with requirements. Reinspect after repairs or replacements are made.
 - 2. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.
- E. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SYSTEM INTEGRATION

- A. Integrate intrusion detection system with the following systems and equipment:
 - 1. Electronic door hardware.
 - 2. Elevators.
 - 3. Network lighting controls.
 - 4. Intercommunications and program systems.
 - 5. Public address and mass notification systems.
 - 6. Access control.
 - 7. Fire-alarm system.
 - 8. Perimeter security system.
 - 9. Video surveillance.
 - 10. **<Insert applicable systems and equipment>**.

3.3 SYSTEM INSTALLATION

- A. Comply with UL 681 and NFPA 731.
- B. Equipment Mounting: Install master control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Connecting to Existing Equipment: Verify that existing perimeter security system is operational before making changes or connections.
1. Connect new equipment to existing control panel in existing part of the building.
 2. Connect new equipment to existing monitoring equipment at the Supervising Station.
 3. Expand, modify, and supplement existing [control] [monitoring] equipment as necessary to extend existing [control] [monitoring] functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- E. Security Fasteners: Where accessible to inmates, install intrusion detection components using security fasteners with head style appropriate for fabrication requirements, strength, and finish of adjacent materials except that a maximum of two different sets of tools shall be required to operate security fasteners for Project. **Provide stainless-steel security fasteners in stainless-steel materials.**
- 3.4 WIRING INSTALLATION
- A. Wiring Method: Install wiring in metal raceways according to Section 260533 "Raceways and Boxes for Electrical Systems." Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
- B. Wiring Method: Install wiring in metal raceways according to Section 260533 "Raceways and Boxes for Electrical Systems," except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
- C. Wiring Method: Cable, concealed in accessible ceilings, walls, and floors when possible.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Wires and Cables:
1. Conductors: Size as recommended in writing by system manufacturer unless otherwise indicated.
 2. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
 3. Control and Signal Transmission Conductors: Install unshielded, twisted-pair cable unless otherwise indicated or if manufacturer recommends shielded cable, according to Section 280513 "Conductors and Cables for Electronic Safety and Security."
 4. Data and Television Signal Transmission Cables: Install according to Section 280513 "Conductors and Cables for Electronic Safety and Security."
- F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

- G. Install power supplies and other auxiliary components for detection devices at control units unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.
- H. Identify components with engraved, laminated-plastic or metal nameplate for master control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with identification requirements in Section 260553 "Identification for Electrical Systems."
- B. Install instructions frame in a location visible from master control unit.

3.6 GROUNDING

- A. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.
- B. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- C. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.
- D. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Section 280526 "Grounding and Bonding for Electronic Safety and Security."

3.7 FIELD QUALITY CONTROL

- A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
 - 1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.
- B. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- E. Tests and Inspections: Comply with provisions in NFPA 731, Ch. 9, "Testing and Inspections."
 - 1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

2. Test Methods: Intrusion detection systems and other systems and equipment that are associated with detection and accessory equipment shall be tested according to Table "Test Methods" and Table "Test Methods of Initiating Devices."

F. Documentation: Comply with provisions in NFPA 731, Ch. 4, "Documentation."

G. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **three** visits to Project during other-than-normal occupancy hours for this purpose. **Visits for this purpose shall be in addition to any required by warranty.**

3.9 DEMONSTRATION

A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain the intrusion detection system. Comply with documentation provisions in NFPA 731, Ch. 4, "Documentation and User Training."

END OF SECTION

SECTION 28 16 43

PERIMETER SECURITY SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Perimeter detection and alarm system.
2. Integration of other electronic and electrical systems and equipment.

B. Related Sections:

1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for cabling between master control units and field-mounted devices and control units.
2. Section 281600 "Intrusion Detection" for indoor-type intrusion detection devices.
3. Section 282300 "Video Surveillance" for CCTV cameras that are used as devices for video motion detection.

1.3 DEFINITIONS

- A. CCTV: Closed-circuit television.
- B. EMI: Electromagnetic interference.
- C. PIR: Passive infrared.
- D. RFI: Radio-frequency interference.
- E. UPS: Uninterruptible power supply.
- F. Control Unit: System component that monitors inputs and controls outputs through various circuits.
- G. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.
- H. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.
- I. Protected Zone: A protected premises or an area within a protected premise that is provided with means to prevent an unwanted event.

- J. Standard Intruder: A person who weighs 100 lb (45 kg) or less and whose height is 60 inches (1525 mm) or less; dressed in a long-sleeved shirt, slacks, and shoes **unless environmental conditions at the site require protective clothing**.
- K. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.
- L. Systems Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.
- M. Zone. A defined area within a protected premise. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

1.4 ACTION SUBMITTALS

- A. Product Data: Components for sensing, detecting, **systems integration**, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.
 - 1. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate methods used to achieve systems integration. Indicate control, signal, and data communication paths and identify **networks and** control interface devices and media to be used. Describe characteristics of network and other data communication lines.
 - a. Indicate methods used to achieve systems integration.
 - b. Indicate control, signal, and data communication paths and identify PLCs, networks, control interface devices, and media to be used.
 - c. Describe characteristics of network and other data communication lines.
 - d. Describe methods used to protect against power outages and transient voltages including types and ratings of isolation and surge suppression devices used in data, communication, signal, control, and ac and dc power circuits.
 - 2. Raceway Riser Diagrams: Detail raceway runs required for perimeter security **and for systems integration**. Include designation of devices connected by raceway, raceway type and size, and type and size of wire and cable fill for each raceway run.
 - 3. UPS: Sizing calculations.
 - 4. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building. **Include room layout for master control-unit console, terminal cabinet, racks, and UPS.**
 - 5. Master Control-Unit Console Layout: Show required artwork and device identification.
 - 6. Device Address List: Coordinate with final system programming.
 - 7. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
 - 8. Details of transient voltage surge protection.
 - 9. Sensor detection patterns and adjustment ranges.
- C. Equipment and System Operation Description: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.
- D. Samples for Initial Selection: For units with factory-applied color finishes.

- E. Samples for Verification: For each type of exposed finish required.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **security systems integrator & testing agency**.
- B. Field quality-control reports.
- C. Warranty: Sample of special warranty.
- D. Other Information Submittals:
 - 1. Test Plan and Schedule: Test plan defining all tests required to ensure that system meets technical, operational, and performance specifications within **60 days** of date of Contract award.
 - 2. Examination reports documenting inspections of substrates, areas, and conditions.
 - 3. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For perimeter security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Data for each type of product, including features and operating sequences, both automatic and manual.
 - 2. Master control-unit hardware and software data.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. **One** spare control-unit board(s) for strain-sensitive cable system and **one** cable repair and splice kit(s).
 - 2. **One** of each type of microwave sensor and one of each type of power supply for microwave perimeter security system.
 - 3. **On** of each spare sensor and PIR unit and **one** alignment telescope(s) for long-range PIR system.
 - 4. **One** spare control-unit board(s) for electrostatic-field system.
 - 5. **One** spare control-unit board(s) for buried, ported coaxial cable system, 10 feet (3 m) of cable; and **one** cable repair and splice kit(s).
 - 6. Fuses: **Three** of each kind and size.
 - 7. Tool Kit: Provide **six** sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.
 - 8. Security Fasteners: Furnish no fewer than **1 box for every 50** boxes or fraction thereof, of each type and size of security fastener installed.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. An employer of workers, at least one of whom is a technician certified by the National Burglar & Fire Alarm Association.
 - 2. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

- B. Security Systems Integrator Qualifications: An experienced perimeter security equipment supplier **and Installer** who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Control Units, Devices, and Communications to Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.
- F. FM Global Compliance: FM-Approved and -labeled perimeter security devices and equipment.
- G. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

- A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. Altitude: Sea level to **4000 feet (1220 m)**.
 - 2. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
 - 3. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambients of **minus 30 to plus 122 deg F (minus 34 to plus 50 deg C)** dry bulb and 20 to 90 percent relative humidity, condensing. Comply with UL 294 and UL 639 for outdoor-use equipment. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to **85 mph (137 km/h)**.
 - 4. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings shall be rated, listed, and installed according to NFPA 70.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of perimeter security devices and equipment that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **Two** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Description: Perimeter protection system with **fence-mounted system** integrated into a single perimeter detection and alarm system.
- B. Supervision: System components shall be continuously monitored for normal, alarm, **supervisory**, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.

1. Alarm Signal: Display at master control unit and actuate audible and visual alarm devices.
 2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or control-unit failure.
 3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or control unit.
- C. System Control: Master control unit shall directly monitor gate detection devices, perimeter detection units, and connecting wiring.
- D. System Control: One or more remote, addressable control units operate under control of a master control-unit microcomputer in a multiplexed distributed control system or as part of a network. Control units shall receive programming by multiplexed signal transmission from the associated master control unit and hold data in nonvolatile memory. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.
- E. Operator Commands:
1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.
 2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
 3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
 4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
 5. Protected Zone Test: Initiate operational test of a specific protected zone.
 6. System Test: Initiate system-wide operational test.
 7. Print reports.
- F. Timed Control at Master Control Unit: Allow automatically timed "secure" and "access" functions of selected protected zones.
- G. Automatic Control of Related Systems: Alarm or supervisory signals from certain perimeter security devices control the following functions in related systems:
1. Switch selected lights.
 2. Open a signal path between certain intercommunication stations.
 3. Shift sound system to "listening mode" and open a signal path to certain system speakers.
 4. Switch signal to selected monitor from CCTV camera in vicinity of sensor signaling an alarm.
- H. Printed Record of Events: Print a record of alarm, supervisory, and trouble events on system printer. Sort and report by protected zone, device, and function. When master control unit receives a signal, print a report of alarm, supervisory, or trouble condition. Report type of signal (alarm, supervisory, or trouble), control-unit address, protected zone description, date, and time of occurrence. Differentiate alarm signals from other indications. When system is reset, report reset event with the same information concerning device, location, date, and time. Commands shall initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.
- I. Response Time: **Two** seconds between actuation of any alarm and its indication at master control unit.
- J. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, control units, and sensors from master control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at master control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.
- K. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times.

Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.

- L. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

2.2 SYSTEM COMPONENT REQUIREMENTS

- A. Compatibility: Detection devices and their communication features, connecting wiring, and master control unit shall be selected and configured with accessories for full compatibility with the following equipment:

1. Door hardware specified in Section 087100 "Door Hardware."
2. Door hardware specified in Section 087111 "Door Hardware (Descriptive Specification)."
3. Lighting controls specified in Section 260923 "Lighting Control Devices."
4. Lighting controls specified in Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."
5. Intercommunications and program systems specified in Section 275123 "Intercommunications and Program Systems."
6. Public address and mass notification systems specified in Section 275116 "Public Address and Mass Notification Systems."
7. Access control system specified in Section 281300 "Access Control."
8. Intrusion detection system specified in Section 281600 "Intrusion Detection."
9. Video surveillance system specified in Section 282300 "Video Surveillance."
10. <Insert system or equipment> specified in Section <Insert Section number> "<Insert Section title>."

- B. Perimeter Security Units: Listed and labeled by a qualified testing agency for compliance with UL 639.

- C. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Listed and labeled by a qualified testing agency for compliance with NFPA 731.

- D. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V rms injected into power supply lines at 10 to 10,000 MHz.

- E. Tamper Protection: Tamper switches on detection devices, control units, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected. Master control-unit alarm display shall identify tamper alarms and indicate locations.

- F. Self-Testing Devices: Automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Devices transmit test failure to master control unit.

- G. Antimasking Devices: Automatically check operation continuously or at intervals of a minute or less, and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational dysfunction. Devices transmit detection of operational dysfunction to master control unit as an alarm signal.

- H. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to master control unit.

- I. Remote-Controlled Devices: Individually and remotely adjustable for sensitivity and individually monitored at master control unit for calibration, sensitivity, and alarm condition.

2.3 ENCLOSURES

- A. Interior Electronics: NEMA 250, Type 12.
- B. Exterior Electronics: NEMA 250, Type 4X, **stainless steel**.
- C. Corrosion Resistant: NEMA 250, Type 4X, **stainless steel**.
- D. Terminal cabinets in handholes and manholes shall be NEMA 250, [Type 6] [Type 6P].
- E. Screw Covers: Where enclosures are readily accessible, secure with security fasteners of type appropriate for enclosure.

2.4 SECURE AND ACCESS DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Digital Security Controls Ltd.
 - 2. Edwards Signaling; UTC Fire & Security.
 - 3. Honeywell International Inc.
- B. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.
- C. Key-Operated Switch: Change protected zone between secure and access conditions.

2.5 STRAIN-SENSITIVE CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Integrated Security Corporation.
 - 2. Safeguards Technology.
 - 3. Southwest Microwave, Inc.
- B. Description: Fence-mounted strain-sensitive, coaxial transducer cable shall monitor chain-link-type and welded-mesh-type fence and generate an alarm when a standard intruder attempts to climb over, cut through, or lift fence fabric.
- C. Environment: Suitable for exterior installation and the following conditions:
 - 1. Ambient Temperatures: Ranging from minus 22 to plus 158 deg F (minus 30 to plus 70 deg C).
- D. Transducer Cable:
 - 1. UV-resistant cable furnished by system manufacturer.
 - 2. Suitable for up to 1000 feet (300 m) of sensor cable per single-zone control unit and up to 2000 feet (600 m) of sensor cable per dual-zone processor.
 - 3. Sensitivity shall be uniform throughout its entire length, requiring only one variable sensitivity adjustment throughout its entire length.
- E. Control Unit:
 - 1. Field mounted, with tamper switch at control-unit board.
 - 2. Electronic circuitry shall discriminate between acceptable fence movement and intrusion-related disturbances.
 - 3. Sensitivity, count control, and climb-over processors shall be adjustable with a minimum of five individual count-control and climb-over adjustments.

4. Control-unit output shall have adjustable pulse width to adjust the time the alarm relay will activate per detected intrusion attempt.

F. System Performance:

1. Immune to RFI and EMI environments; interference shall have no effect on normal operational characteristics.
2. Trouble and Tamper: Entire sensor system shall be fully supervised with individually monitored tamper and supervision alarms. Disconnecting, cutting, or shorting of strain-sensitive cable results in supervisory alarm.
3. Intrusion Simulation: Each zone shall have a self-test feature that, when activated by a signal from master control unit will produce an intrusion alarm and verify operation of sensor.

2.6 MICROWAVE INTRUSION DETECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Honeywell International Inc.
2. Integrated Security Corporation.
3. Southwest Microwave, Inc.

B. Description: Volumetric microwave detection system.

C. Device Performance: Microwave transmitter establishes an electromagnetic field in an adjustable detection pattern and detects intrusion by monitoring changes in that pattern.

1. Movement Sensitivity: Adjustable, able to detect standard-intruder movement within sensor's detection pattern at any speed between 0.1 to 50 fps (0.03 to 15.2 m/s). Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.
2. Detection Range: 15 to 600 feet (5 to 180 m).
3. Range Sensitivity: Adjustable for setting area of protection between 15 to 500 feet (5 to 152 m) in range and from 2 to 40 feet (0.6 to 12 m) in beam diameter.
4. Trouble and Tamper: Fully supervised with individually monitored tamper and supervision alarms. System failure shall result in tamper alarm. System jamming or wrong modulation shall result in supervisory alarm.
5. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test-enabling switch under sensor housing cover.
6. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

D. Environment: Suitable for exterior installation and the following conditions:

1. Ambient Temperatures: Ranging from minus 30 to plus 158 deg F (minus 34 to plus 70 deg C) and in rainfall up to 4 inches (100 mm).

2.7 ELECTROSTATIC FIELD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Integrated Security Corporation.
2. Safeguards Technology.
3. Southwest Microwave, Inc.

B. Description: Fence-mounted, **independently mounted**, above-ground, electrostatic-field detection system, consisting of electronically balanced phase electrostatic-field detection system with a field generator that generates an electrical field in one or more field wires and that has two or more sensing

wires, a sense filter, amplifier, and a control unit. Detection fields shall have a minimum of four different frequencies so adjacent zones cannot interfere with each other.

C. Environment: Suitable for exterior installation and the following conditions:

1. Ambient Temperatures: Ranging from minus 22 to plus 158 deg F (minus 30 to plus 70 deg C).

D. System Performance:

1. Detect, via sense wires, a compound signal form consisting of amplitude change, rate of change, and preset time disturbance that forms a "signature" of human movement. Generate an alarm when all exist simultaneously. Provide detection fields of no fewer than four different frequencies so adjacent zones do not interfere with each other.
2. Control Units: Single or multiple zone, with sense filter. Front panel with calibration meter, status of alarm transmitter, sensitivity selector, test point selector, power indicator, and power control. Control unit shall reject signals due to wind and small objects striking the wires.
3. Motion Detection: Sense standard-intruder movement at rates from 0.15 to 26 fps (0.045 to 8.0 m/s).
4. Zone Length: Not to exceed 325 feet (100 m).
5. Supervision: Generate trouble signal if field or sense wires are cut or shorted to ground or to each other. Generate supervisory alarm if received signal is substantially reduced.

E. Insulators, Wire-Tensioning Devices, and Brackets: Manufacturer's standard for mounting and tensioning of wires.

F. Field and Sensing Wires: Stainless steel.

2.8 BURIED, PORTED COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Magal-Senstar, Inc.
2. Safeguards Technology.
3. Southwest Microwave, Inc.

B. Description: Buried electrostatic-field detection system consisting of parallel, ported coaxial cables that generate a detection field between cables.

C. Environment: Suitable for exterior installation and the following conditions:

1. Ambient Temperatures: Ranging from minus 22 to plus 158 deg F (minus 30 to plus 70 deg C).

D. System Performance: One of two parallel cables receives a continuous wave signal from a transmitter module. Second cable, connected to a sensor module, detects, preamplifies, and analyzes variations in signal. When system senses "signature" of a standard intruder in the detection zone, based on mass, motion, and time of day, it generates an alarm.

1. Transmitter: Locate at one end of zone, with standby battery.
2. Preamplifier-Sensor: Locate at opposite end from transmitter, with standby battery.
3. Front panel with sensitivity calibration meter, calibrated self-test potentiometer, power switch, and LED normal and malfunction indicators.
4. Electromagnetic Radiation: Less than 50 mV per meter at 30 m.
5. Motion Detection: Sense standard-intruder movement at rates from 0.17 to 26 fps (0.05 to 8.0 m/s).
6. Zone Length: Not to exceed 325 feet (100 m).
7. Zone Width: Not to exceed 15 feet (4.6 m), with an average width of 12 feet (3.7 m).
8. Zone Height: Approximately 3.3 feet (1.0 m), depending on sensitivity setting.
9. Supervision: Generate trouble signal if cable is cut or shorted to ground. Generate supervisory alarm if cabinets are tampered with.

- E. Enclosures: Hinged cover with tamper switch and security fasteners.
- F. Buried, Ported Coaxial Cable: Approximately 1/2-inch (1.3-mm) diameter, minimum 10 AWG center conductor, foam polyethylene dielectric, braided copper outer conductor, and polyethylene jacket.

2.9 LONG-RANGE PIR DETECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Honeywell International Inc.
 - 2. Integrated Security Corporation.
 - 3. Southwest Microwave, Inc.
- B. Description: Volumetric passive infrared detection system.
- C. Listed and labeled by a qualified testing agency for compliance with SIA PIR-01.
- D. Environment: Suitable for exterior installation and the following conditions:
 - 1. Ambient Temperatures: Ranging from minus 30 to plus 150 deg F (minus 34 to plus 65 deg C).
- E. System Performance: Detect an interruption of dual-infrared light beams that link transmitters and receivers. Generate an alarm when signal is interrupted due to presence of an object that interrupts both beams.
 - 1. Sensitivity: Field adjustable to allow adjustment of range from 25 to 500 feet (7.6 to 152 m), generating an alarm within 20 to 50 ms when both beams are interrupted.
 - 2. Detection system shall adjust automatically to compensate for weather, including fog, rain, snow, blowing dust, and rapid temperature changes.
 - 3. Motion Detection: Detect standard-intruder movement at rates from 0.1 to 50 fps (0.03 to 15.2 m/s).
 - 4. Supervision: Generate supervisory alarm if any portion of system is tampered with.
 - 5. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

2.10 GEOPHONE FENCE DETECTION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Honeywell International Inc.
 - 2. Safeguards Technology.
 - 3. Southwest Microwave, Inc.
- B. Description: Fence-mounted system to detect attempts to cut or climb the protected fence, using geophone sensors that respond to specific shock or vibrations.
- C. Environment: Suitable for exterior installation and the following conditions:
 - 1. Ambient Temperatures: Ranging from minus 30 to plus 150 deg F (minus 34 to plus 65 deg C).
- D. System Performance:
 - 1. Control Unit: **10** zone capacity for processing geophone generated analog signals. Each zone shall consist of not more than **10** sensors.
 - a. Adjustments: For each zone, provide stepped gain control for sensitivity and switches for geophone signal filters to minimize nuisance alarms. System shall adjust automatically to

compensate for weather, including fog, rain, snow, blowing dust, and rapid temperature changes.

- b. Trouble Condition Signal: Generate when any zone fails.
 - c. Supervisory Condition Signal: Generate on interference with control-unit operation or when detecting a break-in into an enclosure housing electronics.
- 2. Sensors: Fence mounted **20 feet (6 m)** o.c.
 - 3. Cable for Interconnection of System Components: Shielded, PVC jacketed and armored, as supplied by system manufacturer.
 - 4. Test each zone simulating an alarm condition. Test by **command from master control**.

2.11 VIDEO MOTION SENSOR

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Bosch Security Systems, Inc.
 - 2. Honeywell International Inc.
 - 3. Magal-Senstar, Inc.
- B. Description: Video-surveillance-based detection system.
- C. Device Performance: Detect changes in video signal within a user-defined protected zone. Provide an alarm output for each video input.
 - 1. Detect movement within protected zone of standard intruders wearing clothing with a reflectivity that differs from that of background scene by a factor of 2. Reject all other changes in video signal.
 - 2. Modular design that allows for expansion or modification of number of inputs.
 - 3. Adjustable Controls:
 - a. Number of detection zones.
 - b. Size of detection zones.
 - c. Sensitivity of detection of each protected zone.
 - 4. Mounting: Standard 19-inch (480-mm) rack as described in EIA/ECA 310-E.
- D. Environment: Suitable for installation in interior air-conditioned spaces.

2.12 GATE UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aleph America Corporation.
 - 2. Honeywell Security Products- Americas.
 - 3. Safeguards Technology.
- B. Description: Fence-mounted gate-movement detectors, balanced-magnetic type, and UL listed for outdoor locations. Units shall be designed for mounting on single- or double-leaf swinging or rolling gates and have armored jumper cables between switch and stationary junction box for wiring to master control unit and tamper switches in junction box.
- C. Device Performance: Bias magnet and at least three encapsulated-reed switches that resist compromise from introduction of foreign magnetic fields, with integral overcurrent protective device to limit current to 80 percent of switch capacity.
- D. Remote Test: Simulate movement of actuating magnet from master control unit.

2.13 FIELD-MOUNTED CONTROL UNITS

- A. Field-mounted control units shall include the power supply and detector specific functions, and provide for communications with the master control unit. Control unit shall include read-only resident software needed for startup, a time clock, and all automatic operations. Software shall be downloaded from the master control unit.
- B. Battery Backup: UPS, providing **six** hours of run time during a power outage, with two-rate automatic battery charger to fully recharge batteries within **12** hours after normal power is restored.
 - 1. Batteries: Rechargeable, valve-regulated, recombinant, sealed, lead-acid type with nominal 10-year life expectancy.
 - 2. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Charger shall recharge fully discharged battery within 24 hours.
- C. Annunciation: Indicate a change in system condition and switching of system or component to backup power.

2.14 MASTER CONTROL UNIT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. GE Security, Inc.
 - 2. Honeywell Security Products- Americas.
 - 3. Southwest Microwave, Inc.
- B. Description: Supervise sensors and detection subsystems and their connecting communication links, status control (secure or access) of sensors and detector subsystems, activation of alarms and supervisory and trouble signals, and other indicated functions.
 - 1. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - 2. Include a real-time clock for time annotation of events on the event recorder and printer.
 - 3. Addressable initiation devices that communicate device identity and status.
 - 4. Control circuits for operation of mechanical equipment in response to an alarm.
- C. Construction: **Freestanding equipment rack**, modular, with separate and independent alarm and supervisory system modules. **Alarm-initiating protected zone boards shall be plug-in cards**. Arrangements that require removal of field wiring for module replacement are unacceptable.
- D. Comply with **UL 609**.
- E. Console Controls and Displays: Arranged for interface between human operator at master control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 - 1. Annunciator and Display: LCD type, **three** line(s) of **80** characters, minimum.
 - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands
 - 3. Control-Unit Network: Automatic communication of alarm, status changes, commands, and other communications required for system operation. Communication shall return to normal after partial or total network interruption such as power loss or transient event. Total or partial signaling network failures shall identify the failure and record the failure at the annunciator display and at the system printer.
 - 4. Field Device Network: Communicate between the control unit and field devices of the system. Communications shall consist of alarm, network status, and status and control of field-mounted processors. Each field-mounted device shall be interrogated during each interrogation cycle.

5. Operator Controls: Manual switches and push-to-test buttons that do not require a key to operate. Prevent resetting of alarm, supervisory, or trouble signals while alarm or trouble condition persists. Include the following:
 - a. Acknowledge alarm.
 - b. Silence alarm.
 - c. System reset.
 - d. LED test.
 6. Timing Unit: Solid state, programmable, 365 days.
 7. Confirmation: Relays, contactors, and other control devices shall have auxiliary contacts that provide confirmation signals to system for their on or off status. Software shall interpret such signals, display equipment status, and initiate failure signals.
 8. Alarm Indication: An audible signal sounds and an LED lights at master control unit identifying the **addressable detector** originating the alarm. **Annunciator panel displays a common alarm light and sounds an audible tone.**
 9. Alarm Indication: An audible signal sounds and a plain-language identification of the **addressable detector** originating the alarm appears on LED display at master control unit. **Annunciator panel displays a common alarm light and sounds an audible tone.**
 10. Alarm Indication: An audible signal sounds and a plain-language identification of the **addressable detector** originating the alarm appears on LED display at master control unit. **Annunciator panel alarm light and audible tone identify protected zone signaling an alarm.**
 11. Alarm activation sounds a **bell or siren and strobe.**
- F. Protected Zones: Quantity of alarm and supervisory zones as indicated, with capacity for expanding number of protected zones by a minimum of **25** percent.
- G. Power Supply Circuits: Master control units shall provide power for remote power-consuming detection devices. Circuit capacity shall be adequate for at least a **25** percent increase in load.
- H. UPS: Comply with Section 263353 "Static Uninterruptible Power Supply." UPS shall be sized to provide a minimum of six hours of master control-unit operation.
- I. Cabinet: Lockable, steel enclosure arranged so operations required for testing, normal operation, and maintenance are performed from front of enclosure. If more than a single cabinet is required to form a complete control unit, provide exactly matching modular enclosures. Accommodate all components and allow ample gutter space for field wiring. Identify each enclosure by an engraved, laminated, phenolic-resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch (25 mm) high. Identify, with permanent labels, individual components and modules within cabinets.
- J. Transmission to Monitoring Station: A communications device to automatically transmit alarm, supervisory, and trouble signals to the monitoring station, operating over a standard voice grade telephone leased line. Comply with UL 1635.
- K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

2.15 AUDIBLE AND VISUAL ALARM DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Edwards Signaling; UTC Fire & Security.
 2. Honeywell International Inc.
 3. Wheelock; a brand of Eaton.

- B. Bell: 10 inches (254 mm) in diameter, rated to produce a minimum sound output of 84 dB at 10 feet (3 m) from master control unit.
 - 1. Enclosure: Weather-resistant steel box equipped with tamper switches on cover and on back of box.
- C. Klaxon Weatherproof Motor-Driven Hooter: UL listed, rated to produce a minimum sound output of 120 dB at 3 feet (1 m), plus or minus 3 dB, at a frequency of 470 Hz. Rated for intermittent use: two minutes on, five minutes off.
 - 1. Designed for use in industrial areas and in high-noise, severe-weather marine environments.
- D. Siren: 30-W speaker with siren driver, rated to produce a minimum sound output of 103 dB at 10 feet (3 m) from master control unit.
 - 1. Enclosure: Weather-resistant steel box with tamper switches on cover and on back of box.
- E. Strobe: Xenon light complying with UL 1638, with a clear polycarbonate lens.
 - 1. Light Output: 115 cd, minimum.
 - 2. Flash Rate: 60 per minute.

2.16 SECURITY FASTENERS

- A. Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive system type, head style, material, and protective coating as required for assembly, installation, and strength.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acument Global Technologies; Acument Intellectual Properties, LLC.
 - 2. Safety Socket LLC.
 - 3. Tamper-Pruf Screws.
- C. Drive System Types: **pinned hex (Allen)**.
- D. Socket Flat Countersunk Head Fasteners:
 - 1. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - 2. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
- E. Socket Button Head Fasteners:
 - 1. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - 2. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
- F. Socket Head Cap Fasteners:
 - 1. Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
 - 2. Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.
- G. Protective Coatings for Heat-Treated Alloy Steel:
 - 1. Zinc chromate, ASTM F 1135, Grade 3 or Grade 4, for exterior applications and interior applications where indicated.
 - 2. Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.

2.17 SOURCE QUALITY CONTROL

- A. **Electrostatic-Field and Buried, Ported Coaxial Cable** Systems Electronics: Precondition at factory by subjecting modules to at least four days' operational burn-in at temperatures not less than 140 deg F (60 deg C).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of perimeter security.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations of perimeter security connections before perimeter security installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of perimeter security.
- D. Inspect built-in and cast-in anchor installations, before installing perimeter security, to verify that anchor installations comply with requirements. Prepare inspection reports.
 - 1. Remove and replace anchors where inspections indicate that they do not comply with requirements. Reinspect after repairs or replacements are made.
 - 2. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.
- E. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SYSTEMS INTEGRATION

- A. Integrate perimeter security system with the following systems and equipment:
 - 1. Electronic door hardware.
 - 2. Elevators.
 - 3. Network lighting controls.
 - 4. Intercommunications and program systems.
 - 5. Public address and mass notification systems.
 - 6. Access control.
 - 7. Fire-alarm system.
 - 8. Intrusion detection system.
 - 9. Video surveillance.

3.3 SYSTEM INSTALLATION

- A. Comply with UL 681 and NFPA 731.
- B. Equipment Mounting: Install master control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."

- C. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Connecting to Existing Equipment: Verify that existing perimeter security system is operational before making changes or connections.
1. Connect new equipment to existing control panel in existing part of the building.
 2. Connect new equipment to existing monitoring equipment at the Supervising Station.
- E. Security Fasteners: Where accessible to public, install perimeter security components using security fasteners with head style appropriate for fabrication requirements, strength, and finish of adjacent materials except that a maximum of two different sets of tools shall be required to operate security fasteners for Project. **Provide stainless-steel security fasteners in stainless-steel materials.**
- F. Wiring Method: Install power, signal, and data transmission wire and cable in metal raceways according to Section 260543 "Underground Ducts and Raceways for Electrical Systems" and Section 260533 "Raceways and Boxes for Electrical Systems." Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
- G. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with perimeter security system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- H. Wires and Cables:
1. Conductors: Size as recommended in writing by system manufacturer unless otherwise indicated.
 2. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
 3. Cable for Low-Voltage Control and Signal Circuits: Install unshielded, twisted-pair cable unless otherwise indicated or if manufacturer recommends shielded cable, according to Section 280513 "Conductors and Cables for Electronic Safety and Security."
 4. Data and Television Signal Transmission Cables: Install according to Section 280513 "Conductors and Cables for Electronic Safety and Security."
- I. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- J. Install power supplies and other auxiliary components for detection devices at control units unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.
- K. Stain-Sensitive Transducer Cable: Attached to fence at 12-inch (300-mm) intervals with tie wraps.
- L. Electrostatic-Field System: Install field and sense wires on insulators and standoffs on a fence, wall, or roof. Provide intermediate supports recommended in writing by manufacturer as needed for specified performance.
- M. Buried, Ported Coaxial Cable: Transmitters may be located at one end of parallel coaxial cables, and preamplifier-sensor module may be located at opposite end. Install cable so shield is uniform throughout the length, without twisting or distorting cable during installation. Field-cut cables to exact zone length at the site. To attach data transmission cable to sensing cable, use heat-shrink splice kits approved by manufacturer. Provide sufficient overlap of detector cables to eliminate the possibility of entry between zones.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with identification requirements in Section 260553 "Identification for Electrical Systems."
- B. Install instructions frame in a location visible from master control unit.

3.5 GROUNDING

- A. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.
- B. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- C. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.
- D. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Section 280526 "Grounding and Bonding for Electronic Safety and Security."

3.6 FIELD QUALITY CONTROL

- A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
 - 1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.
- B. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- E. Tests and Inspections: Comply with provisions in NFPA 731, Ch. 9, "Testing and Inspections."
 - 1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
 - 2. Test Methods: Perimeter security systems and other systems and equipment that are associated with detection and accessory equipment shall be tested according to Table "Test Methods" and Table "Test Methods of Initiating Devices."
 - 3. Geophone System Tests: Test each zone at a minimum of two different locations. Test each zone as follows:
 - a. Horizontal Movement: Adjust sensitivity to screen out alarms from wind.
 - b. Vertical Climb: 100 percent detection required. Set count at three occurrences within 90-second window.

- c. Cut Test: 100 percent detection required. Set count at two occurrences within 120-second window.
 - d. Set sensitivity to value as low as possible, consistent with reliable detection.
 - e. If performance tests fail, make adjustments to sensors to comply with requirements. Retest failing and adjacent zones to comply with test.
- 4. Strain-Sensitive Cable System Tests: Adjust sensitivity and count control to value as low as possible, consistent with reliable detection.
 - 5. Microwave Perimeter Security System Tests: Adjust sensitivity to value as low as possible, consistent with reliable detection.
 - 6. Long-Range PIR System Tests: Adjust sensitivity and hold time between activity duration to value as low as possible, consistent with reliable detection.
- F. Documentation: Comply with provisions in NFPA 731, Ch. 4, "Documentation."
- G. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to Project during other than normal occupancy hours for this purpose. **Visits for this purpose shall be in addition to any required by warranty.**

3.8 DEMONSTRATION

- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain the perimeter security system. Comply with documentation provisions in NFPA 731, Ch. 4, "Documentation and User Training."

END OF SECTION

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SECTION 06 10 00

ROUGH CARPENTRY

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Floor, wall sheathing.
- B. Wood furring, backing and grounds.
- C. Preservative treatment of wood.

1.2 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations Title 24, Part 2.
- B. ANSI/AF & PA NDS-12 - National Design Specifications for Wood Construction.
- C. MS MIL-L-19140 - Fire Retardant Wood Preservative Chemicals.
- D. National Bureau of Standards - Product Standard PS-1-09 for Construction and Industrial Plywood.
- E. WCLIB - West Coast Lumber Inspection Bureau: Standard Grading Rules for West Coast Lumber.
- F. WWPA - Western Wood Products Association.

1.3 QUALITY ASSURANCE

- A. Lumber Grading Agency: Certified by ALSC.
- B. Plywood Grading Agency: Certified by APA.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 23.
- B. Allowable stress design values shall be in compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 2306, ANSI/AF & PA NDS-12 - National Design Specifications for Wood Construction, and ANSI/SDPWS - Special Design Provisions for Wind and Seismic.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect products under provisions of Section 01 61 00.
- B. Deliver materials free from pest infestation. Protect materials on site to prevent termite, beetle or other wood boring insect attacks.
- C. Stack lumber flat, off grade, with spacers between each bundle to promote air circulation. Provide for air circulation around and under coverings.

2. PART 2 PRODUCTS

2.1 LUMBER MATERIALS

- A. Lumber Grading Rules: WCLIB and WWPA. Lumber shall bear WCLIB grade stamp.
- B. Non-structural Light Framing Studs, Plate and Blocking: Douglas Fir species, construction grade.
- C. Plank and Decking: Douglas Fir species, Com Dex.

2.2 MOISTURE CONTENT

- A. 2x and 3x material, 19 percent moisture content, S-Dry. Structural and non structural framing, beam, rafters, joists, studs, plates and blocking.
- B. 4x and 6x material, 19 percent moisture content at time of application of Architectural finishes. 22 percent maximum moisture content at time of delivery to project site. Materials to be air dried as required to achieve 22 percent moisture content prior to delivery to site. Structural and non structural framing, beam, rafters, joists, studs, plates and blocking.
- C. Lumber materials with a moisture content above 19 percent and less than 22 percent at the time of installation shall be tested for moisture content prior to covering with Architectural finishes. Moisture tests shall be performed under the provisions of Section 01 45 29.
- D. No lumber shall be covered with an Architectural finish until the moisture content of the lumber is 19 percent or below.

2.3 PLYWOOD MATERIALS

- A. Floor Sheathing: APA Structural I, Grade C-D, Exterior grade. Minimum 5-ply construction, meeting Product Standard PS-1-09.
- B. Telephone and Electrical Panel Boards: APA Grade C-D with exterior glue, minimum 5 ply, 3/4 inch thick, meeting PS-1-09.

2.4 ACCESSORIES

- A. Fasteners: Hot-dipped galvanized steel for exterior, high humidity, and treated wood locations; plain finish elsewhere; size and type to suit condition.
- B. Connectors: As indicated.

2.5 WOOD TREATMENT

- A. Preservative Treatment: Where lumber or plywood is indicated as treated or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood).
- B. Pressure treat all lumber in contact with ground. After treatment kiln-dry lumber to a maximum moisture content of 19 percent.
- C. Pressure treat above ground items as indicated. After treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated items and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
 - 2. Horizontal wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.
 - 3. Horizontal wood framing members less than 18 inches above grade.
 - 4. Wood floor plates installed over concrete slabs directly in contact with earth.
- D. Complete fabrication of treated items prior to treatment, where possible. If cut or drilled after treatment, coat cut or drilled surfaces with heavy brush coat of same chemical used for treatment and to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.6 FIRE RETARDANT TREATMENT

- A. Fire retardant wood to have a flame spread of less than 25 when tested in an extended 30-minute tunnel test according to ASTM E84.

- B. Dimensional lumber to be kiln dried to a maximum moisture content of 19 percent after treatment.
- C. Plywood to be kiln dried to a maximum moisture content of 15 percent after treatment.
- D. Fire retardant wood to comply with AWPA Standard C20 for lumber and C27 for plywood.
- E. Fire retardant chemicals to comply with FR-1 of AWPA Standard P-17 and shall be free of halogens, sulfates and ammonium phosphate.
- F. Carbon steel, galvanized steel, aluminum, copper, and red brass in contact with fire retardant wood shall exhibit corrosion rates less than one mil per year when tested in accordance with FS MIL-L-19140, Paragraph 4.6.5.2.
- G. Fire retardant chemicals must be registered for use as a wood preservative buy the U.S. Environmental Protection Agency.

3. PART 3 EXECUTION

3.1 FRAMING

- A. Erect wood framing members level and plumb.
- B. Place horizontal members laid flat, crown side-up.
- C. Construct framing members full length without splices.
- D. Double members at openings over 1 sq ft. Space short studs over and under opening to stud spacing.
- E. Construct double joist headers at floor and ceiling openings. Frame rigidly into joists.
- F. Construct double joists under wall studding.
- G. Bridge joists in excess of 8 feet span at mid-span members. Fit solid blocking at ends of members.

3.2 FURRING, BLOCKING AND GROUNDS

- A. Provide wherever shown and where required for attachment of other work. Coordinate with work of other sections.
- B. Item locations include but are not limited to toilet accessories, toilet partitions, door frames, window frames, hardware, access doors and ladders, cabinetry, miscellaneous equipment locations and mechanical, plumbing and electrical item locations and all other locations of wall mounted items.
- C. Install plywood backboards for telephone, data and other electrical equipment.
- D. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- E. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.
- F. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- G. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finished work.
- H. Firestop all concealed spaces of wood stud walls, ceilings and floor levels at 10 foot intervals both vertically and horizontally.
- I. Firestop all concealed vertical and horizontal spaces as occur at soffits, vents, stair stringers, pipes and similar openings in compliance with CBC, (CCR) Title 24, Part 2, Section 717.

- J. Firestopping shall consist of closely fitted wood blocks of 2 inch nominal thickness lumber of same width as framing members.

3.3 TOLERANCES

- A. Framing Members: 1/4 inch maximum from true position.
- B. Surface Flatness of Floor: 1/4 inch in 10 feet maximum.

END OF SECTION

SECTION 08 14 00

WOOD DOORS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Flush faced wood doors fire rated and non-rated.
- B. Door louvers.

1.2 REFERENCES

- A. ANSI/WDMA - Wood Door Manufacturers Association I.S. 1-A-04-Architectural Wood Flush Doors.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- C. NFPA 80 - Fire Doors and Windows.
- D. NWWDA I.S.1 - Industry Standard For Wood Flush Doors (Includes Standards I.S.1.1 through I.S.1.7).
- E. FSC - Forest Stewardship Council.
- F. UL 10C - Fire Tests of Door Assemblies.
- G. WI - Woodwork Institute: Architectural Woodwork Standards.

1.3 QUALITY ASSURANCE

- A. Conform to requirements of The WI Architectural Woodwork Standards, Section 9 Custom Grade except where otherwise indicated.
- B. All wood doors and the installation of wood doors shall be monitored for compliance under the scope of the WI Certified Compliance Program (CCP).
- C. Issue a WI Certified Compliance Certificate prior to delivery of doors certifying that doors meet all requirements of WI Grade specified.
- D. After completion issue a WI Certified Compliance Certificate for Installation..

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC - California Building Code, for fire rated doors and Transom Panels.
- B. Fire Door and Transom Panel Construction: Conform to UL 10C, Category A.
- C. Installed Doors and Transom Panels: Conform to NFPA 80 for fire rated class indicated.

1.5 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00. Shop drawings shall bear the WI Certified Compliance Label on the first page of each set.
- B. Indicate door elevations, stile and rail reinforcement, internal blocking for hardware attachment, and cutouts for glazing and louvers.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 12 x 12 inch in size illustrating each species and finish.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Protect products under provisions of Section 01 61 00.
- B. Package, deliver, and store doors in accordance with WI requirements as set forth in Section 2 and Appendix B of The Architectural Woodwork Standards.

1.7 WARRANTY

- A. Provide manufacturer's standard lifetime warranty for interior doors under provisions of Section 01 77 00 for solid core doors.
- B. Provide 1 year manufacturer's warranty under provisions of Section 01 77 00 for Stile and Rail Doors.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS, FLUSH FACED DOORS

- A. Algoma Hardwoods, www.algomahardwoods.com.
- B. Door America-American Building Supply, Inc., www.dooramerican.com.
- C. Eggers Industries, www.eggersindustries.com.
- D. Haley Architectural Doors, www.haleybros.com.
- E. Oshkosh Door Co., www.oshkoshdoor.com.
- F. Marshfield Door Systems, Inc., www.marshfielddoors.com.
- G. V.T. Industries, www.vtindustries.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.2 ACCEPTABLE MANUFACTURERS, STILE AND RAIL DOORS

- A. Door America-American Building Supply, Inc., www.dooramerican.com.
- B. Eggers Industries, www.eggersindustries.com.
- C. Pinecrest, www.pinecrestinc.com.
- D. Simpson Door Co., www.simpsondoor.com.
- E. Sun-Dor-Co., www.sundorco.com.
- F. The Maiman Co., www.maiman.com.
- G. Marshfield Door Systems, Inc., www.marshfielddoors.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.3 DOOR AND TRANSOM PANEL CONSTRUCTION

- A. Lumber Materials: FSC - Forest Stewardship Council certified sustainable harvested wood.
- B. Solid Non-rated Core: Solid wood block, framed block glued, or solid particleboard.
- C. Hollow Core: NWWDA I.S.1; mesh or cellular core including lock blocks, vertical edge bands, and top and bottom rails.

- D. Solid, Special Function Core: Labeled fire performance type, UL 10C, Category A. Intumescent seals concealed by outer stile in matching veneer.
- E. Construction: WI, Custom grade, ANSI/WDMA extra heavy duty, 5 ply, manufactured as an edge bonded, sanded core assembly, laminated in a one-step, hot pressed operation. Cold-press method is not acceptable.
- F. Flush Interior Door Veneer: White Birch species; plain sliced with book matched grain, for transparent stain finish. Satin sheen. Medium density overlay face veneer for opaque paint finish. Factory finish. Color as selected.
- G. Flush Exterior Door Veneer: Medium density overlay face veneer for opaque paint finish. Site finish.

2.4 ADHESIVES

- A. Exterior Doors: WI Type I.
- B. Interior Doors: WI Type I.

2.5 ACCESSORIES

- A. Louvers: Roll formed 20 gage galvanized steel; factory primed; inverted 'Y' blade; sightproof.
- B. Glass Stops: Rolled metal to conform to UL requirements.

2.6 FABRICATION

- A. Fabricate non-rated wood doors to requirements of The WI Architectural Woodwork Standards, Section 9, in the WI Grade specified.
- B. Fabricate fire rated doors per manufacturer's standard construction, and labeling agency requirements.
- C. Premachine doors for finish hardware.
- D. For fire rated doors with mineral cores, provide solid wood blocks for hardware reinforcement at lock edge and at top of door for closer.
- E. For fire rated doors with mineral cores, provide solid wood blocking for thru-bolted hardware.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install doors in accordance with The WI Architectural Woodwork Standards Section 9 and Appendix B.
- B. Conform to WI and NFPA requirements for fit tolerances.
- C. Coordinate installation of glass and glazing.
- D. Install door louvers.
- E. Adjust doors for smooth and balanced movements.
- F. Install fire doors in accordance with NFPA 80.

3.2 INSTALLATION TOLERANCES

- A. Edge clearance for swinging doors shall not exceed the following as required by WI and NFPA 80:
 - 1. Between door and frame at head and jamb 1/8 inch
 - 2. Between edge of pair of doors 1/8 inch

- | | | |
|----|--|----------|
| 3. | Diagonal distortion | 1/8 inch |
| 4. | At door sill with threshold. (From bottom of door to top of threshold) | 3/8 inch |
| 5. | At door sill with no threshold | 1/2 inch |
| 6. | At door bottom and rigid floor covering per NFPA 80 | 1/2 inch |
| 7. | At door bottom and nominal floor covering per NFPA 80 | 5/8 inch |

END OF SECTION

SECTION 09 30 16

QUARRY TILE FLOOR FINISHING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Quarry tile floor finish using the thinset application method.
- B. Quarry tile base.

1.2 REFERENCES

- A. ANSI/TCA A108.6 - Ceramic Tile Installed with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.
- B. ANSI/TCA A118.1 - Dry-Set Portland Cement Mortar.
- C. ANSI/TCA A118.3 - Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.
- D. ANSI/TCA A118.4 - Latex-Portland Cement Mortar.
- E. ANSI/TCA A118.12 - Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
- F. ANSI/TCA A137.1 - Specifications for Ceramic Tile.
- G. ASTM A185 - Welded Steel Wire Fabric.
- H. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

- A. Submit samples under provisions of Section 01 33 00.
- B. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- C. Submit manufacturer's certificate under provisions of Section 01 33 00 that products meet or exceed ANSI/TCA A137.1.
- D. Submit maintenance data under provisions of Section 01 77 00.
- E. Include recommended cleaning and stain removal methods, cleaning materials.

1.4 QUALITY ASSURANCE

- A. Conform to ANSI/TCA A137.1 for tile materials.
- B. Conform to ANSI/TCA A137.1 DCOF AcuTest for coefficient of friction.
- C. Conform to ANSI/TCA Standards and TCA Handbook for tile installation.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum five years documented experience.
- B. Installer: Company specializing in applying the work of this Section with minimum five years documented experience.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain 50 degrees F during installation of mortar materials.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS - TILE

- A. American Olean Tile Co., Inc., www.aotile.com.
B. DSA (Buchtal), www.dsa-ceramics.com.
C. Dal-Tile Corp., www.daltile.com.
D. Florida Tile Industries, Inc., www.floridatile.com.
E. Interceramic, www.interceramic.com.
F. Metropolitan Ceramics, www.metroceramics.com.
G. Shaw Commercial, www.shawinc.com.
H. Summitville Tile, Inc., www.summitville.com.
I. Substitutions: Under provisions of Section 01 25 13.

2.2 TILE MATERIALS

- A. Quarry Tile: ANSI/TCA A137.1, conforming to the following:

Table with 2 columns: Property and Requirement. Rows include Manufacturer and Pattern, Moisture Absorption, Size, Edge, Surface Finish, Color, and Coefficient of Friction.

- B. Base: Match quarry tile for moisture absorption, surface finish, and color, conforming to the following:

Table with 2 columns: Property and Requirement. Rows include Length, Height, Top Edge, and Internal Corner.

2.3 MANUFACTURERS - MORTAR AND GROUT

- A. American Olean Tile Co., Inc., www.aotile.com.
B. C-Cure, www.c-cure.com.
C. Custom Building Products, www.custombuildingproducts.com.
D. Dal-Tile Corp., www.doltile.com.
E. H.B. Fuller Co., www.hbfuller.com.

- F. Hydromet, www.bostikfindley-usa.com.
- G. Laticrete International, Inc., www.laticrete.com.
- H. MAPEI, www.mapei.com.
- I. W.R. Bonsal Company, www.bonsal.com.
- J. Substitutions: Under provisions of Section 01 25 13.

2.4 MORTAR MATERIALS

- A. Chemical Resistant Epoxy Mortar for Bond Coat: ANSI/TCA A118.3, water cleanable. Material shall have a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and shall meet South Coast Air Quality Management District (SCAQMD) Rule 1168.

2.5 GROUT MATERIALS

- A. Grout: Chemical resistant type, consisting of epoxy resin and hardener, conforming to ANSI/TCA A118.3 of color selected. Material shall have a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and shall meet South Coast Air Quality Management District (SCAQMD) Rule 1168.

2.6 ACCESSORIES

- A. Thin Load Bearing Direct Bond Membrane: Chlorinated polyethylene elastomer sheet material laminated with fabric on both sides meeting requirements of ANSI A118.12.
 - 1. Dal-Tile Corp., Dal Seal TS, www.daltile.com.
 - 2. Compotite Corp., Composeal Gold, www.compotite.com.
 - 3. NAC Products, Inc., ECB Membrane, www.nac-anti-fracture.com.
 - 4. Noble Company, Noble Seal TS, www.noblecompany.com.
 - 5. Pasco Manufacturing, Inc., Baseline, www.pascoespecialty.com.
 - 6. Substitutions: Under provisions of Section 01 25 13.
- B. Reinforcing Mesh: ASTM A185, 2 x 2 inch size, of WO.3/WO.3 wire size; welded fabric, galvanized.
- C. Sealant: Type specified in Section 07 92 00.

2.7 MORTAR MIX AND GROUT MIX

- A. Mix and proportion pre-mix setting bed, bond coat and grout materials in accordance with manufacturer's instructions and referenced standards.

2.8 SEALER

- A. Tile and Grout Sealer: Aqua Mix Penetrating Sealer manufactured by Aqua Mix, Inc., www.aquamix.com.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means installer accepts condition of existing surfaces.

3.2 PREPARATION

- A. Protect surrounding work from damage or disfiguration.
- B. Vacuum clean existing surfaces and damp clean.
- C. Seal substrate surface cracks with filler.

3.3 INSTALLATION THINSET METHOD

- A. Install mortar, tile and grout in accordance with ANSI/TCA 108.6 and applicable tile installation standards of the TCA Handbook.
- B. Apply bond coat.
- C. Install thin load bearing direct bond membrane with bond coat.
- D. Lay tile to pattern indicated on drawings, or if not indicated, request tile pattern from Architect. Do not interrupt tile pattern through openings.
- E. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align floor, base, and wall joints.
- F. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Provide control joints, vertical and horizontal at not-to-exceed 20'-0" oc. Keep control joints free of mortar or grout. Install joints in accordance with TCA Handbook. Apply sealant to joints.
- I. Allow tile to set for a minimum of 48 hours prior to grouting.
- J. Grout tile joints.
- K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.4 CLEANING

- A. Clean work under provisions of Section 01 77 00.
- B. Clean tile surfaces.

3.5 SEALING

- A. Install sealer in accordance with manufacturer's recommendations.

3.6 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Do not permit traffic over finished floor surface for a minimum of 48 hours. After 48 hours and until 72 hours, cover area with 3/8 inch plywood panels if traffic required.

END OF SECTION

SECTION 27 05 26

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Grounding conductors.
 - 2. Grounding connectors.
 - 3. Grounding busbars.
 - 4. Grounding rods.
 - 5. Grounding labeling.

1.3 DEFINITIONS

- A. BCT: Bonding conductor for telecommunications.
- B. EMT: Electrical metallic tubing.
- C. TGB: Telecommunications grounding busbar.
- D. TMGB: Telecommunications main grounding busbar.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. Shop Drawings: For communications equipment room signal reference grid. Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:
 - 1. Ground rods.
 - 2. Ground and roof rings.
 - 3. BCT, TMGB, TGBs, and routing of their bonding conductors.
- B. Qualification Data: For installation supervisor, and field inspector.

- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Result of the ground-resistance test, measured at the point of BCT connection.
 - b. Result of the bonding-resistance test at each TGB and its nearest grounding electrode.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Installation Supervision: Installation shall be under the direct supervision of ITS **Installer 2**, who shall be present at all times when Work of this Section is performed at Project site.
 - 2. Field Inspector: Currently registered by BICSI as a **registered communications distribution designer** to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

- A. Comply with J-STD-607-A.

2.2 CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Harger Lightning & Grounding.
 - 2. Panduit Corp.
 - 3. TE Connectivity Ltd.
- B. Comply with UL 486A-486B.
- C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
 - 1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
- D. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.

4. Bonding Cable: 28 kcmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, and 1/4 inch (6.3 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Burndy; Part of Hubbell Electrical Systems.
 2. Harger Lightning & Grounding.
 3. Panduit Corp.
- B. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
- C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.
1. Electroplated tinned copper, C and H shaped.
- D. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.
- E. Busbar Connectors: Cast silicon bronze, solderless **compression**-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.
- F. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING BUSBARS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Chatsworth Products, Inc.
 2. Harger Lightning & Grounding.
 3. Panduit Corp.
- B. TMGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as TMGB and shall comply with J-STD-607-A.
1. Predrilling shall be with holes for use with lugs specified in this Section.
 2. Mounting Hardware: Stand-off brackets that provide a 4-inch (100-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- C. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-A. Predrilling shall be with holes for use with lugs specified in this Section.
1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.

2. Rack-Mounted Horizontal Busbar: Designed for mounting in 19- or 23-inch (483- or 584-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
3. Rack-Mounted Vertical Busbar: 72 or 36 inches (1827 or 914 mm) long, with stainless-steel or copper-plated hardware for attachment to the rack.

2.5 GROUND RODS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Harger Lightning & Grounding.
 2. TE Connectivity Ltd.
- B. Ground Rods: [**Copper-clad**] [**Zinc-coated**] [**Stainless-**] steel[, **sectional type**]; [3/4 inch by 10 feet (19 mm by 3 m)] [5/8 by 96 inches (16 by 2400 mm)] in diameter.

2.6 LABELING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Brother International Corporation.
 2. HellermannTyton.
 3. Panduit Corp.
- B. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.
- B. Inspect the test results of the ac grounding system measured at the point of BCT connection.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.
- B. Comply with NECA 1.

- C. Comply with J-STD-607-A.

3.3 APPLICATION

- A. Conductors: Install solid conductor for [No. 8] <Insert number> AWG and smaller and stranded conductors for [No. 6] <Insert number> AWG and larger unless otherwise indicated.
 - 1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than [No. 6] <Insert number> AWG.
 - 2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than [No. 6] <Insert number> AWG.
- B. Underground Grounding Conductors: Install bare copper conductor, **No. 3/0**AWG minimum.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.
- D. Conductor Support:
 - 1. Secure grounding and bonding conductors at intervals of not less than 36 inches (900 mm).
- E. Grounding and Bonding Conductors:
 - 1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
 - 2. Install without splices.
 - 3. Support at not more than 36-inch (900-mm) intervals.
 - 4. Install grounding and bonding conductors in 3/4-inch (21-mm) PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.
 - a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 270528 "Pathways for Communications Systems," and bond both ends of the conduit to a TGB.

3.4 GROUNDING ELECTRODE SYSTEM

- A. The BCT between the TMGB and the ac service equipment ground shall not be smaller than **No. 3/0** AWG.

3.5 GROUNDING BUSBARS

- A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 12 inches (300 mm) above finished floor unless otherwise indicated.
- B. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

3.6 CONNECTIONS

- A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than **No. 6 AWG**.
- B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
 - 1. Use crimping tool and the die specific to the connector.
 - 2. Pretwist the conductor.
 - 3. Apply an antioxidant compound to all bolted and compression connections.
- D. Primary Protector: Bond to the TMGB with insulated bonding conductor.
- E. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot (1 sq. mm/linear meter) of conductor length, up to a maximum size of No. 3/0 AWG [**168 kcmils (85 sq. mm)**] unless otherwise indicated.
- F. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install **vertically mounted** rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.
- G. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.
- H. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each TGB to the ground bar of the panelboard.
- I. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.
- J. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.
- K. Access Floors: Bond all metal parts of access floors to the TGB.
- L. Equipment Room Signal Reference Grid: Provide a low-impedance path between telecommunications cabinets, equipment racks, and the reference grid, using **No. 6 AWG** bonding conductors.
 - 1. Install the conductors in grid pattern on 4-foot (1200-mm) centers, allowing bonding of one pedestal from each access floor tile.
 - 2. Bond the TGB of the equipment room to the reference grid at two or more locations.
 - 3. Bond all conduits and piping entering the equipment room to the TGB at the perimeter of the room.

3.7 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.
- B. Comply with IEEE C2 grounding requirements.

- C. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) extends above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

- D.
- E. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect grounding conductors to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

3.8 IDENTIFICATION

- A. Labels shall be preprinted or computer-printed type.
 - 1. Label TMGB(s) with "fs-TMGB," where "fs" is the telecommunications space identifier for the space containing the TMGB.
 - 2. Label TGB(s) with "fs-TGB," where "fs" is the telecommunications space identifier for the space containing the TGB.
 - 3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.
 - a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.
 - 3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
 - a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB. Maximum acceptable ac current level is 1 A.
- D. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.
- E. Grounding system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION

SECTION 27 05 28

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Nonmetallic wireways and auxiliary gutters.
6. Surface pathways.
7. Boxes, enclosures, and cabinets.
8. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
3. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.3 DEFINITIONS

ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
- C. Samples: For **wireways, nonmetallic wireways, and surface pathways** and for each color and texture specified, 12 inches (300 mm) long.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of pathway groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For pathway racks, enclosures, cabinets, equipment racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 2. Southwire Company.
 - 3. Thomas & Betts Corporation; A Member of the ABB Group.
- B. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with TIA-569-B.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. PVC-Coated Steel Conduit: PVC-coated [**rigid steel conduit**] [**IMC**].
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- G. EMT: Comply with ANSI C80.3 and UL 797.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.

2. Fittings for EMT:
 - a. Material: **die cast**.
 - b. Type: **compression**.
 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems; a part of Atkore International.
 2. Carlton; a brand of Thomas & Betts Corporation.
 3. Thomas & Betts Corporation; A Member of the ABB Group.
- B. General Requirements for Nonmetallic Conduits and Fittings:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. RNC: **Type EPC-40-PVC**, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Rigid HDPE: Comply with UL 651A.
- E. Continuous HDPE: Comply with UL 651B.
- F. RTRC: Comply with UL 1684A and NEMA TC 14.
- G. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- H. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carlton; a brand of Thomas & Betts Corporation.
 2. Dura-Line.
 3. IPEX USA LLC.
- B. Description: Comply with UL 2024; flexible-type pathway, approved for **plenum or general-use** installation unless otherwise indicated.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. B-line, an Eaton business.
 2. Hoffman; a brand of Pentair Equipment Protection.
 3. Square D; by Schneider Electric.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, **Type 3R** or **Type 4** unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: **Flanged-and-gasketed type** unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allied Moulded Products, Inc.
 2. Carlton; a brand of Thomas & Betts Corporation.
 3. Hoffman; a brand of Pentair Equipment Protection.
- B. General Requirements for Nonmetallic Wireways and Auxiliary Gutters:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- F. Solvents and Adhesives: As recommended by conduit manufacturer.

2.6 SURFACE PATHWAYS

- A. General Requirements for Surface Pathways:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.

B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. **Manufacturer's standard enamel finish in color selected by Architect.**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MonoSystems, Inc.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.

C. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from [**manufacturer's standard**] [**custom**] colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton; a brand of Thomas & Betts Corporation.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.

D. Tele-Power Poles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MonoSystems, Inc.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.
2. Material: [**Galvanized steel with ivory baked-enamel finish**] [**Aluminum with clear anodized finish**].
3. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carlton; a brand of Thomas & Betts Corporation.
2. Crouse-Hinds, an Eaton business.
3. O-Z/Gedney; a brand of Emerson Industrial Automation.

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, **ferrous alloy**, Type FD, with gasketed cover.

E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

F. Metal Floor Boxes:

1. Material: **Cast metal or sheet metal.**
2. Type: **Fully adjustable.**

3. Shape: Rectangular.
 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Nonmetallic Floor Boxes: Nonadjustable, **rectangular**.
1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, **galvanized, cast iron** with gasketed cover.
- J. Device Box Dimensions: **4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep)]** .
- K. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, **Type 1** or **Type 3R** with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Nonmetallic Enclosures:
 - a. Material: **Plastic**.
 - b. Finished inside with radio-frequency-resistant paint.
 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- M. Cabinets:
1. NEMA 250, **Type 1** or **Type 3R**, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.
 5. Accessory feet where required for freestanding equipment.
 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING

- A. General Requirements for Handholes and Boxes:
1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. Comply with TIA-569-B.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.

- c. Quazite: Hubbell Power Systems, Inc.
- 2. Standard: Comply with SCTE 77.
- 3. Configuration: Designed for flush burial with **integral closed** bottom unless otherwise indicated.
- 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
- 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- 6. Cover Legend: Molded lettering, "**COMMUNICATIONS.**".
- 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- 8. Handholes **12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long)** and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.9 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: **IMC**.
 - 2. Concealed Conduit, Aboveground: **EMT**.
 - 3. Underground Conduit: RNC, **Type EPC-40-PVC** or **Type EPC-80-PVC**.
 - 4. Boxes and Enclosures, Aboveground: NEMA 250, **Type 3R**.
- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: **EMT**.
 - 2. Exposed, Not Subject to Severe Physical Damage: **EMT**.
 - 3. Exposed and Subject to Severe Physical Damage: **IMC**. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums
 - 4. Concealed in Ceilings and Interior Walls and Partitions: **EMT**.
 - 5. Damp or Wet Locations: **IMC**.
 - 6. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: **EMT**.
 - 7. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: **EMT**.
 - 8. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: **EMT**.
 - 9. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 **stainless steel** in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: 3/4-inch (21-mm) trade size. Minimum size for optical-fiber cables is 1 inch (27 mm).

- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 3. EMT: Use **compression** fittings. Comply with NEMA FB 2.10.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface pathways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

- A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- I. Pathways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
 - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange pathways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from ENT to **IMC** before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits of 2-inch (53-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb ((90-kg))tensile strength. Leave at least 12 inches ((300 mm))of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- R. Surface Pathways:
 - 1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
 - 2. Install surface pathway with a minimum 2-inch (50-mm) radius control at bend points.
 - 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- S. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
 - 1. 3/4-Inch (21-mm) Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15 m).
 - 2. 1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- T. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

- U. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.

- V. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

- W. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to **bottom** of box unless otherwise indicated.

- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

- AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

- BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

- CC. Set metal floor boxes level and flush with finished floor surface.

- DD. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, but a minimum of 6 inches (150 mm) below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes with bottom below frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 27 05 44

SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for pathway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized-steel sheet.
2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Pipeline Seal and Insulator, Inc.
 - c. Proco Products, Inc.
2. Sealing Elements: **EPDM** rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: **Plastic**.
4. Connecting Bolts and Nuts: **Carbon steel, with corrosion-resistant coating**, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. HOLDRITE.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and pathway or cable unless sleeve seal is to be installed **or unless seismic criteria require different clearance.**
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors **2 inches (50 mm)** above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using **cast-iron** pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building.

- B. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 27 11 00

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Grounding.

B. Related Requirements:

1. Section 271300 "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
2. Section 271500 "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.
3. Section 280513 "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. LAN: Local area network.
- C. RCDD: Registered Communications Distribution Designer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Seismic Qualification Certificates: For equipment frames from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of **Commercial Installer, Level 2**.
 2. Installation Supervision: Installation shall be under the direct supervision of **Level 2 Installer**, who shall be present at all times when Work of this Section is performed at Project site.
 3. Field Inspector: Currently registered by **Commercial Installer, Level 2** to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Equipment frames shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.
 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event.**"

2.2 BACKBOARDS

- A. Backboards: Plywood, **fire-retardant treated**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).

2.3 EQUIPMENT FRAMES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. B-line, an Eaton business.
 2. Hubbell Premise Wiring.

3. Leviton Manufacturing Co., Inc.

B. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310-D standard, 19-inch (480-mm) panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, **aluminum** construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, **and a power strip**.
2. Baked-polyester powder coat finish.

D. Modular Freestanding Cabinets:

1. Removable and lockable side panels.
2. Hinged and lockable front and rear doors.
3. Adjustable feet for leveling.
4. Screened ventilation openings in the roof and rear door.
5. Cable access provisions in the roof and base.
6. Grounding bus bar.
7. **Rack-mounted, 550-cfm (260-L/s) fan with filter.**
8. Power strip.
9. Baked-polyester powder coat finish.
10. All cabinets keyed alike.

E. Modular Wall Cabinets:

1. Wall mounting.
2. **Aluminum** construction.
3. Treated to resist corrosion.
4. Lockable front **and rear** doors.
5. Louvered side panels.
6. Cable access provisions top and bottom.
7. Grounding lug.
8. **Rack]-mounted, 250-cfm (118-L/s) fan.**
9. Power strip.
10. All cabinets keyed alike.

F. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Rack mounting.
3. **Six 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R** receptacles.
4. LED indicator lights for power and protection status.
5. LED indicator lights for reverse polarity and open outlet ground.

6. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
7. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
8. **Close-coupled, direct plug-in** line cord.
9. Rocker-type on-off switch, illuminated when in on position.
10. Peak Single-Impulse Surge Current Rating: **33 kA** per phase.
11. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than **330 V**.

2.5 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless **compression**-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with J-STD-607-A.

2.6 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Comply with requirements in Section 270528 "Pathways for Communications Systems" for materials and installation requirements for **underground** pathways.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 2. Record agreements reached in meetings and distribute them to other participants.
 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
 - 1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
- B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for **Class 2** level of administration **including optional identification requirements of this standard.**

D. Labels shall be preprinted or computer-printed type.

END OF SECTION

SECTION 27 13 00

COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cable.
3. **62.5/125**-micrometer, optical fiber cabling.
4. Coaxial cable.
5. Cable connecting hardware, patch panels, and cross-connects.
6. Cabling identification products.

B. Related Sections:

1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. LAN: Local area network.
- F. RCDD: Registered Communications Distribution Designer.
- G. UTP: Unshielded twisted pair.

1.4 BACKBONE CABLING DESCRIPTION

- A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

- 1. For coaxial cable, include the following installation data for each type used:

- a. Nominal OD.
- b. Minimum bending radius.
- c. Maximum pulling tension.

- B. Shop Drawings:

- 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
- 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
- 3. Cabling administration drawings and printouts.
- 4. Wiring diagrams to show typical wiring schematics including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
- 5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
- 6. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
 - a. Vertical and horizontal offsets and transitions.
 - b. Clearances for access above and to side of cable trays.
 - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
 - d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.
- D. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.8 CLOSEOUT SUBMITTALS

- A. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Patch-Panel Units: **One** of each type.
 2. Connecting Blocks: **One** of each type.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings **Cabling Administration Drawings, and field testing program development** by an RCDD.
 2. Installation Supervision: Installation shall be under the direct supervision of **Registered Technician or Level 2 Installer**, who shall be present at all times when Work of this Section is performed at Project site.
 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Testing Agency Qualifications: An NRTL.
1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: **25** or less.
 2. Smoke-Developed Index: **50** or less.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- F. Grounding: Comply with ANSI-J-STD-607-A.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
1. Test optical fiber cable to determine the continuity of the strand end to end. Use **optical fiber flashlight or optical loss test set**.
 2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
 3. Test each pair of UTP cable for open and short circuits.

1.12 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.13 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

1.14 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for **two** years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within **two** years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide **30** days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
- C. Conduit and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

- A. Backboards: Plywood, **fire-retardant treated**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Section 061000 "Rough Carpentry" for plywood backing panels.

2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 2. General Cable; General Cable Corporation.
 - 3. Optical Cable Corporation.

- B. Description: 100-ohm, **100-pair** UTP, formed into 25-pair binder groups covered with a **gray** thermoplastic jacket and **overall metallic shield**.
1. Comply with ICEA S-90-661 for mechanical properties.
 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 3. Comply with TIA/EIA-568-B.2, **Category 5e** for existing and **Category 6** for new.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX.
 - e. Multipurpose: Type MP or MPG.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 2. Berk-Tek Leviton; a Nexans/Leviton alliance.
 3. Hubbell Premise Wiring.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: **110-style IDC for Category 5e** for existing/remodel and **110-style IDC for Category 6** for new. Provide blocks for the number of cables terminated on the block, plus **25** percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
1. Number of Terminals per Field: **One** for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
1. Number of Jacks per Field: **One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.**
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made, 4-pair cables in **48-inch/1200-mm** lengths; terminated with 8-position modular plug at each end.
1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 2. Patch cords shall have color-coded boots for circuit identification.

2.5 OPTICAL FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMP NETCONNECT; a TE Connectivity Ltd. company.
2. General Cable; General Cable Corporation.
3. Optical Cable Corporation.

B. Description: Multimode, **62.5/125**-micrometer, **24** -fiber, **nonconductive**, tight buffer, optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA/EIA-568-B.3 for performance specifications.
3. Comply with **TIA/EIA-492AAAA-B & TIA/EIA-492AAAA-A** for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or OFNG.
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC or OFCG.
 - e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.
5. Conductive cable shall be **aluminum** armored type.
6. Maximum Attenuation: **3.50** dB/km at 850 nm; **1.5** dB/km at 1300 nm.
7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

C. Jacket:

1. Jacket Color: **Orange for 62.5/125-micrometer cable.**
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Technology Systems Industries, Inc.
2. Hubbell Premise Wiring.
3. Optical Cable Corporation.

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: **One** for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

C. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.

D. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
2. Quick-connect, simplex and duplex, **Type SC** connectors. Insertion loss not more than 0.75 dB.
3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Networking Division/NORDX.

2. Coleman Cable, Inc.
 3. Draka USA.
- B. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- C. RG-11/U: NFPA 70, Type CATV.
1. No. **14** AWG, solid, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 4. Jacketed with sunlight-resistant, black PVC or PE.
 5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- D. RG59/U: NFPA 70, Type CATVR.
1. No. **20** AWG, solid, silver-plated, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
 4. Color-coded PVC jacket.
- E. RG-6/U: NFPA 70, Type CATV or CM.
1. No. **16** AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 3. Jacketed with black PVC or PE.
 4. Suitable for indoor installations.
- F. RG59/U: NFPA 70, Type CATV.
1. No. **20** AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
 3. PVC jacket.
- G. RG59/U (Plenum Rated): NFPA 70, Type CMP.
1. No. **20** AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
 3. Copolymer jacket.
- H. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
1. CATV Cable: Type CATV, or **CATVP** or **CATVR**.
 2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 3. CATV Riser Rated: Type CATVR; or **CATVP**, **CATVR**, or **CATV**, complying with UL 1666.
 4. CATV Limited Rating: Type CATVX.

2.8 COAXIAL CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aim Electronics.
 2. Leviton Manufacturing Co., Inc.

3. Siemon Co. (The).

- B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.9 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.10 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.11 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
- E. Cable will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard when entering room from overhead.
 - 4. Extend conduits 3 inches (76 mm) above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
 - 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - 10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 - 11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
 2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- D. Optical Fiber Cable Installation:
1. Comply with TIA/EIA-568-B.3.
 2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
- E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than **60 inches (1524 mm)** apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- F. Outdoor Coaxial Cable Installation:
1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
- G. Group connecting hardware for cables into separate logical fields.
- H. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.5 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Administration Class: 1.
 - 2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for **Class 2** level of administration **including optional identification requirements of this standard**.
- D. Comply with requirements in Section 271500 "Communications Horizontal Cabling" for cable and asset management software.
- E. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, **backbone pathways and cables**, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- G. Cable and Wire Identification:
 - 1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
 - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

- a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:
- 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
- 1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 4. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- F. End-to-end cabling will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

END OF SECTION

SECTION 27 15 00

COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. UTP cabling.
2. **62.5/125**-micrometer, optical fiber cabling.
3. Coaxial cable.
4. Multiuser telecommunications outlet assemblies.
5. Cable connecting hardware, patch panels, and cross-connects.
6. Telecommunications outlet/connectors.
7. Cabling system identification products.
8. Cable management system.

B. Related Requirements:

1. Section 271300 "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
2. Section 280513 "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- D. EMI: Electromagnetic interference.
- E. IDC: Insulation displacement connector.
- F. LAN: Local area network.
- G. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.
- H. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

- I. RCDD: Registered Communications Distribution Designer.
 - J. UTP: Unshielded twisted pair.
- 1.4 ADMINISTRATIVE REQUIREMENTS
- A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.
 - B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.
- 1.5 ACTION SUBMITTALS
- A. Product Data: For each type of product.
 - 1. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
 - B. Shop Drawings:
 - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - 3. Cabling administration drawings and printouts.
 - 4. Wiring diagrams to show typical wiring schematics, including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
 - 5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
 - C. Samples: For workstation outlets, jacks, jack assemblies, **[in specified finish, one for each size and outlet configuration] [and faceplates for color selection and evaluation of technical features]**.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
 - B. Source quality-control reports.
 - C. Field quality-control reports.
- 1.7 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For splices and connectors to include in maintenance manuals.
 - B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Patch-Panel Units: **One** of each type.
 2. Connecting Blocks: **One** of each type.
 3. Device Plates: **One** of each type.
 4. Multiuser Telecommunications Outlet Assemblies: **One** of each type.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings **Cabling Administration Drawings, and field testing program development** by an RCDD.
 2. Installation Supervision: Installation shall be under the direct supervision of **Registered Technician or Level 2 Installer**, who shall be present at all times when Work of this Section is performed at Project site.
 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Testing Agency Qualifications: An NRTL.
1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
1. Test optical fiber cables to determine the continuity of the strand end to end. Use **optical fiber flashlight or optical loss test set**.
 2. Test optical fiber cables while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; including the loss value of each. Retain test data and include the record in maintenance data.
 3. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.

2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.
4. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: **25** or less.
2. Smoke-Developed Index: **50** or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Grounding: Comply with J-STD-607-A.

2.3 BACKBOARDS

A. Backboards: Plywood, **fire-retardant treated**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Section 061000 "Rough Carpentry" for plywood backing panels.

2.4 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMP NETCONNECT; a TE Connectivity Ltd. company.
2. General Cable; General Cable Corporation.
3. Optical Cable Corporation.

B. Description: 100-ohm, four-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. <Double click to insert sustainable design text for lead content.>
4. Comply with TIA/EIA-568-B.2, **Category 5e & Category 6**.
5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX.
 - e. Multipurpose: Type MP or MPG.

- f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
- g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.5 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 2. Hubbell Premise Wiring.
 - 3. Panduit Corp.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: **110-style IDC for Category 5e & 110-style IDC for Category 6**. Provide blocks for the number of cables terminated on the block, plus **25** percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 - 1. Number of Terminals per Field: **One** for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 - 1. Number of Jacks per Field: **One** for each four-pair **conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.**
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made, four-pair cables in **48-inch** 1200-mm lengths; terminated with eight-position modular plug at each end.
 - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 - 2. Patch cords shall have color-coded boots for circuit identification.

2.6 OPTICAL FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 2. Berk-Tek Leviton; a Nexans/Leviton alliance.
 - 3. General Cable; General Cable Corporation.
- B. Description: Multimode, **62.5/125**-micrometer, **24**-fiber, **nonconductive**, tight buffer, optical fiber cable.
 - 1. Comply with ICEA S-83-596 for mechanical properties.
 - 2. Comply with TIA/EIA-568-B.3 for performance specifications.
 - 3. Comply with **TIA-492AAAB & TIA-492AAAA-A** for detailed specifications.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or OFNG.

- b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC or OFCG.
 - e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.
- 5. Conductive cable shall be **aluminum** armored type.
 - 6. Maximum Attenuation: **3.50** dB/km at 850 nm.
 - 7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
- C. Jacket:
- 1. Jacket Color: **Orange for 62.5/125-micrometer cable.**
 - 2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
 - 3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.7 OPTICAL FIBER CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. American Technology Systems Industries, Inc.
 - 2. Hubbell Premise Wiring.
 - 3. Optical Cable Corporation.
- B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
- 1. Number of Connectors per Field: **One** for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
- C. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.
- D. Cable Connecting Hardware:
- 1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 - 2. Quick-connect, simplex and duplex, **Type SC** connectors. Insertion loss not more than 0.75 dB.
 - 3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.8 COAXIAL CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Belden CDT Networking Division/NORDX.
 - 2. CommScope, Inc.
 - 3. Draka USA.
- B. General Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- C. RG-11/U: NFPA 70, Type CATV.
- 1. **No. 14** AWG, solid, copper-covered steel conductor.
 - 2. Gas-injected, foam-PE insulation.
 - 3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 - 4. Jacketed with sunlight-resistant, black PVC or PE.

5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- D. RG59/U: NFPA 70, Type CATVR.
1. **No. 20** AWG, solid, silver-plated, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
 4. Color-coded PVC jacket.
- E. RG-6/U: NFPA 70, Type CATV or CM.
1. **No. 16** AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 3. Jacketed with black PVC or PE.
 4. Suitable for indoor installations.
- F. RG59/U: NFPA 70, Type CATV.
1. **No. 20** AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
 3. PVC jacket.
- G. RG59/U (Plenum Rated): NFPA 70, Type CMP.
1. **No. 20** AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
 3. Copolymer jacket.
- H. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
1. CATV Cable: Type CATV or CATVP or CATVR.
 2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 3. CATV Riser Rated: Type CATVR; or CATVP, CATVR, or CATV, complying with UL 1666.
 4. CATV Limited Rating: Type CATVX.

2.9 COAXIAL CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Emerson Network Power Connectivity Solutions.
 2. Leviton Manufacturing Co., Inc.
 3. Siemon Co. (The).
- B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.10 CONSOLIDATION POINTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Belden CDT Networking Division/NORDX.
 2. Hubbell Premise Wiring.
 3. Panduit Corp.

- B. Description: Consolidation points shall comply with requirements for cable connecting hardware.
1. Number of Terminals per Field: **One** for each conductor in assigned cables.
 2. Number of Connectors per Field:
 - a. **One** for each four-pair UTP cable indicated.
 - b. **One** for each four-pair conductor group of indicated cables, plus **25** percent spare positions.
 3. Mounting: **Recessed in ceiling or Wall**.
 4. NRTL listed as complying with UL 50 and UL 1863.
 5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.11 MULTIUSER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Networking Division/NORDX.
2. Hubbell Premise Wiring.
3. Panduit Corp.

- B. Description: MUTOAs shall meet the requirements for cable connecting hardware.

1. Number of Terminals per Field: **One** for each conductor in assigned cables.
2. Number of Connectors per Field:
 - a. **One** for each four-pair UTP cable indicated.
 - b. **One** for each four-pair conductor group of indicated cables, plus **25** percent spare positions.
3. Mounting: **[Recessed in ceiling or Wall]** .
4. NRTL listed as complying with UL 50 and UL 1863.
5. Label shall include maximum length of work area cords, based on TIA/EIA-568-B.1.
6. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.12 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.

- B. Workstation Outlets: **Four-port-connector** assemblies mounted in **single** faceplate.

1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
2. Metal Faceplate: **Stainless steel**, complying with requirements in Section 262726 "Wiring Devices."
3. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
 - a. Flush mounting jacks, positioning the cord at a 45-degree angle.
4. Legend: Factory labeled by silk-screening or engraving **for stainless steel faceplates**.
5. Legend: Machine printed, in the field, using adhesive-tape label.
6. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.13 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

- B. Comply with J-STD-607-A.

2.14 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.15 CABLE MANAGEMENT SYSTEM

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. iTRACS Corporation.
 - 2. Telsoft Solutions.
- B. Description: Computer-based cable management system, with integrated database capabilities.
- C. Document physical characteristics by recording the network, TIA/EIA details, and connections between equipment and cable.
- D. Information shall be presented in database view, **schematic plans, or technical drawings.**
 - 1. **AutoCAD** drawing software shall be used as drawing and schematic plans software.
- E. System shall interface with the following testing and recording devices:
 - 1. Direct upload tests from circuit testing instrument into the personal computer.
 - 2. Direct download circuit labeling into labeling printer.

2.16 SOURCE QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to evaluate cables.
- B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.
- E. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- F. Cable will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters. Conceal pathways and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements in Section 270528 "Pathways for Communications Systems."
- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
 - 2. Install lacing bars and distribution spools.
 - 3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. MUTOA shall not be used as a cross-connect point.
 - 5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for UTP at least 49 feet (15 m) from communications equipment room.
 - 6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - 10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 12. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
1. Comply with TIA/EIA-568-B.2.
 2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- D. Optical Fiber Cable Installation:
1. Comply with TIA/EIA-568-B.3.
 2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
- E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than [60 inches (1524 mm)] <Insert dimension> apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- F. Outdoor Coaxial Cable Installation:
1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
- G. Group connecting hardware for cables into separate logical fields.
- H. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 1. Administration Class: 1.
 2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
- C. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- D. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for **Class 2** level of administration[, **including optional identification requirements of this standard.**
- E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, **backbone pathways and cables**, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

G. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.

H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections **with the assistance of a factory-authorized service representative**:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually confirm **Category 5e**, & **Category 6**, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
5. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

- b. Link End-to-End Attenuation Tests:
 - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

- 6. UTP Performance Tests:
 - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.
 - 10) Delay skew.

- 7. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.3.
- 8. Coaxial Cable Tests: Conduct tests according to Section 274133 "Master Antenna Television System."
- 9. Final Verification Tests: Perform verification tests for UTP[**and optical fiber**] systems after the complete communications cabling and workstation outlet/connectors are installed.
 - a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
 - b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

- D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

- F. Prepare test and inspection reports.

- 3.8 SOFTWARE SERVICE AGREEMENT
 - A. Technical Support: Beginning with Substantial Completion, provide software support for **two** years.
 - B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within **two** years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide **30** days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets. **Include training in cabling administration software.**

END OF SECTION

SECTION 27 41 33

MASTER ANTENNA TELEVISION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. MATV equipment using **CCTV cameras and video recorders** as the signal source.
2. Off-air antennas.
3. MATV head-end components.
4. Distribution components.

B. Related Sections:

1. Section 271300 "Communications Backbone Cabling" for coaxial, UTP, and fiber-optic cables and connectors.
2. Section 271500 "Communications Horizontal Cabling" for coaxial, UTP, and fiber-optic cables and connectors.
3. Section 282300 "Video Surveillance" for cameras, monitors, computers, and cabling for video surveillance systems.

1.3 DEFINITIONS

- A. Agile Receiver: A broadband receiver that can be tuned to any desired channel.
- B. A/V: Audio/Visual.
- C. Broadband: For the purposes of this Section, wide bandwidth equipment or systems that can carry signals occupying in the frequency range of 54 to 1002 MHz. A broadband communication system can simultaneously accommodate television, voice, data, and many other services.
- D. Carrier: A pure-frequency signal that is modulated to carry information. In the process of modulation, the signal is spread out over a wider band. The carrier frequency is the center frequency on any television channel.
- E. CATV: Community antenna television. A communication system that simultaneously distributes several different channels of broadcast programs and other information to customers via a coaxial cable.
- F. CCTV: Closed-circuit television.
- G. CEA: Consumer Electronics Association.
- H. dBmV: Decibels relative to 1 mV across 75 ohms. Zero dBmV is defined as 1 mV across 75 ohms. $\text{dBmV} = 20 \log_{10}(V_1/V_2)$ where V_1 is the measurement of voltage at a point having identical impedance to V_2 (0.001 V across 75 ohms).

- I. Headend: The control center of the MATV system, where incoming signals are amplified, converted, processed, and combined into a common cable along with any locally originated television signals, for transmission to user-interface points. It is also called the "central retransmission facility."
- J. I/O: Input/Output.
- K. MATV: Master antenna television. A small television antenna distribution system usually restricted to one or two buildings.
- L. RF: Radio frequency.
- M. User Interface: End point of Contractor's responsibility for Work of this Section. User interfaces are the **terminal blocks to which the end user may connect coaxial cabling.**

1.4 SYSTEM DESCRIPTION

- A. System shall consist of **CCTV cameras and video recorders** and a coaxial cable distribution system.
 - 1. Headend equipment shall consist of receiving antennas, satellites, and associated signal distribution amplification and equalization.
 - 2. Distribution of direct broadcast satellite-service signals, which includes coordinating with Owner's selected service provider for installation of its dish-type antennas and processing the signals as needed to provide specified services combined into a single-feed point ready for connection into the distribution system. Obtain signal levels and noise and distortion characteristics from service provider as the point of departure for system layout and final equipment selection.
 - 3. Distribution of cable television service signals, which includes coordinating with Owner's selected service provider for installation of cable to the service point ready for connection into the distribution system. Obtain signal levels and noise and distortion characteristics from service provider as the point of departure for system layout and final equipment selection.
 - 4. Cable distribution system consisting of coaxial cables, user interfaces, signal taps and splitters, RF amplifiers, signal equalizers, power supplies, and required hardware, complying with CEA-310-E and CEA-2032 and resulting in performance parameters specified in this Section. System shall be capable of distributing television channels according to CEA-542-B.
- B. Hardware Requirements: Use plug-in, modular, solid-state electronic components. Mount amplifiers and other powered equipment in standard 19-inch (483-mm) cabinet complying with CEA-310-E.
- C. Off-Air Stations: Install antennas for the reception and distribution of selected stations.

1.5 PERFORMANCE REQUIREMENTS

- A. Minimum acceptable performance of distribution system at all user-interface points shall be as follows:
 - 1. RF Video-Carrier Level: Between 3 and 12 dBmV.
 - 2. Relative Video-Carrier Level: Within 3 dB to adjacent channel.
 - 3. Carrier Level Stability, Short Term: Level shall not change more than 0.5 dB during a 60-minute period.
 - 4. Carrier Level Stability, Long Term: Level shall not change more than 2 dB during a 24-hour period.
 - 5. Channel Frequency Response: Across any 6-MHz channel in the 54- to 220-MHz frequency range, referenced to video; signal amplitude shall be plus or minus 1 dB, maximum.
 - 6. Carrier-to-Noise Ratio: 45 dB or more.
 - 7. RF Visual Signal-to-Noise Ratio: 43 dB or more.
 - 8. Antenna Combiner Insertion Loss: 40 dB maximum.
 - 9. Signal Power Splitter and Isolation Tap Return Loss: 17 dB maximum.
 - 10. Cable Connectors Attenuation: Less than 0.1 dB.
 - 11. Cross Modulation: Less than minus 50 dB.
 - 12. Carrier-to-Echo Ratio: More than 40 dB.
 - 13. Composite Triple Beat: Less than minus 53 dB.

14. Second Order Beat: Less than minus 60 dB.
15. Terminal Isolation from Television to Television: 25 dB, minimum.
16. Terminal Isolation between Television and FM: 35 dB, minimum.
17. Hum Modulation: 2 percent, maximum.
18. RF FM Carrier Level: 13 to 17 dB below video-carrier level.
19. FM Frequency Response: More than in the 88- to 108-MHz frequency range; signal amplitude is plus or minus 0.75 dB, maximum.
20. FM Carrier-to-Noise Ratio: More than 24 dB.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For headend and distribution system. Include plans, elevations, sections, details, and attachments to other work.
 1. Show fabrication and installation details for television equipment.
 2. Functional Block Diagram: Show single-line interconnections between components for headend and distribution system to user-interface points. Show cable types and sizes.
 3. Dimensioned Plan and Elevations of Headend Equipment: Show access and workspace requirements.
 4. Wiring Diagrams: For power, signal, and control wiring. For UTP or fiber-optic cable, include cross connects, patch panels, and patch cords.
- C. Samples: Full size for each outlet device plate in required colors and textures.
- D. Design Calculations: Calculate signal attenuation budget and show calculated line and equipment losses for the system based on the functional block diagram, to show that proposed system layout can be expected to perform up to specification. Calculate signal strength from sources to headend input points for each antenna, satellite dish, and CATV grouping. Allowable losses between components and user interface shall be used to determine size and type of coaxial cable.

1.7 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Include dimensioned plan and elevation views of components and enclosures. Show access and workspace requirements.
- B. Equipment List: Include each piece of equipment and include model number, manufacturer, serial number, location, and date of original installation. Insert testing record of each piece of adjustable equipment, listing name of person testing, date of test, and description of as-left set points.
- C. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For headend and distribution system to include in emergency, operation, and maintenance manuals.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Provide no fewer than one of each item listed below. Deliver extra materials to Owner.
 1. Fuses: One for every 10 of each type and rating.

2. Splitters: One for every **10** installed.
3. MATV Distribution Power Amplifiers: One for every **10** of each type installed.
4. MATV Signal Traps: **One** for every **10** of each type used.
5. MATV Attenuators: **One** for every **10** of each type used.
6. Cable: 100 feet (30 m) of each type used.

1.10 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.11 PROJECT CONDITIONS

- A. Environmental Limitations: System components shall be equipped and rated for the environments in which they are installed.
- B. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 1. Interior, Controlled Environment: System components, except central-station control unit, installed in **air-conditioned** interior environments shall be rated for continuous operation in ambient conditions of [36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 2. Interior, Uncontrolled Environment: System components installed in non-**temperature-controlled**] interior environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.

1.12 COORDINATION

- A. Coordinate size and location of raceway system and provisions for electrical power to equipment specified in this Section.
- B. Coordinate Work of this Section with requirements of **CCTV cameras and video recorders** service provider.
- C. Coordinate sizes and locations of concrete bases with actual equipment provided.
- D. Coordinate installation of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.13 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide **12 months'** full maintenance by skilled employees of MATV system Installer. Include quarterly adjusting as required for optimum system performance. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.
- B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 SYSTEMS REQUIREMENTS

- A. Components: Plug-in, modular, heavy-duty, industrial- or commercial-grade units.
- B. Equipment: Silicon-based, solid-state, integrated circuit devices.
- C. Power Supply Characteristics: Devices shall be within specified parameters for ac supply voltages within the range of 105 to 130 V.
- D. Protect signal cables and connected components against transient-voltage surges by suppressors and absorbers designed specifically for that purpose. Comply with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
- E. Provide ac-powered equipment with integral surge suppressors complying with UL 1449.
- F. RF and Video Impedance Matching: Signal-handling components, including connecting cable, shall have end-to-end impedance-matched signal paths. Match and balance devices used at connections where it is impossible to avoid impedance mismatch or mismatch of balanced circuits to unbalanced circuits.

2.2 MATV EQUIPMENT

- A. Description: Signal-source components, signal-processing and amplifying equipment, distribution components, and interconnecting wiring. System shall receive, amplify, process, and distribute signals to outlets for receiving sets. Equipment shall translate UHF channels to VHF channels before distribution to outlets.
- B. Coordinate first paragraph below with Drawings. Clear descriptions of signal sources used and programs distributed are critical to obtaining meaningful Contractor response to MATV system requirements.
- C. MATV System Qualitative and Quantitative Performance Requirements: Reception quality of color-television program transmissions at each system outlet from each service and source shall be equal to or superior than that obtained with performance checks specified in "Field Quality Control" Article, using standard, commercial, cable-ready, multiple A/V input color-television receivers.

2.3 OFF-AIR ANTENNAS

- A. Antennas shall be tested, marked, and packaged, according to CEA-774-A, CEA-2028, and CEA-2032. Antennas shall be labeled according to CEA antenna mapping program.
- B. Off-Air, Mast-Mounted Antennas: Weatherproof single-channel or broadband type, constructed of high-strength anodized aluminum and rated to survive in a 100-mph (160-km/h) wind, minimum.
 - 1. Elements: Internally dampened against mechanical vibration that may occur in service.
 - 2. Ends of Crossarms and Elements: Sealed.
 - 3. Mounting and Connecting Hardware: Corrosion proof.
 - 4. Frequency Range: Matched to source frequencies.
 - 5. Retain first subparagraph below if reception patterns are not scheduled on Drawings. See Editing Instruction No. 3 in the Evaluations for discussion of CEA antenna reception patterns and scheduling.
 - 6. FM Antenna: Separate from the broadband antenna and the **directional** antenna, with 2-dB minimum gain.
- C. Antenna-Supporting Structures: Prefabricated, hot-dip galvanized-steel units.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Channel Master.
 - b. Winegard Company.
2. Strength of Structure and Attachments: Adequate to withstand 100-mph (160-km/h) winds while supporting installed antennas.
3. Comply with 47 CFR 17 and TIA 222-G.
4. Comply with FAA AC 70/7460-1K.

2.4 MATV HEADEND COMPONENTS

- A. Headend Equipment: **Combining networks** for receiving off-air television and FM signals and outputting the signals to cable distribution system. Equip coaxial down-leads of the off-air antennas with preamplifiers to send signals at strength required by headend. Headend component performance specified in this article is minimum acceptable; better performance may be required to comply with minimum acceptable system performance standard in "Performance Requirements" Article.
 1. House units in standard 19-inch (483-mm) electronic equipment cabinet complying with EIA 310.
- B. Antenna Combiner: Directional coupler design network, combining up to eight antenna signals into a single output. Frequency response of the device shall be 5 to 400 MHz, and the insertion loss between input ports shall be not less than 40 dB.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATX Networks Inc.
 - b. Blonder Tongue Laboratories, Inc.
- C. Down-Lead Preamplifiers: Antenna mast-mounted preamplifier, designed to boost antenna signal and contained in weatherproof housing; single-channel or broadband type. Install power supplies indoors at headend equipment, connected through power inserters to provide power to preamplifiers through the coaxial down-lead cable.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Blonder Tongue Laboratories, Inc.
 - b. Channel Master.
 - c. Leviton Manufacturing Co., Inc.
 2. Frequency Response: Plus or minus 0.75 dB.
 3. Minimum Input: Minus 20 dBmV.
 4. Return Loss: 14 dB.
 5. I/O Impedance: 75 ohms.
- D. Channel Mixers: Use for nonadjacent channels only.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATX Networks Inc.
 - b. Blonder Tongue Laboratories, Inc.
 - c. Leviton Manufacturing Co., Inc.
 2. Insertion Loss (Maximum 54 to 216 MHz): 2.5 dB.
 3. Return Loss: 14 dB.
 4. Out-of-Band Rejection: 12 dB.

5. I/O Impedance: 75 ohms.
- E. Processors: One for each channel to be translated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATX Networks Inc.
 - b. Blonder Tongue Laboratories, Inc.
 - c. Cisco Systems, Inc.
 2. Bandwidth: 6 MHz.
 3. Return Loss: 16 dB, within the 6-MHz bandwidth.
 4. Noise: Not more than 10 dB at maximum gain.
 5. Input Level Range, VHF: Minus 20 to plus 30 dBmV.
 6. Input Level Range, UHF: Minus 20 to plus 25 dBmV.
 7. Output Level Range: 50 to 60 dBmV.
 8. Carrier-to-Noise Ratio: Minus 57 dB at plus 10-dBmV input.
 9. Automatic Gain Control: Plus or minus 1-dB output variation for rated input level range variation.
 10. Frequency Stability: Plus or minus 10 kHz over the operational temperature range.
 11. Spurious Output: 60 dB below the video carrier with video-carrier output level at plus 60 dBmV and audio-carrier level at plus 45 dBmV.
 12. Adjacent Channel Rejection: Not less than 60 dB.
 13. I/O Impedance: 75 ohms.
- F. Broadband Amplifier:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATX Networks Inc.
 - b. Blonder Tongue Laboratories, Inc.
 - c. Leviton Manufacturing Co., Inc.
 2. Frequency Range: **54 to 220** MHz.
 3. Frequency Response: Plus or minus 1.0 dB across passband.
 4. Maximum Noise: 10 dB.
 5. Minimum Return Loss: 16 dB.
 6. I/O Impedance: 75 ohms.
- G. Single-Channel Amplifiers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Blonder Tongue Laboratories, Inc.
 - b. Cisco Systems, Inc.
 - c. Leviton Manufacturing Co., Inc.
 2. Frequency: 6 MHz for specified channel.
 3. Frequency Response: Plus or minus 0.5 dB.
 4. Maximum Noise: 10 dB.
 5. Minimum Return Loss: 14 dB.
 6. Automatic Gain Control: Plus or minus 1-dB output variation for rated input level range variation.
 7. Skirt Rejection: Minus 26 dB at plus or minus 5 MHz from channel center.
 8. Sound Trap: Adjustable to 10 VdB of attenuation of the sound carrier.
 9. I/O Impedance: 75 ohms.
- H. FM Module: One RF processor module for each station listed.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Blonder Tongue Laboratories, Inc.
 - b. Cisco Systems, Inc.
 - c. Leviton Manufacturing Co., Inc.
 2. Frequency Range: Between 88 and 108 MHz.
 3. Output Level: 52 dBmV.
 4. Output Level Control: Plus or minus 10 dB.
 5. Stability: 0.005 percent, crystal controlled.
 6. Sensitivity: 3 mV for 30-dB quieting.
 7. Input Level: 60 mV, stereo.
 8. Image Rejection: 901 dB.
 9. Passband: 200 kHz.
 10. Selectivity: Plus or minus 150 kHz or less, at 30 dB down. Plus or minus 250 kHz or less, at 50 dB down.
- I. Combining Network (Mixer): Combines the off-air television [FM] [CCTV] [and] [CATV] signals into a single-broadband output. An output test point, a 75-ohm television jack, a mixer output step attenuator dual-pilot insertion network, and a removable mixer-to-trunk jumper are included.
1. Passband: As required by system performance.
 2. Distortion: Not more than plus or minus 0.1 dB over any 6-MHz segment.
 3. Distortion: Not more than plus or minus 0.5 dB over the 54- to 216-MHz frequency range.
 4. Nominal Insertion Loss:
 - a. 15 dB maximum, channel input to single-system output.
 - b. 13 dB maximum, channel input to mixer output.
 - c. 20 dB maximum at test point, e.g., loss from trunk output.
 5. Isolation between any Two Inputs: 30 dB.
 6. I/O Impedance: 70 ohms.

2.5 DISTRIBUTION COMPONENTS

- A. Signal Power Splitters and Isolation Taps: Metal-enclosed directional couplers with brass connector parts. Where installed in signal circuits used to supply cable-powered amplifiers, power throughput capacity shall exceed load by at least 25 percent.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATX Networks Inc.
 - b. Leviton Manufacturing Co., Inc.
 2. Return Loss: 17 dB.
 3. RFI Shielding: 100 dB.
 4. Isolation: 25 dB.
 5. I/O Impedance: 75 ohms.
- B. Distribution System Amplifiers: Powered by coaxial cable system and equipped with surge protection device and external test points to allow convenient signal monitoring.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ARRIS.
 - b. ATX Networks Inc.

- c. Leviton Manufacturing Co., Inc.
 - C. Cable System Power Supplies: Plug-in, modular construction, with surge, short-circuit, and overload protection.
 - D. Signal Traps: Packaged filters tuned to interference frequencies encountered in Project.
 - E. Attenuators: Passive, of fixed value, and used to balance signal levels.
 - F. Terminating Resistors: Enclosed units rated 0.5 W and matched for coaxial impedance.
 - G. User-Interface Device: Flush, female-type outlets, designed to mimic power duplex outlet; for mounting in standard outlet box; with metallic parts of anodized brass, beryllium copper, or phosphor bronze. Cable connector mounting shall be semirecessed so its protrusion is flush with the plane of device plate. [**Feed-through-type cable connection shall not be used**] [except in area housing a single tenant] [except within a single-dwelling unit].
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATX Networks Inc.
 - b. Cisco Systems, Inc.
 - c. Leviton Manufacturing Co., Inc.
 - 2. Cable Connector: Female, Type F.
 - 3. Wall Plates: Match materials and finish of power outlets in same space.
 - 4. Attenuation: Less than 0.1 dB.
 - 5. Voltage Standing-Wave Ratio: Less than 1.15 to 1.
- 2.6 ENCLOSURES
- A. Enclosures for Interior, Controlled Environments: NEMA 250, Type 1.
 - B. Enclosures for Interior, Uncontrolled Environments: NEMA 250, **Type 4**.
 - C. Enclosures for Exterior Environments: NEMA 250, **Type 3R** or **Type 4X**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for antenna to verify actual locations of cable connections before antenna installation.
- B. Examine walls, floors, roofs, equipment bases, and roof supports for suitable conditions where television equipment is to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install signal line surge suppressors on coaxial cables entering headend equipment space and at antenna-mounted amplifiers. Comply with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."

- B. Install antenna towers, masts, and mountings on concrete bases. Comply with requirements for concrete bases specified in **Section 033000 "Cast-in-Place Concrete."**
 - 1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.3 ANTENNA AND HEADEND INSTALLATION

- A. Mount headend equipment in electronic-equipment cabinets recommended by manufacturer. Group related items in methodical sequence.
- B. Arrange equipment to facilitate access for maintenance and to preserve headroom and passage space. Parts that require periodic service or maintenance shall be readily accessible. Headend components that require tuning adjustments shall be accessible from the front of equipment cabinets.
- C. Align antenna elements to achieve maximum signal level and quality.
- D. Antenna-Supporting Structure: Increase antenna height as required to obtain signal strength needed for specified system performance.
 - 1. Attachment to Building: Use 0.375-inch- (10-mm-) minimum expansion anchors for masonry, and place anchors clear of grout or mortar joints.
 - 2. Attachment to Building: Use 0.375-inch- (10-mm-) minimum lag bolts for attachment to wood.
 - 3. Lightning Protection: Comply with requirements in Section 264113 "Lightning Protection for Structures."
- E. Antenna Cable Entrance: Use weatherproof entrance fittings, and seal at penetrations of the building envelope.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
- D. Tests and Inspections:
 - 1. Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements.
 - 2. Replace malfunctioning or damaged items.
 - 3. Retest until satisfactory performance and conditions are achieved.
 - 4. Prepare television equipment for acceptance and operational testing.

5. Use an agile receiver and signal strength meter or spectrum analyzer for testing.
6. Off-Air, Mast-Mounted Antenna Sources: Connect receiver to the down-lead of a 10-element, single-channel antenna, tuned and oriented to optimize reception for the channel and placed at system antenna's location. Alternatively, connect receiver to a single-channel video amplifier connected to the down-lead of the above single-channel antenna.
7. CATV Sources: Connect receiver to an agile demodulator or CATV set-top converter at CATV service entrance to the facility.
8. Satellite Earth-Station System Sources: Adapt receiver to the output of satellite-television receiver.
9. CCTV Sources: Connect receiver to the output of each CCTV signal source or the distribution amplifier associated with it.
10. Test Schedule: Schedule tests after pretesting has successfully been completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
11. Operational Tests: Perform tests of operational system to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
12. Distribution System Acceptance Tests:
 - a. Field-Strength Instrument: Rated for minus 40-dBmV measuring sensitivity and a frequency range of 54 to 812 MHz, minimum. Provide documentation of recent calibration against recognized standards.
 - b. Signal Level and Picture Quality: Use a field-strength meter or spectrum analyzer, and a standard television receiver to measure signal levels and check picture quality at **all** user-interface outlets.
 - 1) Test the signal strength in dBmV at 55[, 151, 547,] and 750 MHz.
 - 2) Minimum acceptable signal level is 0 dBmV (1000 mV).
 - 3) Maximum acceptable signal level over the entire bandwidth is 15 dBmV.
 - 4) Television receiver shall show no evidence of cross-channel intermodulation, ghost images, or beat interference.
13. Signal-to-Noise-Ratio Test: Use a field-strength meter to make a sequence of measurements at the output of the last distribution amplifier or of another agreed-on location in system. With system operating at normal levels, tune meter to the picture carrier frequency of each of the designated channels in turn and record the level. With signal removed and input to corresponding headend amplifier terminated at 75 ohms, measure the level of noise at same tuning settings. With meter correction factor added to last readings, differences from first set must not be less than 45 dB.
14. Qualitative and Quantitative Performance Tests: Demonstrate reception quality of color-television program transmissions at each user interface from each designated channel and source. Quality shall be equal to or superior than that obtained with performance checks specified below, using a standard, commercial, cable-ready, color-television receiver. Level and quality of signal at each outlet and from each service and source shall comply with the following Specifications when tested according to 47 CFR 76:
 - a. RF video-carrier level.
 - b. Relative video-carrier level.
 - c. Carrier level stability, during 60-minute and 24-hour periods.
 - d. Broadband frequency response.
 - e. Channel frequency response.
 - f. Carrier-to-noise ratio.
 - g. RF visual signal-to-noise ratio.
 - h. Antenna combiner insertion loss.
 - i. Signal power splitter loss.
 - j. Cable connector attenuation.
 - k. Cross modulation.
 - l. Carrier-to-echo ratio.
 - m. Composite triple beat.
 - n. Second order beat.
 - o. Terminal isolation.
 - p. Terminal isolation between television and FM.
 - q. Hum modulation.

- r. RF FM carrier level.
- s. FM frequency response.
- t. FM carrier-to-noise ratio.

- E. Headend and distribution system will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. For fiber-optic- and UTP-cable performance test, see Section 271500 "Communications Horizontal Cabling."
- H. Cap all unused connectors and seal weathertight.

3.6 DEMONSTRATION

- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain MATV equipment.
 - 1. Train Owner's maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment.
 - 2. Demonstrate methods of determining optimum alignment and adjustment of components and settings for system controls.
 - 3. Demonstrate programming and tuning of satellite receivers.

END OF SECTION

SECTION 27 51 16

PUBLIC ADDRESS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Preamplifiers.
 - 2. Power amplifiers.
 - 3. Transfer to standby amplifier.
 - 4. Microphones.
 - 5. Volume limiter/compressors.
 - 6. Control console.
 - 7. Equipment cabinet.
 - 8. Equipment rack.
 - 9. Telephone paging adapters.
 - 10. Tone generator.
 - 11. Monitor panel.
 - 12. Loudspeakers.
 - 13. Noise-operated gain controllers.
 - 14. Microphone and headphone outlets.
 - 15. Battery backup power unit.
 - 16. Conductors and cables.
 - 17. Pathways.

1.3 DEFINITIONS

- A. Channels: Separate parallel signal paths, from sources to loudspeakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.
- B. VU: Volume unit.
- C. Zone: Separate group of loudspeakers and associated supply wiring that may be arranged for selective switching between different channels.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Power, signal, and control wiring.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.

3. Console layouts.
4. Control panels.
5. Rack arrangements.
6. Calculations: For sizing backup battery.
7. Wiring Diagrams: For power, signal, and control wiring.

- a. Identify terminals to facilitate installation, operation, and maintenance.
- b. Single-line diagram showing interconnection of components.
- c. Cabling diagram showing cable routing.

C. Delegated-Design Submittal: For supports and seismic restraints for control consoles, equipment cabinets and racks, and components indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of supports and seismic restraints for control consoles, equipment cabinets and racks, and components.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.

B. Qualification Data: For **Installer & testing agency**.

C. Seismic Qualification Certificates: For control consoles, equipment cabinets and racks, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Include qualification data for testing agency.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For public address systems to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017700 "Closeout Procedures" and Section 017823 "Operation and Maintenance Data," include the following:
 - a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
 - b. Operating instructions laminated and mounted adjacent to operating console location.
 - c. Training plan.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Microphone: **One**
2. Microphone Desk Stand(s): **One**.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
 1. Personnel certified by NICET as Audio Systems Level II Technician.
- B. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated.
 1. Testing Agency's Field Supervisor: Currently certified by NICET at Level III to supervise on-site testing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Atlas Sound LP.
 2. Bogen Communications, Inc.
 3. Edwards Signaling; UTC Fire & Security.
- B. Source Limitations: Obtain public address system from single source from single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. System Functions:
 1. Selectively connect any zone to any available signal channel.
 2. Selectively control sound from microphone outlets and other inputs.
 3. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.
 4. Telephone paging adapter shall allow paging by dialing an extension from any local telephone instrument and speaking into the telephone.
 5. Produce a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
 6. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of nonuniform coverage of amplified sound.

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports and seismic restraints for control consoles, equipment cabinets and racks, and components, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Seismic Performance: Supports and seismic restraints for control consoles, equipment cabinets and racks, and components shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event.**"

2.4 SYSTEM DESCRIPTION

- A. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
- C. Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch (483-mm) housing complying with EIA/ECA-310-E.
- D. Weather-Resistant Equipment: Listed and labeled by a qualified testing agency for duty outdoors or in damp locations.

2.5 PREAMPLIFIERS

- A. Preamp: Separately mounted.
- B. Preamp: Integral to power amplifier.
- C. Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.
- D. Total Harmonic Distortion: Less than 1 percent.
- E. Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.
- F. Input Jacks: Minimum of three. One matched for low-impedance microphone; one USB port; and the other matchable to DVD or CD player, or radio tuner signals without external adapters.
- G. Minimum Noise Level: Minus 55 dB below rated output.
- H. Controls: On-off, input levels, and master gain.

2.6 POWER AMPLIFIERS

- A. Mounting: **Console**.
- B. Output Power: 70-V balanced line. **80 percent of the sum of wattage settings of connected** for each station and speaker connected in all-call mode of operation, plus a **25 percent** allowance for future stations.
- C. Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.
- D. Minimum Signal-to-Noise Ratio: 80 dB, at rated output.
- E. Frequency Response: Within plus or minus 3 dB from 20 to 12,000 Hz.

- F. Output Regulation: Less than 2 dB from full to no load.
- G. Controls: On-off, input levels, and low-cut filter.
- H. Input Sensitivity: Matched to preamplifier and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.

2.7 TRANSFER TO STANDBY AMPLIFIER

- A. Monitoring Circuit and Sensing Relay: Detect reduction in output of power amplifier of 40 percent or more and, in such event, transfer load and signal automatically to standby amplifier.

2.8 MICROPHONES

- A. Paging Microphone:
 1. Type: Dynamic, with **omnidirectional** polar characteristic.
 2. Impedance: **250** ohms.
 3. Frequency Response: Uniform, 50 to 15,000 Hz.
 4. Sensitivity: Minus 70 dB.
 5. Output Level: Minus 58 dB, minimum.
 6. Cable: Braided shield cable with **Amphenol** XLR connectors. Coordinate impedance with microphone impedance.
 7. Mounting: Desk stand with integral-locking, press-to-talk switch.

2.9 VOLUME LIMITER/COMPRESSOR

- A. Minimum Performance Requirements:
 1. Frequency Response: 45 to 15,000 Hz, plus or minus 1 dB minimum.
 2. Reduction Ratio: Automatically vary compression ratio, and attack and release times for voice and music inputs.
 - a. Compression Ratio Range: 3:1 to 10:1 minimum.
 - b. Averaging Compressor Attack Time: Up to 500 milliseconds.
 - c. Signal Fast Compression Attack Time: Less than 10 milliseconds.
 - d. Release time: Up to 500 milliseconds.
 3. Distortion: 0.5 percent, maximum.
 4. Rated Output: Minimum of plus 14 dB.
 5. Inputs: Minimum of two inputs with variable front-panel gain controls and VU or decibel meter for input adjustment.
 6. Rack mounted.

2.10 CONTROL CONSOLE

- A. Cabinet: Modular, **desk style**; complying with EIA/ECA-310-E.
- B. Housing: Steel, 0.0478 inch (1.2 mm) minimum, with removable front and rear panels. Side panels are removable for interconnecting side-by-side mounting.
- C. Panel for Equipment and Controls: Rack mounted.
- D. Controls:

1. Switching devices to select signal sources for distribution channels.
 2. Program selector switch to select source for each program channel.
 3. Switching devices to select zones for paging.
 4. All-call selector switch.
- E. Indicators: A visual annunciation for each distribution channel to indicate source being used.
- F. Self-Contained Power and Control Unit: A single assembly of basic control, electronics, and power supply necessary to accomplish specified functions.
- G. Spare Positions: 20 percent spare zone control and annunciation positions on console.
- H. Microphone jack.
- 2.11 EQUIPMENT CABINET
- A. Comply with EIA/ECA-310-E.
 - B. House amplifiers and auxiliary equipment at each location.
 - C. Cabinet Housing:
 1. Constructed of 0.0478-inch (1.2-mm) steel, minimum, with front- and rear-locking doors and standard EIA/ECA-310-E-compliant, 19-inch (483-mm) racks.
 2. Arranged for floor or wall mounting as indicated.
 3. Sized to house all equipment indicated, plus spare capacity.
 4. Include **20** percent minimum spare capacity for future equipment in addition to space required for **future** DVD or CD player.
 - D. Power Provisions: A single switch in cabinet shall disconnect cabinet power distribution system and electrical outlets, which shall be uniformly spaced to accommodate ac-power cords for each item of equipment.
 - E. Ventilation: A low-noise fan for forced-air cabinet ventilation. Fan shall be equipped with a filtered input vent and shall be connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switched; arranged to be powered when main cabinet power switch is on.
- 2.12 EQUIPMENT RACK
- A. Racks: 19 inches (483 mm) standard, complying with EIA/ECA-310-E.
 - B. Power-Supply Connections: Compatible plugs and receptacles.
 - C. Enclosure Panels: Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.
 - D. Finish: Uniform, baked-enamel factory finish over rust-inhibiting primer.
 - E. Power-Control Panel: On front of equipment housing, with master power on-off switch and pilot light; and with cartridge fuse protection for rack equipment power.
 - F. Service Light: At top rear of rack with an adjacent control switch.
 - G. Vertical Plug Strip: Grounded receptacles, 12 inches (300 mm) o.c.; the full height of rack for public address system equipment use only.

- H. Maintenance Receptacles: Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.
 - I. Spare Capacity: **20** percent in rack for future equipment.
- 2.13 TELEPHONE PAGING ADAPTER
- A. Adapters shall accept voice signals from telephone extension dialing access and automatically provide amplifier input and program override for preselected zones.
 1. Minimum Frequency Response: Flat, 200 to 2500 Hz.
 2. Impedance Matching: Adapter matches telephone line to public address equipment input.
 3. **Cabinet** mounted.
- 2.14 TONE GENERATOR
- A. Tone generator shall provide clock and program interface with public address system.
 - B. Signals: Minimum of seven distinct, audible signal types including wail, warble, high/low, alarm, repeating and single-stroke chimes, and tone.
 - C. Pitch Control: Chimes and tone.
 - D. Volume Control: All outputs.
 - E. Activation-Switch Network: Establishes priority and hierarchy of output signals produced by different activation setups.
 - F. Mounting: **Cabinet**.
- 2.15 MONITOR PANEL
- A. Monitor power amplifiers.
 - B. Components: VU or dB meter, speaker with volume control, and multiple-position rotary selector switch.
 - C. Selector Switch and Volume Control: Selective monitoring of output of each separate power amplifier via VU or dB meter and speaker.
 - D. Mounting: **Cabinet**.
- 2.16 LOUDSPEAKERS
- A. Cone-Type Loudspeakers:
 1. Minimum Axial Sensitivity: 91 dB at 1 m, with 1-W input.
 2. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
 3. Size: **6 inches**150 mm with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.
 4. Rated Output Level: **10 W**.
 5. Minimum Dispersion Angle: 100 degrees.
 6. Matching Transformer: Full-power rated with four taps. Maximum insertion loss of 0.5 dB.
 7. Surface-Mounted Units: Ceiling, wall, or pendant mounted, as indicated, in steel back boxes, acoustically dampened. Front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and shop primed for field painting.

8. Flush-Ceiling-Mounted Units: In steel back boxes, acoustically dampened. Metal ceiling grille with **white** baked enamel.

B. Horn-Type Loudspeakers:

1. Type: Single-horn units, double-reentrant design, with minimum full-range power rating of 15 W.
2. Matching Transformer: Full-power rated with four standard taps. Maximum insertion loss of 0.5 dB.
3. Frequency Response: Within plus or minus 3 dB from 250 to 12,000 Hz.
4. Dispersion Angle: 130 by 110 degrees.
5. Mounting: Integral bracket.
6. Units in Damp, Wet, or Outdoor Locations: Listed and labeled for environment in which they are located.
7. Units in Hazardous (Classified) Locations: Listed and labeled for environment in which they are located. Provide any accessories required to maintain listing.

2.17 NOISE-OPERATED GAIN CONTROLLER

- A. Gain controller shall be designed to continuously sense space noise level and automatically adjust signal level to local speakers.
- B. Frequency Response: 20 to 20,000 Hz, plus or minus 1 dB.
- C. Level Adjustment Range: 30 dB minimum.
- D. Maximum Distortion: 0.5 percent.
- E. Control: Permits adjustment of sensing level of device.

2.18 OUTLETS

- A. Volume Attenuator Station: Wall-plate-mounted autotransformer type with paging priority feature.
 1. Wattage Rating: 10 W unless otherwise indicated.
 2. Attenuation per Step: 3 dB, with positive off position.
 3. Insertion Loss: 0.4 dB maximum.
 4. Attenuation Bypass Relay: SPDT. Connected to operate and bypass attenuation when all-call, paging, program signal, or prerecorded message features are used. Relay returns to normal position at end of priority transmission.
 5. Label: "PA Volume."
- B. Microphone Outlet: Three-pole, polarized, locking-type, microphone receptacles in single-gang boxes. Equip wall outlets with brushed stainless-steel device plates. Equip floor outlets with gray tapered rubber or plastic cable nozzles and fixed outlet covers.
- C. Headphone Outlet (for the Hearing Impaired): Microphone receptacles in single-gang boxes. Equip wall outlets with brushed stainless-steel device plates. Equip floor outlets with gray tapered rubber or plastic cable nozzles and fixed-outlet covers.

2.19 BATTERY BACKUP POWER UNIT

- A. Unit shall be rack mounted, consisting of time-delay relay, sealed lead-calcium battery, battery charger, on-off switch, "normal" and "emergency" indicating lights, and adequate capacity to supply maximum equipment power requirements for one hour of continuous full operation.
- B. Unit shall supply public address equipment with 12- to 15-V dc power automatically during an outage of normal 120-V ac power.

- C. Battery shall be on float charge when not supplying system and able to transfer automatically to supply system after three to five seconds of continuous outage of normal power, as sensed by time-delay relay.
- D. Unit shall automatically retransfer system to normal supply when normal power has been reestablished for three to five seconds continuously.

2.20 CONDUCTORS AND CABLES

- A. Jacketed, twisted pair and twisted multipair, untinned solid copper.
 - 1. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
 - 2. Microphone Cables: Neoprene jacketed, not less than 2/64 inch (0.8 mm) thick, over shield with filled interstices. Shield No. 34 AWG, tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.
 - 3. Plenum Cable: Listed and labeled for plenum installation.

2.21 PATHWAYS

- A. Conduit and Boxes: Comply with Section 270528 "Pathways for Communications Systems."
 - 1. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method: Install cables in pathways except within consoles, cabinets, desks, and counters. Conceal pathway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for pathways and boxes specified in Section 270528 "Pathways for Communications Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF PATHWAYS

- A. Comply with requirements in Section 270528 "Pathways for Communications Systems." for installation of conduits and wireways.
- B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Cable Installation Requirements:

1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
3. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceiling by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate pathways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other communication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

A. Coordinate layout and installation of system components and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

C. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

D. Equipment Cabinets and Racks:

1. Group items of same function together, either vertically or side by side, and arrange controls symmetrically. Mount monitor panel above the amplifiers.
2. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
3. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.

E. Volume Limiter/Compressor: Equip each zone with a volume limiter/compressor. Install in central equipment cabinet. Arrange to provide a constant input to power amplifiers.

F. Wall-Mounted Outlets: Flush mounted.

G. Floor-Mounted Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.

- H. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.
- I. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
- J. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.
- K. Connect wiring according to Section 271500 "Communications Horizontal Cabling" and Section 280513 "Conductors and Cables for Electronic Safety and Security."

3.5 GROUNDING

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
- C. Install grounding electrodes as specified in Section 270526 "Grounding and Bonding for Communications Systems."

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Schedule tests with at least seven days' advance notice of test performance.
 - 2. After installing public address system and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
 - 4. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
 - a. Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.
 - b. Repeat test for each separately controlled zone of loudspeakers.
 - c. Minimum acceptance ratio is 50 dB.
 - 5. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For

each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.

6. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
 7. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
 8. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Section 270526 "Grounding and Bonding for Communications Systems."
- E. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
- F. Public address system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
1. Include a record of final speaker-line matching transformer-tap settings and signal ground-resistance measurement certified by Installer.
- 3.7 STARTUP SERVICE
- A. **Engage a factory-authorized service representative to perform** startup service.
1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
 2. Complete installation and startup checks according to manufacturer's written instructions.
- 3.8 ADJUSTING
- A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.
- B. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.
- 3.9 DEMONSTRATION
- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain the public address system and equipment. Refer to Section 017900 "Demonstration and Training."

END OF SECTION

SECTION 27 51 19

SOUND MASKING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Electronic noise generators.
 - 2. Amplifiers.
 - 3. Wiring.
 - 4. Masking speaker assemblies.
 - 5. Controls.
 - 6. Component mounting racks.

1.3 DEFINITIONS

- A. Covered Spaces: Spaces above which masking speakers are installed.

1.4 SYSTEM DESCRIPTION

- A. Zones: **Multiple**-zone coverage.
- B. Channels: Single channel of masking sound to each zone.
- C. Channels: Separate channel of masking sound to each of **three** groups of speakers in each zone.
- D. Signal Levels: Individually adjustable for each of 14 one-third octave bands centered at 200 through 4000 Hz, for sound-masking noise channels.
- E. Sound-Power Level Produced by System: Match **NC 40** contour between **400 and 2000 Hz**, with smooth roll-off above and below those frequencies.
 - 1. Initial Level: **40 dB**, A-weighted.
 - 2. Final Adjusted Level: **40 to 50 dB**, A-weighted. Determine final level for each space individually by measurement as specified in Part 3.
 - 3. Measurements: Made under calibration conditions.
- F. Maximum Local Variance of Sound-Power Level: **6 dB** for the 500-Hz octave band and **3 dB** for the 1000-, 2000-, and 4000-Hz octave bands for 75 percent of the locations in covered spaces.
- G. Maximum Average Range of Sound-Power-Level Deviation: **2 dB** in the 250-, 2000-, and 4000-Hz octave bands and **1.5 dB** for the 500- and 1000-Hz octave bands for all locations.

- H. Directional Effect: People in covered spaces under calibration conditions cannot determine source of masking sound.
- I. Uniformity with Respect to Time: One-minute time-averaged sound-pressure level of any octave band of masking sound from **250 to 8000 Hz** remains constant in any space to within a standard deviation of **2 dB** when measured over a 30-minute period.
- J. Sound Quality: No audible hum or noise from this system in covered spaces when noise generators are off and power amplifiers are on with input volume controls set at **50** percent.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include nationally recognized testing laboratory listing data.
- B. Shop Drawings: Dimensioned plans and elevations showing minimum clearances and installed features and devices for system components. Show types and locations of masking speakers and their wiring connections, channel assignments, and axis orientations. Show ducts, beams, and other significant sound-reflecting and -absorbing elements in ceiling space and show locations of partitions below ceiling. Include a diagram showing interconnection of major system components for each zone and channel and indicating grounding connections.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified **manufacturer and testing agency**.
- B. Product Certificates: For sound-masking equipment and components, signed by product manufacturer.
- C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sound-masking equipment and components to include in emergency, operation, and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sound-Masking Speaker Assemblies: **One** for each 10 of each type used, but no fewer than one.
 - 2. Fuses: **One** for each type used, but no fewer than one.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer trained and approved by manufacturer of sound-masking equipment.
- B. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing of sound-masking systems according to ASTM E 1130. Required experience includes having

tested a minimum of five different systems within the last five years, each system similar in size and complexity to Project system.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.
- E. Comply with UL 813 unless a more stringent standard is specified in Part 2.

1.10 COORDINATION

- A. Coordinate quantity and arrangement of speaker assemblies with ceiling space configuration and with components occupying ceiling space, including structural members, pipes, air-distribution components, raceways, cable trays, recessed lighting fixtures, and other items.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Sound Masking, LLC.
 - 2. Atlas Sound LP.
 - 3. GE Security, Sound and Communications.

2.2 GENERAL REQUIREMENTS FOR SOUND-MASKING EQUIPMENT

- A. Components: Modular plug-in, heavy-duty, industrial-grade integrated circuit devices.
- B. AC Supply Voltage Tolerance: 105 to 130 V with no degradation of system performance.
- C. Protection from Power Line Surges: Integral surge protection devices listed in UL 1449; with the following features:
 - 1. Suppression Level: 300 V.
 - 2. Maximum Response Time: 5 nanoseconds.
 - 3. Circuit: Multistage, using inductors and silicon-avalanche zener diodes or equivalent.
 - 4. Indicator Lamp: Neon or light-emitting diode located on control panel and arranged to extinguish on failure of protection.
 - 5. Fuses: Externally accessible.
- D. Component Housings: Suitable for mounting in standard 19-inch (480-mm) relay racks, with connections at rear and controls either on rear panel or protected by a screw-fastened security cover.

2.3 NOISE GENERATOR AND FILTER UNITS

- A. Digital Masking Generator Spectra: Pink, white, and superwhite.
- B. Pink Noise Generator: Output octave bands from 30 to 4000 Hz.
- C. Filters for One-Third Octave Bands: Adjustable from 10 dB of boost to 10 dB of cut at each center frequency.

- D. Mixer Inputs: Two high level and one microphone level.
- E. High-Pass Filter: Approximate range of cutoff adjustment is 37 to 400 Hz.
- F. Low-Pass Filter: Adjustable roll-off frequency 100 Hz to 10 kHz.
- G. High-Cut Filter: Approximate range of cutoff adjustment is 180 to 9000 Hz with slope varying to 12 dB per octave.
- H. Auxiliary Inputs: Able to accept two, high-level, auxiliary signals such as music and telephone paging as well as general paging.
- I. Mounting: Shelf or rack 3-1/2 inches (90 mm) high.

2.4 PROGRAMMABLE AUDIO-LEVEL CONTROL UNIT

- A. Automatic Sound-Power-Level Changes: Six system channel changes, four times per day, and capable of different time settings for each day of week.
- B. Level Changes: Programmable from front panel of unit, and automatically incremented over a period long enough for sound-level variations to be imperceptible to occupants of covered spaces.
- C. Muting: Control unit shall be programmed to permit muting for emergency paging.
- D. Built-in zone-level control shall drive other amplifiers and provide minimum 7-position level control.
- E. Program Memory: Nonvolatile for at least one year without power. When re-energized after a power outage, control starts at zero level and automatically advances system sound level at same rate used for programmed level changes.

2.5 POWER AMPLIFIERS

- A. Power Amplifiers: Comply with CEA-426, and have the following minimum features:
 - 1. Mounting: Rack mounted.
 - 2. Output Regulation: Less than 2 dB from zero to full load.
 - 3. Total Harmonic Distortion: Less than 3 percent, at rated power output from 50 to 12,000 Hz.
 - 4. Signal-to-Noise Ratio: 60 dB or greater, at rated output.
 - 5. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.
 - 6. Input: From internal masking or mixer board, or from an exterior source such as an automatic level control or other mixer.

2.6 MASKING SPEAKER ASSEMBLIES

- A. Speakers: Cone type, with the following minimum features:
 - 1. Minimum Axial Sensitivity: 45 dB.
 - 2. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
 - 3. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (142-g) ceramic magnet unless otherwise indicated.
 - 4. Dispersion Angle: 100 degrees.
 - 5. Rated Output Level: 10 W.
- B. Configuration: Dual 8-inch (200-mm) and dual 5-inch (125-mm) units mounted on metal baffles and arranged for optimum, multidirectional, angular sound distribution. Arrange units for suspension from the building structure above the ceiling.

- C. Matching Transformers: Full-power rated with 4 standard taps, and a maximum insertion loss of 0.5 dB.
- D. Assemblies installed in air-handling spaces shall comply with NFPA 70 requirements for rate of heat-release and rate of smoke-release characteristics. Tests for these requirements shall be according to UL 2043.

2.7 WIRE

- A. Speaker Wire: UTP cable complying with manufacturer's requirements; listed and labeled for environmental air plenums where cable is indicated in plenum spaces and is not indicated to be in raceway. Comply with requirements in Section 271500 "Communications Horizontal Cabling."

2.8 COMPONENT MOUNTING RACKS

- A. Configuration: Comply with CEA-310-E. Factory-fabricated units designed for interchangeable mounting, forced or convection air cooling, wiring connection, and enclosure of standard 19-inch (482-mm) relay rack modules.
- B. Mounting Provisions: Equipped for freestanding floor mounting.
- C. Cabinet: Factory-finished steel with component mounting rails and prewired plug strips for component power connections. Full front and rear doors with continuous hinges, handles, and cylindrical keyed locks.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Speaker Assemblies: Suspend with chains from building structure above ceilings so bottom of assembly is 6 to 8 inches (150 to 200 mm) above upper plane of finished ceiling material. Use eyebolts on speaker assemblies for attachment. Suspend independently of supports for components of other building systems.
- B. Install seismic restraints on speakers. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Speaker Connections: For two- or three-channel systems, connect speaker assemblies alternatively so masking sound is redundant throughout zones of coverage.
- D. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and unless otherwise indicated.
 - 1. Except raceways are not required in accessible indoor ceiling spaces and attics.
 - 2. Except raceways are not required in hollow gypsum board partitions.
 - 3. Conceal raceways and wiring except in unfinished spaces.
- E. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements specified in Section 271500 "Communications Horizontal Cabling" for cable trays
 - 3. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
 - 4. Comply with requirements in Section 271500 "Communications Horizontal Cabling."
- F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

- G. Exposed Cable: Install parallel to building lines, follow surface contours, and support as recommended by manufacturer.
- H. Grounding: As recommended by manufacturers unless more stringent requirements are indicated. Ground equipment and conductors to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments with a maximum of 5-ohm to ground at main equipment location. Measure, record, and report ground resistance.
- I. Impedance Matching: For system components, including connecting cable, provide end-to-end level and impedance-matched signal paths. Use matching networks and balancing devices at connections where necessary to avoid mismatches.
- J. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.2 IDENTIFICATION

- A. Use color-coded conductors and apply wire and cable marking tape to designate wires and cables so media are identified in coordination with system wiring diagrams. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Label speaker assemblies as to channel, zone, and address.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Operational Test: Start system to confirm proper operation. Remove malfunctioning units, replace with new units, and retest. Make initial sound-spectrum and -level adjustments for each zone.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
 - 4. Pretesting: Tune, align, and adjust system and pretest components, wiring, and functions to verify they comply with specified material, installation, and performance requirements. Correct deficiencies and retest until satisfactory performance and conditions are achieved.
 - 5. Masking Sound-Power-Level Adjustments: Adjust independently for each space to minimum level between 40 and 50 dB that will provide speech privacy between adjacent workstations while complying with other system requirements.
- E. Final Acceptance Testing: Provide a minimum of 10 days' notice of acceptance test performance schedule. Schedule tests after pretesting has been successfully completed.
 - 1. Tests and Calibration Conditions: Spaces shall be completely furnished but unoccupied; lights and HVAC systems shall be on; HVAC system testing and balancing shall be completed; and electronic ballasts, lighting relay panels, and low voltage transformers shall be in place.

2. Test Conditions: Complying with ASTM E 1130 and calculated according to ANSI S3.5.
 3. Instrumentation: Use a professional-quality, sound-level meter with octave-band filters and documentation of recent calibration against recognized standards.
 4. Record test observations, readings, and corrective actions.
 5. System Tests: Include the following for each system zone:
 - a. Speaker Circuit Impedance Test: Measure impedance at 1000 Hz with amplifier disconnected, using a professional impedance meter or bridge. Locate and correct faults denoted by abnormal readings.
 - b. Ambient Sound-Level Tests: With system off, measure ambient sound level in one-third octave bands. Also measure ambient sound level as a single, wide-band, A-weighted reading.
 - c. Amplifier Noise Test: Check for performance specified in "System Description" Article with masking noise generator off and amplifiers on.
 - d. System Noise Test: With masking noise signal on and amplifiers adjusted at a working level 10 dB above ambient sound level, check for hum, buzz, rattle, or other operating deficiencies.
 - e. Spatial Uniformity Test: Measure sound level at locations no greater than 15 feet (4.6 m) o.c. throughout covered spaces to determine compliance with specified performance level.
 - f. Frequency Response Adjustment and Test: Adjust one-third octave frequency bands and other unit filters to provide response. Adjust to meet requirement of space speech intelligibility and quality of background sound. Comply with ANSI S3.2, CEA 426, and ASTM E 1110.
 6. Adjust level of masking sound for each space so one-third octave band centered at 500 Hz has final selected sound-power level for that space. Measure deviation from listed values in one-third octave bands from 100 to 1000 Hz. Measured values must not deviate from those listed by more than 4 dB for open plan areas and 8 dB for enclosed offices. The total of individual band deviations in eight bands must not exceed 16 dB for open plan areas and 30 dB for enclosed offices.
 7. Walk-through Test: People in covered spaces cannot discern speaker locations.
 8. Temporal Stability Test: Check for uniformity of time by measuring sound level in each of 14 octave bands at one-minute intervals over a 30-minute test period. Deviations must not exceed limits specified in "System Description" Article.
 9. Where required, space shall meet the Health Insurance Portability and Accountability Act for privacy and the Gramm-Leach Bliley Act to protect consumer personal and financial information in open office layouts.
- F. Retest: Correct deficiencies identified by tests and observations and retest until meeting specified requirements.
- G. Recording Control Settings and System Adjustments: Record final control settings and programming, and final tap setting of speaker matching transformers. Record final sound-level measurements and observations.

3.4 ADJUSTING

- A. Occupancy Adjustments: When requested within [12] <Insert number> months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to [two] <Insert number> visits to Project during other-than-normal occupancy hours for this purpose.

3.5 DEMONSTRATION

- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain services.

END OF SECTION

SECTION 27 51 23

INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: **Microprocessor-switched** intercommunications and program systems with the following components:

1. Master stations.
2. Speaker-microphone stations.
3. Call-switch unit.
4. All-call amplifier.
5. Intercommunication amplifier.
6. Paging amplifier.
7. Loudspeakers/speaker microphones.
8. Conductors and cables.
9. Raceways.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For intercommunications and program systems. Include plans, elevations, sections, details, and attachments to other work.
 1. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Include scaled drawings for master station that detail built-in equipment.
 3. Wiring Diagrams: For power, signal, and control wiring.
 - a. Identify terminals to facilitate installation, operation, and maintenance.
 - b. Single-line diagram showing interconnection of components.
 - c. Cabling diagram showing cable routing.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from Installers of the items involved.
- B. Qualification Data: For qualified **testing agency**.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For intercommunications and program systems to include in operation and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. A record of Owner's equipment-programming option decisions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated.
 - 1. Testing Agency's Field Supervisor: Certified by NICET as Audio Systems **Level II** Technician.
 - 2. Testing Agency's Field Supervisor.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted speaker microphones with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aiphone Corporation.
 - 2. Alpha Communications.
 - 3. Federal Signal Corporation.

2.2 FUNCTIONAL DESCRIPTION OF MANUALLY SWITCHED SYSTEMS

- A. Master Station:
 - 1. Communicating selectively with other master and speaker-microphone stations by actuating selector switches.
 - 2. Communicating simultaneously with all other stations by actuating a single all-call switch.
 - 3. Communicating with individual stations in privacy.
 - 4. Including other master-station connections in a multiple-station conference call.
 - 5. Accessing separate paging speakers or groups of paging speakers by actuating selector switches.
 - 6. Overriding any conversation by a designated master station.
- B. Speaker-Microphone Station:

1. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
2. Communicating hands free.
3. Calling master station by actuating call switch.
4. Returning a busy signal to indicate that station is already in use.
5. Being free of noise and distortion during operation and when in standby mode.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.3 FUNCTIONAL DESCRIPTION OF MICROPROCESSOR-SWITCHED SYSTEMS

A. Master Station:

1. Communicating selectively with other master and speaker-microphone stations by dialing station's number on a 12-digit keypad.
2. Communicating simultaneously with all other stations by dialing a designated number on a 12-digit keypad.
3. Communicating with individual stations in privacy.
4. Including other master-station connections in a multiple-station conference call.
5. Accessing separate paging speakers or groups of paging speakers by dialing designated numbers on a 12-digit keypad.
6. Overriding any conversation by a designated master station.
7. Displaying selected station.

B. Speaker-Microphone Station:

1. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
2. Communicating hands free.
3. Calling master station by actuating call switch.
4. Returning a busy signal to indicate that station is already in use.
5. Being free of noise and distortion during operation and when in standby mode.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.4 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

- A. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Expansion Capability: Increase number of stations in the future by **25** percent above those indicated without adding any internal or external components or main trunk cable conductors.
- C. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
- D. Weather-Resistant Equipment: Listed and labeled by an NRTL for duty outdoors or in damp locations.

2.5 MASTER STATION FOR MANUALLY SWITCHED SYSTEMS

- A. Station-Selector and Talk-Listen Switches: Heavy-duty type with gold-plated contacts rated for five million operations.
- B. Volume Control: Regulates incoming-call volume.

- C. LED Annunciation: Identifies calling stations and stations in use. LED remains on until call is answered.
- D. Tone Annunciation: Momentary audible tone signal announces incoming calls.
- E. Speaker Microphone: Transmits and receives calls.
- F. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.
- G. Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and auxiliary equipment.

2.6 MASTER STATION FOR MICROPROCESSOR-SWITCHED SYSTEMS

- A. 12-Digit Keypad Selector: Transmits calls to other stations and initiates commands for programming and operation.
- B. Volume Control: Regulates incoming-call volume.
- C. LED Annunciation: Identifies calling stations and stations in use. LED remains on until call is answered.
- D. Tone Annunciation: Momentary audible tone signal announces incoming calls.
- E. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.
- F. Reset Control: Cancels call and resets system for next call.
- G. Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions.

2.7 SPEAKER-MICROPHONE STATIONS

- A. Mounting: Flush unless otherwise indicated, and suitable for mounting conditions indicated.
- B. Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.
- C. Back Box: Two-gang galvanized steel with 2-1/2-inch (64-mm) minimum depth.
- D. Speaker: 3 inches (76 mm), 2.3 oz. (65 g) minimum; permanent magnet.
- E. Tone Annunciation: Recurring momentary tone indicates incoming calls.
- F. Call Switch: Mount on faceplate. Permits calls to master station.
- G. Privacy Switch: Mount on faceplate. When in on position, switch prevents transmission of sound from remote station to system; when in off position, without further switch manipulation, response can be made to incoming calls.
- H. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.

2.8 CALL-SWITCH UNIT

- A. Enclosure: Single-gang box with stainless-steel faceplate.
- B. Call Switch: Momentary contact signals system that a call has been placed.
- C. Privacy Switch: Prevents transmission of sound signals from station to system.
- D. Volume Control: Operated by screwdriver blade through a hole in faceplate to adjust output level of associated speaker.
- E. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.

2.9 ALL-CALL AMPLIFIER

- A. Output Power: 70-V balanced line. **80 percent of the sum of wattage settings of connected** for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.
- B. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to quantity of stations connected in all-call mode of operation.
- C. Minimum Signal-to-Noise Ratio: 45 dB, at rated output.
- D. Frequency Response: Within plus or minus 3 dB from 70 to 12,000 Hz.
- E. Output Regulation: Maintains output level within 2 dB from full to no load.
- F. Input Sensitivity: Compatible with master stations and central equipment so amplifier delivers full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on master stations, speaker microphones, or handset transmitters.
- G. Amplifier Protection: Prevents damage from shorted or open output.

2.10 INTERCOMMUNICATION AMPLIFIER

- A. Minimum Output Power: **2 W** adequate for all functions.
- B. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to one station connected to output terminals.
- C. Minimum Signal-to-Noise Ratio: 45 dB, at rated output.
- D. Frequency Response: Within plus or minus 3 dB from 70 to 10,000 Hz.
- E. Output Regulation: Maintains output level within 2 dB from full to no load.
- F. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on master stations, speaker microphones, or handset transmitters.
- G. Amplifier Protection: Prevents damage from shorted or open output.

2.11 PAGING AMPLIFIER

- A. Input Voltage: 120-V ac, 60 Hz.

- B. Frequency Response: Within plus or minus 3 dB from 60 to 10,000 Hz.
- C. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
- D. Total Harmonic Distortion: Less than 3 percent at rated power output from 70 to 12,000 Hz.
- E. Output Regulation: Less than 2 dB from full to no load.
- F. Controls: On-off, input levels, and low-cut filter.
- G. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphones or handset transmitters.
- H. Amplifier Protection: Prevents damage from shorted or open output.
- I. Output Circuit: 70-V line.

2.12 CONE-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES

- A. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
- B. Frequency Response: Within plus or minus 3 dB from 70 to 15,000 Hz.
- C. Minimum Dispersion Angle: 100 degrees.
- D. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.
- E. Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and factory primed; complete with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; with relief of back pressure.
- F. Baffle: For flush speakers, minimum thickness of 0.032-inch (0.8-mm) aluminum **with textured white finish**.
- G. Vandal-Proof, High-Strength Baffle: For **flush** and **surface-mounted** speakers, self-aging cast aluminum with tensile strength of 44,000 psi (303 MN/sq. m), 0.025-inch (0.65-mm) minimum thickness; countersunk heat-treated alloy mounting screws; and textured white epoxy finish.
- H. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.

2.13 HORN-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES

- A. Speakers shall be all-metal, weatherproof construction; complete with universal mounting brackets.
- B. Frequency Response: Within plus or minus 3 dB from 275 to 14,000 Hz.
- C. Minimum Power Rating of Driver: 15 W, continuous.
- D. Minimum Dispersion Angle: 110 degrees.
- E. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.

2.14 HORN-TYPE EXPLOSION-PROOF LOUDSPEAKERS

- A. Speakers shall be all-metal construction; complete with universal mounting brackets.
- B. Units in Hazardous (Classified) Locations: Listed and labeled for environment in which they are located.
- C. Frequency Response: Within plus or minus 3 dB from 300 to 12,000 Hz.
- D. Minimum Power Rating of Driver: **60 W**, continuous.
- E. Minimum Dispersion Angle: **60 by 120** degrees.
- F. Line Transformer: Internally mounted and factory installed, power rating equal to speaker's, and at least four level taps.

2.15 CONDUCTORS AND CABLES

- A. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.
- B. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
- C. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.
 - 1. Minimum Shielding Coverage on Conductors: 60 percent.
- D. Plenum Cable: Listed and labeled for plenum installation.

2.16 RACEWAYS

- A. Intercommunication and Program System Raceways and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems."
- B. Intercommunication and Program System Raceways and Boxes: Same as required for electrical branch circuits specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- C. Intercommunication and Program System Raceways and Boxes: **EMT**.
- D. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- E. Flexible metal conduit is prohibited.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."

- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF RACEWAYS

- A. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements:
 1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
 2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
 3. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
 5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
- C. Open-Cable Installation:
 1. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
 2. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceiling by cable supports not more than 60 inches (1524 mm) apart.
 3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
- D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

- A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.
- C. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.

- D. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.
 - E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- 3.5 GROUNDING
- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
 - B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
 - C. Install grounding electrodes as specified in Section 270526 "Grounding and Bonding for Communications Systems."
- 3.6 SYSTEM PROGRAMMING
- A. Programming: Fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.
- 3.7 FIELD QUALITY CONTROL
- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
 - B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
 - C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - D. Tests and Inspections:
 - 1. Schedule tests with at least seven days' advance notice of test performance.
 - 2. After installing intercommunications and program systems and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: Test originating station-to-station, **all-call, and page** messages at each intercommunication station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.
 - 4. Frequency Response Test: Determine frequency response of two transmission paths, **including all-call and paging**, by transmitting and recording audio tones. Minimum acceptable performance is within 3 dB from 150 to 2500 Hz.
 - 5. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
 - a. Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio at **paging** speakers.
 - b. Repeat test for four speaker microphones **and for each separately controlled zone of paging loudspeakers**.
 - c. Minimum acceptable ratio is 35 dB.

6. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into **each paging and all-call amplifier, and** a minimum of two selected intercommunication amplifiers. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.
 7. **Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at three locations in each paging zone. Maximum permissible variation in level is plus or minus 3 dB; in levels between adjacent zones, plus or minus 5 dB.**
 8. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 150, 1000, and 2500 Hz. Maximum variation in power output at these frequencies is plus or minus 3 dB.
 9. Signal Ground Test: Measure and report ground resistance at system signal ground. Comply with testing requirements in Section 270526 "Grounding and Bonding for Communications Systems."
- E. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
 - F. Intercommunications and program systems will be considered defective if they do not pass tests and inspections.
 - G. Prepare test and inspection reports.
- 3.8 STARTUP SERVICE
- A. **Engage a factory-authorized service representative to perform startup service and initial system programming.**
 1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
 2. Complete installation and startup checks according to manufacturer's written instructions.
- 3.9 ADJUSTING
- A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.
 - B. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.
- 3.10 DEMONSTRATION
- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain the intercommunications and program systems.
 1. Train Owner's maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining the system and equipment.

END OF SECTION

SECTION 27 51 23 .50

EDUCATIONAL INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: **Microprocessor-switched telephone/intercommunications]** and program systems with the following components:

1. Master stations.
2. Call control console.
3. Speaker-microphone stations.
4. Call-switch unit.
5. All-call amplifier.
6. Intercommunication amplifier.
7. Paging amplifier.
8. Loudspeakers/speaker microphones.
9. Conductors and cables.
10. Raceways.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For educational intercommunications and program systems. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Include scaled drawings for station arrangement of built-in equipment.
 3. Wiring Diagrams: For power, signal, and control wiring.
 - a. Identify terminals to facilitate installation, operation, and maintenance.
 - b. Single-line diagram showing interconnection of components.
 - c. Cabling diagram showing cable routing.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.
- B. Qualification Data: For qualified **testing agency**.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For educational intercommunications and program systems to include in operation and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. A record of final matching transformer-tap settings and signal ground-resistance measurement certified by Installer.
 2. A record of Owner's equipment-programming option decisions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated.
1. Testing Agency's Field Supervisor: Certified by NICET as Audio Systems **Level II** Technician.
 2. Testing Agency's Field Supervisor.
- C. Source Limitations: Obtain educational intercommunications and program systems from single source from single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for location and application.
- E. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted speaker microphones and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bogen Communications, Inc.
 2. Rauland-Borg Corporation.
 3. Valcom, Inc.

2.2 FUNCTIONAL DESCRIPTION OF MANUALLY SWITCHED SYSTEMS

- A. Master Station:
1. Communicating selectively with other master and speaker-microphone stations by actuating selector switches.
 2. Communicating simultaneously with all other stations by actuating a single all-call switch.
 3. Communicating with individual stations in privacy.

4. Including other master-station connections in a multiple-station conference call.
5. Accessing separate paging speakers or groups of paging speakers by actuating selector switches.
6. Overriding any conversation by a designated master station.

B. Speaker-Microphone Station:

1. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
2. Communicating hands free.
3. Calling master station by actuating call switch.
4. Returning a busy signal to indicate that station is already in use.
5. Being free of noise and distortion during operation and when in standby mode.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.3 FUNCTIONAL DESCRIPTION OF MICROPROCESSOR-SWITCHED SYSTEMS

A. Master Station:

1. Communicating selectively with other master and speaker-microphone stations by dialing station's number on a 12-digit keypad.
2. Communicating with individual stations in privacy.
3. Communicating on a minimum of three voice channels with up to two simultaneous conversations between master stations and one conversation between a master station and a speaker-microphone station.
4. Increasing the number of conversation channels by adding a module in central-control cabinet.
5. Including up to three other station connections in a conference call.
6. Accessing separate paging speakers or groups of paging speakers by dialing designated numbers on a 12-digit keypad.
7. Overriding any conversation by a designated master station.
8. Displaying selected station.
9. Communicating simultaneously with all other stations by dialing a designated number on a 12-digit keypad.
10. Automatically controlling gain to ensure constant intercom speech level.
11. Controlling the simultaneous distribution of program material to various combinations of speaker-microphone stations or groups over two program channels by using keypad to control sources and distribute programs.
12. Operating and correcting secondary clocks and controlling class-change signals to speakers and bells by using keypad.
13. User-programmable features include the following:
 - a. Station calling by room number.
 - b. Room station call-in priority levels.
 - c. Clock signal schedule functions.
 - d. Schedule characteristics of audible signals.
 - e. Call-in tone characteristic.
 - f. Precedence among master stations as destinations for incoming calls from room stations.
 - g. Grouping of rooms and speakers into zones for paging and program distribution purposes.

B. Speaker-Microphone Station:

1. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
2. Communicating hands free.
3. Calling master station by actuating call switch.
4. Returning a busy signal to indicate that station is already in use.

- C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.4 FUNCTIONAL DESCRIPTION OF TELEPHONE/INTERCOMMUNICATION SYSTEMS

A. Integrated central system with the following:

1. Direct-dial, full duplex private telephone communications between all locations equipped with telephones. Call initiation among master stations and between master and remote stations by dialing station's number on a 12-digit keypad.
2. **16** channels for unrestricted simultaneous communications.
3. Initial system operation with master and remote stations, expandable to 360 stations.
4. Direct-dial, two-way amplified voice intercommunication between master telephones and remote stations without use of press-to-talk or talk-listen switches.
5. Automatic queuing for intercommunication channels, with automatic call waiting.
6. Call transfer among master stations.
7. Display of selected station and answering calling station by pressing a single "response button."
8. Simultaneous communication with other stations on system by dialing a designated number on a 12-digit keypad.
9. Automatic gain control to ensure constant intercom speech level.
10. Simultaneous distribution of emergency announcements to all locations equipped with speakers by dialing a predetermined code number.
11. User-selectable facility for providing selected telephones with dial tone.
12. User-selectable facility for permitting linkage of selected stations to media retrieval center and for permitting on- and off-premise computer linkage.
13. Assignment of speaker locations within any one or more of eight zones for zone paging or time signal reception.
14. Digital readout displays on which up to three incoming calls are displayed with additional calls stored for subsequent display.
15. Off-site diagnostics through a serial data port on central-control station.
16. Control of simultaneous distribution of program material to various combinations of remote stations or groups by using keypad to control sources and distribute programs.
17. Operation and correction of secondary clocks and control of class-change signals to speakers and bells by using keypad.
18. User-programmable features include the following:
 - a. Station calling by room number.
 - b. Room station call-in priority levels.
 - c. Clock signal schedule functions.
 - d. Schedule characteristics of audible signals.
 - e. Call-in tone characteristic.
 - f. Precedence among master stations as destinations for incoming calls from room stations.
 - g. Grouping rooms and speakers into zones for paging and program distribution purposes.
19. Telephone interconnect features include the following:
 - a. Direct connection to central office trunk lines with initial system wiring for trunk lines.
 - b. Routing of outside trunk lines for "attendant answer incoming" and "direct inward line" functions.
 - c. Station programming for access to outside trunk lines to be any of the following:
 - 1) Totally unrestricted access.
 - 2) Restricted access.
 - 3) No access.
 - d. System programming to allow or disallow local prefixes, and to authorize access for as many as three area codes.
 - e. Discriminating ringing for identifying internal and outside calls.
 - f. Circular hunting for outside trunks to prevent excess usage of any one trunk.
 - g. Direct connection of a single trunk to designated telephone with transfer to attendant if unanswered.

- h. Call parking allowing paged party to remotely pick up outside call from any master station.
- i. Night-answer mode to allow one or all of the following:
 - 1) Incoming call transferred to predetermined extension.
 - 2) Tone transmitted to speakers to notify key personnel to answer telephone.
 - 3) Dial tone to remote stations to allow answering call from all locations.
- j. Call control console to do as follows:
 - 1) Identify, answer, and route incoming outside calls, with reminder and recall features.
 - 2) Directly access outside trunk lines.
 - 3) Hold, park, and transfer calls.
 - 4) Screen outside calls.

B. Remote Stations:

1. Speaker-Microphone Station:

- a. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
- b. Communicating hands free.
- c. Calling master station by actuating call switch.
- d. Returning a busy signal to indicate that station is already in use.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.5 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

- A. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Expansion Capability: Increase number of stations in the future by [25] <Insert number> percent above those indicated without adding any internal or external components or main trunk cable conductors.
- C. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz. Comply with UL 813.
- D. Weather-Resistant Equipment: Listed and labeled by an NRTL for duty outdoors or in damp locations.

2.6 MASTER STATION FOR MANUALLY SWITCHED SYSTEMS

- A. Station-Selector and Talk-Listen Switches: Heavy-duty type with gold-plated contacts rated for five million operations.
- B. Volume Control: Regulates incoming-call volume.
- C. LED Annunciation: Identifies calling stations and stations in use. LED remains on until call is answered.
- D. Tone Annunciation: Momentary audible tone signal announces incoming calls.
- E. Speaker Microphone: Transmits and receives calls.
 - 1. Minimum Speaker Sensitivity: 91 dB at one meter, with 1-W input.

- F. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.
- G. Central-Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and auxiliary equipment.

2.7 MASTER STATION FOR MICROPROCESSOR-SWITCHED SYSTEMS

- A. 12-Digit Keypad Selector: Transmits calls to other stations and initiates commands for programming and operation.
- B. Volume Control: Regulates incoming-call volume.
- C. Tone Annunciation: Momentary audible tone signal announces incoming calls.
- D. Lamp Annunciation: Identifies calling stations and stations in use. Lamp remains on until call is answered.
- E. Speaker Microphone: Transmits intercom voice signals when used via a voice-operated switch.
 - 1. Minimum Speaker Sensitivity: 91 dB at one meter, with 1-W input.
- F. Link Button: To transfer calls.
- G. Reset Control: Cancels call and resets system for next call.
- H. Digital Display: 16-digit alphanumeric LCD readout to register up to four three-digit station numbers.
- I. Central-Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions.

2.8 CALL CONTROL CONSOLE

- A. Microprocessor-based instrument to process outside and internal calls with a 12-digit keypad selector.
- B. 20-character alphanumeric display for the following:
 - 1. Simultaneous display of up to three calling stations plus last station dialed.
 - 2. Display of calls in order received with emergency calls taking precedence on the display.
 - 3. Review of calls stored in groups of four.
 - 4. Display of prompt messages to assist in system operation.
- C. Programmable Keys: Minimum of 20 with LED indicators for ringing/busy status; programmable for trunk and operator functions.
- D. Transfer Button: Calls to busy extensions and unanswered calls automatically returned to call control console.
- E. Hold Button: With reminder feature every 30 seconds for parked calls or calls placed on hold.
- F. Release Button: For use with parked calls or calls placed on hold.
- G. Page Button: For engaging system paging functions.
- H. Programmable for night answer, remote answer, and remote pickup features.

- I. Programmable for distribution of emergency announcements, all-page announcements, zone-page announcements, and emergency/evacuation alert.
- J. Central-Control Cabinet Equipment: Central switching equipment, central office adapter module, line link modules, power supplies, chassis adapters, and other switching and control devices required for trunk and internal conversation channels and control functions.

2.9 SPEAKER-MICROPHONE STATIONS

- A. Mounting: Flush unless otherwise indicated, and suitable for mounting conditions indicated.
- B. Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.
- C. Back Box: Two-gang galvanized steel with 2-1/2-inch (64-mm) minimum depth.
- D. Speaker: Minimum axial sensitivity shall be 91 dB at one meter, with 1-W input. Voice coil shall be not less than 3 inches (76 mm), 2.3 oz. (65 g) minimum; permanent magnet.
- E. Tone Annunciation: Recurring momentary tone indicates incoming calls.
- F. Call Switch: Mount on faceplate. Permits calls to master station.
- G. Privacy Switch: Mount on faceplate. When in on position, switch prevents transmission of sound from remote station to system; when in off position, without further switch manipulation, response can be made to incoming calls.

2.10 CALL-SWITCH UNIT

- A. Enclosure: Single-gang box with stainless-steel faceplate.
- B. Call Switch: Momentary contact signals system that a call has been placed.
- C. Privacy Switch: Prevents transmission of sound signals from station to system.
- D. Volume Control: Operated by screwdriver blade through a hole in faceplate to adjust output level of associated speaker.

2.11 ALL-CALL AMPLIFIER

- A. Output Power: 70-V balanced line. **80 percent of the sum of wattage settings of connected** for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.
- B. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to quantity of stations connected in all-call mode of operation.
- C. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
- D. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.
- E. Output Regulation: Maintains output level within 2 dB from full to no load.
- F. Input Sensitivity: Compatible with master stations and central equipment so amplifier delivers full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on master stations, speaker microphones, or handset transmitters.

- G. Amplifier Protection: Prevents damage from shorted or open output.

2.12 INTERCOMMUNICATION AMPLIFIER

- A. Minimum Output Power: 15 W; adequate for all functions.
- B. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to one station connected to output terminals.
- C. Minimum Signal-to-Noise Ratio: 50 dB, at rated output.
- D. Frequency Response: Within plus or minus 3 dB from 70 to 10,000 Hz.
- E. Output Regulation: Maintains output level within 2 dB from full to no load.
- F. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on microphones in master stations, speaker microphones, or handset transmitters.
- G. Amplifier Protection: Prevents damage from shorted or open output.

2.13 PAGING AMPLIFIER

- A. Input Voltage: 120-V ac, 60 Hz.
- B. Frequency Response: Within plus or minus 3 dB from 60 to 10,000 Hz.
- C. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
- D. Total Harmonic Distortion: Less than 3 percent at rated output power from 70 to 12,000 Hz.
- E. Output Regulation: Less than 2 dB from full to no load.
- F. Controls: On-off, input levels, and low-cut filter.
- G. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphones or handset transmitters.
- H. Amplifier Protection: Prevents damage from shorted or open output.

2.14 CONE-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES

- A. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
- B. Frequency Response: Within plus or minus 3 dB from 70 to 15,000 Hz.
- C. Minimum Dispersion Angle: 100 degrees.
- D. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.
- E. Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and factory primed; complete with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; with relief of back pressure.

- F. Baffle: For flush speakers, minimum thickness of 0.032-inch (0.8-mm) aluminum **with textured white finish]** <Insert finish>.
- G. Vandal-Proof, High-Strength Baffle: For **flush & surface**-mounted speakers, self-aging cast aluminum with tensile strength of 44,000 psi (303 MN/sq. m), 0.025-inch (0.65-mm) minimum thickness; countersunk heat-treated alloy mounting screws; and textured white epoxy finish.
- H. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.

2.15 HORN-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES

- A. Speakers shall be all-metal, weatherproof construction; complete with universal mounting brackets.
- B. Frequency Response: Within plus or minus 3 dB from 275 to 14,000 Hz.
- C. Minimum Power Rating of Driver: 15 W, continuous.
- D. Minimum Dispersion Angle: 110 degrees.
- E. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.

2.16 CONDUCTORS AND CABLES

- A. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.
- B. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
- C. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.
 - 1. Minimum Shielding Coverage on Conductors: 60 percent.
- D. Plenum Cable: Listed and labeled for plenum installation.

2.17 RACEWAYS

- A. Educational Intercommunication and Program System Raceways and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems."
- B. Educational Intercommunication and Program System Raceways and Boxes: Same as required for electrical branch circuits specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- C. Educational Intercommunication and Program System Raceways and Boxes: **EMT**.
- D. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- E. Flexible metal conduit is prohibited.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF RACEWAYS

- A. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements:
 - 1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
 - 2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
 - 3. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
 - 5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
- C. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
 - 2. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceiling by cable supports not more than 60 inches (1524 mm) apart.
 - 3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
- D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

- A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.
- C. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 GROUNDING

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
- C. Install grounding electrodes as specified in Section 270526 "Grounding and Bonding for Communications Systems."

3.6 SYSTEM PROGRAMMING

- A. Programming: Fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Schedule tests with at least seven days' advance notice of test performance.
 - 2. After installing educational intercommunications and program systems and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: Test originating station-to-station, **all-call**, and **page** messages at each intercommunication station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.
 - 4. Frequency Response Test: Determine frequency response of two transmission paths, **including all-call and paging**, by transmitting and recording audio tones. Minimum acceptable performance is within 3 dB from 150 to 2500 Hz.
 - 5. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

- a. Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio at **paging** speakers.
 - b. Repeat test for three speaker microphones, **and one master station microphone, and for each separately controlled zone of paging loudspeakers.**
 - c. Minimum acceptable ratio is 45 dB.
- 6. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into each intercom[, **paging, and all-call amplifier**]. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.
 - 7. **Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each paging zone. Maximum permissible variation in level is plus or minus 3 dB; in levels between adjacent zones, plus or minus 5 dB.**
 - 8. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 150, 1000, and 2500 Hz. Maximum variation in power output at these frequencies is plus or minus 3 dB.
 - 9. Signal Ground Test: Measure and report ground resistance at system signal ground. Comply with testing requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
- E. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging and independent room speaker-line matching transformers.
 - F. Educational intercommunications and program systems will be considered defective if they do not pass tests and inspections.
 - G. Prepare test and inspection reports.
- 3.8 STARTUP SERVICE
- A. **Engage a factory-authorized service representative to perform startup service and initial system programming.**
 - 1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
 - 2. Complete installation and startup checks according to manufacturer's written instructions.
- 3.9 ADJUSTING
- A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.
 - B. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.
- 3.10 DEMONSTRATION
- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain the educational intercommunications and program systems.
 - 1. Train Owner's maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining the system and equipment.

END OF SECTION

SECTION 27 53 13

CLOCK SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Master clock **and program** control unit.
 - 2. Secondary indicating clocks.
 - 3. Program signal devices.
 - 4. Clock circuit power boosters.
 - 5. Interface with **public-address** system.
 - 6. System wire and cable.

1.3 DEFINITIONS

- A. NIST: The National Institute of Science and Technology.
- B. PC: Personal computer.
- C. UTC: Universal time coordinated. The precisely measured time at zero degrees longitude; a worldwide standard for time synchronization.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Master clock and housing shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event.**"

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes (including available colors) for each product indicated and describe features and operating sequences, both automatic and manual, for the following:
 - 1. Master unit.
 - 2. Indicating clocks.
 - 3. Signal equipment.
 - 4. Equipment enclosures and back boxes.

5. Accessory components.
- B. Shop Drawings: For clock systems. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring and correction circuits.
 - a. Identify terminals and wiring color codes to facilitate installation, operation, and maintenance.
 - b. Indicate recommended wire types and sizes, and circuiting arrangements for field-installed system wiring. Show protection from overcurrent, static discharge, and voltage surge.
 2. Details of seismic restraints including mounting, anchoring, and fastening devices for the following system components:
 - a. Surface-mounted and semi recessed secondary indicating clocks.
 - b. Master clock **mounting racks**.
 - c. Clock circuit power boosters.
 3. Details of seismic strengthening of master clock **mounting racks**.
 4. Dimensioned Outline Drawings of the Mounting Rack for the Master Clock: Show internal seismic bracing, and locate center of gravity of fully equipped and assembled unit. Locate and describe mounting and anchorage provisions.
- C. Samples for Initial Selection:
1. Manufacturer's color photographs or color chips showing the full range of colors available for clocks, signal equipment, and control panels.
 2. Representative operating models of clock type.
- D. Delegated-Design Submittal: For the master clock and housing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of the master clock and housing.
 2. Design Calculations: Calculate requirements for selecting seismic restraints.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Seismic Qualification Certificates: For the master clock, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.
- 1.7 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For clock and program control to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MASTER AND SECONDARY CLOCK SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Dukane Communication Systems.
 - 2. Rauland-Borg Corporation.
 - 3. SimplexGrinnell LP.
- B. System Functions and Features:
 - 1. Supply power to remote indicating clocks.
 - 2. Maintain correct synchronized time and transmit time-correction signals over dedicated system wiring from a master clock to any [one] [two] <Insert number> type(s) of secondary indicating clocks, including the following:
 - a. Analog Synchronous Clocks: Correct for minute- and second-hand synchronization at least once each hour and for hour-hand synchronization at least once each day.
 - b. Digital Clocks: Test clocks automatically for synchronization with master time control at least once every hour and automatically correct those not synchronized with the time reference unit. **Automatically correct clocks immediately when power is restored after an outage of power to the master clock.**
 - 3. Initiate and execute programs for scheduled automatic operation of remote devices. Include **audible signal devices and visual signal devices**.
 - 4. Provide for manual control of programmed signal and equipment-switching circuits.
 - 5. Communicate with remote PC **for access to UTC time base and to permit programming from remote location**.
 - 6. Maintain system access security with a minimum of **three levels** of user-access control to restrict use of system controls to authorized personnel. **Levels of access apply to both local access and access from a remote computer**. Access to user programming and control functions is accomplished by entering a minimum three-digit code. Access levels include the following:
 - a. Access to review existing programs only.
 - b. Access to normal system operating controls.
 - c. Access to all user-programming and control functions.
 - 7. Regulate system timing functions using power-line frequency, backed up for power outages by an internal battery-powered, crystal-controlled oscillator.
 - 8. Regulate system timing functions using power-line frequency, backed up for power outages by an internal battery-powered, crystal-controlled oscillator, and automated periodic reference to NIST or UTC time signals via **internal modem and network or microcomputer Internet access**. Reference time signals shall be automatically accessed at programmable intervals.
 - 9. Provide for programming multiple independent event schedules into memory and running them simultaneously for different output circuits.
 - a. Quantity of Programmable Schedules: **250**, minimum.
 - b. Number of Weekly Events That Can Be Programmed for Each Schedule: **2500**, minimum.
 - c. Simultaneous operation of independent schedules shall be limited only by the number of signal-device and equipment-switching output circuits.

- d. Advance Programming for Automatic Holiday Schedule Changes: Number of schedule changes that can be programmed to suit holidays and vacations shall be **100**, and each change may be programmed up to a year in advance to occur on any day of the calendar year.
- 10. Automatically check functioning of LEDs, switches, input keys, central processor, read-only memory, random access memory, and output circuits. A display on the control panel **or a remote computer with the proper access code** shall indicate failure by identifying faulty component or circuit and shall recommend corrective action.
- 11. Provide **programming for automatic** daylight savings time correction.
- 12. Provide for adjustments to master clock output signals. Duration of momentary signal shall be individually programmable for each signal and equipment-control output circuit from 1 to 99 seconds. Signals shall be programmable for either on or off switching to suit equipment-operation scheduling.

2.2 MASTER CLOCK

- A. Description: Microprocessor-based, software-controlled unit complying with Class A device requirements in 47 CFR 15.
 - 1. Programming and control switches.
 - 2. Informational Display: LED or backlit LCD type.
 - a. Normally shows current time, **date, and day of week** display.
 - b. Provides programming cues when system is being programmed.
 - 3. Output Circuits for Power and Correction of Secondary Indicating Clocks:
 - a. Wired Synchronous Clock Power-and-Correction Circuits: For **digital** clocks; a minimum of **two** required. Relay controlled.
 - b. Wired Synchronous Digital Clock Power-and-Correction Circuits: **One** required.
 - 4. Data Output Port for **Digital** Secondary Clock Correction Circuit: RS485 or similar circuit for scheduled periodic correction signals.
 - 5. Modem and PC interface software suitable for **remote programming and automatic NIST or UTC synchronization**.
 - 6. Circuits for Audible **and Visual** Signal Devices: Relay controlled, manually switchable, using controls on the master clock. Rated 120-V ac, **10 A** minimum. A minimum of **eight** circuits.
 - 7. Circuits for Programmable Switching of Remote Equipment and Circuits: Relay controlled, manually switchable, using controls on the master clock. Rated 120-V ac, **10 A** minimum. A minimum of **eight** circuits.
 - 8. Power Supplies: Capacity for internal loads and power-and correction circuits of connected clocks.
 - 9. Enclosure: Metal cabinet with locking front panel. When cabinet is locked, display indication shall be visible on or through front panel face. Arrange cabinet for surface, semirecessed, or flush mounting as indicated.
 - 10. Housing: Rack-mounting metal enclosure with display indication visible on front panel face.
 - a. Reinforce mounting and attachment capable of resisting seismic forces described in Section 260548.16 "Seismic Controls for Electrical Systems."
 - 11. Battery Backup for Time Base: Lithium battery to maintain the timekeeping function and retain the programs in memory during outage of normal ac power supply for up to 10 years.
 - 12. Electrostatic Discharge Resistance: Master clock **and secondary indicating clocks** shall be tested and certified according to IEC 61000-4-2 in both human-discharge and direct-injection modes.

2.3 SECONDARY INDICATING CLOCKS

- A. Analog Clock: Equipped with a sweep second hand. Movement shall be driven by self-starting, permanently lubricated, sealed synchronous motor equipped with a correcting solenoid actuator, or be a microprocessor-based, second impulse unit, compatible with the master clock.
- B. Digital Clock: Microprocessor-controlled unit complying with Class A device requirements in 47 CFR 15, with red LED digital time display of hours , **minutes, and seconds**.
1. Display Height: 2-1/2-Inch (64-mm) Clock: Hour and minute numerals readable at 50 feet (15 m).
 2. Display Height: 4-Inch (102-mm) Clock: Hour and minute numerals readable at 100 feet (30 m).
 3. Display Format: Selectable between 12-hour with "PM" LED display and 24-hour formats.
 4. Connections for Power and Correction:
 - a. Wired synchronous connection to the master clock for both operating power and correction.
 - 1) Time-Base Backup: Internal alkaline battery shall back up internal time base to maintain timekeeping during power outages of up to six days' duration.
 - 2) Time-Base Backup: Internal capacitor shall back up internal time base to maintain timekeeping during power outages of up to 12 hours' duration.
 - b. Correction by RS485, Ethernet, or similar data line with operating power supplied over a separate connection.
 - c. Power Connection for Secondary Indicating Clocks: **Plug connector**.
- C. Interval-Timer Clock: Digital microprocessor-controlled, 4-inch (102-mm) unit with 2-1/2-inch (64-mm), red LED digital display for hours and minutes and 1-5/16-inch (33-mm) display for seconds; a separately mounted, mode-control switch; and the following features:
1. Display Visibility: Hour and minute numerals readable at **30 feet (10 m)** in normal ambient light.
 2. Operating Modes:
 - a. Normal: Clock operates as a regular secondary system clock, displaying corrected time in normal display configuration, selectable between 12- and 24-hour formats, with "PM" digital display for 12-hour format.
 - b. Count-Down or Count-Up Timer: Selected by mode-control switch count-up and count-down positions, and capable of being preset at the mode-control station.
 3. Mode-Selector Switch: Push-button or rotary, multiposition type, flush mounted; with start, stop, and reset capability in both count-up and count-down modes.
 4. Audible tone signal: Housed in clock or mode-selector-switch box. Sounds at end of preset up or down count.
- D. Provision for Modular Panel Installation: Equip designated clock for panel mounting. Mount flush or semi recessed with arrangement and trim as indicated. Coordinate wiring with other modular panel components, including **room lighting switches, intercom devices, convenience outlets, data outlets, speaker** and other similar devices.
- E. Provision for Time-Tone-Unit Installation: Equip indicated clocks for housing or mounting in an acoustically treated and baffled speaker compartment specified in Section 275116 "Public Address and Mass Notification Systems."
- F. Secondary Indicating Clock Characteristics:
1. Clock Type: **Digital**.
 2. Face Configuration: **Double**.
 3. Mounting: **Recessed, Semi recessed, Pendant or Surface**.
 4. Casing Finish: white.
 5. Special Environmental Conditions: **damp, or dry locations**.
 6. Face Color: white.

7. Seconds Display: **Yes**.
8. Digital Clock Lens: Antiglare acrylic material.
9. Battery Backup: **Yes**.
10. Interval-Timer Display: **Yes**.

2.4 PROGRAM SIGNAL DEVICES

- A. Bells: Heavy-duty, modular, vibrating type with the following sound-output ratings measured at 10 feet (3 m):
 1. 4-Inch (100-mm) Bell: 90 dB.
 2. 6-Inch (150-mm) Bell: 95 dB.
 3. 10-Inch (250-mm) Bell: 104 dB.
- B. Chimes: Heavy-duty, modular, vibrating chimes with polished-chrome tone bar and enamel-finished housing. Minimum sound-output rating measured at 10 feet (3 m) shall be 75 dB.
- C. Clock Buzzers: Adjustable output signal device designed for mounting within clock housing or outlet box.
 1. Sound-Output Rating Measured at 3 Feet (1 m): 75 dB.
 2. Audible Tone Frequency: Manufacturer's standard between 120 Hz and 2 kHz.
- D. Horns: Modular, adjustable-output, vibrating type with minimum full-intensity-rated sound output of 103 dB measured at 10 feet (3 m).
- E. Projector Horns: Adjustable-output, vibrating type with **[single]** **[double]** projector arranged to channel sound in the direction of the projector axis, and with minimum full-intensity-rated sound output of 104 dB measured at 10 feet (3 m).
- F. Loudspeakers for Audible Tones: See Section 275116 "Public Address and Mass Notification Systems."
- G. Visible Signal Devices: Strobe lights with **blue** polycarbonate lens and xenon flash tube, with lens mounted on an aluminum faceplate and the word "Program" engraved in letters at least 1 inch (25 mm) high on lens. Lamp unit shall have a minimum rated light output of 75 candela.
- H. Combination Audible and Visible Signal Devices: Factory-integrated horn and strobe light in a single mounting assembly.
- I. Outdoor Signal Equipment: Weatherproof models listed for outdoor use.
- J. Mounting Arrangement for Signal Devices: Designed for attachment with screws on the mounting plate of a flush-mounted back box unless otherwise indicated.
- K. Enclosures for Flush-Mounting Bells and Horns: Enclosure, mounting plate, and grille assembly shall be furnished by device manufacturer to match features of the device to be mounted. Enclosure shall be recessed in wall, completely enclosing the device, with grille mounting over the open side of the enclosure and flush with the wall.
- L. Connection Provision for Signal-Indicating Devices: **Plug connector**.

2.5 CLOCK CIRCUIT POWER BOOSTER

- A. Description: Transformer power supply, mounted in steel cabinet with hinged door, and having fuse-protected input and output circuits.

2.6 BACK BOXES FOR SECONDARY INDICATING CLOCKS AND PROGRAM DEVICES

- A. Description: Box and cover-plate assembly shall be furnished by device manufacturer and be suitable for device to be mounted. Back boxes shall be equipped with knockouts and hanger straps or mounting adapters arranged for flush mounting the device unless otherwise indicated.

2.7 GUARDS

- A. Description: Formed-steel wire, shaped to fit around guarded device, with 1-inch (25-mm) maximum clearance.
 - 1. Mounting Provisions: Fixed tabs, welded to guard and arranged for screw attachment to mounting surface.
 - 2. Finish for Indoor Devices: **Clear** epoxy lacquer over zinc plating.
 - 3. Finish for Outdoor Devices: **Black** powder coat over zinc plating and primer.

2.8 RACK-MOUNTING PROVISION FOR MASTER CLOCK

- A. Equipment Cabinet: **Floor**-mounted, rack type. Comply with EIA-310-D and the following:
 - 1. Cabinet Housing: Constructed of steel, with front **and rear** doors; with manufacturer's standard tumbler locks, keyed alike.
 - a. Front door shall have a clear panel in front of the master clock display.
 - b. Housing shall enclose master clock and auxiliary clock system components, plus a minimum of **20** percent spare capacity for future equipment.
 - 2. Forced Ventilation: Internal low-noise fan with a filtered intake vent, connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switchable and arranged to be powered when main cabinet power switch is on.
 - 3. Natural Ventilation: Ventilated rear and sides with louvers and solid top.
 - 4. Arrange inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
 - 5. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by equipment or panels.
 - 6. Finish: Uniform, baked-enamel, **manufacturer's standard color** finish over rust-inhibiting primer.
 - 7. Power-Control Panel: On front of equipment housing; with master power on-off switch and pilot light, and socket for a 5-A, indicating, cartridge fuse for rack equipment power.
 - 8. Vertical Plug Strip: Grounded receptacles, 12 inches (300 mm) o.c. the full height of rack, to supply rack-mounting equipment.
 - 9. Maintenance Receptacles: Duplex convenience outlet with supply terminals separate from equipment plug strip and located in front of rack.

2.9 CONDUCTORS AND CABLES

- A. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but not smaller than No. 22 AWG. Voltage drop for signal, control, and clock correction circuits shall not exceed 10 percent under peak load conditions. Comply with requirements in Section 271500 "Communications Horizontal Cabling."
- B. 120-V AC and Class 1 Signal and Control Circuits: Stranded, single conductors of size and type recommended by system manufacturer. Materials and installation requirements are specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 2 and Class 3 Signal and Control Circuits: Single conductor or twisted-pair cable, unshielded, unless manufacturer recommends shielded cable.

- D. Data Circuits: Category 6 minimum, unshielded, twisted-pair cable, unless manufacturer recommends shielded cable.
- E. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
- F. Plenum Cable: Listed and labeled for plenum installation.
- G. Conductor Color-Coding: Uniformly identified and coordinated with wiring diagrams.
- H. Shielding: For speaker-microphone leads and at other locations recommended by manufacturer; No. 34 AWG tinned, soft-copper strands formed into a braid or equivalent foil.
 - 1. Minimum Shielding Coverage on Conductors: 60 percent.

2.10 PATHWAYS

- A. Intercommunication and Program System Raceways and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems."
- B. Intercommunication and Program System Raceways and Boxes: Same as required for electrical branch circuits specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- C. Intercommunication and Program System Raceways and Boxes: **Metal wire ways.**
- D. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- E. Flexible metal conduit is prohibited.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount system components with fastening methods and devices designed to resist the seismic forces indicated in Section 260548.16 "Seismic Controls for Electrical Systems."

3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- D. Support cables not enclosed in raceways on J-Hooks. Install, size, and space J-Hooks to comply with TIA/EIA-568-B.

3.3 ELECTRICAL CONNECTIONS

- A. Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- B. Use **plug connectors** for connections to clocks and signal devices.
- C. Ground clocks, programming equipment, and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.4 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Color-code wires, and apply wire and cable marking tape to designate wires and cables so they are uniformly identified and coordinated with wiring diagrams throughout the system.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installation, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Perform operational-system tests to verify compliance with the Specifications and make adjustments to bring system into compliance. Include operation of all modes of clock correction and all programming and manually programmed signal and relay operating functions.
 - 2. Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
- D. Clock system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Program system according to Owner's requirements. Set system so signal devices operate on Owner-required schedules and are activated for durations selected by Owner. Program equipment-control output circuits to suit Owner's operating schedule for equipment controlled.
- B. Adjust sound-output level of adjustable signal devices to suit Owner's requirements.
- C. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain clock-and-program-control system components.

END OF SECTION

SECTION 28 05 13

CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. UTP cabling.
 - 2. **62.5/125**-micrometer, multimode optical-fiber cabling.
 - 3. Coaxial cabling.
 - 4. RS-232 cabling.
 - 5. RS-485 cabling.
 - 6. Control-voltage cabling.
 - 7. Control-circuit conductors.
 - 8. Fire alarm wire and cable.
 - 9. Identification products.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. IDC: Insulation displacement connector.
- C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- D. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- E. RCDD: Registered Communications Distribution Designer.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of electronic safety and security cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Installation data for UTP and optical-fiber cables as specified in TIA 569-C-1.
2. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.
4. Wiring diagrams to show typical wiring schematics, including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL.
 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 1. Test optical-fiber cable to determine the continuity of the strand, end to end. Use **optical-fiber flashlight or optical loss test set**.
 2. Test optical-fiber cable on reels. Use an optical time domain reflectometer to verify the cable length, and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
 3. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: **25** or less.
 - 2. Smoke-Developed Index: **50** or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 BACKBOARDS

- A. Backboards: Plywood, **fire-retardant treated**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Section 061000 "Rough Carpentry."

2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 2. General Cable Technologies Corporation.
 - 3. Hubbell Incorporated.
- B. Description: 100-ohm, four-pair UTP, covered with a blue thermoplastic jacket.
 - 1. Comply with ICEA S-90-661 for mechanical properties.
 - 2. Comply with TIA-568-C.1 for performance specifications.
 - 3. Comply with TIA-568-C.2, **Category 5e & Category 6**.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or Type CMG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX.
 - e. Multipurpose: Type MP or Type MPG.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 2. Leviton Manufacturing Co., Inc.
 - 3. Panduit Corp.
- B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

- C. Connecting Blocks: [110-style for Category 5e] [110-style for Category 6] [66-style for Category 5e]. Provide blocks for the number of cables terminated on the block, plus [25] <Insert number> percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL-FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. Berk-Tek Leviton; a Nexans/Leviton alliance.
3. General Cable Technologies Corporation.

- B. Description: Multimode, **62.5/125**-micrometer, **24**-fiber, [**nonconductive**,]tight buffer, optical-fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with **TIA-492AAAB & TIA-492-B** for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or Type OFNG.
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC or Type OFCG.
 - e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.
5. Conductive cable shall be **aluminum** armored type.
6. Maximum Attenuation: **3.50** db/km at 850 nm; **1.5** db/km at 1300 nm.
7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

- C. Jacket:

1. Jacket Color: **Orange for 62.5/125-micrometer cable.**
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL-FIBER CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMP NETCONNECT; a TE Connectivity Ltd. company.
2. Belden Inc.
3. Leviton Manufacturing Co., Inc.

- B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: **One** for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

- C. Patch Cords: Factory-made, dual-fiber cables in **36-inch (915-mm)** lengths.

- D. Cable Connecting Hardware: Comply with the Fiber Optic Connector Intermateability Standard (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA-604-12. Comply with TIA-568-C.3.

1. Quick-connect, simplex and duplex, **Type SC** connectors. Insertion loss not more than 0.75 db.

2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 COAXIAL CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 2. General Cable Technologies Corporation.
 3. West Penn Wire.
- B. General Coaxial-Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data-transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 db maximum from 7 to 806 MHz.
- C. RG-11/U: NFPA 70, Type CATV.
 1. **No. 14** AWG, solid, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 4. Jacketed with sunlight-resistant, black PVC or PE.
 5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- D. RG-6/U: NFPA 70, Type CATV or CM.
 1. **No. 18** AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 3. Jacketed with PVC or PE.
 4. Suitable for indoor installations.
- E. RG-6/U (Plenum Rated): NFPA 70, Type CMP.
 1. **No. 18** AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 3. Jacketed with PE.
- F. NFPA and UL Compliance: Coaxial cables shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, Article 820 "Radio and Television Equipment" and Article 830 "Community Antenna Television and Radio Distribution Systems." Types are as follows:
 1. CATV Cable: Type CATV.
 2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 3. CATV Riser Rated: Type CATVR, complying with UL 1666.
 4. CATV Limited Rating: Type CATVX.

2.8 COAXIAL-CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 2. Leviton Manufacturing Co., Inc.
 3. West Penn Wire.
- B. Coaxial-Cable Connectors:
 1. Type BNC, 75 ohms, crimp on style.

2. Type F compression style for RG-6/U cables.

2.9 RS-232 CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. General Cable Technologies Corporation.
3. Genesis Cable Products; Honeywell International, Inc.

B. Standard Cable: NFPA 70, Type CM.

1. **Three**, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Polypropylene insulation.
3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
4. PVC jacket.
5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with UL 1581.

C. Plenum-Rated Cable: NFPA 70, Type CMP.

1. **Three**, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PE insulation.
3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
4. Fluorinated ethylene propylene jacket.
5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.10 RS-485 CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. General Cable Technologies Corporation.
3. Southwire Company.

B. Standard Cable: NFPA 70, Type CM[or Type CMG].

1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

C. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.11 CONTROL-VOLTAGE CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. General Cable Technologies Corporation.
3. Southwire Company.

B. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, [**No. 16 AWG, stranded (19x29)**] [and] [**No. 18 AWG, stranded (19x30)**] tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

C. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, [**No. 16 AWG, stranded (19x29)**] [and] [**No. 18 AWG, stranded (19x30)**] tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.12 CONTROL-CIRCUIT CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. General Cable Technologies Corporation.
3. Southwire Company.

B. Class 1 Control Circuits: Stranded copper, **Type THHN-THWN, complying with UL 83, in pathway.**

C. Class 2 Control Circuits: Stranded copper, **Type THHN-THWN, complying with UL 83, in pathway.**

D. Class 3 Remote-Control and Signal Circuits: **Stranded copper, Type TW or TF in pathway, complying with UL 83.**

2.13 FIRE ALARM WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Wire & Cable Inc.
2. Genesis Cable Products; Honeywell International, Inc.
3. West Penn Wire.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, **not less than No. 18 AWG AWG & as recommended by system manufacturer].**

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
 2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor[**with outer jacket**] with red identifier stripe, NRTL listed for fire alarm and cable tray installation, plenum rated.

2.14 CONSOLIDATION POINTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Belden CDT Networking Division/NORDX.
 2. Hubbell Premise Wiring.
 3. Panduit Corp.
- B. Description: Consolidation points shall comply with requirements for cable connecting hardware.
1. Number of Terminals per Field: [**One**] <Insert number> for each conductor in assigned cables.
 2. Number of Connectors per Field:
 - a. **One** for each four-pair UTP cable indicated.
 - b. **One** for each four-pair conductor group of indicated cables, plus **25** percent spare positions.
 3. Mounting: **Recessed in ceiling** or wall.
 4. NRTL listed as complying with UL 50 and UL 1863.
 5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.15 IDENTIFICATION PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
 2. HellermannTyton.
 3. Panduit Corp.
- B. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.16 CABLE MANAGEMENT SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Chatsworth Products, Inc.
 2. Telsoft Solutions.
 3. Total Wire Software Company, Inc.
- B. Description: Computer-based cable management system, with integrated database[**and graphic**] capabilities.
- C. Document physical characteristics by recording the network, TIA details, and connections between equipment and cable.

- D. Information shall be presented in database view **technical drawings**.
 - 1. **AutoCAD** drawing software shall be used as drawing and schematic plans software.
- E. System shall interface with the following testing and recording devices:
 - 1. Direct upload tests from circuit-testing instrument into the personal computer.
 - 2. Direct download circuit labeling into labeling printer.

2.17 SOURCE QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to evaluate cables.
- B. Factory test UTP and optical-fiber cables on reels according to TIA-568-C.1.
- C. Factory test UTP cables according to TIA-568-C.2.
- D. Factory test multimode optical fiber cables according to TIA-526.14-B and TIA-568-C.3.
- E. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results. Structural Return Loss shall be less than 20 db.
- F. Cable will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

3.2 WIRING METHOD

- A. Install wiring in metal pathways and wireways.
 - 1. Minimum conduit size shall be **3/4 inch (21 mm)**. Control and data-transmission wiring shall not share conduits with other building wiring systems.
 - 2. Comply with requirements in Section 280528 "Pathways for Electronic Safety and Security."
 - 3. Comply with requirements in Section 260536 "Cable Trays for Electrical Systems."
 - 4. Comply with requirements in Section 270536 "Cable Trays for Communications Systems."
- B. Install cable, concealed in accessible ceilings, walls, and floors when possible.
- C. Wiring on Racks and within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM's "Cabling Termination Practices" chapter. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered.
 - 2. Install lacing bars and distribution spools.

3. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
4. Install conductors parallel with or at right angles to sides and back of enclosure.
5. Connect conductors associated with intrusion system that are terminated, spliced, or interrupted in any enclosure onto terminal blocks.
6. Mark each terminal according to system's wiring diagrams.
7. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1 and NFPA 70.
- B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.
- C. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.
- D. Install UTP, optical-fiber, and coaxial cables and connecting materials after spaces are complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- E. General Requirements for Cabling:
 1. Comply with TIA-568-C.1.
 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels. Leave a minimum of 6 inches (150 mm) of slack at outlet terminations and coil loosely into box after termination on outlet fitting.
 4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 5. Maintain minimum cable bending radius during installation and termination of cables.
 6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions. Do not exceed manufacturer's rated cable-pulling tension.
 9. Riser Cable: Riser cable support intervals shall be in accordance with manufacturer's recommendations.
 10. Comply with Section 280544 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."
- F. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with **Category 5e & Category 6** rating of components and that ensure **Category 5e & Category 6** performance of completed and linked signal paths, end to end.
 1. Comply with TIA-568-C.2.
 2. Install 110-style IDC termination hardware unless otherwise indicated.
 3. Do not untwist UTP cables more than 1/2 inch (12 mm) from point of termination to maintain cable geometry.
- G. Optical-Fiber Cable Installation:
 1. Comply with TIA-568-C.3.
 2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
- H. Coaxial-Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
3. Install indoor cables in pathway.

I. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than [60 inches (1525 mm)] <Insert dimension> apart. Cable supports shall be fastened to structural members or floor slabs in accordance with Section 260529 "Hangers and Supports for Electrical Systems."
3. Cable shall not be run in contact with pipes, ducts, or other potentially damaging items. Cables shall not be run through structural members or use structural members, pipes, ducts, or equipment as a support.

J. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (300 mm) in diameter below each feed point.

K. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-C recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communication cables or cables in nonmetallic pathways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
3. Separation between communication cables in grounded metallic pathways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between cables in grounded metallic pathways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or hp and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.

- B. Wiring Method: Install wiring in metal pathway according to Section 280528 "Pathways for Electronic Safety and Security."
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated pathway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
 - 1. Cables and pathways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
 - 2. Fire-Rated Cables: Use of two-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is[**not**] permitted.
 - 3. Signaling Line Circuits: Power-limited fire alarm cables **shall not** be installed in the same cable or pathway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and another for supervisory circuits. Color code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- H. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS

- A. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
- B. Minimum Conductor Sizes:
 - 1. Class 1 remote-control and signal circuits, No. 14 AWG.
 - 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
 - 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.6 CONNECTIONS

- A. Comply with requirements in Section 281643 "Perimeter Security Systems" for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Section 281600 "Intrusion Detection" for connecting, terminating, and identifying wires and cables.

- C. Comply with requirements in Section 281300 "Access Control" for connecting, terminating, and identifying wires and cables.
 - D. Comply with requirements in Section 282300 "Video Surveillance" for connecting, terminating, and identifying wires and cables.
 - E. Comply with requirements in Section 284619 "PLC Electronic Detention Monitoring and Control Systems" for connecting, terminating, and identifying wires and cables.
 - F. Comply with requirements in **Section 283111 "Digital, Addressable Fire-Alarm System"** for connecting, terminating, and identifying wires and cables.
 - G. Comply with requirements in Section 283500 "Refrigerant Detection and Alarm" for connecting, terminating, and identifying wires and cables.
- 3.7 FIRESTOPPING
- A. Comply with requirements in Section 078413 "Penetration Firestopping."
 - B. Comply with TIA-569-C, "Firestopping" Annex A.
 - C. Comply with BICSI TDMM, "Firestopping Systems" Article.
- 3.8 GROUNDING
- A. For communication wiring, comply with J-STD-607-A and with BICSI TDMM's "Grounding, Bonding, and Electrical Protection" chapter.
 - B. For low-voltage wiring and cabling, comply with requirements in Section 280526 "Grounding and Bonding for Electronic Safety and Security."
- 3.9 IDENTIFICATION
- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- 3.10 FIELD QUALITY CONTROL
- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
 - B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
 - C. Perform the following tests and inspections **with the assistance of a factory-authorized service representative**:
 1. Visually inspect UTP and optical-fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.

- a. Test instruments shall comply with or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Optical-Fiber Cable Tests:
- a. Test instruments shall comply with or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA-526-14-B, Method B, One Reference Jumper.
 - 2) Attenuation test results for links shall be less than 2.0 db. Attenuation test results shall be less than that calculated according to equation in TIA-568-C.1.
5. Coaxial-Cable Tests:
- a. Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements.
 - b. Replace malfunctioning or damaged items.
 - c. Retest until satisfactory performance and conditions are achieved.
 - d. Use an agile receiver and signal strength meter or spectrum analyzer for testing.
 - e. CCTV Sources: Connect receiver to the output of each CCTV signal source or the distribution amplifier associated with it.
 - f. Test Schedule: Schedule tests after pretesting has successfully been completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
 - g. Operational Tests: Perform tests of operational system to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
 - h. Distribution System Acceptance Tests:
 - 1) Field-Strength Instrument: Rated for minus 40-db mV measuring sensitivity and a frequency range of 54 to 812 MHz, minimum. Provide documentation of recent calibration against recognized standards.
 - 2) Signal Level and Picture Quality: Use a field-strength meter or spectrum analyzer, as well as a standard television receiver, to measure signal levels and check picture quality at [all] [25 percent of] <Insert number or percentage> user-interface outlets.
 - a) Test the signal strength in db mV at 55[, 151, 547,] and 750 MHz.
 - b) Minimum acceptable signal level is zero db mV (1000 mV).
 - c) Maximum acceptable signal level over the entire bandwidth is 15 db mV.
 - d) Television receiver shall show no evidence of cross-channel intermodulation, ghost images, or beat interference.
 - i. Signal-to-Noise-Ratio Test: Use a field-strength meter to make a sequence of measurements at the output of the last distribution amplifier or of another agreed-on location in system. With system operating at normal levels, tune meter to the picture carrier frequency of each of the designated channels in turn, and record the level. With signal removed and input to corresponding headend amplifier terminated at 75 ohms, measure the level of noise at same tuning settings. With meter correction factor added to last readings, differences from first set shall not be less than 45 db.
 - j. Qualitative and Quantitative Performance Tests: Demonstrate reception quality of color-television program transmissions at each user interface from each designated channel and source. Quality shall be equal or superior to that obtained with performance checks specified below, using a standard, commercial, cable-ready, color-television receiver. Level

and quality of signal at each outlet and from each service and source shall comply with the following Specifications when tested according to 47 604-12 76:

- 1) RF video-carrier level.
- 2) Relative video-carrier level.
- 3) Carrier-level stability, during 60-minute and 24-hour periods.
- 4) Broadband frequency response.
- 5) Channel frequency response.
- 6) Carrier-to-noise ratio.
- 7) RF visual signal-to-noise ratio.
- 8) Antenna combiner insertion loss.
- 9) Signal power splitter loss.
- 10) Cable connector attenuation.
- 11) Cross modulation.
- 12) Carrier-to-echo ratio.
- 13) Composite triple beat.
- 14) Second order beat.
- 15) Terminal isolation.
- 16) Terminal isolation between television and FM.
- 17) Hum modulation.
- 18) RF FM carrier level.
- 19) FM frequency response.
- 20) FM carrier-to-noise ratio.

- D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION

SECTION 28 05 26

GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Grounding conductors.
 - 2. Grounding connectors.
 - 3. Grounding busbars.

1.3 DEFINITIONS

- A. Signal Ground: The ground reference point designated by manufacturer of the system that is considered to have zero voltage.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. Harger Lightning & Grounding.
 - 3. Panduit Corp.
- B. Comply with UL 486A-486B.
- C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
 - 1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
- D. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, and 1/4 inch (6.3 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

- A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Burndy: Part of Hubbell Electrical Systems.
 2. Harger Lightning & Grounding.
 3. Panduit Corp.
- C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.
 1. Electroplated tinned copper, C and H shaped.
- D. Busbar Connectors: Cast silicon bronze, solderless **compression or exothermic**-type mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.
- E. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING BUSBARS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Chatsworth Products, Inc.
 2. Harger Lightning & Grounding.
 3. Panduit Corp.
- B. Grounding Busbars: Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 2 inches (6.3 by 50 mm) in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-A.
 1. Predrilling shall be with holes for use with lugs specified in this Section.
 2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch (50-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.)
 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600 V switchboards, impulse tested at 5000 V.
- C. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-A. Predrilling shall be with holes for use with lugs specified in this Section.
 1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
 2. Rack-Mounted Horizontal Busbar: Designed for mounting in 19- or 23-inch (483- or 584-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.

3. Rack-Mounted Vertical Busbar: 72 or 36 inches (1827 or 914 mm long, with)stainless-steel or copper-plated hardware for attachment to the rack.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."
 1. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
 2. Bond shields and drain conductors to ground at only one point in each circuit.
- B. Signal Ground:
 1. For each system, establish the signal ground and label that location as such.
 2. Bond the signal ground to the alternating-current (ac) power system service by connecting to one of the following listed locations, using insulated **No. 6 AWG**, stranded, Type THHN wire:
 - a. Grounding bar in an electrical power panelboard if located in the same room or space as the signal ground.
 - b. Telecommunications grounding busbar.
- C. Comply with NECA 1.

3.2 APPLICATION

- A. Conductors: Install solid conductor for **No. 8 AWG** and smaller and stranded conductors for **No. 6 AWG** and larger unless otherwise indicated.
- B. Grounding and Bonding Conductors:
 1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
 2. Install without splices.
 3. Support at not more than 36-inch (900-mm) intervals.

3.3 CONNECTIONS

- A. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- B. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
 1. Use crimping tool and the die specific to the connector.
 2. Pretwist the conductor.
 3. Apply an antioxidant compound to all bolted and compression connections.
- C. Shielded Cable: Bond the shield of shielded cable to the signal ground. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.
- D. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the

power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 28 05 28

PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetallic conduits, tubing, and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Nonmetallic wireways and auxiliary gutters.
6. Surface pathways.
7. Boxes, enclosures, and cabinets.
8. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
3. Section 270528 "Pathways for Communications Systems" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving communications systems.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
- C. Samples: For **wireway and surface pathways** and for each color and texture specified, 12 inches (300 mm) long.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of pathway groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For pathway racks, enclosures, cabinets, and equipment racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 3. Thomas & Betts Corporation; A Member of the ABB Group.
- B. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with TIA-569-B.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. PVC-Coated Steel Conduit: PVC-coated **IMC**.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- G. EMT: Comply with ANSI C80.3 and UL 797.
- H. FMC: Comply with UL 1; **zinc-coated steel**.
- I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

- J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: **Steel or die cast.**
 - b. Type: **compression.**
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 467, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- K. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems; a part of Atkore International.
 - 2. Allied Tube & Conduit; a part of Atkore International.
 - 3. Thomas & Betts Corporation; A Member of the ABB Group.
- B. General Requirements for Nonmetallic Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with TIA-569-B.
- C. ENT: Comply with NEMA TC 13 and UL 1653.
- D. RNC: **Type EPC-40-PVC**, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. LFNC: Comply with UL 1660.
- F. Rigid HDPE: Comply with UL 651A.
- G. Continuous HDPE: Comply with UL 651B.
- H. RTRC: Comply with UL 1684A and NEMA TC 14.
- I. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- J. Fittings for LFNC: Comply with UL 514B.
- K. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire.
 - 2. Arco Corporation.
 - 3. Endot Industries Inc.

- B. Description: Comply with UL 2024; flexible-type pathway, approved for [plenum] [riser] [or] [general-use] installation unless otherwise indicated.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. B-line, an Eaton business.
 2. Hoffman; a brand of Pentair Equipment Protection.
 3. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, **Type 3R** unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: **Flanged-and-gasketed type** unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allied Moulded Products, Inc.
 2. Hoffman; a brand of Pentair Equipment Protection.
 3. Lamson & Sessions.
- B. General Requirements for Nonmetallic Wireways and Auxiliary Gutters:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- F. Solvents and Adhesives: As recommended by conduit manufacturer.

2.6 SURFACE PATHWAYS

A. General Requirements for Surface Pathways:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. **Manufacturer's standard enamel finish in color selected by Architect.**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MonoSystems, Inc.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.

C. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from **custom** colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lamson & Sessions.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.

D. Tele-Power Poles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MonoSystems, Inc.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.
2. **Material: Galvanized steel with ivory baked-enamel finish.**
3. **Fittings and Accessories:** Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Crouse-Hinds, an Eaton business.
2. Hoffman; a brand of Pentair Equipment Protection.
3. Lamson & Sessions.

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, **ferrous alloy**, Type FD, with gasketed cover.

- E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- F. Metal Floor Boxes:
 - 1. Material: **Cast metal**.
 - 2. Type: **Fully adjustable**.
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Nonmetallic Floor Boxes: Nonadjustable, **rectangular**.
 - 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, **galvanized, cast iron** with gasketed cover.
- J. Device Box Dimensions: **4-inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep)**.
- K. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, **Type 3R** with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures:
 - a. Material: **Plastic**.
 - b. Finished inside with radio-frequency-resistant paint.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- M. Cabinets:
 - 1. NEMA 250, **Type 3R**, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING

- A. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. Comply with TIA-569-B.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Quazite: Hubbell Power Systems, Inc.
2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with **integral closed** bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "**ELECTRIC.**".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes **12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long)** and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.9 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed Conduit: **IMC**.
 2. Concealed Conduit, Aboveground: **EMT**.
 3. Underground Conduit: RNC, **Type EPC-40-PVC**.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): **LFMC**.
 5. Boxes and Enclosures, Aboveground: NEMA 250, **Type 3R or Type 4**.
- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: **EMT**.
 2. Exposed, Not Subject to Severe Physical Damage: **EMT**.
 3. Exposed and Subject to Severe Physical Damage: **IMC**. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums
 4. Concealed in Ceilings and Interior Walls and Partitions: **EMT**.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric-Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: **IMC**.
 7. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: **EMT**.
 8. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: **EMT**.
 9. Pathways for Concealed General Purpose Distribution of Optical-Fiber or Communications Cable: **EMT**.
 10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 **stainless steel** in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: [1/2-inch (16-mm)] [3/4-inch (21-mm)] trade size. Minimum size for optical-fiber cables is 1 inch (27 mm).
- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use **compression cast-metal** fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface pathways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds **120 deg F (49 deg C)**.

3.2 INSTALLATION

- A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications wiring conduits for which only two 90-degree bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- I. Pathways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
 3. Arrange pathways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 5. Change from ENT to **IMC** before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for pathways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to conduit assembly to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits of 2-inch (53-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- R. Surface Pathways:
1. Install surface pathway for surface electrical outlet boxes only where indicated on Drawings.
 2. Install surface pathway with a minimum 2-inch (50-mm) radius control at bend points.
 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- S. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch (21-mm) Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15 m).
 2. 1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- T. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

- U. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.

- V. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

- W. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC[**and EMT**] conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: **125 deg F (70 deg C)** temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: **155 deg F (86 deg C)** temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: **125 deg F (70 deg C)** temperature change.
 - d. Attics: **135 deg F (75 deg C)** temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.00078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

- X. Flexible Conduit Connections: Comply with NEMA RV 3. Use maximum of 72 inches (1830 mm) of flexible conduit for **recessed and semirecessed luminaires**, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

- Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to **bottom** of box unless otherwise indicated.

- Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

- AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

- DD. Set metal floor boxes level and flush with finished floor surface.
- EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, but a minimum of 6 inches (150 mm) below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes with bottom below frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

- F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 28 16 00

INTRUSION DETECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Intrusion detection with communication links to perform monitoring, alarm, and control functions.
2. Integration of other electronic and electrical systems and equipment.

B. Related Sections:

1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for cabling between master control units and field-mounted devices and control units.
2. Section 281643 "Perimeter Security Systems" for outdoor intrusion detection devices, including lighting and communications associated with chain-link fence gates.
3. Section 282300 "Video Surveillance" for CCTV cameras that are used as devices for video motion detection.

1.3 DEFINITIONS

- A. CCTV: Closed-circuit television.
- B. PIR: Passive infrared.
- C. RFI: Radio-frequency interference.
- D. UPS: Uninterruptible power supply.
- E. Control Unit: System component that monitors inputs and controls outputs through various circuits.
- F. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.
- G. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.
- H. Protected Zone: A protected premises or an area within a protected premises that is provided with means to prevent an unwanted event.
- I. Standard Intruder: A person who weighs 100 lb (45 kg) or less and whose height is 60 inches (1525 mm) or less; dressed in a long-sleeved shirt, slacks, and shoes **unless environmental conditions at the site require protective clothing.**

- J. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.
- K. Systems Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.
- L. Zone. A defined area within a protected premises. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

1.4 ACTION SUBMITTALS

- A. Product Data: Components for sensing, detecting, **systems integration**, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.
 - 1. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate methods used to achieve systems integration. Indicate control, signal, and data communication paths and identify **networks and** control interface devices and media to be used. Describe characteristics of network and other data communication lines.
 - a. Indicate methods used to achieve systems integration.
 - b. Indicate control, signal, and data communication paths and identify PLCs, networks, control interface devices, and media to be used.
 - c. Describe characteristics of network and other data communication lines.
 - d. Describe methods used to protect against power outages and transient voltages including types and ratings of isolation and surge suppression devices used in data, communication, signal, control, and ac and dc power circuits.
 - 2. Raceway Riser Diagrams: Detail raceway runs required for intrusion detection **and for systems integration**. Include designation of devices connected by raceway, raceway type and size, and type and size of wire and cable fill for each raceway run.
 - 3. UPS: Sizing calculations.
 - 4. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building. **Include room layout for master control-unit console, terminal cabinet, racks, and UPS.**
 - 5. Master Control-Unit Console Layout: Show required artwork and device identification.
 - 6. Device Address List: Coordinate with final system programming.
 - 7. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
 - 8. Details of surge-protection devices and their installation.
 - 9. Sensor detection patterns and adjustment ranges.
- C. Equipment and System Operation Description: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification: For each type of exposed finish required.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **intrusion detection systems integrator** and **testing agency**.
- B. Field quality-control reports.
- C. Warranty: Sample of special warranty.
- D. Other Information Submittals:
 - 1. Test Plan and Schedule: Test plan defining all tests required to ensure that system meets technical, operational, and performance specifications within **60 days** of date of Contract award.
 - 2. Examination reports documenting inspections of substrates, areas, and conditions.
 - 3. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For intrusion detection system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Data for each type of product, including features and operating sequences, both automatic and manual.
 - 2. Master control-unit hardware and software data.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Intrusion Detection Devices: Furnish quantity equal to **[five]** <Insert number> percent of the number of units of each type installed, but no fewer than one of each type.
 - 2. Fuses: **Three** of each kind and size.
 - 3. Tool Kit: Provide **six** sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.
 - 4. Security Fasteners: Furnish no fewer than **1 box for every 50** boxes or fraction thereof, of each type and size of security fastener installed.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. An employer of workers, at least one of whom is a technician certified by the National Burglar & Fire Alarm Association.
 - 2. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Intrusion Detection Systems Integrator Qualifications: An experienced intrusion detection equipment supplier **and Installer** who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Control Units, Devices, and Communications with Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.
- F. FM Global Compliance: FM-Approved and -labeled intrusion detection devices and equipment.
- G. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

- A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 1. Altitude: Sea level to **4000 feet (1220 m)**.
 2. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
 3. Interior, Controlled Environment: System components, except master control unit, installed in **air-conditioned** interior environments shall be rated for continuous operation in ambients of **36 to 122 deg F (2 to 50 deg C)** dry bulb and 20 to 90 percent relative humidity, noncondensing.
 4. Interior, Uncontrolled Environment: System components installed in **non-air-conditioned, non-temperature-controlled** interior environments shall be rated for continuous operation in ambients of **[0 to 122 deg F (minus 18 to plus 50 deg C)** dry bulb and 20 to 90 percent relative humidity, noncondensing.
 5. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambients of **minus 30 to plus 122 deg F (minus 34 to plus 50 deg C)** dry bulb and 20 to 90 percent relative humidity, condensing. Comply with UL 294 and UL 639 for outdoor-use equipment. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to **85 mph (137 km/h)**.
 6. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flying shall be rated, listed, and installed according to NFPA 70.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: **Two** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Description: **Multiplexed**, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.
- B. Supervision: System components shall be continuously monitored for normal, alarm, **supervisory**, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.
 1. Alarm Signal: Display at master control unit and actuate audible and visual alarm devices.

2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or control-unit failure.
 3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or control unit.
- C. System Control: Master control unit shall directly monitor intrusion detection units and connecting wiring.
- D. System Control: Master control unit shall directly monitor intrusion detection devices, **control units associated with perimeter detection units**, and connecting wiring in a multiplexed distributed control system or as part of a network.
- E. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.
- F. Operator Commands:
1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.
 2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
 3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
 4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
 5. Protected Zone Test: Initiate operational test of a specific protected zone.
 6. System Test: Initiate system-wide operational test.
 7. Print reports.
- G. Timed Control at Master Control Unit: Allow automatically timed "secure" and "access" functions of selected protected zones.
- H. Automatic Control of Related Systems: Alarm or supervisory signals from certain intrusion detection devices control the following functions in related systems:
1. Switch selected lights.
 2. Shift elevator control to a different mode.
 3. Open a signal path between certain intercommunication stations.
 4. Shift sound system to "listening mode" and open a signal path to certain system speakers.
 5. Switch signal to selected monitor from CCTV camera in vicinity of sensor signaling an alarm.
- I. Printed Record of Events: Print a record of alarm, supervisory, and trouble events on system printer. Sort and report by protected zone, device, and function. When master control unit receives a signal, print a report of alarm, supervisory, or trouble condition. Report type of signal (alarm, supervisory, or trouble), protected zone description, date, and time of occurrence. Differentiate alarm signals from other indications. When system is reset, report reset event with the same information concerning device, location, date, and time. Commands shall initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.
- J. Response Time: **Two** seconds between actuation of any alarm and its indication at master control unit.
- K. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from master control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at master control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.
- L. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.

- M. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

2.2 SYSTEM COMPONENT REQUIREMENTS

- A. Compatibility: Detection devices and their communication features, connecting wiring, and master control unit shall be selected and configured with accessories for full compatibility with the following equipment:
 - 1. Door hardware specified in Section 087100 "Door Hardware."
 - 2. Door hardware specified in Section 087111 "Door Hardware (Descriptive Specification)."
 - 3. Elevators specified in Section 142100 "Electric Traction Elevators."
 - 4. Elevators specified in Section 142400 "Hydraulic Elevators."
 - 5. Lighting controls specified in Section 260923 "Lighting Control Devices."
 - 6. Lighting controls specified in Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."
 - 7. Intercom and program systems specified in Section 275123 "Intercommunications and Program Systems."
 - 8. Public address and mass notification systems specified in Section 275116 "Public Address and Mass Notification Systems."
 - 9. Access control system specified in Section 281300 "Access Control."
 - 10. Fire alarm system specified in Section 283111 "Digital, Addressable Fire-Alarm System."
 - 11. Perimeter security system specified in Section 281643 "Perimeter Security Systems."
 - 12. Video surveillance system specified in Section 282300 "Video Surveillance."
- B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.
 - 1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
 - 2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Listed and labeled by a qualified testing agency for compliance with NFPA 731.
- C. Intrusion Detection Units: Listed and labeled by a qualified testing agency for compliance with UL 639.
- D. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V rms injected into power supply lines at 10 to 10,000 MHz.
- E. Tamper Protection: Tamper switches on detection devices, control units, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected. Master control-unit alarm display shall identify tamper alarms and indicate locations.
- F. Self-Testing Devices: Automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Devices transmit test failure to master control unit.
- G. Antimasking Devices: Automatically check operation continuously or at intervals of a minute or less, and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational dysfunction. Devices transmit detection of operational dysfunction to master control unit as an alarm signal.
- H. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to master control unit.
- I. Remote-Controlled Devices: Individually and remotely adjustable for sensitivity and individually monitored at master control unit for calibration, sensitivity, and alarm condition.

2.3 ENCLOSURES

- A. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping noncorrosive liquids.
- B. Interior Electronics: NEMA 250, Type 12.
- C. Exterior Electronics: NEMA 250, Type 4X, **stainless steel**.
- D. Corrosion Resistant: NEMA 250, Type 4X, **stainless steel**.
- E. Screw Covers: Where enclosures are readily accessible, secure with security fasteners of type appropriate for enclosure.

2.4 SECURE AND ACCESS DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Digital Security Controls Ltd.
 - 2. Edwards Signaling; UTC Fire & Security.
 - 3. Honeywell International Inc.
- B. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.
- C. Key-Operated Switch: Change protected zone between secure and access conditions.

2.5 DOOR AND WINDOW SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. GE Security, Inc.
 - 2. Honeywell International Inc.
 - 3. Honeywell Security Products- Americas.
- B. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral overcurrent device to limit current to 80 percent of switch capacity. Bias magnet and minimum of **[two]** **[three]** encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.
- C. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.
- D. Overhead Door Switch: Balanced-magnetic type, listed for outdoor locations, and having door-mounted magnet and floor-mounted switch unit.
- E. Remote Test: Simulate movement of actuating magnet from master control unit.

2.6 PIR SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Digital Security Controls Ltd.
 - 2. GE Security, Inc.
 - 3. Honeywell International Inc.
- B. Listed and labeled by a qualified testing agency for compliance with SIA PIR-01.

- C. Description: Sensors detect intrusion by monitoring infrared wavelengths emitted from a human body within their protected zone and by being insensitive to general thermal variations.
1. Wall-Mounted Unit Maximum Detection Range: 125 percent of indicated distance for individual units and not less than 50 feet (15 m). **Provide adjustable coverage pattern as indicated.**
 2. Ceiling-Mounted Unit Spot-Detection Pattern: Full 360-degree conical.
 3. Ceiling-Mounted Unit Pattern Size: 84-inch (2135-mm) diameter at floor level for units mounted 96 inches (2440 mm) above floor; 18-foot (5.5-m) diameter at floor level for units mounted 25 feet (7.6 m) above floor.
- D. Device Performance:
1. Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F (1 deg C) or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s) across two adjacent segments of detector's field of view.
 2. Test Indicator: LED test indicator that is not visible during normal operation. When visible, indicator shall light when sensor detects an intruder. Locate test enabling switch under sensor housing cover.
 3. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

2.7 MICROWAVE INTRUSION DETECTORS (INTERIOR)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Digital Security Controls Ltd.
 2. GE Security, Inc.
 3. Visonic Inc.
- B. Device Performance: Microwave transmitter establishes an electromagnetic field in an adjustable detection pattern and detects intrusion by monitoring changes in that pattern.
1. Sensitivity: Adjustable, able to detect standard-intruder movement within sensor's detection pattern at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s). Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.
 2. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test-enabling switch under sensor housing cover.
 3. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

2.8 ACOUSTIC-TYPE, GLASS-BREAK SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Digital Security Controls Ltd.
 2. GE Security, Inc.
 3. Honeywell International Inc.
- B. Listed and labeled by a qualified testing agency for compliance with SIA GB-01.
- C. Device Performance: Detect unique, airborne acoustic energy spectrum caused by breaking glass.
1. Sensor Element: Microprocessor-based, digital device to detect breakage of plate, laminate, tempered, and wired glass while rejecting common causes of false alarms. Detection pattern shall be at least a 20-foot (6-m) range.
 2. Hookup Cable: Factory installed, not less than 72 inches (1830 mm).
 3. Activation Indicator: LED on sensor housing that lights when responding to vibrations, remaining on until manually reset at sensor control unit[**or at master control unit**].

4. Control Unit: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.
5. Glass-Break Simulator: A device to induce frequencies into protected glass pane that simulate breaking glass without causing damage to glass.

2.9 PIEZOELECTRIC-TYPE, GLASS-BREAK SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [GE Security, Inc.](#)
2. [Honeywell International Inc.](#)
3. [Potter Electric Signal Company, LLC.](#)

B. Listed and labeled by a qualified testing agency for compliance with SIA GB-01.

C. Device Performance: Detect unique, high-frequency vibrations caused by breaking glass.

1. Sensor Element: Piezoelectric crystals in a housing designed to mount directly to glass surface with adhesive provided by element manufacturer. Circular detection pattern, with at least a 60-inch (1525-mm) radius on a continuous glass pane. Sensor element shall not be larger than 4 sq. in. (25.80 sq. cm).
2. Hookup Cable: Factory installed, not less than 72 inches (1830 mm).
3. Activation Indicator: LED on sensor housing that lights when responding to vibrations, remaining on until manually reset at sensor control unit[or at master control unit].
4. Control Unit: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.
5. Glass-Break Simulator: A device to induce frequencies into protected glass pane that simulate breaking glass without causing damage to glass.

2.10 VIBRATION SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [GE Security, Inc.](#)
2. [Honeywell International Inc.](#)
3. [Potter Electric Signal Company, LLC.](#)

B. Listed and labeled by a qualified testing agency for compliance with SIA GB-01.

C. Description: A sensor control unit and piezoelectric crystal sensor elements that are designed to be rigidly mounted to structure being protected.

D. Device Performance: Detects high-frequency vibrations generated by use of such tools as oxyacetylene torches, oxygen lances, high-speed drills and saws, and explosives that penetrate a structure while not responding to any other mechanical vibration.

1. Circular detection pattern, with at least a 72-inch (1830-mm) radius on protected structure.
2. Hookup Cable: Factory installed, not less than 72 inches (1830 mm).
3. Control Unit: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.
4. Glass-Break Simulator: A device to induce frequencies to protected glass pane that simulate breaking glass without causing damage to glass.

2.11 PHOTOELECTRIC SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [GE Security, Inc.](#)
2. [Honeywell International Inc.](#)
3. [Potter Electric Signal Company, LLC.](#)

B. Device Performance: Detect an interruption of a pulsed, infrared, light beam that links transmitter and receiver.

1. Sensitivity: Detect standard-intruder movement within sensor's detection patterns at any speed of less than 7.5 fps (2.3 m/s) through the beam. Allow installation of multiple sensors within same protected zone that will not interfere with each other.
2. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test enabling switch under sensor housing cover.
3. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

2.12 MICROWAVE-PIR DUAL-TECHNOLOGY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [Aleph America Corporation.](#)
2. [GE Security, Inc.](#)
3. [Honeywell International Inc.](#)

B. Description: Single unit combining a sensor that detects changes in microwave signals and a PIR sensor that detects changes in ambient level of infrared emissions caused by standard-intruder movement within detection pattern.

C. Listed and labeled by a qualified testing agency for compliance with SIA PIR-01.

D. Device Performance: An alarm is transmitted when either sensor detects a standard intruder within a period of three to eight seconds from when the other sensor detects a standard intruder.

1. Minimum Detection Pattern: A room 20 by 30 feet (6 by 9 m).
2. PIR Sensor Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F (1 deg C) or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s) across two adjacent segments of detector's field of view.
3. Microwave Sensor Sensitivity: Adjustable, able to detect standard-intruder movement within sensor's detection pattern at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s). Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.
4. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test enabling switch under sensor housing cover.
5. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

2.13 DURESS-ALARM SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [GE Security, Inc.](#)
2. [Honeywell International Inc.](#)
3. [Visonic Inc.](#)

B. Description: A switch with a shroud over the activating lever that allows an individual to covertly send a duress signal to master control unit, with no visible or audible indication when activated. Switch shall lock in activated position until reset with a key.

1. Minimum Switch Rating: 50,000 operations.

2. Foot Rail: Foot activated, floor mounting.
3. Push Button: Finger activated, suitable for mounting on horizontal or vertical surface.

2.14 VIDEO MOTION SENSORS (INTERIOR)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aleph America Corporation.
 2. GE Security, Inc.
 3. Visonic Inc.
- B. Device Performance: Detect changes in video signal within a user-defined protected zone. Provide an alarm output for each video input.
1. Detect movement within protected zone of standard intruders wearing clothing with a reflectivity that differs from that of background scene by a factor of 2. Reject all other changes in video signal.
 2. Modular design that allows for expansion or modification of number of inputs.
 3. Controls:
 - a. Number of detection zones.
 - b. Size of detection zones.
 - c. Sensitivity of detection of each protected zone.
 4. Mounting: Standard 19-inch (480-mm) rack as described in EIA/ECA 310-E.

2.15 MASTER CONTROL UNIT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Digital Security Controls Ltd.
 2. GE Security, Inc.
 3. Honeywell Security Products- Americas.
- B. Description: Supervise sensors and detection subsystems and their connecting communication links, status control (secure or access) of sensors and detector subsystems, activation of alarms and supervisory and trouble signals, and other indicated functions.
1. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 2. Include a real-time clock for time annotation of events on the event recorder and printer.
 3. Addressable initiation devices that communicate device identity and status.
 4. Control circuits for operation of mechanical equipment in response to an alarm.
- C. Construction: **Freestanding equipment rack**, modular, with separate and independent alarm and supervisory system modules. **Alarm-initiating protected zone boards shall be plug-in cards.** Arrangements that require removal of field wiring for module replacement are unacceptable.
- D. Comply with **UL 609.**
- E. Console Controls and Displays: Arranged for interface between human operator at master control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: LCD, **three** line(s) of **80** characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

3. Control-Unit Network: Automatic communication of alarm, status changes, commands, and other communications required for system operation. Communication shall return to normal after partial or total network interruption such as power loss or transient event. Total or partial signaling network failures shall identify the failure and record the failure at the annunciator display and at the system printer.
 4. Field Device Network: Communicate between the control unit and field devices of the system. Communications shall consist of alarm, network status, and status and control of field-mounted processors. Each field-mounted device shall be interrogated during each interrogation cycle.
 5. Operator Controls: Manual switches and push-to-test buttons that do not require a key to operate. Prevent resetting of alarm, supervisory, or trouble signals while alarm or trouble condition persists. Include the following:
 - a. Acknowledge alarm.
 - b. Silence alarm.
 - c. System reset.
 - d. LED test.
 6. Timing Unit: Solid state, programmable, 365 days.
 7. Confirmation: Relays, contactors, and other control devices shall have auxiliary contacts that provide confirmation signals to system for their on or off status. Software shall interpret such signals, display equipment status, and initiate failure signals.
 8. Alarm Indication: Audible signal sounds and an LED lights at master control unit identifying the **addressable detector** originating the alarm. **Annunciator panel displays a common alarm light and sounds an audible tone.**
 9. Alarm Indication: Audible signal sounds and a plain-language identification of the **addressable detector** originating the alarm appears on LED display at master control unit. **Annunciator panel displays a common alarm light and sounds an audible tone.**
 10. Alarm Indication: Audible signal sounds and a plain-language identification of the **addressable detector** originating the alarm appears on LED display at master control unit. **Annunciator panel alarm light and audible tone identify protected zone signaling an alarm.**
 11. Alarm activation sounds a **bell or siren and strobe.**
- F. Protected Zones: Quantity of alarm and supervisory zones as indicated, with capacity for expanding number of protected zones by a minimum of 25 percent.
- G. Power Supply Circuits: Master control units shall provide power for remote power-consuming detection devices. Circuit capacity shall be adequate for at least a [25] <Insert number> percent increase in load.
- H. UPS: Comply with Section 263353 "Static Uninterruptible Power Supply." UPS shall be sized to provide a minimum of six hours of master control-unit operation.
- I. Cabinet: Lockable, steel enclosure arranged so operations required for testing, normal operation, and maintenance are performed from front of enclosure. If more than a single cabinet is required to form a complete control unit, provide exactly matching modular enclosures. Accommodate all components and allow ample gutter space for field wiring. Identify each enclosure by an engraved, laminated, phenolic-resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch (25 mm) high. Identify, with permanent labels, individual components and modules within cabinets.
- J. Transmission to Monitoring Station: A communications device to automatically transmit alarm, supervisory, and trouble signals to the monitoring station, operating over a standard voice grade telephone leased line. Comply with UL 1635.
- K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

2.16 AUDIBLE AND VISUAL ALARM DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Edwards Signaling; UTC Fire & Security.
 2. Honeywell International Inc.
 3. Wheelock; a brand of Eaton.
- B. Bell: 10 inches (254 mm) in diameter, rated to produce a minimum sound output of 84 dB at 10 feet (3 m) from master control unit.
1. Enclosure: Weather-resistant steel box equipped with tamper switches on cover and on back of box.
- C. Klaxon Weatherproof Motor-Driven Hooter: UL listed, rated to produce a minimum sound output of 120 dB at 3 feet (1 m), plus or minus 3 dB, at a frequency of 470 Hz. Rated for intermittent use: two minutes on and five minutes off.
1. Designed for use in industrial areas and in high-noise, severe-weather marine environments.
- D. Siren: 30-W speaker with siren driver, rated to produce a minimum sound output of 103 dB at 10 feet (3 m) from master control unit.
1. Enclosure: Weather-resistant steel box with tamper switches on cover and on back of box.
- E. Strobe: Xenon light complying with UL 1638, with a clear polycarbonate lens.
1. Light Output: 115 cd, minimum.
 2. Flash Rate: 60 per minute.

2.17 SECURITY FASTENERS

- A. Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive system type, head style, material, and protective coating as required for assembly, installation, and strength.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Acument Global Technologies; Acument Intellectual Properties, LLC.
 2. Safety Socket LLC.
 3. Tamper-Pruf Screws.
- C. Drive System Types: **pinned hex (Allen).**
- D. Socket Flat Countersunk Head Fasteners:
1. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 2. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
- E. Socket Button Head Fasteners:
1. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 2. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
- F. Socket Head Cap Fasteners:
1. Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
 2. Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.

- G. Protective Coatings for Heat-Treated Alloy Steel:
 - 1. Zinc chromate, ASTM F 1135, Grade 3 or Grade 4, for exterior applications and interior applications where indicated.
 - 2. Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of intrusion detection.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before intrusion detection installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of intrusion detection.
- D. Inspect built-in and cast-in anchor installations, before installing intrusion detection, to verify that anchor installations comply with requirements. Prepare inspection reports.
 - 1. Remove and replace anchors where inspections indicate that they do not comply with requirements. Reinspect after repairs or replacements are made.
 - 2. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.
- E. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SYSTEM INTEGRATION

- A. Integrate intrusion detection system with the following systems and equipment:
 - 1. Electronic door hardware.
 - 2. Elevators.
 - 3. Network lighting controls.
 - 4. Intercommunications and program systems.
 - 5. Public address and mass notification systems.
 - 6. Access control.
 - 7. Fire-alarm system.
 - 8. Perimeter security system.
 - 9. Video surveillance.
 - 10. **<Insert applicable systems and equipment>**.

3.3 SYSTEM INSTALLATION

- A. Comply with UL 681 and NFPA 731.
- B. Equipment Mounting: Install master control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Connecting to Existing Equipment: Verify that existing perimeter security system is operational before making changes or connections.
1. Connect new equipment to existing control panel in existing part of the building.
 2. Connect new equipment to existing monitoring equipment at the Supervising Station.
 3. Expand, modify, and supplement existing [control] [monitoring] equipment as necessary to extend existing [control] [monitoring] functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- E. Security Fasteners: Where accessible to inmates, install intrusion detection components using security fasteners with head style appropriate for fabrication requirements, strength, and finish of adjacent materials except that a maximum of two different sets of tools shall be required to operate security fasteners for Project. **Provide stainless-steel security fasteners in stainless-steel materials.**
- 3.4 WIRING INSTALLATION
- A. Wiring Method: Install wiring in metal raceways according to Section 260533 "Raceways and Boxes for Electrical Systems." Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
- B. Wiring Method: Install wiring in metal raceways according to Section 260533 "Raceways and Boxes for Electrical Systems," except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
- C. Wiring Method: Cable, concealed in accessible ceilings, walls, and floors when possible.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Wires and Cables:
1. Conductors: Size as recommended in writing by system manufacturer unless otherwise indicated.
 2. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
 3. Control and Signal Transmission Conductors: Install unshielded, twisted-pair cable unless otherwise indicated or if manufacturer recommends shielded cable, according to Section 280513 "Conductors and Cables for Electronic Safety and Security."
 4. Data and Television Signal Transmission Cables: Install according to Section 280513 "Conductors and Cables for Electronic Safety and Security."
- F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

- G. Install power supplies and other auxiliary components for detection devices at control units unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.
- H. Identify components with engraved, laminated-plastic or metal nameplate for master control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with identification requirements in Section 260553 "Identification for Electrical Systems."
- B. Install instructions frame in a location visible from master control unit.

3.6 GROUNDING

- A. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.
- B. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- C. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.
- D. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Section 280526 "Grounding and Bonding for Electronic Safety and Security."

3.7 FIELD QUALITY CONTROL

- A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
 - 1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.
- B. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- E. Tests and Inspections: Comply with provisions in NFPA 731, Ch. 9, "Testing and Inspections."
 - 1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

2. Test Methods: Intrusion detection systems and other systems and equipment that are associated with detection and accessory equipment shall be tested according to Table "Test Methods" and Table "Test Methods of Initiating Devices."

F. Documentation: Comply with provisions in NFPA 731, Ch. 4, "Documentation."

G. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **three** visits to Project during other-than-normal occupancy hours for this purpose. **Visits for this purpose shall be in addition to any required by warranty.**

3.9 DEMONSTRATION

A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain the intrusion detection system. Comply with documentation provisions in NFPA 731, Ch. 4, "Documentation and User Training."

END OF SECTION

SECTION 28 16 43

PERIMETER SECURITY SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Perimeter detection and alarm system.
2. Integration of other electronic and electrical systems and equipment.

B. Related Sections:

1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for cabling between master control units and field-mounted devices and control units.
2. Section 281600 "Intrusion Detection" for indoor-type intrusion detection devices.
3. Section 282300 "Video Surveillance" for CCTV cameras that are used as devices for video motion detection.

1.3 DEFINITIONS

- A. CCTV: Closed-circuit television.
- B. EMI: Electromagnetic interference.
- C. PIR: Passive infrared.
- D. RFI: Radio-frequency interference.
- E. UPS: Uninterruptible power supply.
- F. Control Unit: System component that monitors inputs and controls outputs through various circuits.
- G. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.
- H. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.
- I. Protected Zone: A protected premises or an area within a protected premise that is provided with means to prevent an unwanted event.

- J. Standard Intruder: A person who weighs 100 lb (45 kg) or less and whose height is 60 inches (1525 mm) or less; dressed in a long-sleeved shirt, slacks, and shoes **unless environmental conditions at the site require protective clothing.**
- K. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.
- L. Systems Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.
- M. Zone. A defined area within a protected premise. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

1.4 ACTION SUBMITTALS

- A. Product Data: Components for sensing, detecting, **systems integration**, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.
 - 1. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate methods used to achieve systems integration. Indicate control, signal, and data communication paths and identify **networks and** control interface devices and media to be used. Describe characteristics of network and other data communication lines.
 - a. Indicate methods used to achieve systems integration.
 - b. Indicate control, signal, and data communication paths and identify PLCs, networks, control interface devices, and media to be used.
 - c. Describe characteristics of network and other data communication lines.
 - d. Describe methods used to protect against power outages and transient voltages including types and ratings of isolation and surge suppression devices used in data, communication, signal, control, and ac and dc power circuits.
 - 2. Raceway Riser Diagrams: Detail raceway runs required for perimeter security **and for systems integration**. Include designation of devices connected by raceway, raceway type and size, and type and size of wire and cable fill for each raceway run.
 - 3. UPS: Sizing calculations.
 - 4. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building. **Include room layout for master control-unit console, terminal cabinet, racks, and UPS.**
 - 5. Master Control-Unit Console Layout: Show required artwork and device identification.
 - 6. Device Address List: Coordinate with final system programming.
 - 7. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
 - 8. Details of transient voltage surge protection.
 - 9. Sensor detection patterns and adjustment ranges.
- C. Equipment and System Operation Description: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.
- D. Samples for Initial Selection: For units with factory-applied color finishes.

- E. Samples for Verification: For each type of exposed finish required.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **security systems integrator & testing agency**.
- B. Field quality-control reports.
- C. Warranty: Sample of special warranty.
- D. Other Information Submittals:
 - 1. Test Plan and Schedule: Test plan defining all tests required to ensure that system meets technical, operational, and performance specifications within **60 days** of date of Contract award.
 - 2. Examination reports documenting inspections of substrates, areas, and conditions.
 - 3. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For perimeter security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Data for each type of product, including features and operating sequences, both automatic and manual.
 - 2. Master control-unit hardware and software data.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. **One** spare control-unit board(s) for strain-sensitive cable system and **one** cable repair and splice kit(s).
 - 2. **One** of each type of microwave sensor and one of each type of power supply for microwave perimeter security system.
 - 3. **On** of each spare sensor and PIR unit and **one** alignment telescope(s) for long-range PIR system.
 - 4. **One** spare control-unit board(s) for electrostatic-field system.
 - 5. **One** spare control-unit board(s) for buried, ported coaxial cable system, 10 feet (3 m) of cable; and **one** cable repair and splice kit(s).
 - 6. Fuses: **Three** of each kind and size.
 - 7. Tool Kit: Provide **six** sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.
 - 8. Security Fasteners: Furnish no fewer than **1 box for every 50** boxes or fraction thereof, of each type and size of security fastener installed.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. An employer of workers, at least one of whom is a technician certified by the National Burglar & Fire Alarm Association.
 - 2. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

- B. Security Systems Integrator Qualifications: An experienced perimeter security equipment supplier **and Installer** who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Control Units, Devices, and Communications to Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.
- F. FM Global Compliance: FM-Approved and -labeled perimeter security devices and equipment.
- G. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

- A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. Altitude: Sea level to **4000 feet (1220 m)**.
 - 2. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
 - 3. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambients of **minus 30 to plus 122 deg F (minus 34 to plus 50 deg C)** dry bulb and 20 to 90 percent relative humidity, condensing. Comply with UL 294 and UL 639 for outdoor-use equipment. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to **85 mph (137 km/h)**.
 - 4. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flytings shall be rated, listed, and installed according to NFPA 70.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of perimeter security devices and equipment that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **Two** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Description: Perimeter protection system with **fence-mounted system** integrated into a single perimeter detection and alarm system.
- B. Supervision: System components shall be continuously monitored for normal, alarm, **supervisory**, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.

1. Alarm Signal: Display at master control unit and actuate audible and visual alarm devices.
 2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or control-unit failure.
 3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or control unit.
- C. System Control: Master control unit shall directly monitor gate detection devices, perimeter detection units, and connecting wiring.
- D. System Control: One or more remote, addressable control units operate under control of a master control-unit microcomputer in a multiplexed distributed control system or as part of a network. Control units shall receive programming by multiplexed signal transmission from the associated master control unit and hold data in nonvolatile memory. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.
- E. Operator Commands:
1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.
 2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
 3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
 4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
 5. Protected Zone Test: Initiate operational test of a specific protected zone.
 6. System Test: Initiate system-wide operational test.
 7. Print reports.
- F. Timed Control at Master Control Unit: Allow automatically timed "secure" and "access" functions of selected protected zones.
- G. Automatic Control of Related Systems: Alarm or supervisory signals from certain perimeter security devices control the following functions in related systems:
1. Switch selected lights.
 2. Open a signal path between certain intercommunication stations.
 3. Shift sound system to "listening mode" and open a signal path to certain system speakers.
 4. Switch signal to selected monitor from CCTV camera in vicinity of sensor signaling an alarm.
- H. Printed Record of Events: Print a record of alarm, supervisory, and trouble events on system printer. Sort and report by protected zone, device, and function. When master control unit receives a signal, print a report of alarm, supervisory, or trouble condition. Report type of signal (alarm, supervisory, or trouble), control-unit address, protected zone description, date, and time of occurrence. Differentiate alarm signals from other indications. When system is reset, report reset event with the same information concerning device, location, date, and time. Commands shall initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.
- I. Response Time: **Two** seconds between actuation of any alarm and its indication at master control unit.
- J. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, control units, and sensors from master control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at master control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.
- K. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times.

Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.

- L. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

2.2 SYSTEM COMPONENT REQUIREMENTS

- A. Compatibility: Detection devices and their communication features, connecting wiring, and master control unit shall be selected and configured with accessories for full compatibility with the following equipment:

1. Door hardware specified in Section 087100 "Door Hardware."
2. Door hardware specified in Section 087111 "Door Hardware (Descriptive Specification)."
3. Lighting controls specified in Section 260923 "Lighting Control Devices."
4. Lighting controls specified in Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."
5. Intercommunications and program systems specified in Section 275123 "Intercommunications and Program Systems."
6. Public address and mass notification systems specified in Section 275116 "Public Address and Mass Notification Systems."
7. Access control system specified in Section 281300 "Access Control."
8. Intrusion detection system specified in Section 281600 "Intrusion Detection."
9. Video surveillance system specified in Section 282300 "Video Surveillance."
10. <Insert system or equipment> specified in Section <Insert Section number> "<Insert Section title>."

- B. Perimeter Security Units: Listed and labeled by a qualified testing agency for compliance with UL 639.

- C. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Listed and labeled by a qualified testing agency for compliance with NFPA 731.

- D. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V rms injected into power supply lines at 10 to 10,000 MHz.

- E. Tamper Protection: Tamper switches on detection devices, control units, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected. Master control-unit alarm display shall identify tamper alarms and indicate locations.

- F. Self-Testing Devices: Automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Devices transmit test failure to master control unit.

- G. Antimasking Devices: Automatically check operation continuously or at intervals of a minute or less, and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational dysfunction. Devices transmit detection of operational dysfunction to master control unit as an alarm signal.

- H. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to master control unit.

- I. Remote-Controlled Devices: Individually and remotely adjustable for sensitivity and individually monitored at master control unit for calibration, sensitivity, and alarm condition.

2.3 ENCLOSURES

- A. Interior Electronics: NEMA 250, Type 12.
- B. Exterior Electronics: NEMA 250, Type 4X, **stainless steel**.
- C. Corrosion Resistant: NEMA 250, Type 4X, **stainless steel**.
- D. Terminal cabinets in handholes and manholes shall be NEMA 250, [Type 6] [Type 6P].
- E. Screw Covers: Where enclosures are readily accessible, secure with security fasteners of type appropriate for enclosure.

2.4 SECURE AND ACCESS DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Digital Security Controls Ltd.
 - 2. Edwards Signaling; UTC Fire & Security.
 - 3. Honeywell International Inc.
- B. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.
- C. Key-Operated Switch: Change protected zone between secure and access conditions.

2.5 STRAIN-SENSITIVE CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Integrated Security Corporation.
 - 2. Safeguards Technology.
 - 3. Southwest Microwave, Inc.
- B. Description: Fence-mounted strain-sensitive, coaxial transducer cable shall monitor chain-link-type and welded-mesh-type fence and generate an alarm when a standard intruder attempts to climb over, cut through, or lift fence fabric.
- C. Environment: Suitable for exterior installation and the following conditions:
 - 1. Ambient Temperatures: Ranging from minus 22 to plus 158 deg F (minus 30 to plus 70 deg C).
- D. Transducer Cable:
 - 1. UV-resistant cable furnished by system manufacturer.
 - 2. Suitable for up to 1000 feet (300 m) of sensor cable per single-zone control unit and up to 2000 feet (600 m) of sensor cable per dual-zone processor.
 - 3. Sensitivity shall be uniform throughout its entire length, requiring only one variable sensitivity adjustment throughout its entire length.
- E. Control Unit:
 - 1. Field mounted, with tamper switch at control-unit board.
 - 2. Electronic circuitry shall discriminate between acceptable fence movement and intrusion-related disturbances.
 - 3. Sensitivity, count control, and climb-over processors shall be adjustable with a minimum of five individual count-control and climb-over adjustments.

4. Control-unit output shall have adjustable pulse width to adjust the time the alarm relay will activate per detected intrusion attempt.

F. System Performance:

1. Immune to RFI and EMI environments; interference shall have no effect on normal operational characteristics.
2. Trouble and Tamper: Entire sensor system shall be fully supervised with individually monitored tamper and supervision alarms. Disconnecting, cutting, or shorting of strain-sensitive cable results in supervisory alarm.
3. Intrusion Simulation: Each zone shall have a self-test feature that, when activated by a signal from master control unit will produce an intrusion alarm and verify operation of sensor.

2.6 MICROWAVE INTRUSION DETECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Honeywell International Inc.
2. Integrated Security Corporation.
3. Southwest Microwave, Inc.

B. Description: Volumetric microwave detection system.

C. Device Performance: Microwave transmitter establishes an electromagnetic field in an adjustable detection pattern and detects intrusion by monitoring changes in that pattern.

1. Movement Sensitivity: Adjustable, able to detect standard-intruder movement within sensor's detection pattern at any speed between 0.1 to 50 fps (0.03 to 15.2 m/s). Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.
2. Detection Range: 15 to 600 feet (5 to 180 m).
3. Range Sensitivity: Adjustable for setting area of protection between 15 to 500 feet (5 to 152 m) in range and from 2 to 40 feet (0.6 to 12 m) in beam diameter.
4. Trouble and Tamper: Fully supervised with individually monitored tamper and supervision alarms. System failure shall result in tamper alarm. System jamming or wrong modulation shall result in supervisory alarm.
5. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test-enabling switch under sensor housing cover.
6. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

D. Environment: Suitable for exterior installation and the following conditions:

1. Ambient Temperatures: Ranging from minus 30 to plus 158 deg F (minus 34 to plus 70 deg C) and in rainfall up to 4 inches (100 mm).

2.7 ELECTROSTATIC FIELD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Integrated Security Corporation.
2. Safeguards Technology.
3. Southwest Microwave, Inc.

B. Description: Fence-mounted, **independently mounted**, above-ground, electrostatic-field detection system, consisting of electronically balanced phase electrostatic-field detection system with a field generator that generates an electrical field in one or more field wires and that has two or more sensing

wires, a sense filter, amplifier, and a control unit. Detection fields shall have a minimum of four different frequencies so adjacent zones cannot interfere with each other.

C. Environment: Suitable for exterior installation and the following conditions:

1. Ambient Temperatures: Ranging from minus 22 to plus 158 deg F (minus 30 to plus 70 deg C).

D. System Performance:

1. Detect, via sense wires, a compound signal form consisting of amplitude change, rate of change, and preset time disturbance that forms a "signature" of human movement. Generate an alarm when all exist simultaneously. Provide detection fields of no fewer than four different frequencies so adjacent zones do not interfere with each other.

2. Control Units: Single or multiple zone, with sense filter. Front panel with calibration meter, status of alarm transmitter, sensitivity selector, test point selector, power indicator, and power control. Control unit shall reject signals due to wind and small objects striking the wires.

3. Motion Detection: Sense standard-intruder movement at rates from 0.15 to 26 fps (0.045 to 8.0 m/s).

4. Zone Length: Not to exceed 325 feet (100 m).

5. Supervision: Generate trouble signal if field or sense wires are cut or shorted to ground or to each other. Generate supervisory alarm if received signal is substantially reduced.

E. Insulators, Wire-Tensioning Devices, and Brackets: Manufacturer's standard for mounting and tensioning of wires.

F. Field and Sensing Wires: Stainless steel.

2.8 BURIED, PORTED COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Magal-Senstar, Inc.

2. Safeguards Technology.

3. Southwest Microwave, Inc.

B. Description: Buried electrostatic-field detection system consisting of parallel, ported coaxial cables that generate a detection field between cables.

C. Environment: Suitable for exterior installation and the following conditions:

1. Ambient Temperatures: Ranging from minus 22 to plus 158 deg F (minus 30 to plus 70 deg C).

D. System Performance: One of two parallel cables receives a continuous wave signal from a transmitter module. Second cable, connected to a sensor module, detects, preamplifies, and analyzes variations in signal. When system senses "signature" of a standard intruder in the detection zone, based on mass, motion, and time of day, it generates an alarm.

1. Transmitter: Locate at one end of zone, with standby battery.

2. Preamplifier-Sensor: Locate at opposite end from transmitter, with standby battery.

3. Front panel with sensitivity calibration meter, calibrated self-test potentiometer, power switch, and LED normal and malfunction indicators.

4. Electromagnetic Radiation: Less than 50 mV per meter at 30 m.

5. Motion Detection: Sense standard-intruder movement at rates from 0.17 to 26 fps (0.05 to 8.0 m/s).

6. Zone Length: Not to exceed 325 feet (100 m).

7. Zone Width: Not to exceed 15 feet (4.6 m), with an average width of 12 feet (3.7 m).

8. Zone Height: Approximately 3.3 feet (1.0 m), depending on sensitivity setting.

9. Supervision: Generate trouble signal if cable is cut or shorted to ground. Generate supervisory alarm if cabinets are tampered with.

- E. Enclosures: Hinged cover with tamper switch and security fasteners.
- F. Buried, Ported Coaxial Cable: Approximately 1/2-inch (1.3-mm) diameter, minimum 10 AWG center conductor, foam polyethylene dielectric, braided copper outer conductor, and polyethylene jacket.

2.9 LONG-RANGE PIR DETECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Honeywell International Inc.
 - 2. Integrated Security Corporation.
 - 3. Southwest Microwave, Inc.
- B. Description: Volumetric passive infrared detection system.
- C. Listed and labeled by a qualified testing agency for compliance with SIA PIR-01.
- D. Environment: Suitable for exterior installation and the following conditions:
 - 1. Ambient Temperatures: Ranging from minus 30 to plus 150 deg F (minus 34 to plus 65 deg C).
- E. System Performance: Detect an interruption of dual-infrared light beams that link transmitters and receivers. Generate an alarm when signal is interrupted due to presence of an object that interrupts both beams.
 - 1. Sensitivity: Field adjustable to allow adjustment of range from 25 to 500 feet (7.6 to 152 m), generating an alarm within 20 to 50 ms when both beams are interrupted.
 - 2. Detection system shall adjust automatically to compensate for weather, including fog, rain, snow, blowing dust, and rapid temperature changes.
 - 3. Motion Detection: Detect standard-intruder movement at rates from 0.1 to 50 fps (0.03 to 15.2 m/s).
 - 4. Supervision: Generate supervisory alarm if any portion of system is tampered with.
 - 5. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

2.10 GEOPHONE FENCE DETECTION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Honeywell International Inc.
 - 2. Safeguards Technology.
 - 3. Southwest Microwave, Inc.
- B. Description: Fence-mounted system to detect attempts to cut or climb the protected fence, using geophone sensors that respond to specific shock or vibrations.
- C. Environment: Suitable for exterior installation and the following conditions:
 - 1. Ambient Temperatures: Ranging from minus 30 to plus 150 deg F (minus 34 to plus 65 deg C).
- D. System Performance:
 - 1. Control Unit: **10** zone capacity for processing geophone generated analog signals. Each zone shall consist of not more than **10** sensors.
 - a. Adjustments: For each zone, provide stepped gain control for sensitivity and switches for geophone signal filters to minimize nuisance alarms. System shall adjust automatically to

compensate for weather, including fog, rain, snow, blowing dust, and rapid temperature changes.

- b. Trouble Condition Signal: Generate when any zone fails.
 - c. Supervisory Condition Signal: Generate on interference with control-unit operation or when detecting a break-in into an enclosure housing electronics.
- 2. Sensors: Fence mounted **20 feet (6 m)** o.c.
 - 3. Cable for Interconnection of System Components: Shielded, PVC jacketed and armored, as supplied by system manufacturer.
 - 4. Test each zone simulating an alarm condition. Test by **command from master control**.

2.11 VIDEO MOTION SENSOR

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Bosch Security Systems, Inc.
 - 2. Honeywell International Inc.
 - 3. Magal-Senstar, Inc.
- B. Description: Video-surveillance-based detection system.
- C. Device Performance: Detect changes in video signal within a user-defined protected zone. Provide an alarm output for each video input.
 - 1. Detect movement within protected zone of standard intruders wearing clothing with a reflectivity that differs from that of background scene by a factor of 2. Reject all other changes in video signal.
 - 2. Modular design that allows for expansion or modification of number of inputs.
 - 3. Adjustable Controls:
 - a. Number of detection zones.
 - b. Size of detection zones.
 - c. Sensitivity of detection of each protected zone.
 - 4. Mounting: Standard 19-inch (480-mm) rack as described in EIA/ECA 310-E.
- D. Environment: Suitable for installation in interior air-conditioned spaces.

2.12 GATE UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aleph America Corporation.
 - 2. Honeywell Security Products- Americas.
 - 3. Safeguards Technology.
- B. Description: Fence-mounted gate-movement detectors, balanced-magnetic type, and UL listed for outdoor locations. Units shall be designed for mounting on single- or double-leaf swinging or rolling gates and have armored jumper cables between switch and stationary junction box for wiring to master control unit and tamper switches in junction box.
- C. Device Performance: Bias magnet and at least three encapsulated-reed switches that resist compromise from introduction of foreign magnetic fields, with integral overcurrent protective device to limit current to 80 percent of switch capacity.
- D. Remote Test: Simulate movement of actuating magnet from master control unit.

2.13 FIELD-MOUNTED CONTROL UNITS

- A. Field-mounted control units shall include the power supply and detector specific functions, and provide for communications with the master control unit. Control unit shall include read-only resident software needed for startup, a time clock, and all automatic operations. Software shall be downloaded from the master control unit.
- B. Battery Backup: UPS, providing **six** hours of run time during a power outage, with two-rate automatic battery charger to fully recharge batteries within **12** hours after normal power is restored.
 - 1. Batteries: Rechargeable, valve-regulated, recombinant, sealed, lead-acid type with nominal 10-year life expectancy.
 - 2. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Charger shall recharge fully discharged battery within 24 hours.
- C. Annunciation: Indicate a change in system condition and switching of system or component to backup power.

2.14 MASTER CONTROL UNIT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. GE Security, Inc.
 - 2. Honeywell Security Products- Americas.
 - 3. Southwest Microwave, Inc.
- B. Description: Supervise sensors and detection subsystems and their connecting communication links, status control (secure or access) of sensors and detector subsystems, activation of alarms and supervisory and trouble signals, and other indicated functions.
 - 1. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - 2. Include a real-time clock for time annotation of events on the event recorder and printer.
 - 3. Addressable initiation devices that communicate device identity and status.
 - 4. Control circuits for operation of mechanical equipment in response to an alarm.
- C. Construction: **Freestanding equipment rack**, modular, with separate and independent alarm and supervisory system modules. **Alarm-initiating protected zone boards shall be plug-in cards**. Arrangements that require removal of field wiring for module replacement are unacceptable.
- D. Comply with **UL 609**.
- E. Console Controls and Displays: Arranged for interface between human operator at master control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 - 1. Annunciator and Display: LCD type, **three** line(s) of **80** characters, minimum.
 - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands
 - 3. Control-Unit Network: Automatic communication of alarm, status changes, commands, and other communications required for system operation. Communication shall return to normal after partial or total network interruption such as power loss or transient event. Total or partial signaling network failures shall identify the failure and record the failure at the annunciator display and at the system printer.
 - 4. Field Device Network: Communicate between the control unit and field devices of the system. Communications shall consist of alarm, network status, and status and control of field-mounted processors. Each field-mounted device shall be interrogated during each interrogation cycle.

5. Operator Controls: Manual switches and push-to-test buttons that do not require a key to operate. Prevent resetting of alarm, supervisory, or trouble signals while alarm or trouble condition persists. Include the following:
 - a. Acknowledge alarm.
 - b. Silence alarm.
 - c. System reset.
 - d. LED test.
 6. Timing Unit: Solid state, programmable, 365 days.
 7. Confirmation: Relays, contactors, and other control devices shall have auxiliary contacts that provide confirmation signals to system for their on or off status. Software shall interpret such signals, display equipment status, and initiate failure signals.
 8. Alarm Indication: An audible signal sounds and an LED lights at master control unit identifying the **addressable detector** originating the alarm. **Annunciator panel displays a common alarm light and sounds an audible tone.**
 9. Alarm Indication: An audible signal sounds and a plain-language identification of the **addressable detector** originating the alarm appears on LED display at master control unit. **Annunciator panel displays a common alarm light and sounds an audible tone.**
 10. Alarm Indication: An audible signal sounds and a plain-language identification of the **addressable detector** originating the alarm appears on LED display at master control unit. **Annunciator panel alarm light and audible tone identify protected zone signaling an alarm.**
 11. Alarm activation sounds a **bell or siren and strobe.**
- F. Protected Zones: Quantity of alarm and supervisory zones as indicated, with capacity for expanding number of protected zones by a minimum of **25** percent.
- G. Power Supply Circuits: Master control units shall provide power for remote power-consuming detection devices. Circuit capacity shall be adequate for at least a **25** percent increase in load.
- H. UPS: Comply with Section 263353 "Static Uninterruptible Power Supply." UPS shall be sized to provide a minimum of six hours of master control-unit operation.
- I. Cabinet: Lockable, steel enclosure arranged so operations required for testing, normal operation, and maintenance are performed from front of enclosure. If more than a single cabinet is required to form a complete control unit, provide exactly matching modular enclosures. Accommodate all components and allow ample gutter space for field wiring. Identify each enclosure by an engraved, laminated, phenolic-resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch (25 mm) high. Identify, with permanent labels, individual components and modules within cabinets.
- J. Transmission to Monitoring Station: A communications device to automatically transmit alarm, supervisory, and trouble signals to the monitoring station, operating over a standard voice grade telephone leased line. Comply with UL 1635.
- K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

2.15 AUDIBLE AND VISUAL ALARM DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Edwards Signaling; UTC Fire & Security.
 2. Honeywell International Inc.
 3. Wheelock; a brand of Eaton.

- B. Bell: 10 inches (254 mm) in diameter, rated to produce a minimum sound output of 84 dB at 10 feet (3 m) from master control unit.
 - 1. Enclosure: Weather-resistant steel box equipped with tamper switches on cover and on back of box.
- C. Klaxon Weatherproof Motor-Driven Hooter: UL listed, rated to produce a minimum sound output of 120 dB at 3 feet (1 m), plus or minus 3 dB, at a frequency of 470 Hz. Rated for intermittent use: two minutes on, five minutes off.
 - 1. Designed for use in industrial areas and in high-noise, severe-weather marine environments.
- D. Siren: 30-W speaker with siren driver, rated to produce a minimum sound output of 103 dB at 10 feet (3 m) from master control unit.
 - 1. Enclosure: Weather-resistant steel box with tamper switches on cover and on back of box.
- E. Strobe: Xenon light complying with UL 1638, with a clear polycarbonate lens.
 - 1. Light Output: 115 cd, minimum.
 - 2. Flash Rate: 60 per minute.

2.16 SECURITY FASTENERS

- A. Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive system type, head style, material, and protective coating as required for assembly, installation, and strength.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acument Global Technologies; Acument Intellectual Properties, LLC.
 - 2. Safety Socket LLC.
 - 3. Tamper-Pruf Screws.
- C. Drive System Types: **pinned hex (Allen)**.
- D. Socket Flat Countersunk Head Fasteners:
 - 1. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - 2. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
- E. Socket Button Head Fasteners:
 - 1. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - 2. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
- F. Socket Head Cap Fasteners:
 - 1. Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
 - 2. Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.
- G. Protective Coatings for Heat-Treated Alloy Steel:
 - 1. Zinc chromate, ASTM F 1135, Grade 3 or Grade 4, for exterior applications and interior applications where indicated.
 - 2. Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.

2.17 SOURCE QUALITY CONTROL

- A. **Electrostatic-Field and Buried, Ported Coaxial Cable** Systems Electronics: Precondition at factory by subjecting modules to at least four days' operational burn-in at temperatures not less than 140 deg F (60 deg C).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of perimeter security.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations of perimeter security connections before perimeter security installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of perimeter security.
- D. Inspect built-in and cast-in anchor installations, before installing perimeter security, to verify that anchor installations comply with requirements. Prepare inspection reports.
 - 1. Remove and replace anchors where inspections indicate that they do not comply with requirements. Reinspect after repairs or replacements are made.
 - 2. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.
- E. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SYSTEMS INTEGRATION

- A. Integrate perimeter security system with the following systems and equipment:
 - 1. Electronic door hardware.
 - 2. Elevators.
 - 3. Network lighting controls.
 - 4. Intercommunications and program systems.
 - 5. Public address and mass notification systems.
 - 6. Access control.
 - 7. Fire-alarm system.
 - 8. Intrusion detection system.
 - 9. Video surveillance.

3.3 SYSTEM INSTALLATION

- A. Comply with UL 681 and NFPA 731.
- B. Equipment Mounting: Install master control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."

- C. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Connecting to Existing Equipment: Verify that existing perimeter security system is operational before making changes or connections.
1. Connect new equipment to existing control panel in existing part of the building.
 2. Connect new equipment to existing monitoring equipment at the Supervising Station.
- E. Security Fasteners: Where accessible to public, install perimeter security components using security fasteners with head style appropriate for fabrication requirements, strength, and finish of adjacent materials except that a maximum of two different sets of tools shall be required to operate security fasteners for Project. **Provide stainless-steel security fasteners in stainless-steel materials.**
- F. Wiring Method: Install power, signal, and data transmission wire and cable in metal raceways according to Section 260543 "Underground Ducts and Raceways for Electrical Systems" and Section 260533 "Raceways and Boxes for Electrical Systems." Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
- G. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with perimeter security system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- H. Wires and Cables:
1. Conductors: Size as recommended in writing by system manufacturer unless otherwise indicated.
 2. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
 3. Cable for Low-Voltage Control and Signal Circuits: Install unshielded, twisted-pair cable unless otherwise indicated or if manufacturer recommends shielded cable, according to Section 280513 "Conductors and Cables for Electronic Safety and Security."
 4. Data and Television Signal Transmission Cables: Install according to Section 280513 "Conductors and Cables for Electronic Safety and Security."
- I. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- J. Install power supplies and other auxiliary components for detection devices at control units unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.
- K. Stain-Sensitive Transducer Cable: Attached to fence at 12-inch (300-mm) intervals with tie wraps.
- L. Electrostatic-Field System: Install field and sense wires on insulators and standoffs on a fence, wall, or roof. Provide intermediate supports recommended in writing by manufacturer as needed for specified performance.
- M. Buried, Ported Coaxial Cable: Transmitters may be located at one end of parallel coaxial cables, and preamplifier-sensor module may be located at opposite end. Install cable so shield is uniform throughout the length, without twisting or distorting cable during installation. Field-cut cables to exact zone length at the site. To attach data transmission cable to sensing cable, use heat-shrink splice kits approved by manufacturer. Provide sufficient overlap of detector cables to eliminate the possibility of entry between zones.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with identification requirements in Section 260553 "Identification for Electrical Systems."
- B. Install instructions frame in a location visible from master control unit.

3.5 GROUNDING

- A. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.
- B. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- C. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.
- D. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Section 280526 "Grounding and Bonding for Electronic Safety and Security."

3.6 FIELD QUALITY CONTROL

- A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
 - 1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.
- B. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- E. Tests and Inspections: Comply with provisions in NFPA 731, Ch. 9, "Testing and Inspections."
 - 1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
 - 2. Test Methods: Perimeter security systems and other systems and equipment that are associated with detection and accessory equipment shall be tested according to Table "Test Methods" and Table "Test Methods of Initiating Devices."
 - 3. Geophone System Tests: Test each zone at a minimum of two different locations. Test each zone as follows:
 - a. Horizontal Movement: Adjust sensitivity to screen out alarms from wind.
 - b. Vertical Climb: 100 percent detection required. Set count at three occurrences within 90-second window.

- c. Cut Test: 100 percent detection required. Set count at two occurrences within 120-second window.
 - d. Set sensitivity to value as low as possible, consistent with reliable detection.
 - e. If performance tests fail, make adjustments to sensors to comply with requirements. Retest failing and adjacent zones to comply with test.
- 4. Strain-Sensitive Cable System Tests: Adjust sensitivity and count control to value as low as possible, consistent with reliable detection.
 - 5. Microwave Perimeter Security System Tests: Adjust sensitivity to value as low as possible, consistent with reliable detection.
 - 6. Long-Range PIR System Tests: Adjust sensitivity and hold time between activity duration to value as low as possible, consistent with reliable detection.
- F. Documentation: Comply with provisions in NFPA 731, Ch. 4, "Documentation."
- G. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

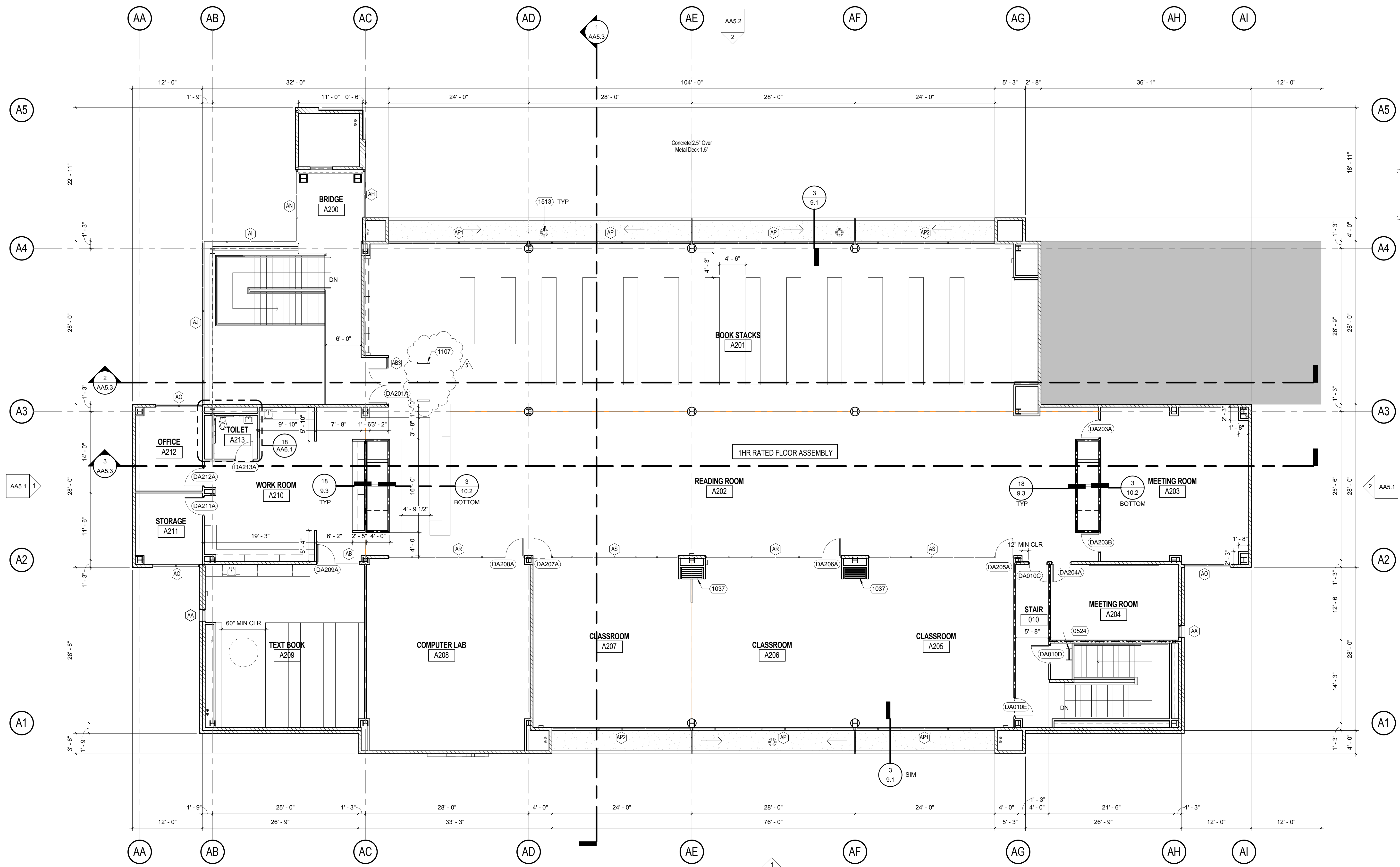
3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to Project during other than normal occupancy hours for this purpose. **Visits for this purpose shall be in addition to any required by warranty.**

3.8 DEMONSTRATION

- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain the perimeter security system. Comply with documentation provisions in NFPA 731, Ch. 4, "Documentation and User Training."

END OF SECTION



ADMINISTRATION / LIBRARY BUILDING A SECOND FLOOR 1/8" = 1'-0" 1

KEYNOTE LEGEND	
KEYNOTE	DESCRIPTION
0524	ROOF ACCESS LADDER PER DETAIL 8/5.1
1037	FOLDING PANEL PARTITION
1107	LIBRARY SECURITY SYSTEM - 3M MODEL 3802 OR EQUAL
1513	ROOF DRAIN PER PLUMBING DRAWING

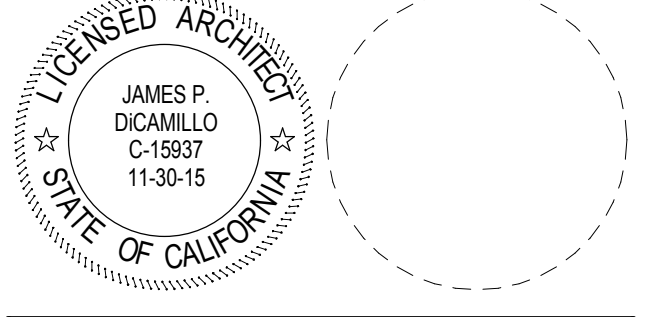
- 4" METAL STUD WALL AT 16" O.C.
INTERIOR: ONE LAYER OF GYPSUM BOARD BOTH SIDES. FULL HEIGHT FROM FLOOR TO FLOOR OR ROOF DECK ON BOTH SIDES, WITH BATT SOUND INSULATION.
- 6" METAL STUD WALL AT 16" O.C.
EXTERIOR: PLASTER OUTSIDE, ONE LAYER OF GYPSUM BOARD INSIDE. FULL HEIGHT FROM FLOOR TO FLOOR OR ROOF DECK WITH BATT THERMAL INSULATION.
INTERIOR: ONE LAYER OF GYPSUM BOARD BOTH SIDES. FULL HEIGHT FROM FLOOR TO FLOOR OR ROOF DECK ON BOTH SIDES, WITH BATT SOUND INSULATION.
- 8" METAL STUD WALL AT 16" O.C.
INTERIOR: ONE LAYER OF GYPSUM BOARD BOTH SIDES. FULL HEIGHT FROM FLOOR TO FLOOR OR ROOF DECK ON BOTH SIDES, WITH BATT SOUND INSULATION.
- 4" METAL STUD WALL AT 16" O.C. - 60 MIN RATED FIRE PARTITION OR FIRE BARRIER IN SHAFT CONDITION
INTERIOR: ONE LAYER OF GYPSUM BOARD TYPE X BOTH SIDES, FULL HEIGHT FROM FLOOR TO FLOOR OR ROOF DECK ON BOTH SIDES WITH BATT SOUND INSULATION. FOLLOW 2013 CBC TABLE 721.102.13-1.1 FOR INSTALLATION REQUIREMENTS
- 6" METAL STUD WALL AT 16" O.C. - 60 MIN RATED FIRE PARTITION OR FIRE BARRIER IN SHAFT CONDITION
INTERIOR: ONE LAYER OF GYPSUM BOARD TYPE X FULL HEIGHT FROM FLOOR TO FLOOR OR ROOF DECK ON BOTH SIDES WITH BATT SOUND INSULATION. FOLLOW 2013 CBC TABLE 721.102.13-1.1 FOR INSTALLATION REQUIREMENTS
- 6" METAL STUD WALL AT 16" O.C. - 120 MIN RATED FIRE WALL
INTERIOR: 2 LAYERS OF GYPSUM BOARD TYPE X FULL HEIGHT FROM FLOOR TO FLOOR OR ROOF DECK ON BOTH SIDES WITH BATT SOUND INSULATION. FOLLOW 2013 CBC TABLE 721.102.13-1.2 FOR INSTALLATION REQUIREMENTS
EXTERIOR: BELOW ROOF LEVEL: 2 LAYERS OF GYPSUM BOARD TYPE X FULL HEIGHT FROM FLOOR TO FLOOR OR ROOF DECK ON INTERIOR SIDE AND PLASTER OVER 2 LAYERS OF FIRE RATED GLASS MAT GYPSUM SHEATHING BOARD ON THE EXTERIOR SIDE WITH BATT THERMAL INSULATION. REFER TO UL NO U404
EXTERIOR ABOVE ROOF LEVEL: MEMBRANE ROOFING OVER 2 LAYERS OF FIRE RATED GLASS MAT GYPSUM PARAPET SHEATHING FULL HEIGHT DECK ON INTERIOR SIDE AND PLASTER OVER 2 LAYERS OF FIRE RATED GLASS MAT GYPSUM SHEATHING BOARD ON THE EXTERIOR SIDE. REFER TO UL NO U404
- 8" METAL STUD WALL AT 16" O.C. - 60 MIN RATED FIRE PARTITION OR FIRE BARRIER IN SHAFT CONDITION
INTERIOR: ONE LAYER OF GYPSUM BOARD TYPE X FULL HEIGHT FROM FLOOR TO FLOOR OR ROOF DECK ON BOTH SIDES WITH BATT SOUND INSULATION. FOLLOW 2013 CBC TABLE 721.102.13-1.1 FOR INSTALLATION REQUIREMENTS

- 1.5" OR 4" FURR FRAMING WITH 5/8" DRYWALL ON ONE SIDE PER DET 16/9.2. ACTUAL CONFIGURATION VARIES PER PLAN
 - ROOF DRAIN AND OVERFLOW DRAIN INSIDE WALL OR CAVITY PER PLAN
 - 18" STAINLESS STEEL COLUMN COVERS, REF DETAIL 7/5.3. RECTANGULAR SHAPE (16"x18") SIM. REFER DETAIL 19/9.3 FOR CEILING TRANSITION CONDITION
 - 18" & 30" CONCRETE COLUMN COVERS, REF DETAIL 20/3.1. REFER DETAIL 19/9.3 FOR CEILING TRANSITION CONDITION
- NOTES
- FOLLOW THE MORE RESTRICTIVE REQUIREMENT BETWEEN SPECIFICATION AND CBC / I.L. GUIDELINES.
 - REFER TO DETAILS IN DRAWING 9.1 FOR GENERAL WALL BASE AND HEAD CONDITIONS
 - ONE LAYER OF BATT INSULATION IS REQUIRED ON DOUBLE FRAMING. NO INSULATION IN NON HABITABLE SPACE UNDER STAIRWAYS
 - FINISH MATERIAL IS NOT REQUIRED IN THE NON ACCESSIBLE CAVITY (EX: COLUMN FURRING, UNDER STAIRWAYS)
 - FINISH FLOOR ELEVATION TO BE 0'-0" UNLESS NOTED OTHERWISE

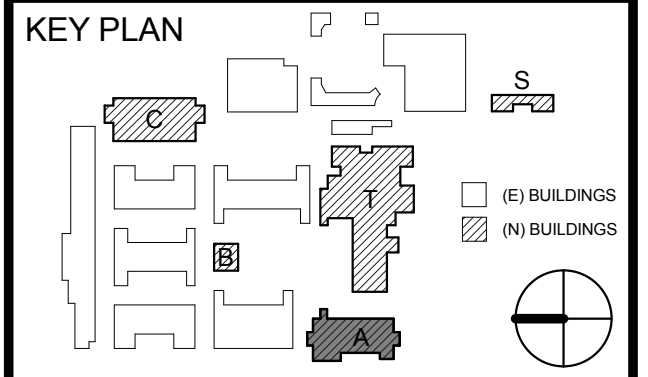
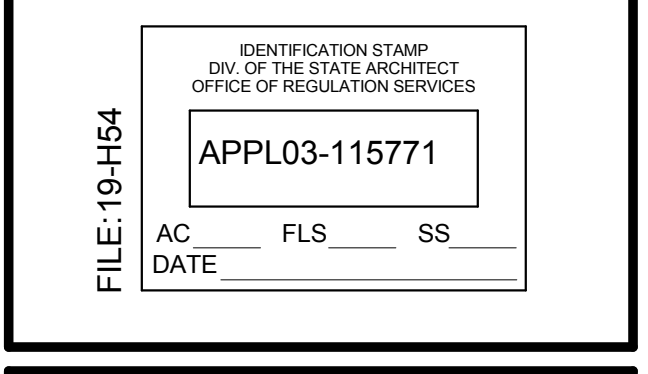
WALL LEGEND 1/8" = 1'-0"

ARCHITECTS
WLC
CLIENT FOCUSED • PASSION DRIVEN
SOUTHERN CALIFORNIA
8163 ROCHESTER AVENUE, SUITE 100
RANCHO CUCAMONGA
CALIFORNIA 91730-0729
TEL: 909-987-0909
www.wlarchitects.com

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ROWLAND UNIFIED SCHOOL DISTRICT
2000 OTTERBEIN AVE
ROWLAND HEIGHTS, CALIFORNIA



CONSULTANT



REVISION SCHEDULE		
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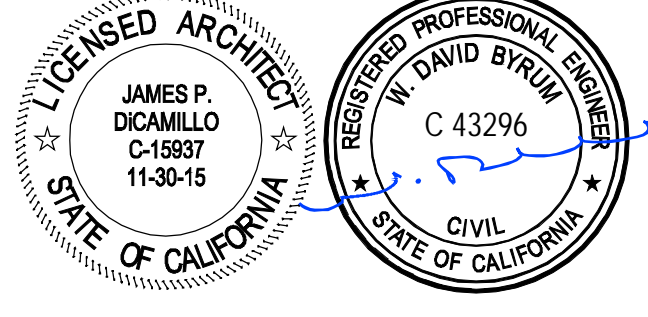
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ADMINISTRATION BUILDING 2ND FLOOR PLAN

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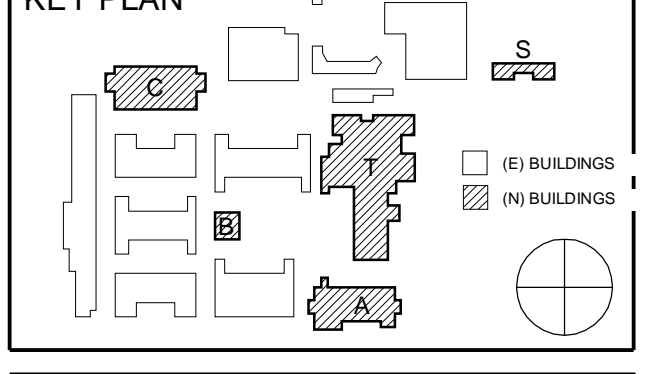
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 118 West Lime Avenue
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Civil, Water, Wastewater, Drainage, and Transportation Engineering, Construction Management, Surveying, California & Arizona.

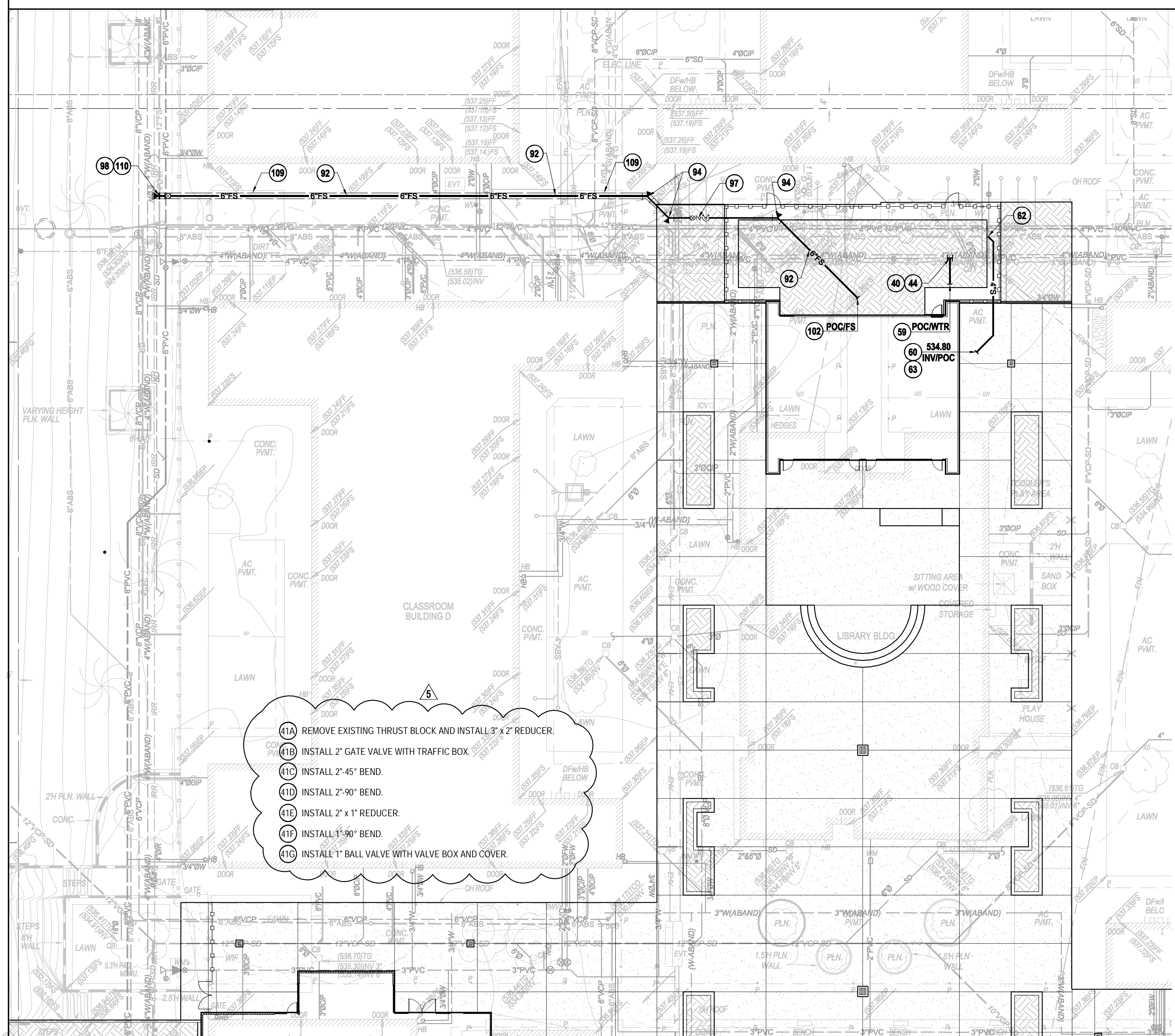
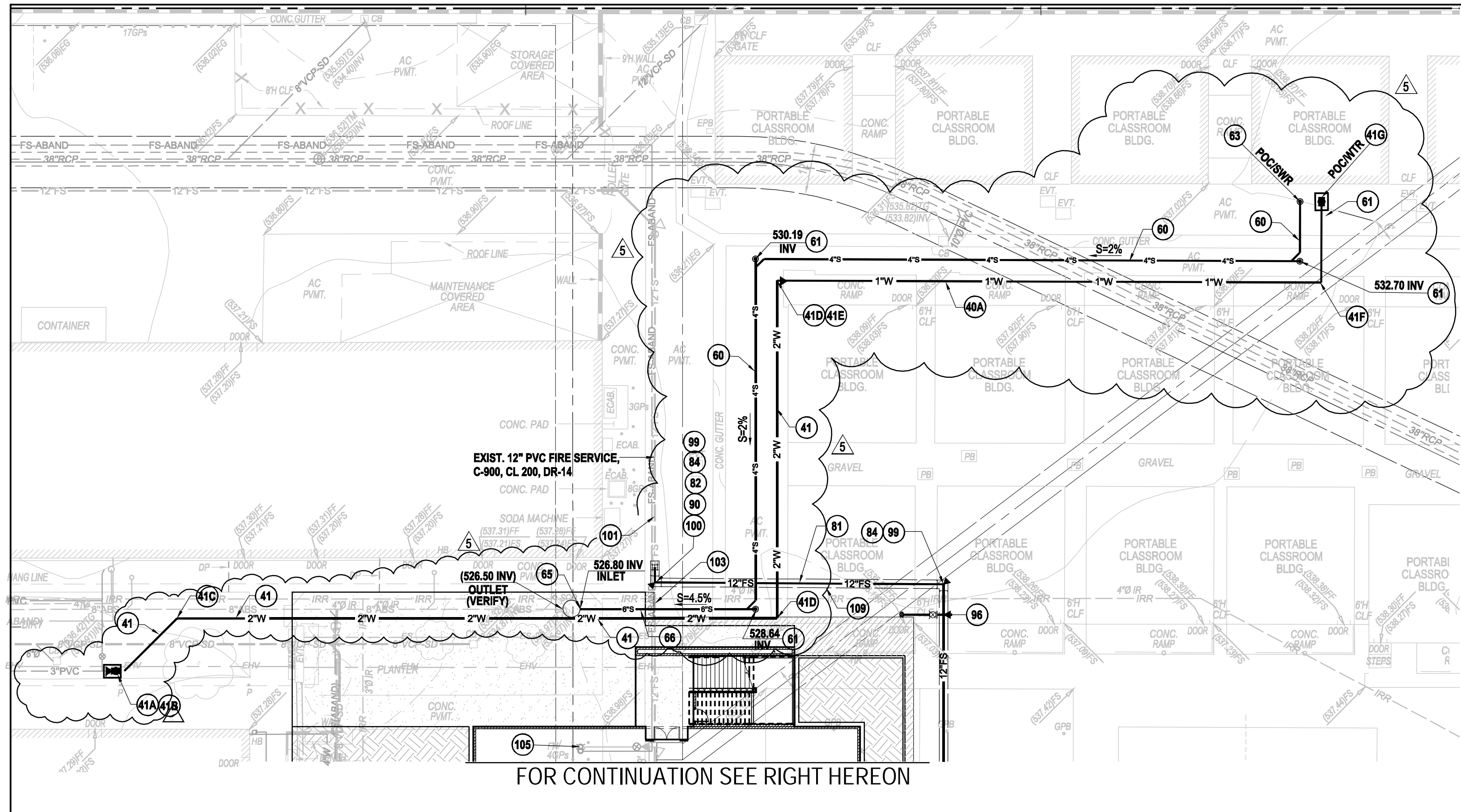
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 DIVISION OF THE STATE ARCHITECT
 OFFICE OF REGULATION SERVICES
APPL03-115771
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 DATE _____



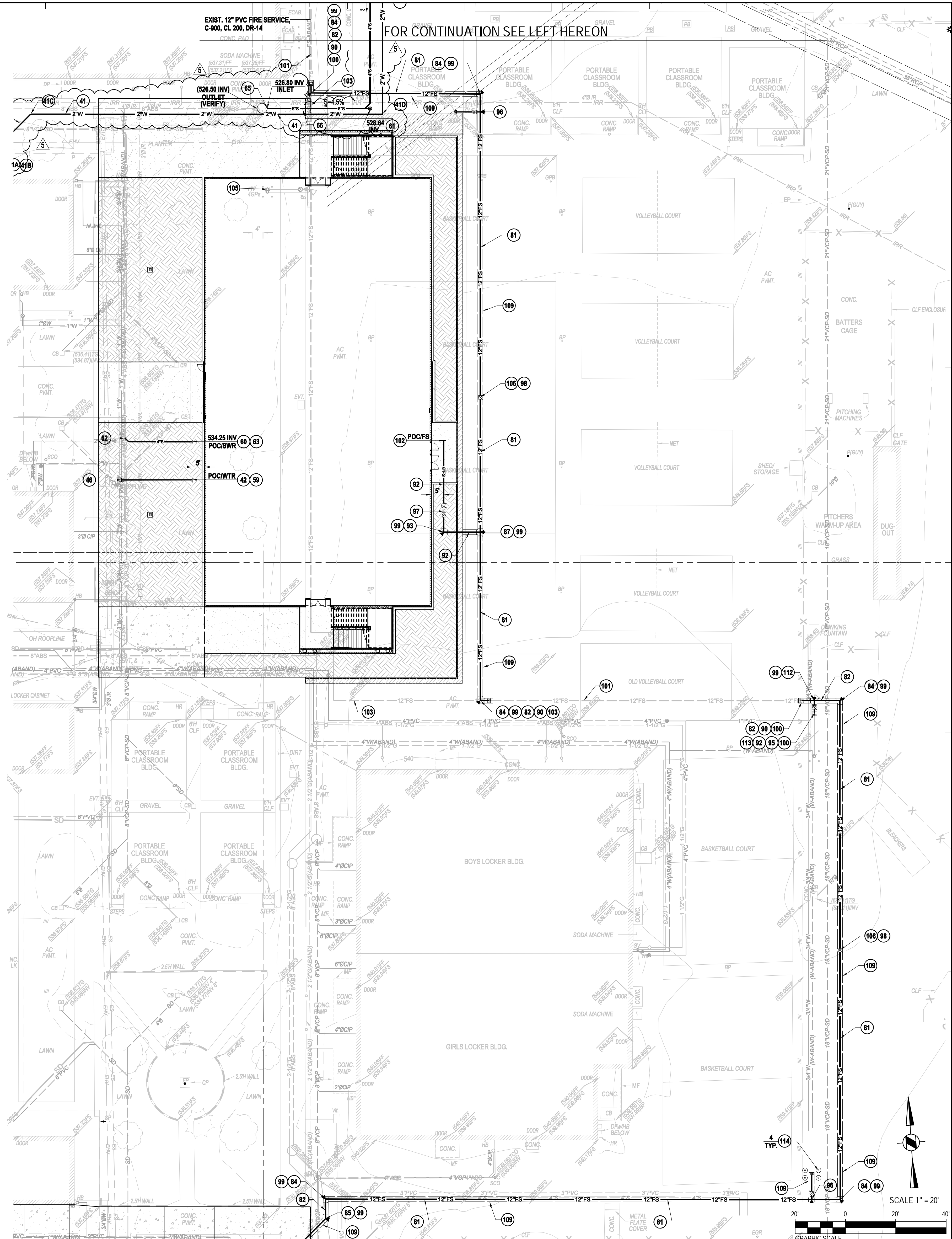
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NO	DATE	DESCRIPTION
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05/08/2014		90% CD PROGRESS
05/29/2014		DSA SUBMITTAL
04/08/2015		DSA BACK CHECK
5/5/2016		ADDENDUM 5

DRWN: CEI CHKD: CEI
 DATE: 04/08/2015 SCALE: AS SHOWN
 PROJECT NUMBER: 1310700

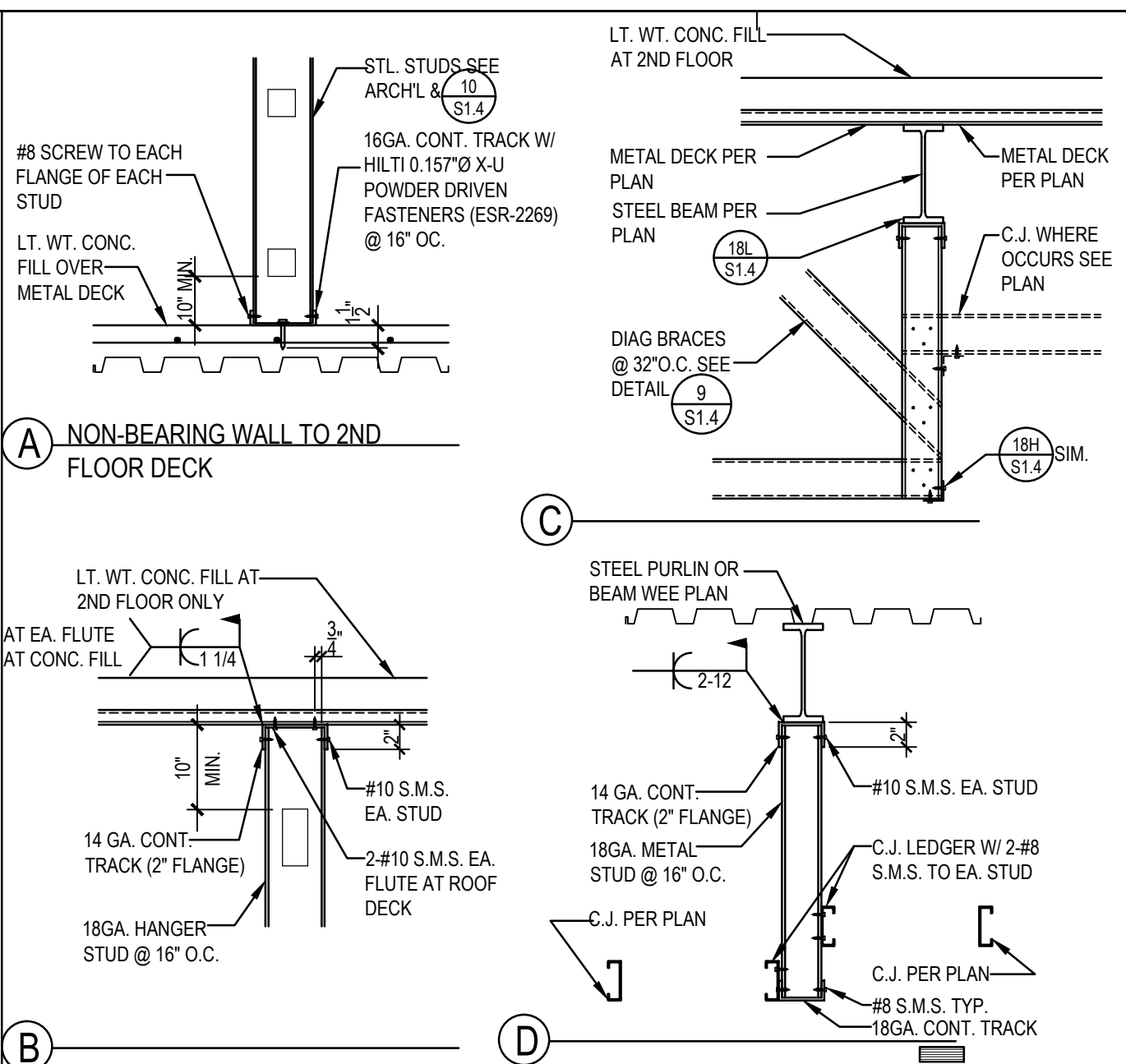
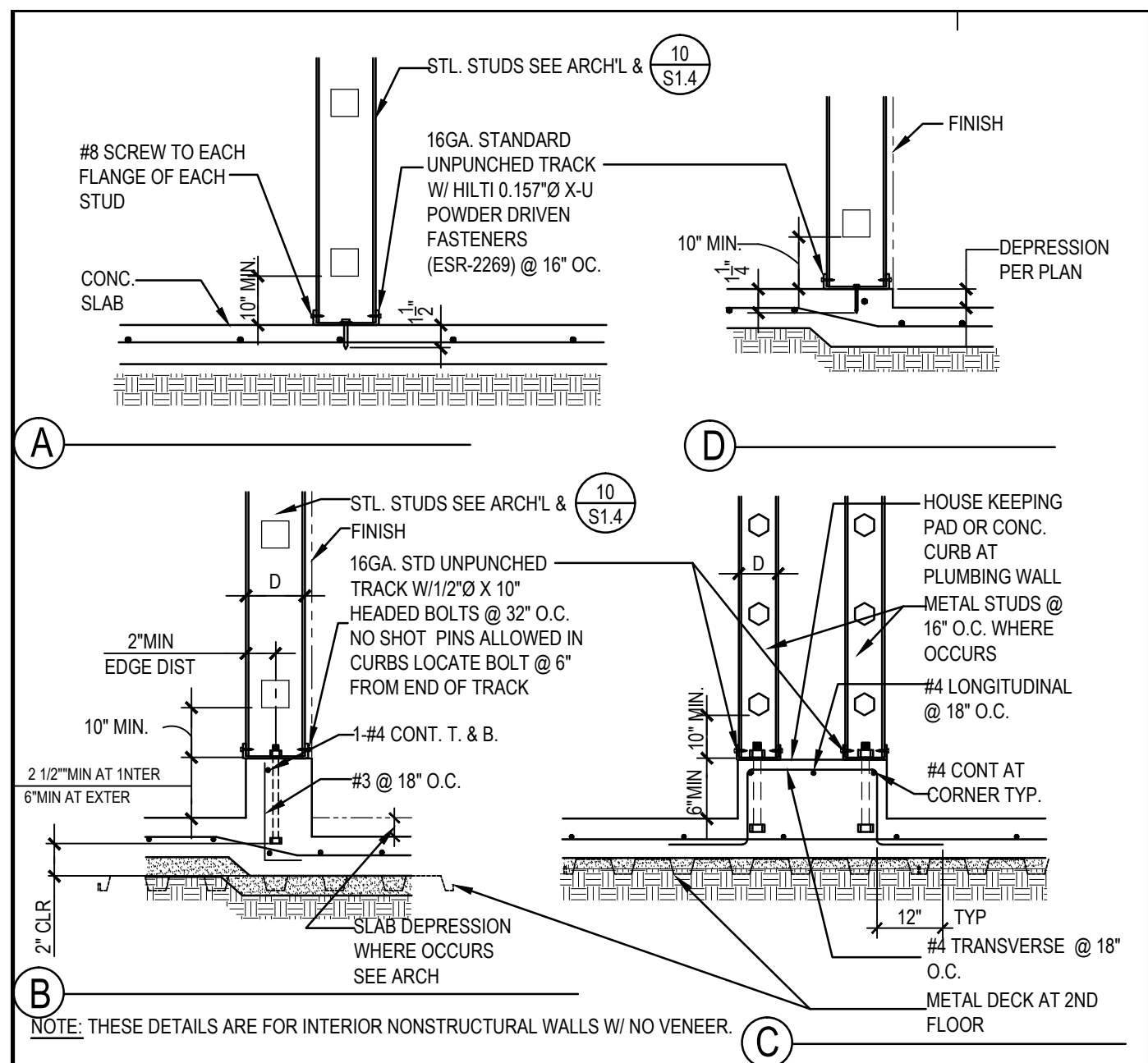
UTILITY PLAN
 DRAWING NUMBER: **C4.03**



- CONSTRUCTION NOTES: DOMESTIC WATER**
- 40. INSTALL 1-1/2" DOMESTIC WATER PIPE LINE.
 - 41. INSTALL 2" DOMESTIC WATER PIPE LINE.
 - 42. INSTALL 2-1/2" DOMESTIC WATER PIPE LINE.
 - 43. INSTALL 3" DOMESTIC WATER PIPE LINE.
 - 44. INSTALL 4" DOMESTIC WATER PIPE LINE.
 - 45. INSTALL 6" DOMESTIC WATER PIPE LINE.
 - 46. INSTALL 1-1/2" SINGLE STRAP SERVICE SADDLE, ROMAC STYLE 101S, OR APPROVED EQUAL.
 - 47. INSTALL 2-1/2" DOUBLE STRAP SERVICE SADDLE, ROMAC STYLE 202S, OR APPROVED EQUAL.
 - 48. INSTALL 6" - 45° DUCTILE IRON BEND, M.J x M.J.
 - 49. INSTALL 4" - 90° DUCTILE IRON BEND, M.J x M.J.
 - 50. INSTALL 6" x 4" x 2" DUCTILE IRON TEE, M.J x M.J x M.J.
 - 51. INSTALL 6" x 4" x 3" DUCTILE IRON TEE, FLG x FLG x M.J.
 - 52. INSTALL 6" x 4" DUCTILE IRON REDUCER, FLG x M.J.
 - 53. INSTALL 6" RESILIENT WEDGE GATE VALVE, FLG x M.J.
 - 54. INSTALL 6" RESILIENT WEDGE GATE VALVE, FLG x FLG.
 - 55. INSTALL VALVE CAN ASSEMBLY PER WALNUT VALLEY WATER DISTRICT STANDARD DRAWING NO. 11. REFERENCE DETAIL 6 ON SHEET NO. C5.04.
 - 56. REMOVE EXISTING THRUST BLOCK AND INSTALL 3" x 2" REDUCER.
 - 57. INSTALL 2" GATE VALVE WITH TRAFFIC BOX.
 - 58. INSTALL 2" x 45° BEND.
 - 59. INSTALL 2" x 90° BEND.
 - 60. INSTALL 2" x 1" REDUCER.
 - 61. INSTALL 1" x 90° BEND.
 - 62. INSTALL 1" BALL VALVE WITH VALVE BOX AND COVER.
- CONSTRUCTION NOTES: SEWER**
- 60. INSTALL 4" PVC SANITARY SEWER, SDR 35.
 - 61. INSTALL SANITARY SEWER CLEAN OUT. REFERENCE DETAIL 8 ON SHEET C5.04.
 - 62. CONNECT TO EXISTING SEWER LINE. FIELD VERIFY LOCATION, SIZE AND DEPTH PRIOR TO CONSTRUCTION. INSTALL FITTINGS AS NECESSARY. REFER TO BUILDING PLUMBING PLANS FOR LOCATION, ELEVATION AND SIZE OF PIPE.
 - 63. EXISTING SEWER LINE TO BE PROTECTED IN PLACE.
 - 64. EXISTING SEWER LINE TO BE PROTECTED IN PLACE.
 - 65. BREAK INTO EXISTING MANHOLE. PER SPPWC STD. PLAN 208-2.
 - 66. INSTALL 6" PVC SANITARY SEWER, SDR 35.
- CONSTRUCTION NOTES: FIRE SERVICE**
- 80. HOT TAP EXISTING 12" FIRE SERVICE LINE WITH 12" TAPPING SLEEVE AND 12" TAPPING VALVE, FE x M.J.
 - 81. INSTALL 12" PVC FIRE SERVICE, C900, CLASS 150.
 - 82. INSTALL 12" PVC SPOOL C900, CLASS 150.
 - 83. INSTALL 12" x 12" x 12" DUCTILE IRON TEE, FLG x FLG x FLG.
 - 84. INSTALL 12" - 90° DUCTILE IRON BEND, M.J x M.J.
 - 85. INSTALL 12" - 45° DUCTILE IRON BEND, M.J x M.J.
 - 86. INSTALL 12" FLANGE ADAPTER.
 - 87. INSTALL 12" x 12" x 6" DUCTILE IRON TEE, M.J x M.J x M.J.
 - 88. INSTALL 12" x 10" DUCTILE IRON REDUCER, M.J x FLG.
 - 89. INSTALL 12" x 6" DUCTILE IRON REDUCER, FLG x FLG.
 - 90. INSTALL 12" TRANSITION COUPLING.
 - 91. INSTALL 10" FIRE SERVICE ASSEMBLY WITH DOUBLE DETECTOR CHECK ASSEMBLY PER WALNUT VALLEY WATER DISTRICT STANDARD DRAWING NO. 20A. REFERENCE DETAIL 4 ON SHEET C5.04.
 - 92. INSTALL 6" PVC FIRE SERVICE, C900, CLASS 150.
 - 93. INSTALL 6" - 90° DUCTILE IRON BEND, M.J x M.J.
 - 94. INSTALL 6" - 45° DUCTILE IRON BEND, M.J x M.J.
 - 95. INSTALL 6" GATE VALVE, FLG x M.J.
 - 96. INSTALL FIRE HYDRANT ASSEMBLY PER WALNUT VALLEY WATER DISTRICT STANDARD DRAWING NO. 8. REFERENCE DETAIL 5 ON SHEET C5.04.
 - 97. INSTALL FIRE DEPARTMENT CONNECTION, CHECK VALVE, AND POST INDICATOR VALVE. REFERENCE DETAIL 3 ON SHEET C5.04.
 - 98. INSTALL VALVE CAN ASSEMBLY PER WALNUT VALLEY WATER DISTRICT STANDARD DRAWING NO. 11. REFERENCE DETAIL 6 ON SHEET NO. C5.04.
 - 99. INSTALL 12" x 10" DUCTILE IRON REDUCER, M.J x FLG.
 - 100. CUT AND REMOVE INTERFERING PORTIONS OF EXISTING WATER LINE AS NECESSARY.
 - 101. EXISTING WATER LINE TO BE PROTECTED IN PLACE.
 - 102. REFER TO BUILDING PLUMBING PLANS FOR LOCATION, ELEVATION AND SIZE OF STUB RISER.
 - 103. REMOVE EXISTING WATER LINE AND APPURTENANCES AS NECESSARY.
 - 104. ABANDON IN PLACE EXISTING WATER LINE AND CAP END. SHUT OFF WATER AT NEAREST WATER VALVE.
 - 105. EXISTING FIRE HYDRANT ASSEMBLY, TO BE REMOVED.
 - 106. INSTALL 12" GATE VALVE, M.J x M.J.
 - 107. INSTALL 12" x 12" x 12" DUCTILE IRON TEE, M.J x M.J x FLG.
 - 108. REMOVE DCCDA AND APPURTENANCES. CONTRACTOR TO COORDINATE DISPOSITION WITH WVC.
 - 109. FIRE SERVICE PIPE TRENCH LIMITS. REFERENCE DETAIL 5 ON SHEET C5.01.
 - 110. HOT TAP EXISTING 12" FIRE SERVICE LINE WITH 12" TAPPING SLEEVE WITH 6" NOZZLE AND 6" TAPPING VALVE, FE x M.J.
 - 111. INSTALL 6" - 90° DUCTILE IRON BEND, M.J x FE.
 - 112. INSTALL 12" x 12" x 6" DUCTILE IRON TEE, M.J x M.J x FLG.
 - 113. INSTALL 6" TRANSITION COUPLING.

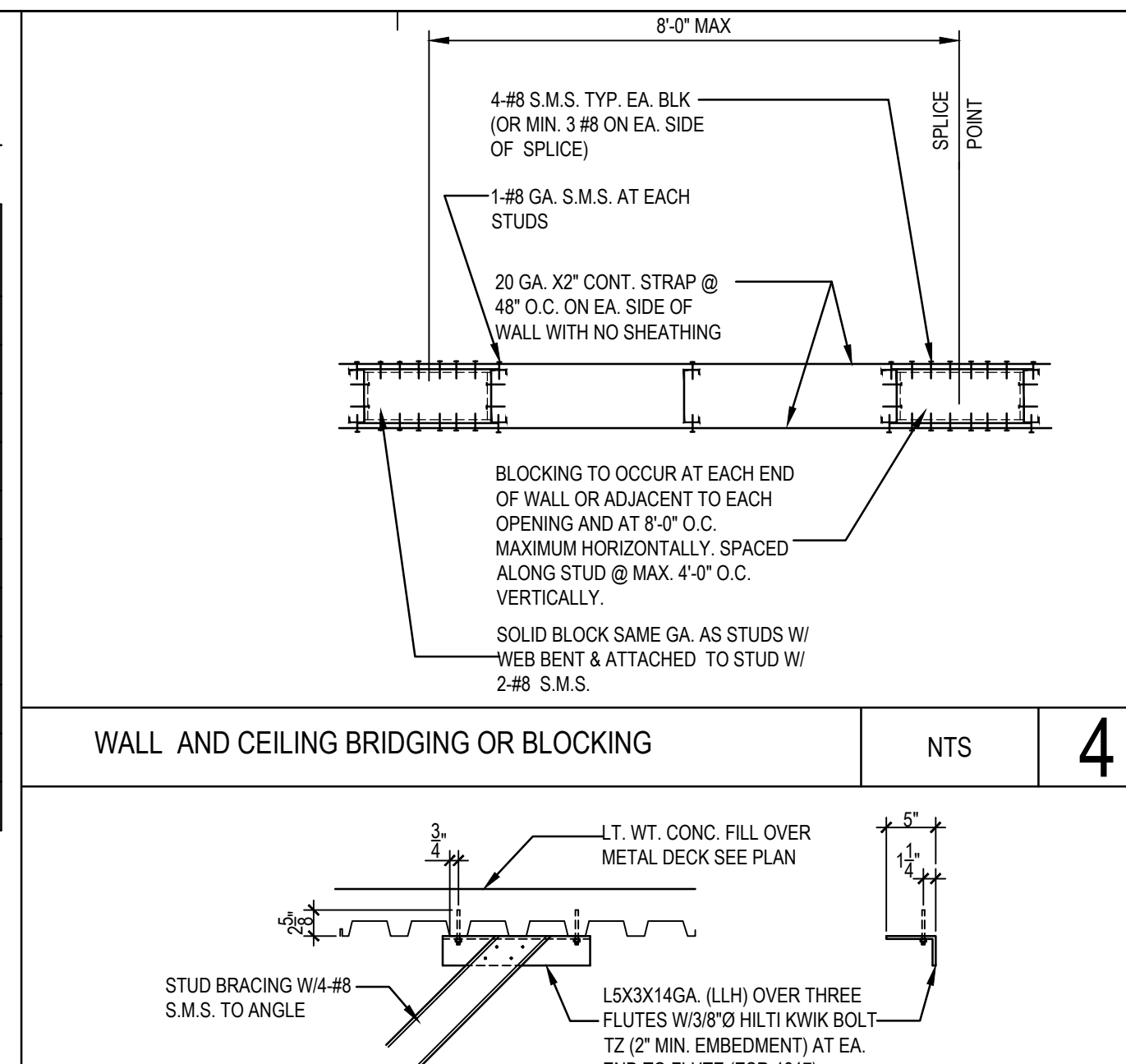


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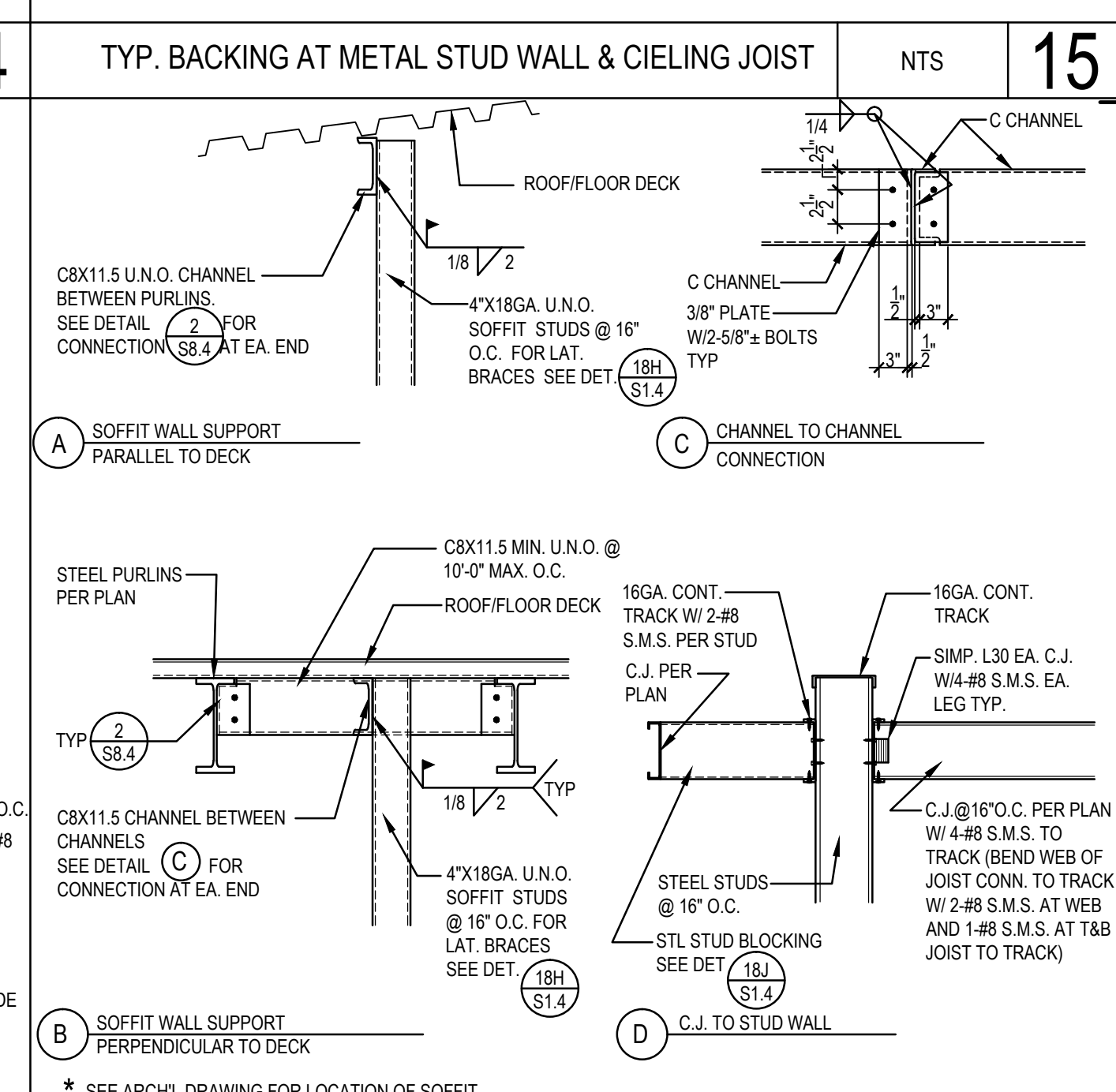
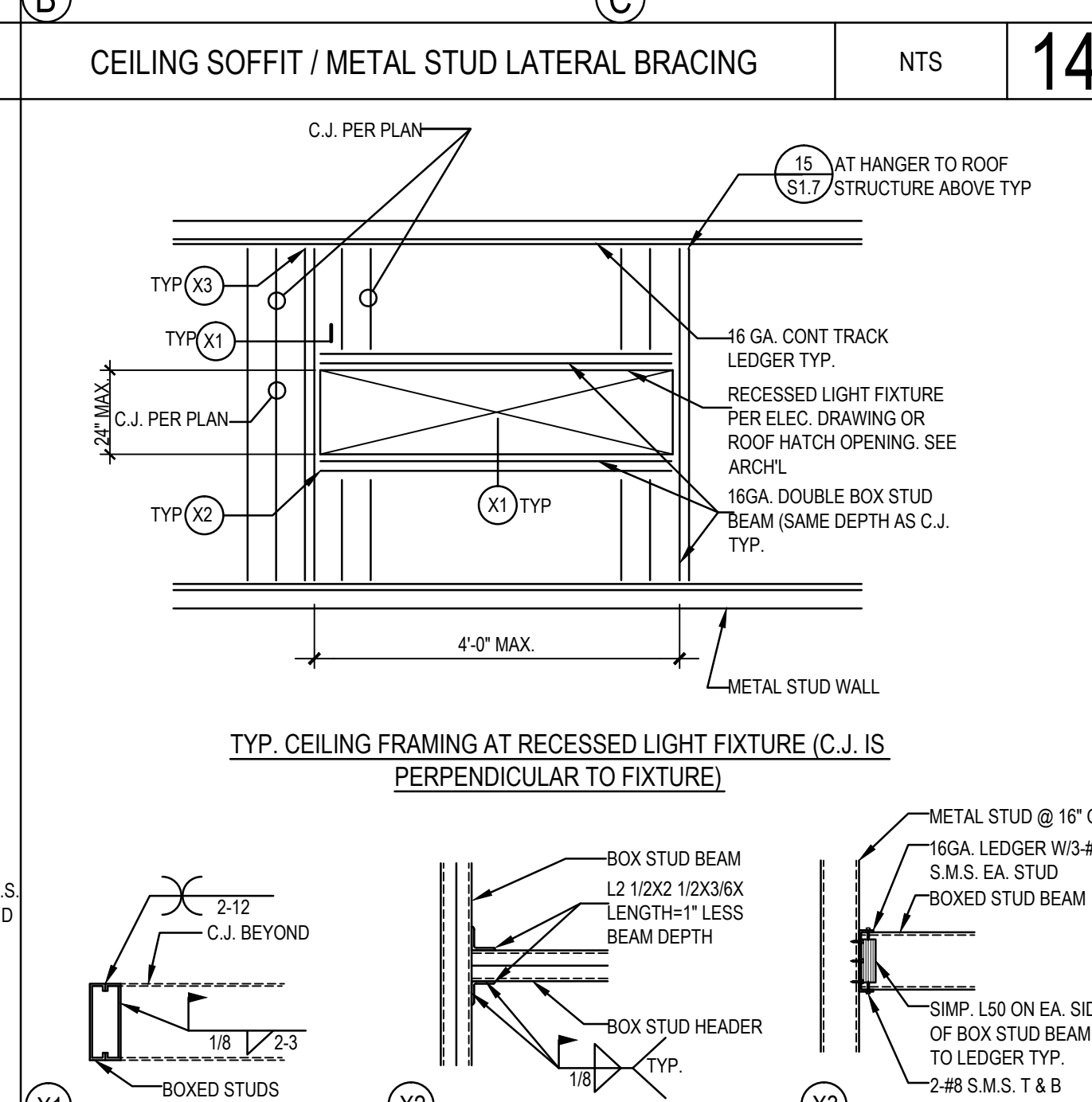
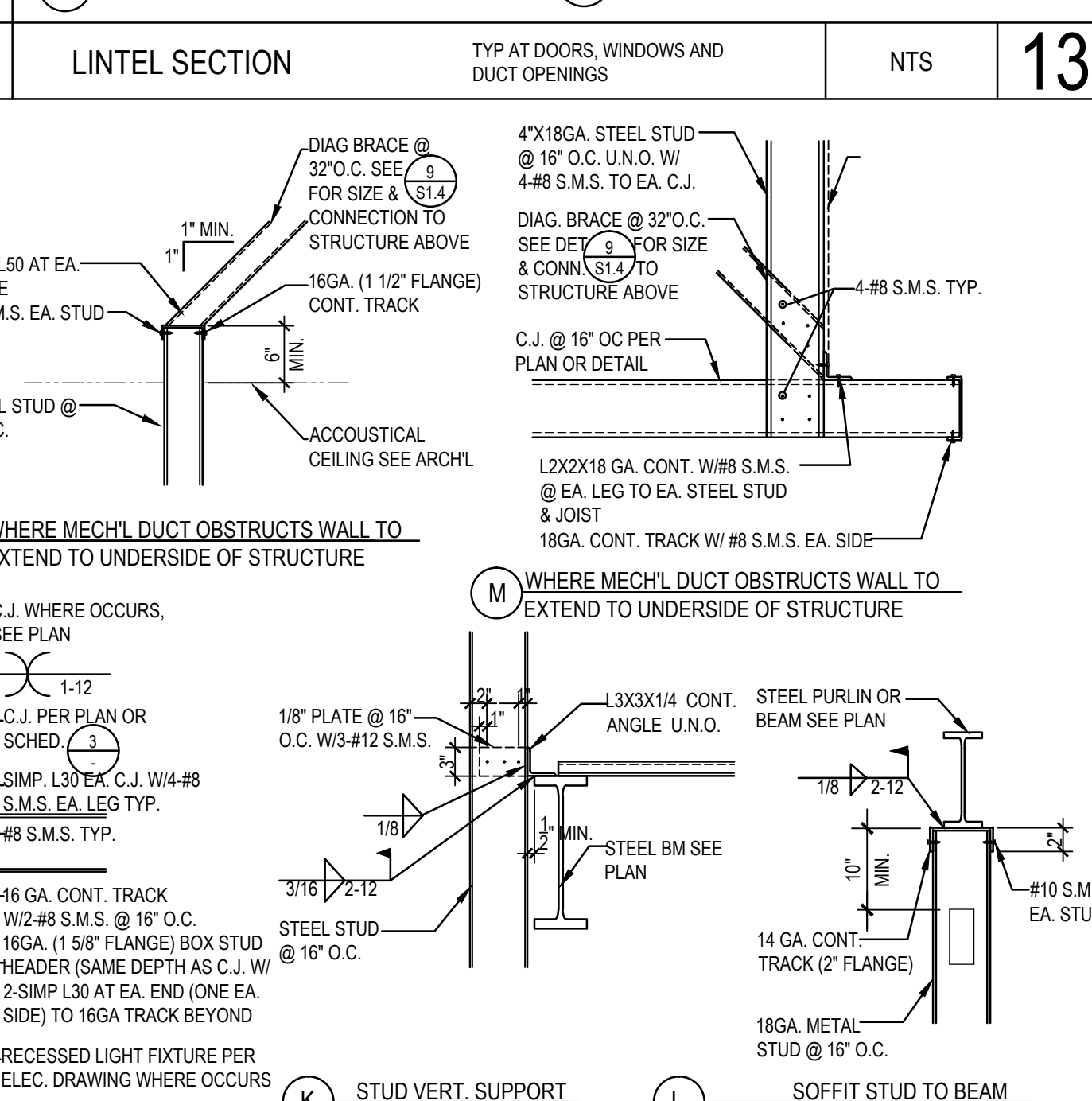
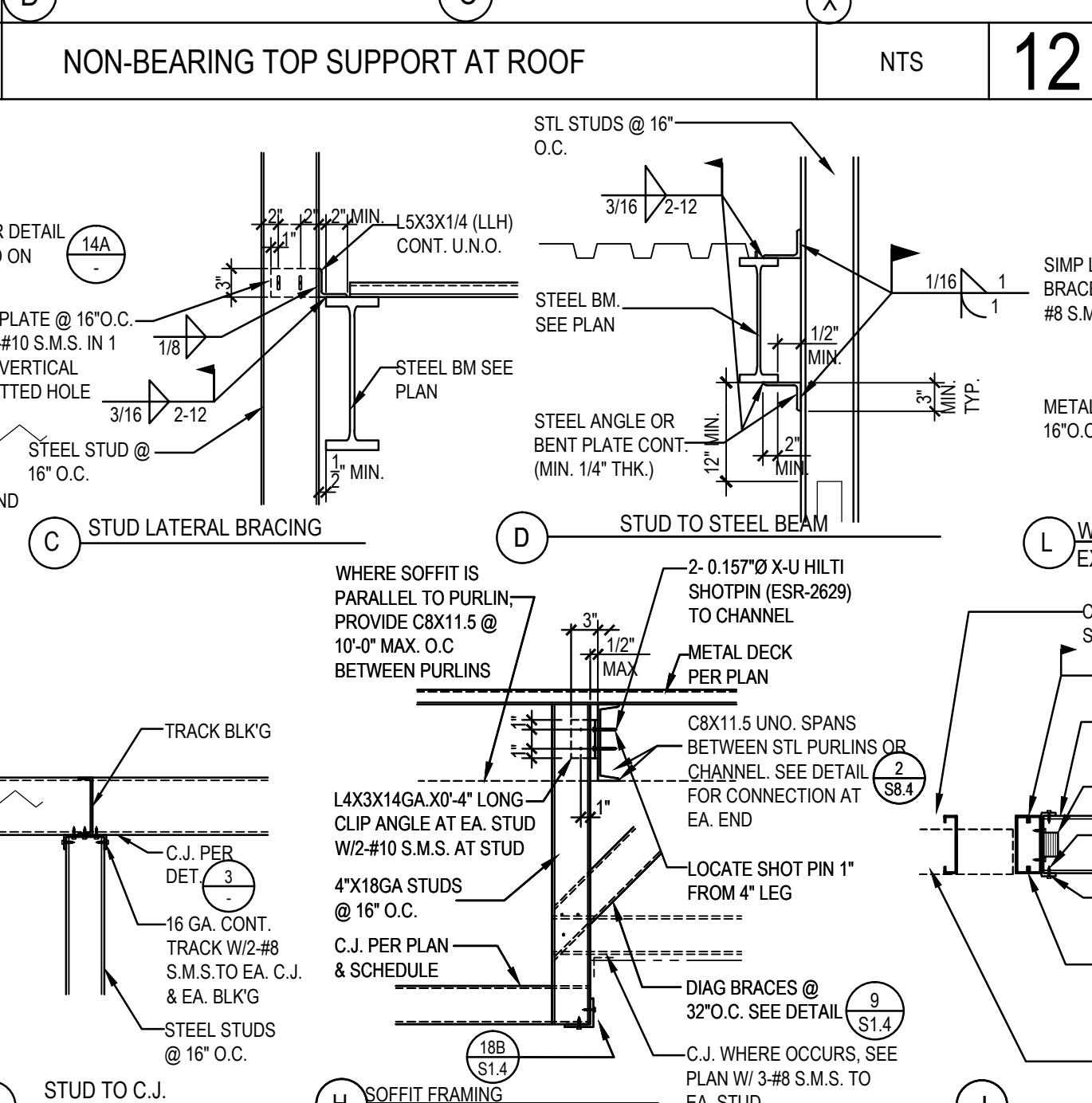
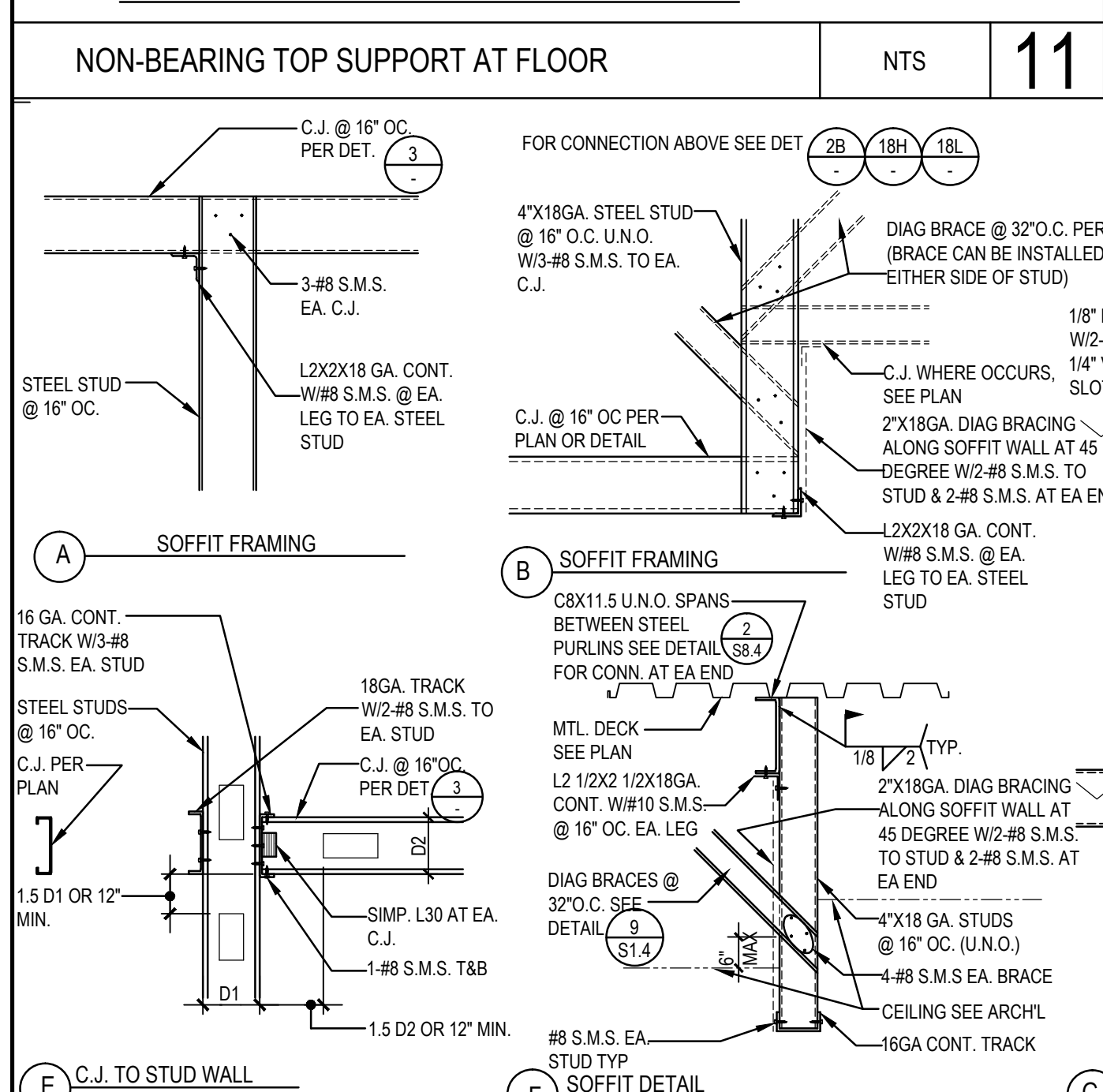
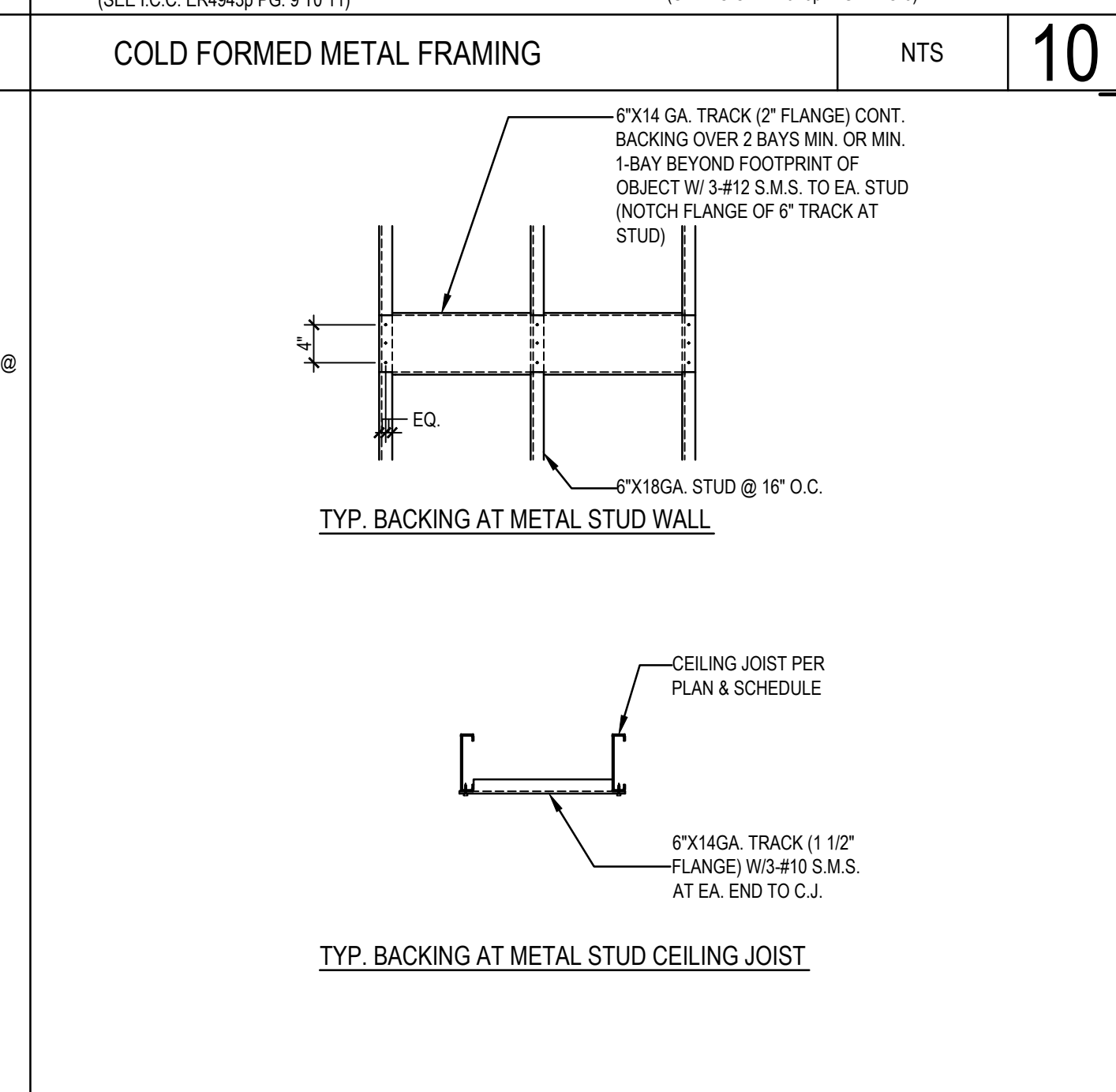
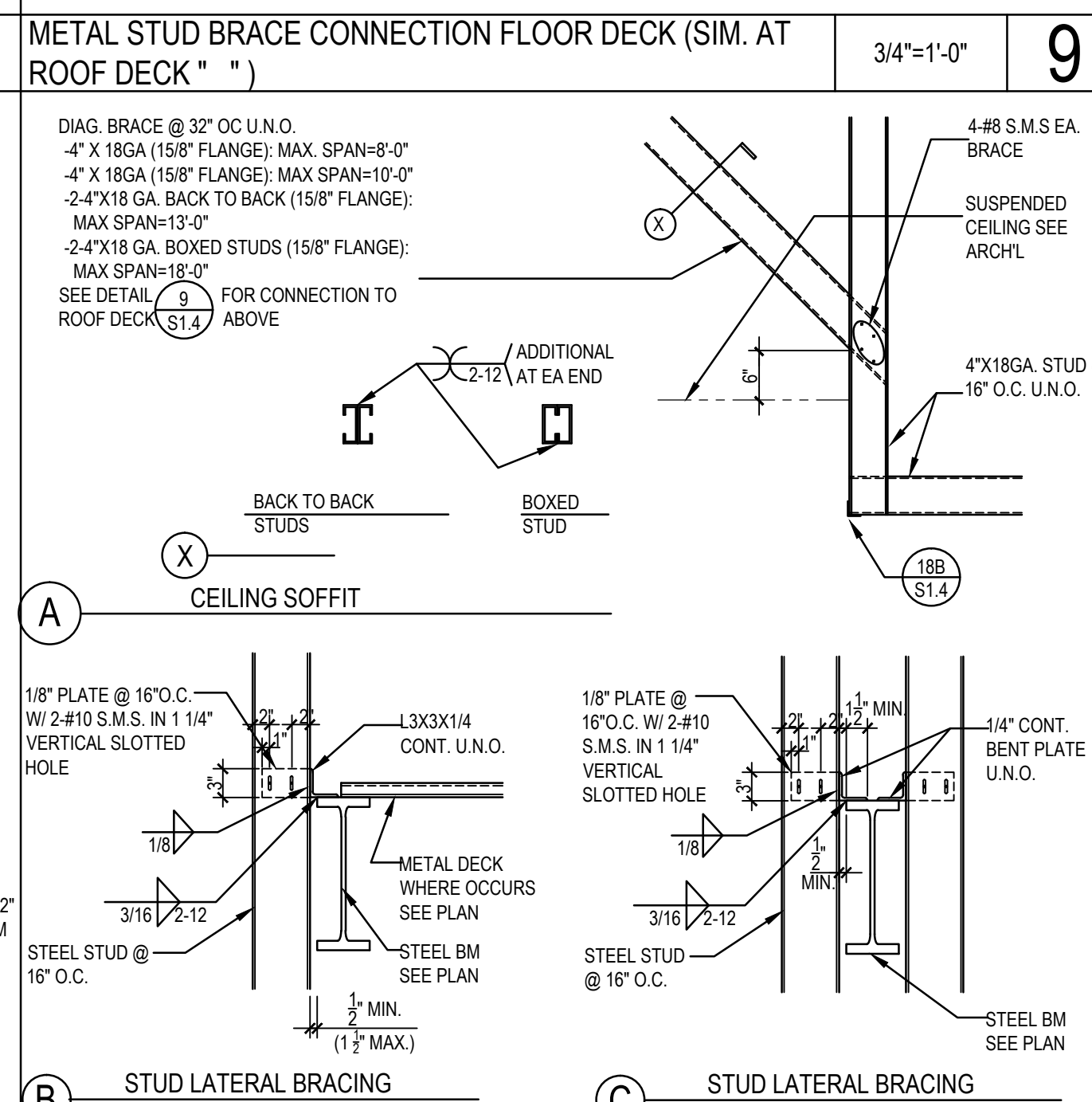
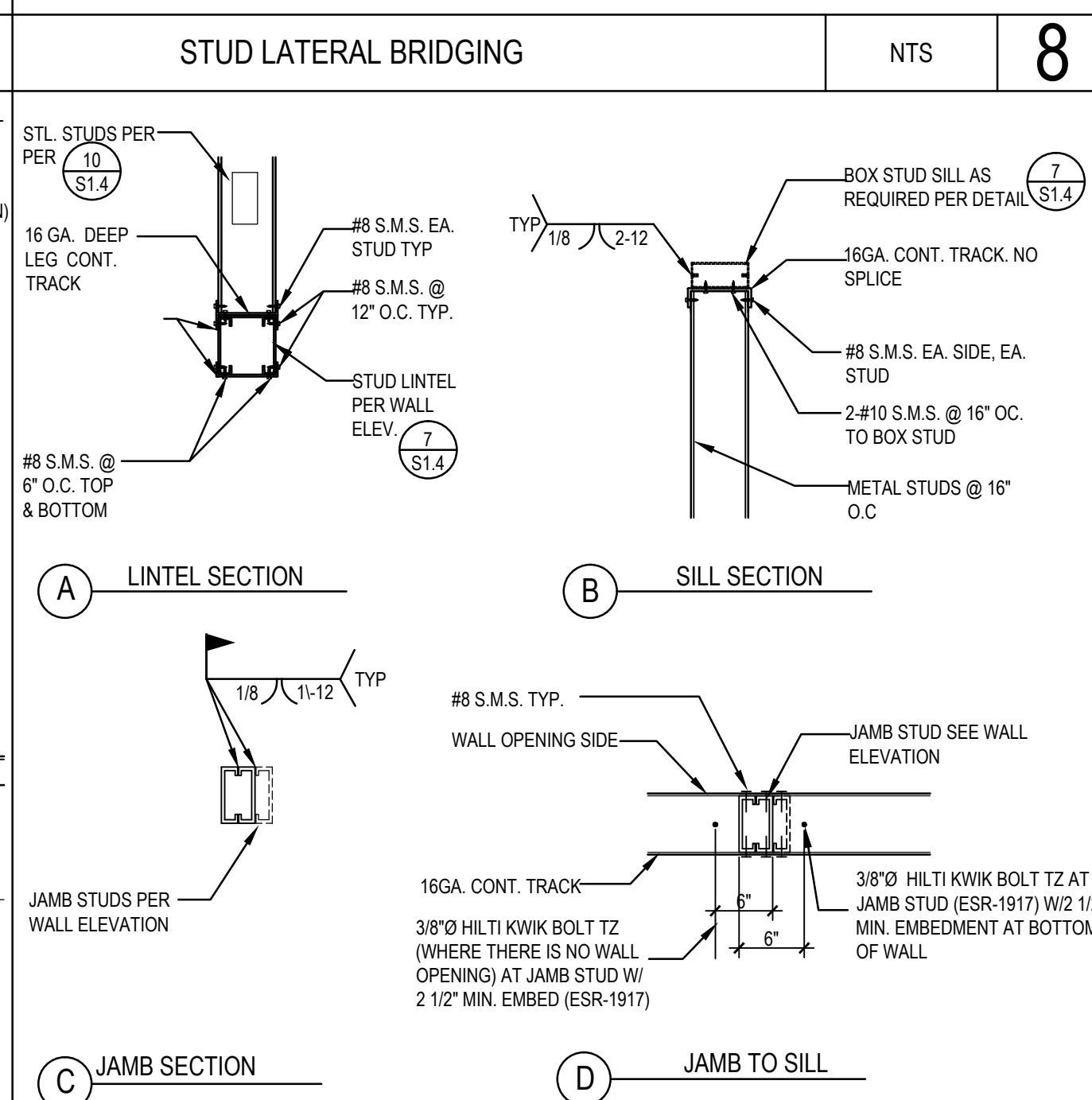
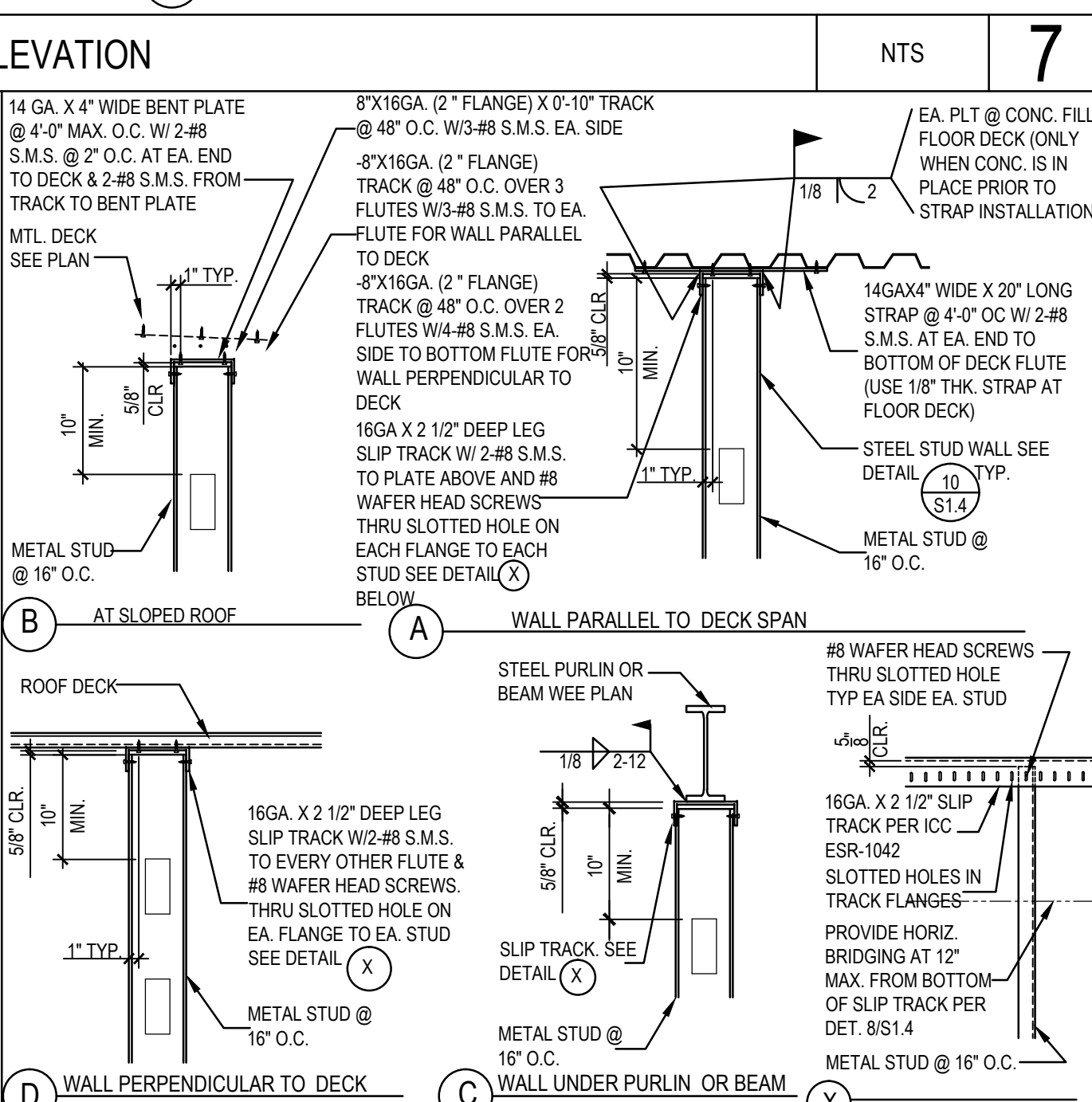
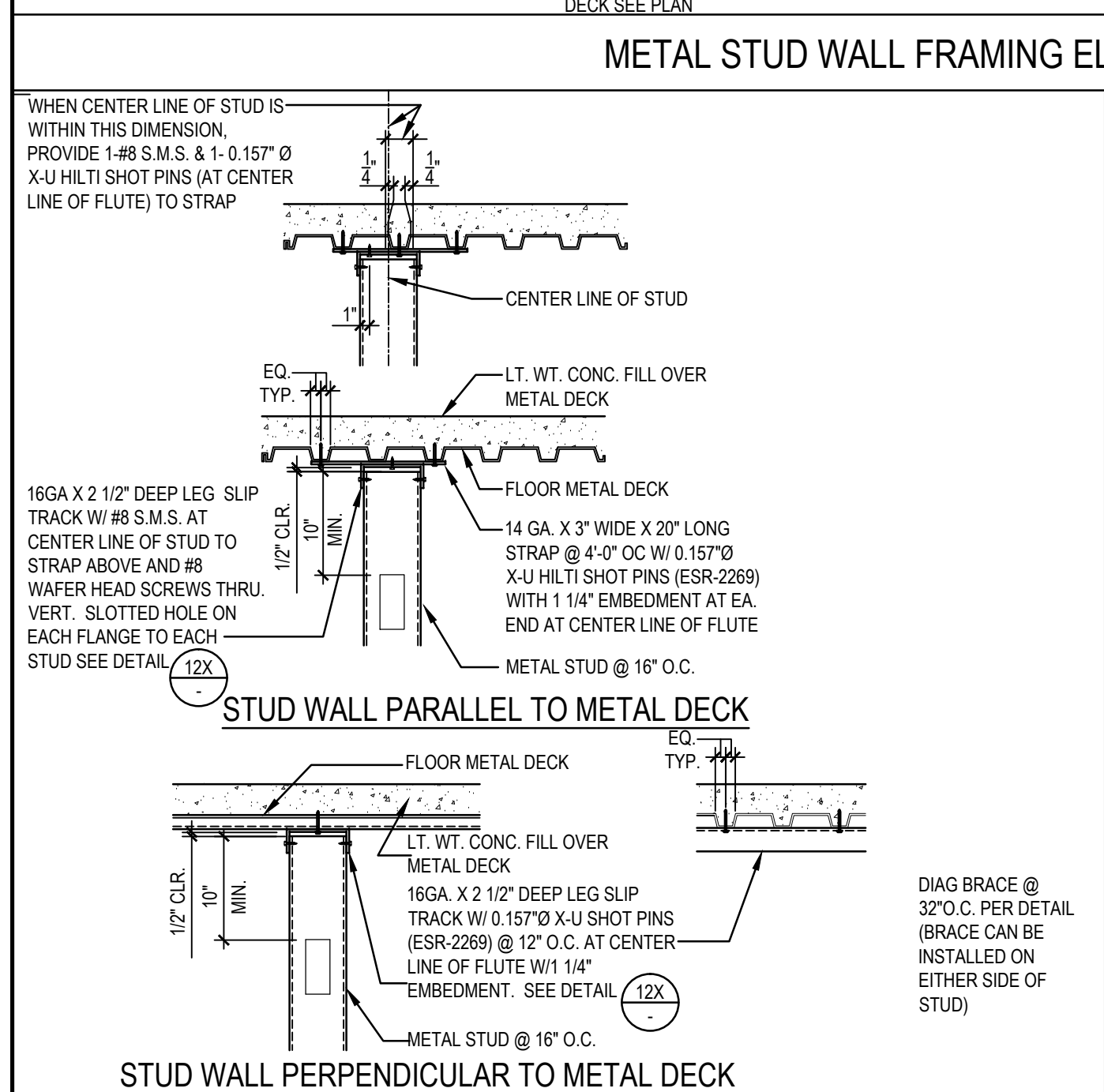
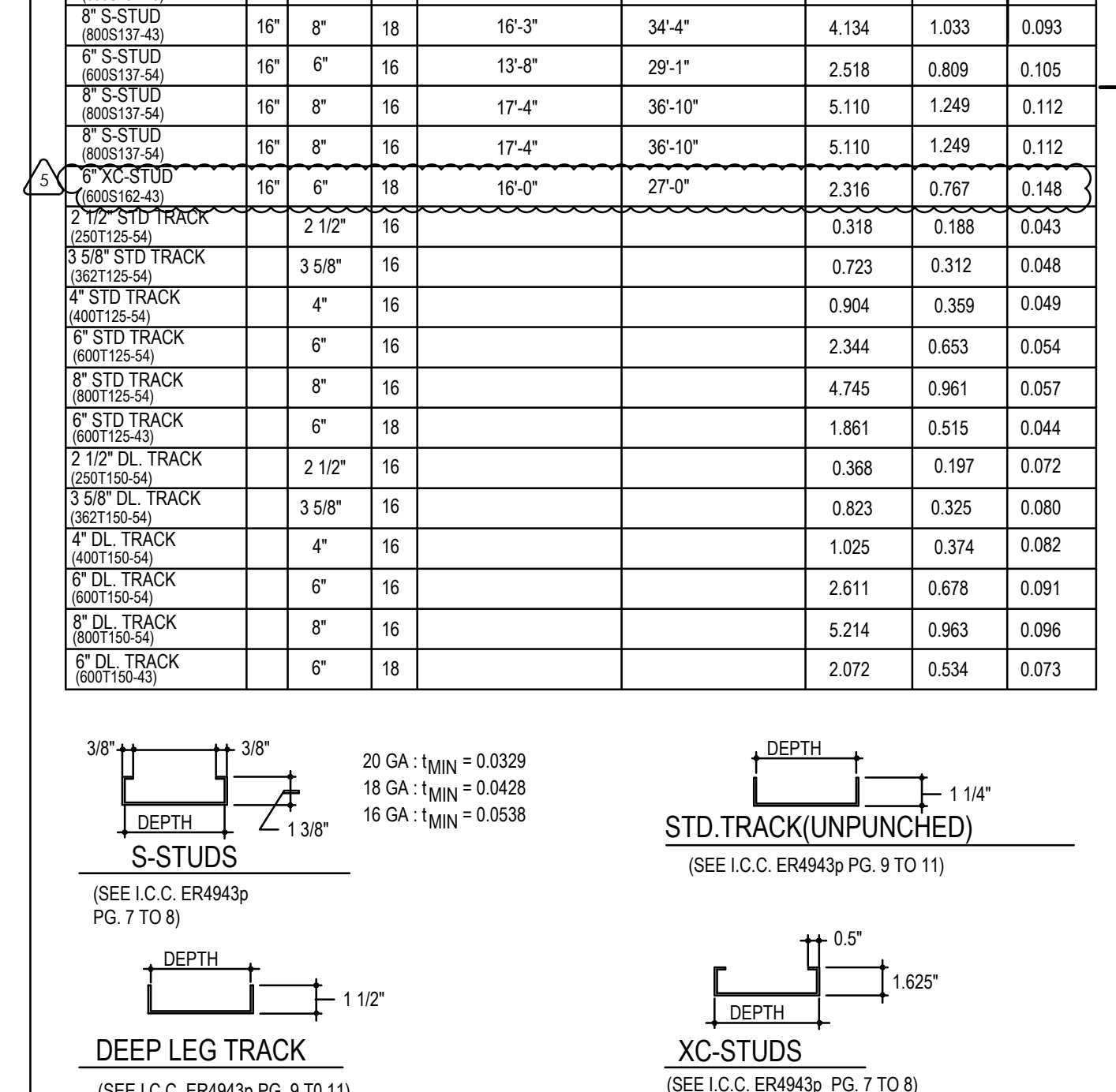
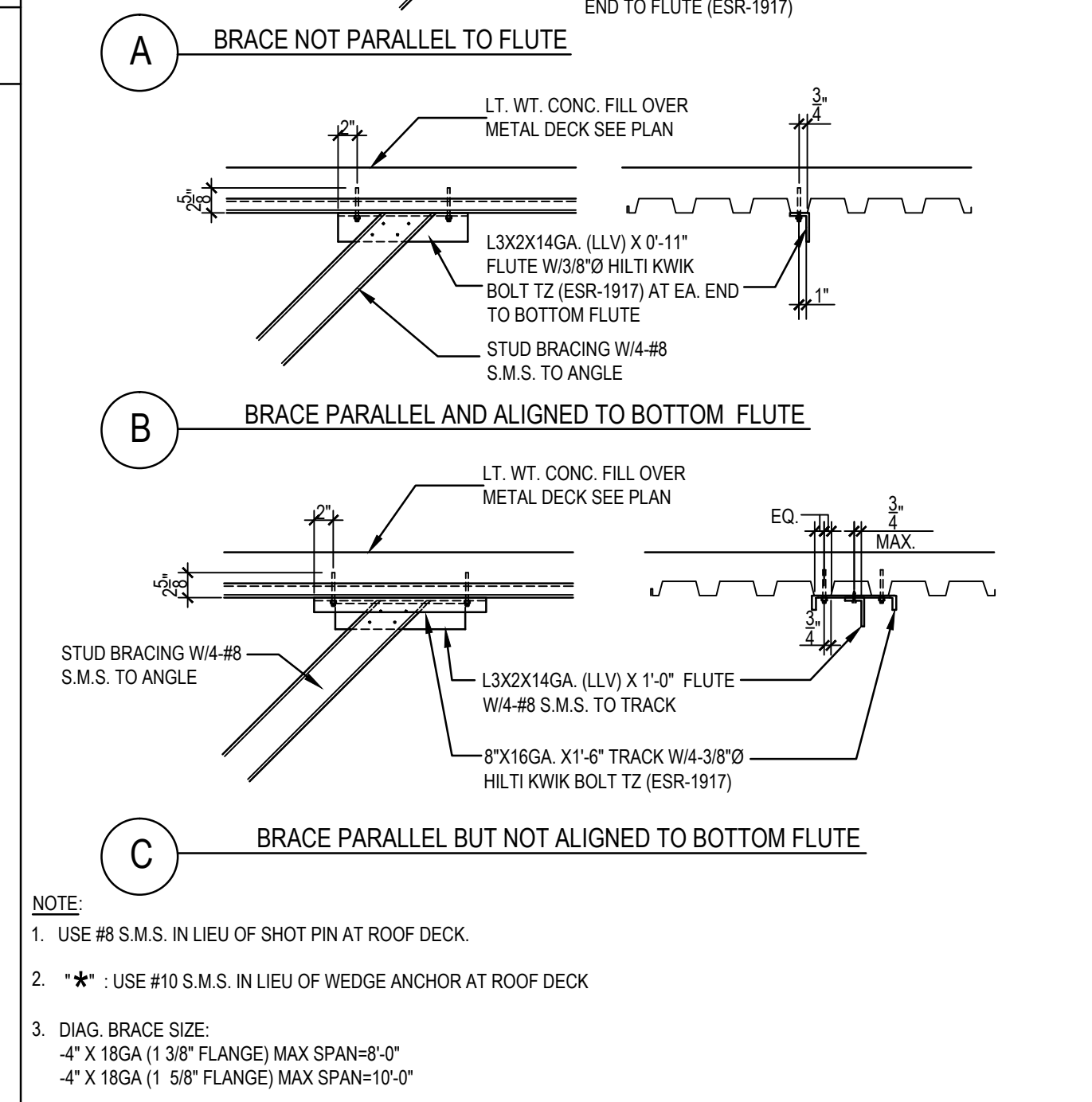
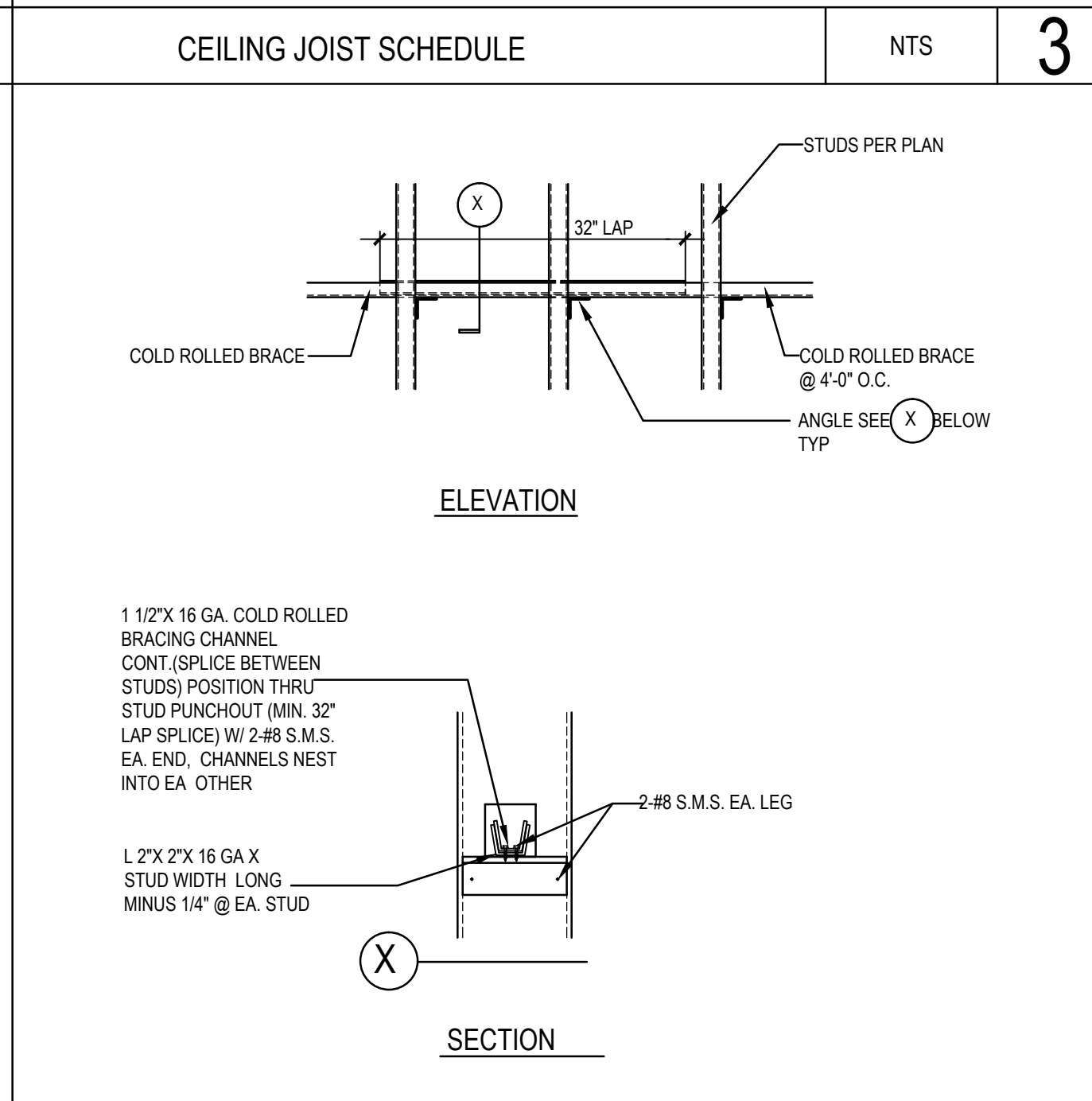
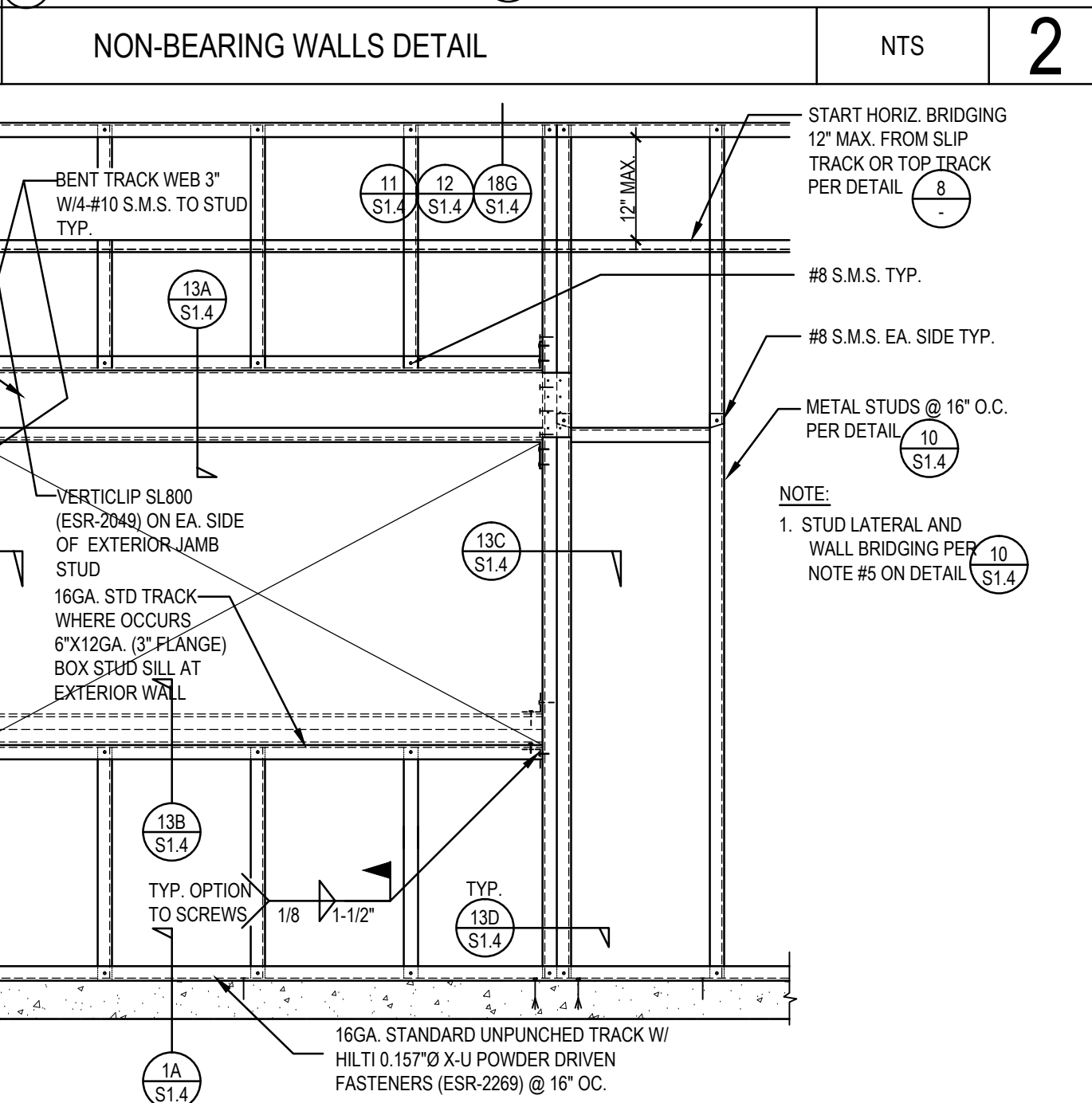
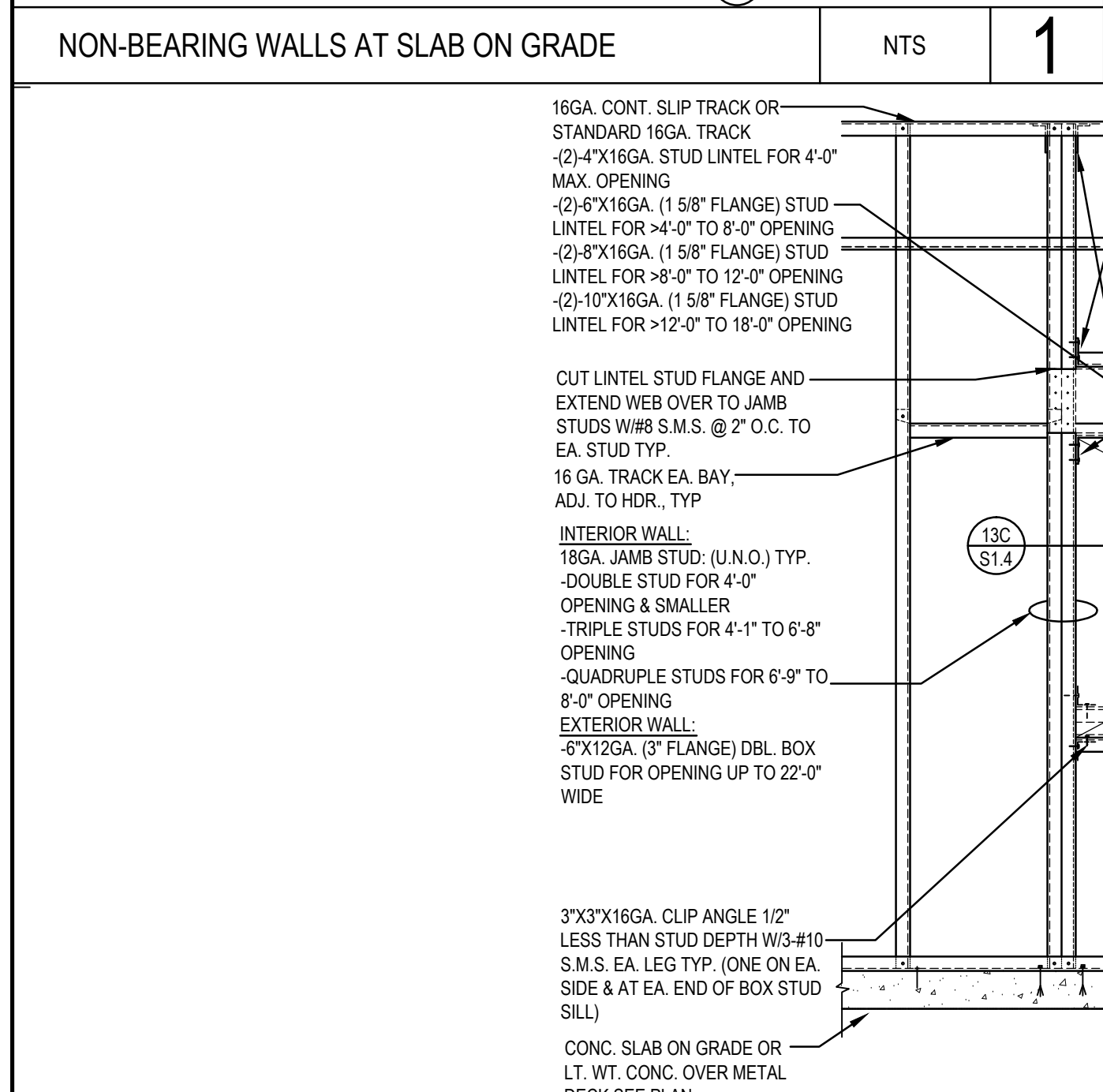
CEILING JOIST SCHEDULE (MAX. 15 PSF TOTAL LOAD) (NTS) **3**

SYMBOL	MAXIMUM SPAN	CEILING JOIST	SP.	l x b	GROSS	Sx EFF.	TOP FLANGE BRACING LOCATION
CJ-1	7'-0"	4" X 20 GA. STL. S-STUD (A005137-33)	16"	0.603	0.091	0.290	NOT REQUIRED
CJ-2	8'-2"	4" X 18 GA. STL. S-STUD (A005137-33)	16"	0.776	0.078	0.382	NOT REQUIRED
CJ-3	9'-4"	4" X 18 GA. STL. S-STUD (A005137-33) UNPUNCHED	16"	1.582	0.069	0.510	NOT REQUIRED
CJ-4	11'-2"	4" X 20 GA. STL. S-STUD (A005137-33)	16"	0.603	0.091	0.290	AT MID-POINT
CJ-5	12'-0"	4" X 18 GA. STL. S-STUD (A005137-33)	16"	0.776	0.078	0.382	AT MID-POINT
CJ-6	15'-0"	4" X 18 GA. STL. S-STUD (A005137-33) UNPUNCHED	16"	1.582	0.069	0.510	AT THIRD POINT
CJ-7	17'-0"	4" X 18 GA. STL. S-STUD (A005137-33) UNPUNCHED	16"	4.134	0.063	1.033	AT THIRD POINT
CJ-8	18'-0"	4" X 18 GA. STL. S-STUD (A005137-33) UNPUNCHED	16"	2.042	0.087	0.670	AT QUARTER POINT
CJ-9	21'-10"	4" X 18 GA. STL. S-STUD (A005137-33) UNPUNCHED	16"	8.025	0.168	1.414	AT THIRD POINT
CJ-10	26'-3"	4" X 18 GA. STL. S-STUD (A005137-33) UNPUNCHED	16"	8.025	0.168	1.414	4" O.C. MAX.
CJ-11	28'-0"	4" X 18 GA. STL. S-STUD (A005137-33) UNPUNCHED	16"	8.025	0.168	1.414	4" O.C. MAX.



STL STUD PROPERTIES AND APPLICATION (NTS) **5**

STUD OR TRACK	SP.	DEPTH	GA.	MAX UNSUPPORTED WALL HEIGHT (NON-BEARING)		Sx EFF.	Iy GROSS
				23 PSF LATERAL LOAD	INTERIOR PARTITIONS (5 PSF LATERAL LOAD)		
2 1/2" S-STUD (A005137-33)	16"	2 1/2"	20	6'-0"	12'-4"	0.203	0.156
3 5/8" S-STUD (A005137-33)	16"	3 5/8"	20	8'-0"	16'-9"	0.479	0.254
4" S-STUD (A005137-33)	16"	4"	20	8'-6"	18'-1"	0.603	0.290
6" S-STUD (A005137-33)	16"	6"	20	11'-6"	24'-3"	1.582	0.510
8" S-STUD (A005137-33)	16"	8"	18	9'-3"	19'-8"	0.776	0.382
10" S-STUD (A005137-33)	16"	10"	18	12'-6"	27'-2"	2.042	0.670
12" S-STUD (A005137-33)	16"	12"	16	13'-6"	29'-1"	2.518	0.809
14" S-STUD (A005137-33)	16"	14"	16	17'-4"	36'-10"	5.110	1.249
16" S-STUD (A005137-33)	16"	16"	16	17'-4"	36'-10"	5.110	1.249
18" S-STUD (A005137-33)	16"	18"	16	17'-0"	27'-0"	2.316	0.767
2 1/2" S-STUD TRACK (A007125-54)	16"	2 1/2"	16			0.316	0.043
3 5/8" S-STUD TRACK (A007125-54)	16"	3 5/8"	16			0.723	0.312
4" S-STUD TRACK (A007125-54)	16"	4"	16			0.904	0.359
6" S-STUD TRACK (A007125-54)	16"	6"	16			2.344	0.653
8" S-STUD TRACK (A007125-54)	16"	8"	16			4.745	0.951
10" S-STUD TRACK (A007125-54)	16"	10"	16			1.861	0.515
12" S-STUD TRACK (A007125-54)	16"	12"	16			0.368	0.197
14" S-STUD TRACK (A007125-54)	16"	14"	16			0.823	0.325
16" S-STUD TRACK (A007125-54)	16"	16"	16			1.025	0.374
18" S-STUD TRACK (A007125-54)	16"	18"	16			2.611	0.678
6" DL TRACK (A007125-54)	16"	6"	16			5.214	0.963
8" DL TRACK (A007125-54)	16"	8"	16			2.072	0.534



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ROWLAND HIGH SCHOOL ADDITION
ROWLAND UNIFIED SCHOOL DISTRICT
2000 OTTERBEIN AVE
ROWLAND HEIGHTS, CALIFORNIA

Professional Engineer
JAMES P. O'NEILL
No. 1528
Exp. 9-30-17
State of California

CONSULTANT
KLING STUBBINS ASSOCIATES
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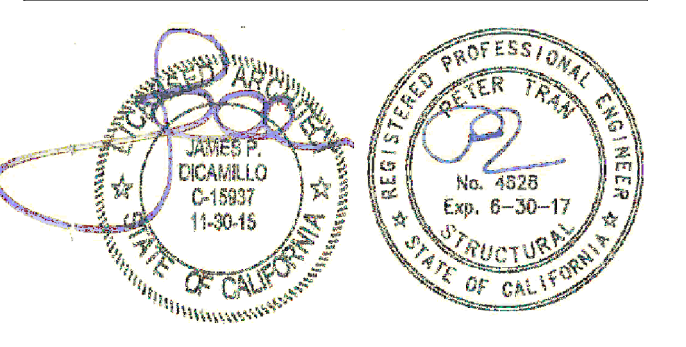
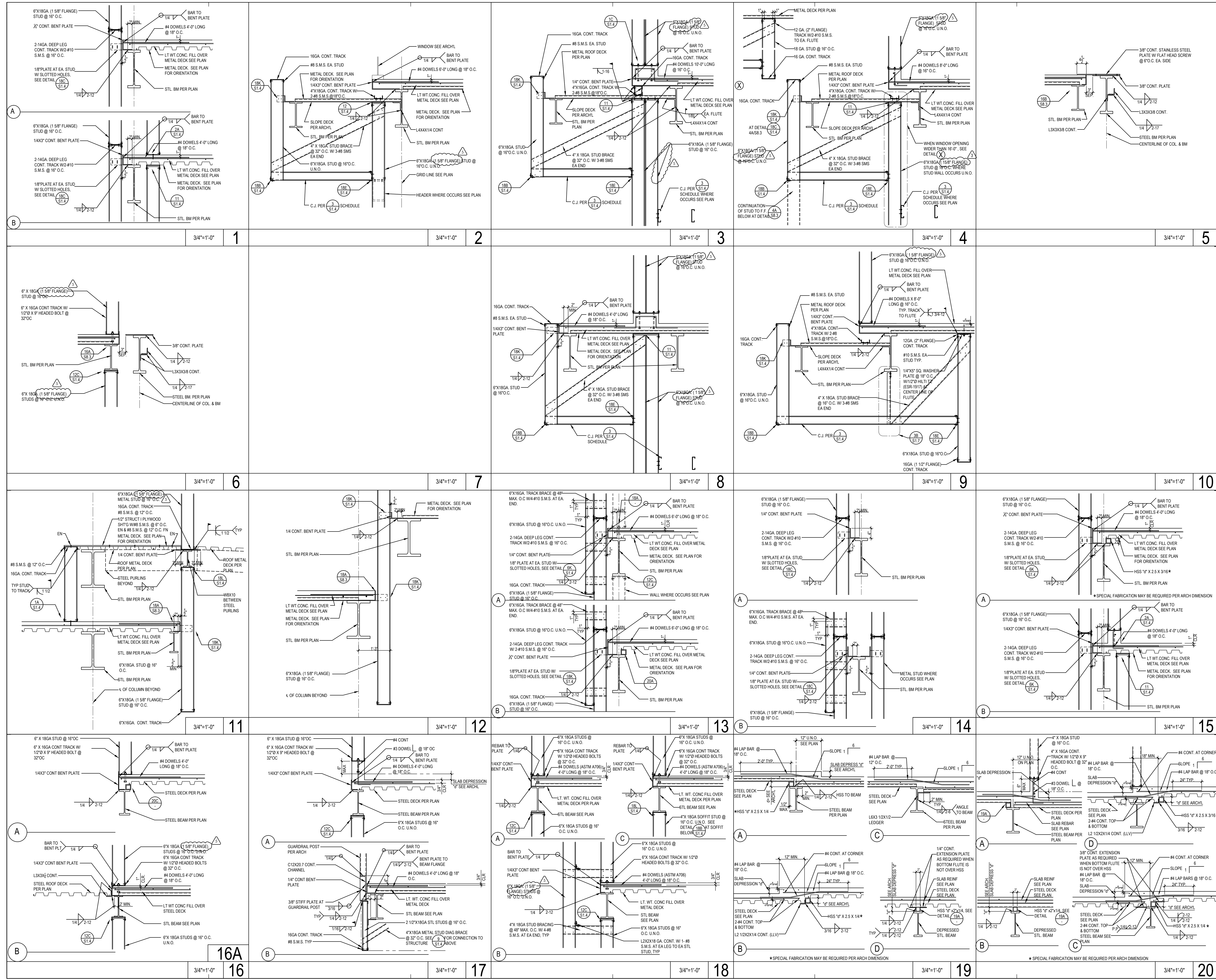
KEY PLAN

REVISION SCHEDULE

NO.	DATE	DESCRIPTION
02/17/2014	100% DESIGN DEVELOPMENT	
05/08/2014	90% CD PROGRESS	
05/29/2014	DSA SUBMITTAL	
04/08/2015	DSA BACKCHECK	
12/12/2015	ADDENDUM 1	
01/08/2016	ADDENDUM 2	
01/16/2016	REVISION 5	

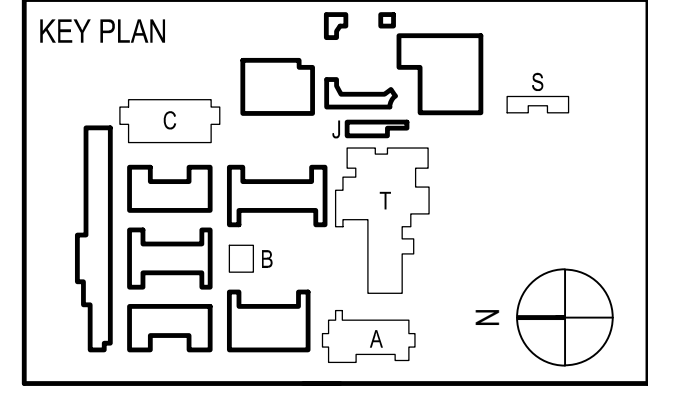
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DATE: 4/8/15 SCALE: AS NOTED
PROJECT NUMBER: 1310700
TYPICAL DETAILS
DRAWING NUMBER: **S1.4**

ROWLAND HIGH SCHOOL ADDITION
 ROWLAND UNIFIED SCHOOL DISTRICT
 2000 OTTERBEIN AVE
 ROWLAND HEIGHTS, CALIFORNIA



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REVISION SCHEDULE		
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02/17/2014		100% DESIGN DEVELOPMENT
05/08/2014		90% CD PROGRESS
05/29/2014		DSA SUBMITTAL
04/08/2015		DSA BACKCHECK
12/12/2015		ADDENDUM 1
4/06/2016		ADDENDUM 2
5/16/2016		REVISION 5

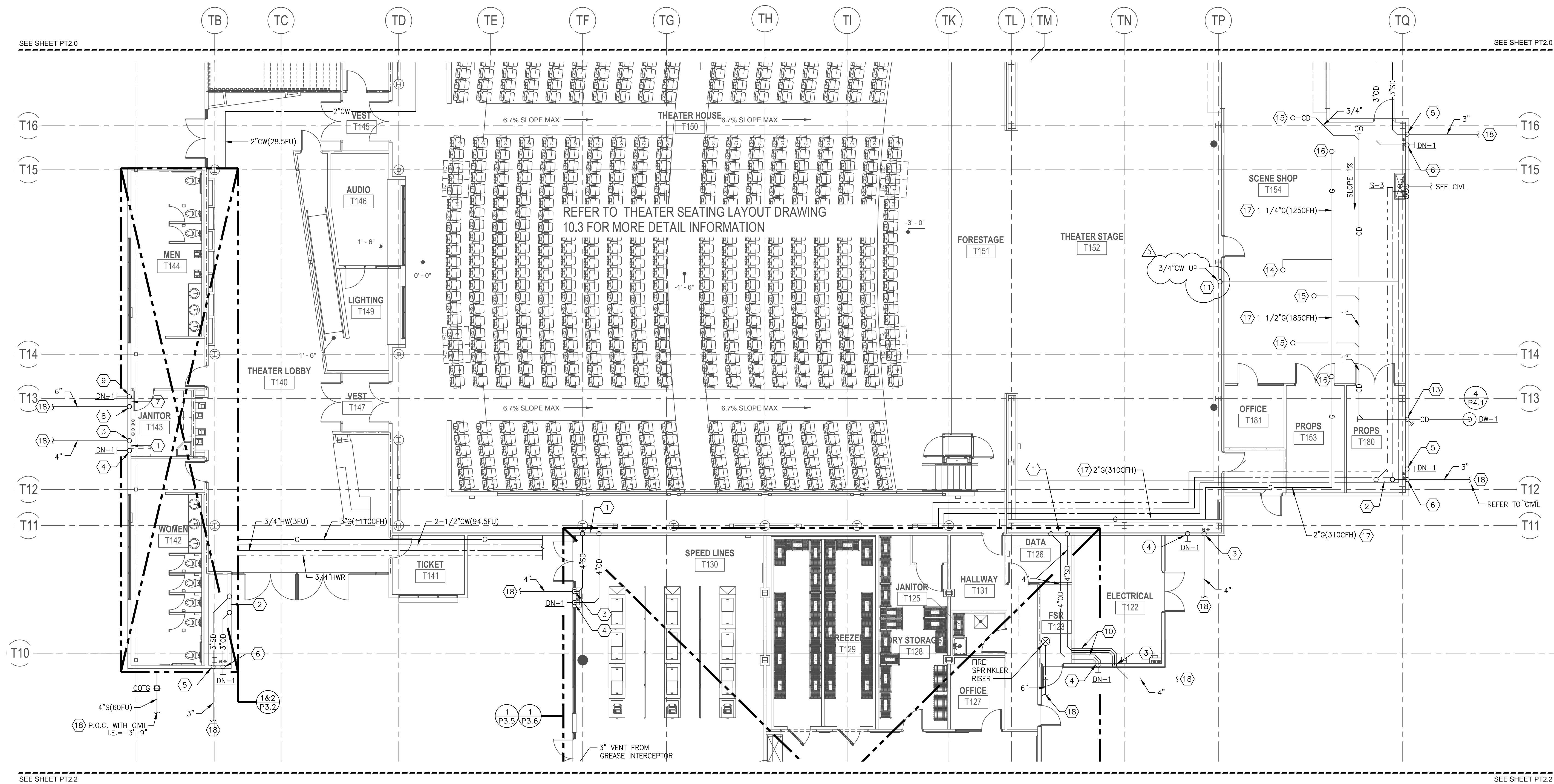
DRWN: IDK
 CHKD: PT
 DATE: 4/8/15
 SCALE: AS NOTED
 PROJECT NUMBER: 1310700

DETAILS
 DRAWING NUMBER: **S8.3**

NOTE: PAINT ALL EXPOSED STORM AND OVERFLOW DRAIN PIPING TO MATCH ADJACENT SURROUNDINGS

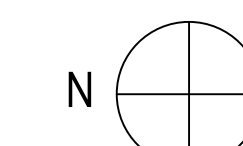
KEYED NOTES:

- 1 4"SD & 4"OD DOWN FROM RD/1 & OD/1 ON ROOF TO CEILING SPACE.
- 2 3"SD & 3"OD DOWN FROM RD/1 & OD/1 ON ROOF TO CEILING SPACE.
- 3 4"SD DOWN TO BELOW FLOOR. FOR CONTINUATION SEE SHEET P1.0.
- 4 4"OD DOWN IN WALL. TERMINATE WITH OVERFLOW NOZZLE 6" ABOVE FINISHED EXTERIOR GRADE.
- 5 3"SD DOWN TO BELOW FLOOR. FOR CONTINUATION SEE SHEET P1.0.
- 6 3"OD DOWN IN WALL. TERMINATE WITH OVERFLOW NOZZLE 6" ABOVE FINISHED EXTERIOR GRADE.
- 7 6"SD & 6"OD DOWN FROM RD/1 & OD/1 ON ROOF TO CEILING SPACE.
- 8 6"SD DOWN TO BELOW FLOOR. FOR CONTINUATION SEE SHEET P1.0.
- 9 6"OD DOWN IN WALL. TERMINATE WITH OVERFLOW NOZZLE 6" ABOVE FINISHED EXTERIOR GRADE.
- 10 PROVIDE DRAIN PAN FOR STORM DRAIN AND OVERFLOW PIPING IN ELECTRICAL ROOM.
- 11 3/4" CW UP TO HOSE BIBB ON ROOF.
- 12 NOT USED
- 13 1" CONDENSATE DOWN IN WALL TO DRYWELL.
- 14 1" GAS UP THROUGH ROOF TO HVAC UNIT, ROUGH-IN AND CONNECT.
- 15 3/4" CONDENSATE DOWN FROM HVAC UNIT ON ROOF TO CEILING SPACE.
- 16 1-1/4" GAS UP THROUGH ROOF TO HVAC UNIT, ROUGH-IN AND CONNECT.
- 17 GAS PIPING SHALL BE INSTALLED AS HIGH AS POSSIBLE TO AVOID CONFLICTS WITH OTHER TRADES AND EQUIPMENT INSTALLATIONS.
- 18 FOR CONTINUATION SEE SHEET P1.0.



PLUMBING THEATER BUILDING FIRST FLOOR PLAN AREA B

SCALE
1/8"=1'-0" 1



PLUMBING THEATER
BUILDING FIRST
FLOOR PLAN AREA B

DRAWING NUMBER: **PT2.1**

CONSULTANT

IDS

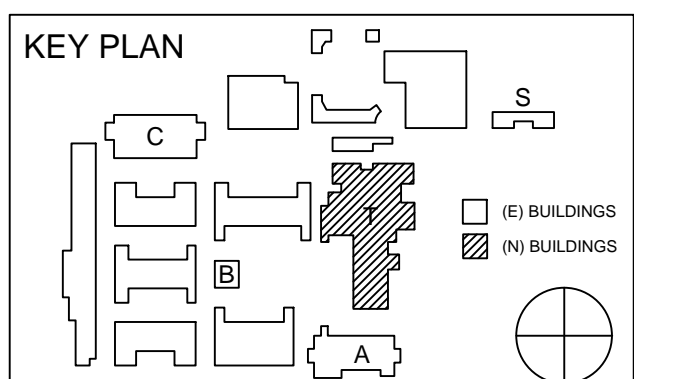
IDS GROUP

1 PETERS CANYON ROAD, SUITE 130
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NO	DATE	DESCRIPTION
02/17/2014		100% DESIGN DEVELOPMENT
05/08/2014		90% CD PROGRESS
05/29/2014		DSA SUBMITTAL
04/08/2015		DSA BACK CHECK
12/12/2015		ADDENDUM 1
05/06/2016		ADDENDUM 5

DRWN: G.W CHKD: FF.T
DATE: 04/08/2015 SCALE: 1/8"=1'-0"
PROJECT NUMBER: 1310700

DRAWING NUMBER: **PT2.1**

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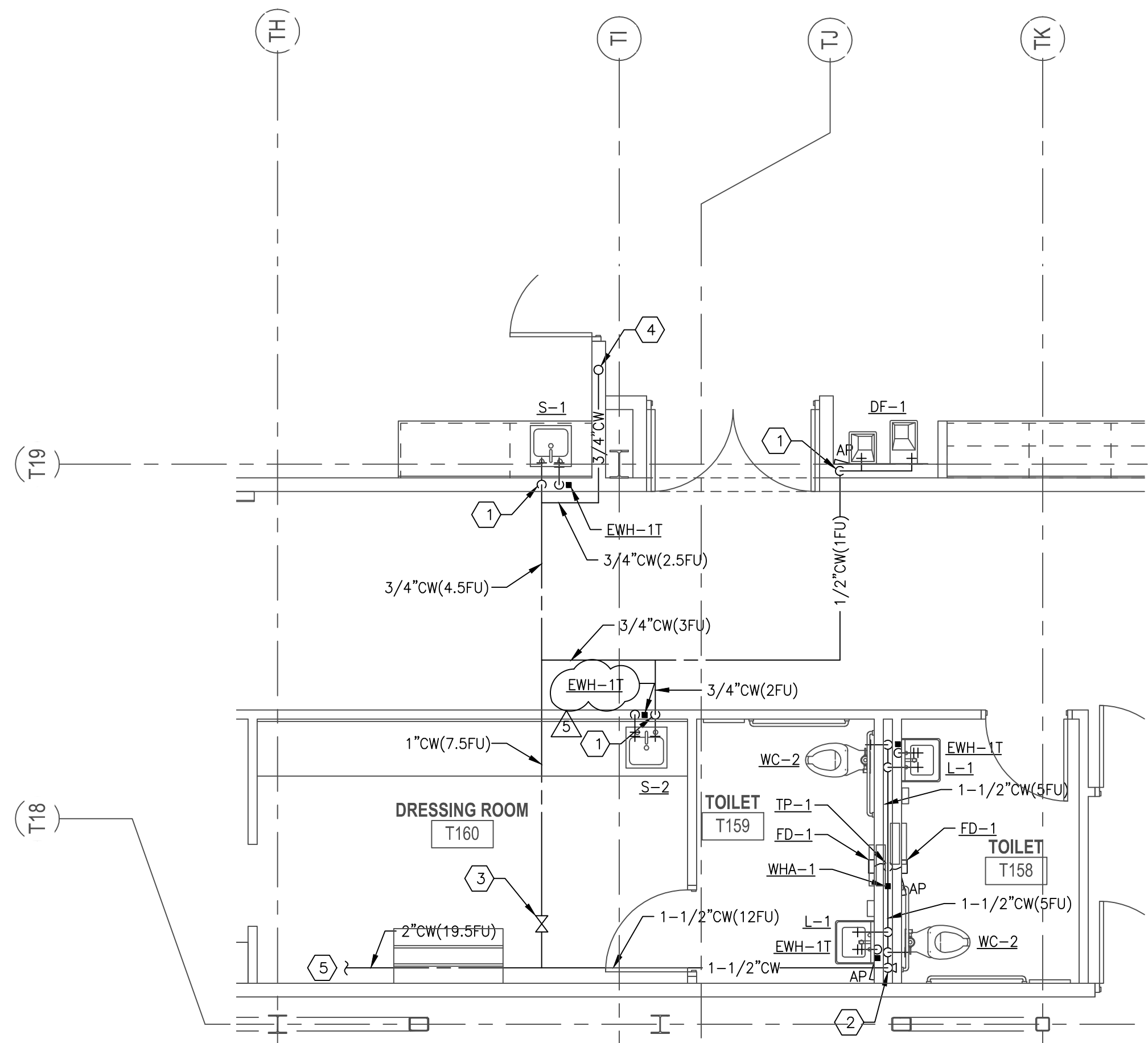
JAMES P. DICAMILLO
C-15937
11-30-15

PROFESSIONAL ENGINEER

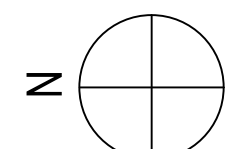
ANDREW KALAMBEIT
C-22219
Exp. 03/31/17

MECHANICAL

STATE OF CALIFORNIA

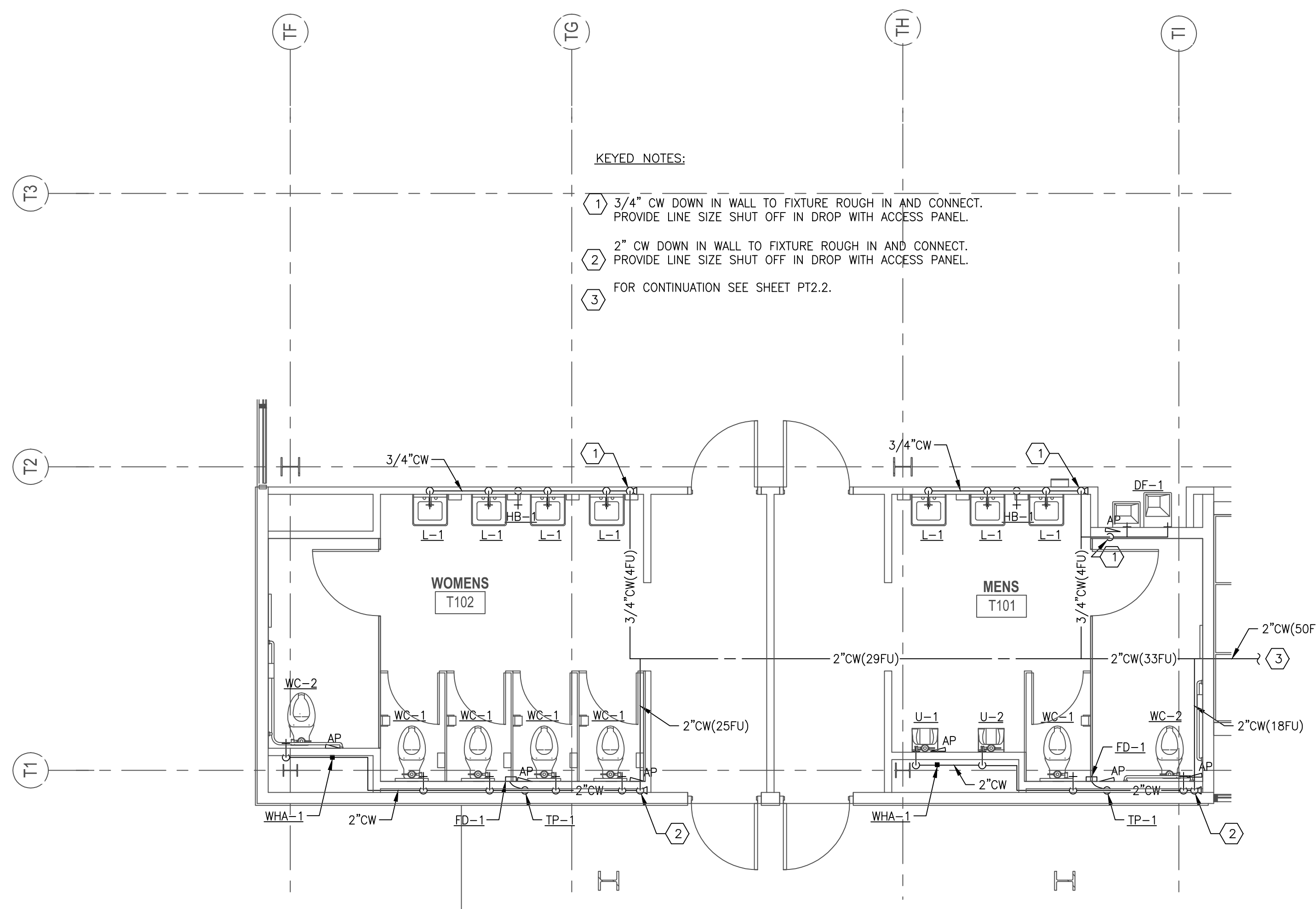


- KEYED NOTES:**
- 3/4" CW DOWN IN WALL TO FIXTURE, ROUGH-IN AND CONNECT.
 - 1-1/2" CW DOWN IN WALL TO FIXTURE, ROUGH-IN AND CONNECT. PROVIDE LINE SIZE SHUT OFF IN DROP WITH ACCESS PANEL.
 - LINE SIZE SHUT OFF VALVE ABOVE CEILING BEHIND ACCESS PANEL.
 - 3/4" CW UP THROUGH ROOF. SEE SHEET PT2.0.
 - FOR CONTINUATION SEE SHEET PT2.0.

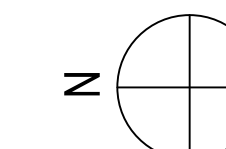


ENLARGED DOMESTIC WATER PLUMBING PLAN

SCALE
1/4"=1'-0" **4**

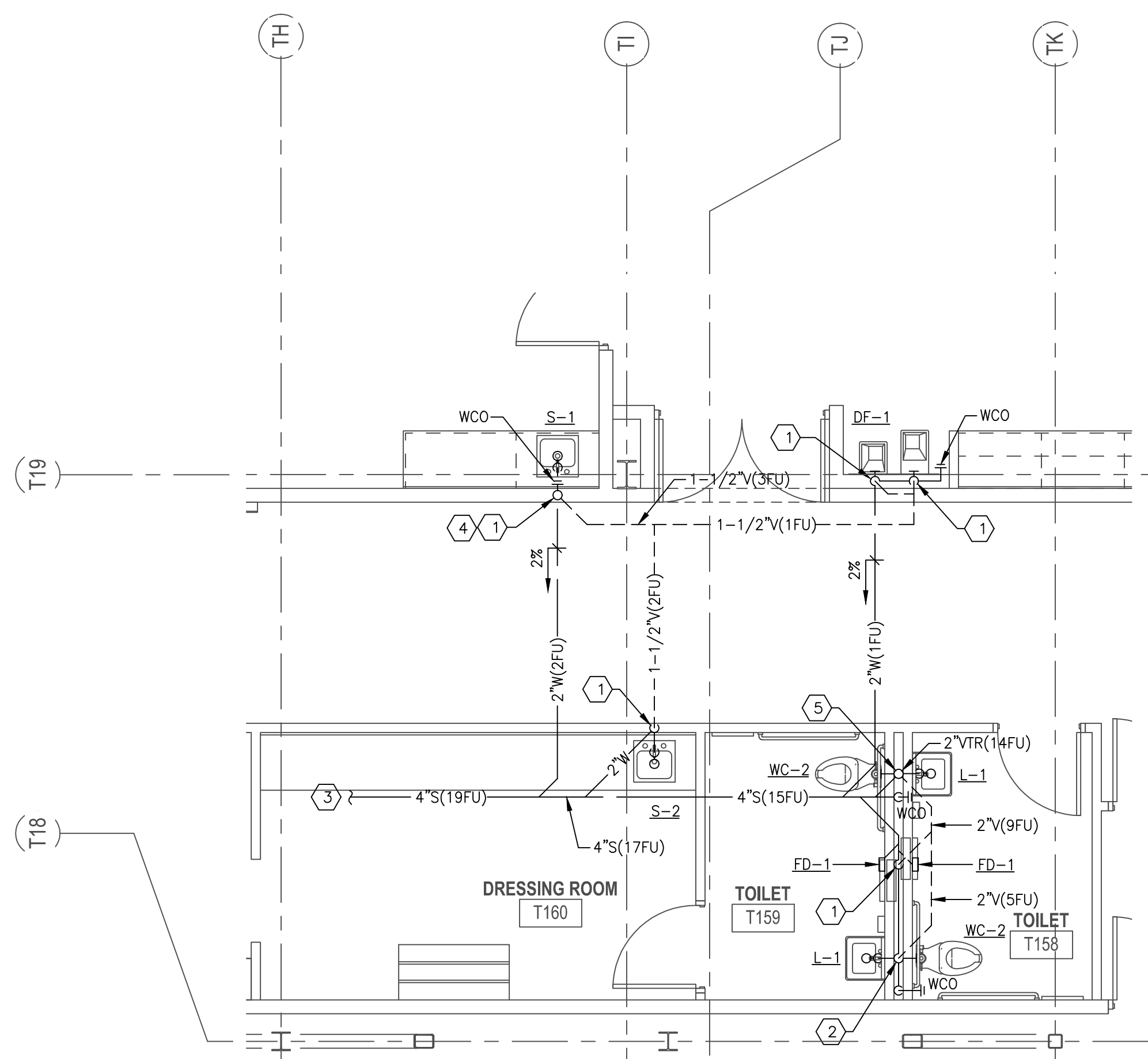


- KEYED NOTES:**
- 3/4" CW DOWN IN WALL TO FIXTURE ROUGH IN AND CONNECT. PROVIDE LINE SIZE SHUT OFF IN DROP WITH ACCESS PANEL.
 - 2" CW DOWN IN WALL TO FIXTURE ROUGH IN AND CONNECT. PROVIDE LINE SIZE SHUT OFF IN DROP WITH ACCESS PANEL.
 - FOR CONTINUATION SEE SHEET PT2.2.

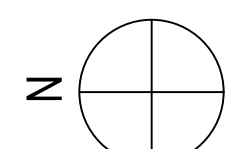


ENLARGED DOMESTIC WATER PLUMBING PLAN

SCALE
1/4"=1'-0" **2**

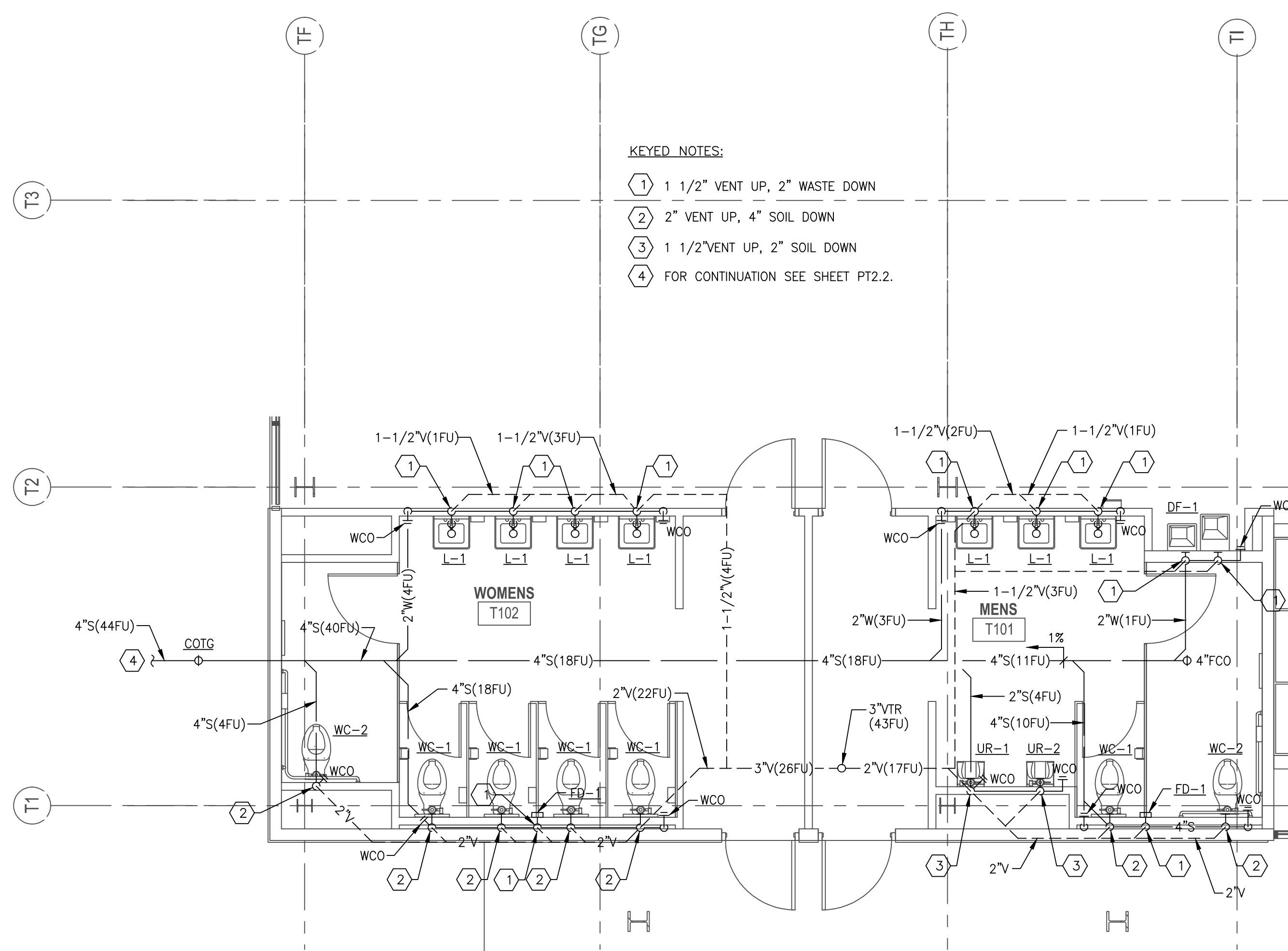


- KEYED NOTES:**
- 1-1/2" VENT UP, 2" WASTE DOWN.
 - 2" VENT UP, 4" SOIL DOWN.
 - FOR CONTINUATION SEE SHEET PT2.0.
 - 1-1/2" VTR.
 - 2" VTR.

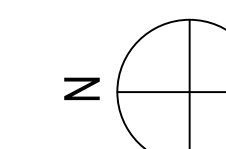


ENLARGED SOIL, WASTE AND VENT PLUMBING PLAN

SCALE
1/4"=1'-0" **3**

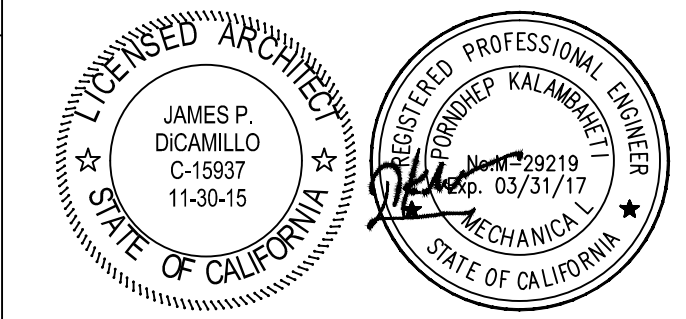


- KEYED NOTES:**
- 1 1/2" VENT UP, 2" WASTE DOWN
 - 2" VENT UP, 4" SOIL DOWN
 - 1 1/2" VENT UP, 2" SOIL DOWN
 - FOR CONTINUATION SEE SHEET PT2.2.



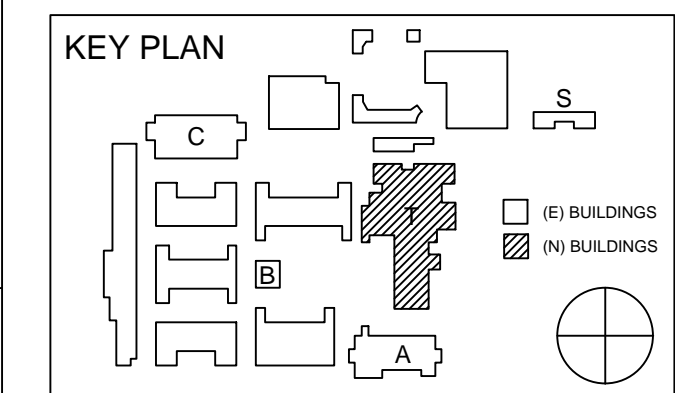
ENLARGED SOIL, WASTE AND VENT PLUMBING PLAN

SCALE
1/4"=1'-0" **1**



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REVISION SCHEDULE		
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	05/08/2014	90% CD PROGRESS
	05/29/2014	DSA SUBMITTAL
	04/08/2015	DSA BACK CHECK
	05/06/2016	ADDENDUM 5

DRWN: G.W CHKD: FF.T
DATE: 04/08/2015 SCALE: 1/4"=1'-0"
PROJECT NUMBER: 1310700

ENLARGED PLUMBING PLANS

DRAWING NUMBER: **P3.3**

GENERAL NOTES

SHEET INDEX

SYMBOL LIST

(NOT ALL SYMBOLS ARE USED)

- THE SCOPE OF WORK SHALL INCLUDE FURNISHING ALL LABOR, MATERIALS, EQUIPMENT, TOOLS AND SERVICES REQUIRED FOR THIS COMPLETE INSTALLATION OF THE ELECTRICAL SYSTEMS AS INDICATED AND SPECIFIED. ALL WORK SHALL BE NEW UNLESS NOTED OR SHOWN OTHERWISE.
- CONTRACTOR SHALL VISIT THE SITE INCLUDING SPECIFICALLY ALL AREAS INDICATED ON THE DRAWINGS. HE SHALL THOROUGHLY FAMILIARIZE HIMSELF WITH THESE EXISTING CONDITIONS AND BY SUBMITTING A BID ACCEPTS CONDITIONS UNDER WHICH HE WILL BE REQUIRED TO PERFORM HIS WORK.
- ALL ELECTRICAL EQUIPMENT, MATERIAL AND DETAILS OF INSTALLATION SHALL CONFORM TO THE REQUIREMENTS OF THE LATEST REVISIONS OF THE NATIONAL ELECTRIC CODE OF THE NATIONAL BOARD OF FIRE UNDERWRITERS, OF THE STATE OF CALIFORNIA TITLE 24, BASIC ELECTRICAL REGULATIONS OF THE STATE FIRE MARSHALL AND OTHER APPLICABLE CODES. NOTHING IN THESE SPECIFICATIONS SHALL BE CONSTRUED AS PERMITTING WORK NOT CONFORMING TO THE MOST STRINGENT OF THE APPLICABLE CODES.
- THE BIDDER SHALL VISIT THE SITE AND MAKE A SURVEY OF EXISTING CONDITIONS WHICH MAY AFFECT OR BE AFFECTED BY THE WORK UNDER THIS SECTION. REFERENCE MADE IN THE SPECIFICATIONS OR ON THE DRAWINGS TO EXISTING WORK OR CORRECTNESS OF WAYS AND MEANS OF PERFORMING SHALL BE SUBJECT TO VERIFICATIONS BY THE CONTRACTOR IN HIS SURVEY AND THE PROGRESS OF HIS WORK.
- THE CONTRACTOR SHALL NOT DISCONNECT OR TURN OFF ANY SERVICES UNTIL SUCH ACTION IS APPROVED BY THE OWNER. ALL OUTAGES SHALL BE SCHEDULED WITH THE OWNER MAINTENANCE SUPERVISOR AN LEAST FIVE (5) WORKING DAY PRIOR TO THE OUTAGE.
- EXACT ROUTING OF ALL CONDUIT WITHIN EXISTING BUILDING SHALL BE DETERMINED BY THE CONTRACTOR. ANY COSTS REQUIRED TO ROUTE CONDUIT DIFFERENT THAN SHOWN ON THESE DRAWINGS SHALL BE INCURRED BY THE CONTRACTOR.
- THE CONTRACTOR SHALL SECURE AND PAY FOR PERMITS AND FEES NECESSARY FOR EXECUTION AND COMPLETION OF ELECTRICAL WORK, INCLUDING ALL CHARGES BY THE LOCAL GOVERNMENT AND STATE AGENCIES.
- IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DO ALL CORING, CUTTING, PATCHES, AND REFINISHING OF EXISTING WALLS AND SURFACES WHEREVER IT IS NECESSARY FOR HIM TO PENETRATE FOR HIS WORK. ALL OPENINGS MADE SHALL BE SEALED TO MEET RATED INTEGRITY OF THE PARTICULAR WALL, FLOOR OR CEILING.
- EXACT METHOD AND LOCATION OF CONDUIT PENETRATION AND/OR OPENINGS IN CONCRETE WALLS OR FLOORS SHALL BE DIRECTED BY THE STRUCTURAL ENGINEER.
- ALL ELECTRICAL EQUIPMENT SHALL BE BRACED OR ANCHORED TO RESIST A HORIZONTAL FORCE OF 20% OF ITS OPERATING WEIGHT ACTING IN ANY DIRECTION WHERE ANCHORAGE DETAILS ARE NOT SHOWN ON THE DRAWINGS THE FIELD INSTALLATION SHALL BE SUBJECT TO THE APPROVAL OF THE ELECTRICAL ENGINEER.
- FINAL INSPECTION AND ACCEPTANCE: AFTER ALL REQUIREMENTS OF THE SPECIFICATIONS AND/OR THE DRAWINGS HAVE BEEN FULLY COMPLETED, REPRESENTATIVES OF THE OWNER WILL INSPECT THE WORK. CONTRACTOR SHALL PROVIDE COMPETENT PERSONAL TO DEMONSTRATE THE OPERATION OF ANY ITEM OR SYSTEM, TO THE FULL SATISFACTION OF EACH REPRESENTATIVE. FINAL ACCEPTANCE OF THE WORK WILL BE MADE BY THE OWNER AFTER RECEIPT OF APPROVAL AND RECOMMENDATION OF ACCEPTANCE FROM EACH REPRESENTATIVE.
- THE CONTRACTOR SHALL MAINTAIN A COMPLETE SET OF RECORD DRAWINGS AND AFTER COMPLETION OF HIS WORK TURN THEM OVER TO THE ENGINEER/OWNER.
- FINAL CONNECTIONS TO MECHANICAL EQUIPMENT SHALL BE MADE BY THIS CONTRACTOR.
- ALL FIRE ALARM DEVICES SHALL BE U.L. LISTED AND APPROVED BY THE CALIFORNIA STATE FIRE MARSHAL.
- CUTTING, BORING, SAW CUTTING OR DRILLING THROUGH THE NEW OR EXISTING STRUCTURAL ELEMENTS TO BE DONE ONLY WHEN SO DETAILED IN THE DRAWINGS OR ACCEPTED BY THE ARCHITECT AND STRUCTURAL ENGINEER WITH THE APPROVAL OF DSA REPRESENTATIVE.
- THE SEISMIC ANCHORAGE OF MECHANICAL AND ELECTRICAL EQUIPMENT SHALL CONFORM TO ASCE 7-05 SECTION 13.3.1 AND TABLE 13.6-1. ANCHORAGE DETAILS FOR ROOF/FLOOR MOUNTED EQUIPMENT SHALL BE SHOWN ON PLANS.
- ALL BRACING OF DUCTS AND PIPING SHALL BE INSTALLED IN ACCORDANCE WITH SMACNA GUIDELINES AS APPROVED BY DSA.
- WHERE BRACING DETAILS ARE NOT SHOWN ON THE DRAWINGS OR IN THE GUIDELINES, THE FIELD INSTALLATION SHALL BE SUBJECT TO THE APPROVAL OF THE ARCHITECT, STRUCTURAL ENGINEER AND DSA FILED ENGINEER. A COPY OF THE GUIDELINES PUBLISHED BY SMACNA AND APPROVED BY DSA SHALL BE PROVIDED BY THE CONTRACTOR AND KEPT ON THE JOB AT ALL TIMES.
- PROVIDE FLEXIBLE CONNECTION WHERE EXPANSION JOINTS OCCUR IN BUILDING STRUCTURE.

- THE CONTRACTOR SHALL VISIT THE JOB SITE TO ACQUAINT HIMSELF WITH ACTUAL CONDITIONS OF EXISTING AND TO BECOME FAMILIAR WITH THE TOTAL SCOPE OF WORK REQUIRED AND HE SHALL REVIEW AS-BUILT RECORD DRAWINGS. SUBMISSION OF BID WILL BE INDICATION THAT CONTRACTOR HAS MADE VISUAL INSPECTION OF THE SITE, HAS REVIEWED ALL PLANS AND AS-BUILTS, OUTLINE REQUIREMENTS AND HAS INCLUDED IN THE PRICE ALL LABOR, MATERIALS AND EQUIPMENT TO COMPLETE THE ELECTRICAL DEMOLITION WORK.
NOTE: REFER TO FIRE ALARM COMPONENT LIST, SHEET FA0.0 FOR ALL FIRE ALARM SYMBOLS.
 - UNLESS SPECIFICALLY SHOWN ON THESE PLANS NO STRUCTURAL MEMBER SHALL BE CUT, NEITHER DRILLED NOR NOTCHED WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE STRUCTURAL ENGINEER AND THE DIVISION OF THE STATE ARCHITECT.
 - THE SEISMIC ANCHORAGE OF THE MECHANICAL AND ELECTRICAL EQUIPMENT SHALL CONFORM TO C.C.R. TITLE 24, 2013 CBC SECTION 1614A.1.2, ASCE7 SECTION 13.5.6.2 ANCHORAGE DETAILS FOR ROOF / FLOOR MOUNTED EQUIPMENT SHALL BE SHOWN ON PLANS.
 - INSTALL EQUIPMENT GREEN GROUNDING CONDUCTOR SIZED PER NEC 250-95 IN ALL CONDUITS. GROUND CONDUCTORS ARE NOT SHOWN ON DRAWINGS.
COMPLETE PLAN SUBMITTAL FOR FULLY AUTOMATIC FIRE ALARM SYSTEM PER DSA POLICY 95-03 FLS.
- MEP COMPONENT ANCHORAGE NOTE:**
- ALL MECHANICAL AND ELECTRICAL EQUIPMENT SHALL BE ANCHORED AND INSTALLED PER THE DETAILS ON THE DSA APPROVED CONSTRUCTION DOCUMENTS. WHERE NO DETAILS INDICATED, THE FOLLOWING COMPONENTS SHALL BE ANCHORED OR BRACED TO MEET THE FORCE AND DISPLACEMENT REQUIREMENTS PRESCRIBED IN THE 2013 CBC, SECTIONS 1615A.1.12 THROUGH 1615A.1.22 AND ASCE 7-05 CHAPTER 6 AND 13.
- ALL PERMANENT EQUIPMENT AND COMPONENTS.
 - TEMPORARY OR MOVABLE EQUIPMENT THAT IS PERMANENTLY ATTACHED (E.G. HARD WIRED) TO THE BUILDING UTILITY SERVICE SUCH AS GAS ELECTRIC OR WATER.
 - MOVABLE EQUIPMENT WHICH IS STATIONED IN ONE PLACE FOR MORE THAN 8 HOURS AND HEAVIER THAN 400 POUNDS ARE REQUIRED TO BE ANCHORED WITH TEMPORARY ATTACHMENTS.
- THE ATTACHMENT OF THE FOLLOWING MECHANICAL AND ELECTRICAL COMPONENTS SHALL BE POSITIVELY ATTACHED TO THE STRUCTURE, BUT NEED NOT BE DETAILED ON THE PLANS. THESE COMPONENTS SHALL HAVE FLEXIBLE CONNECTIONS PROVIDED BETWEEN THE COMPONENT AND ASSOCIATED DUCT WORK, PIPING, AND CONDUIT.
- COMPONENTS WEIGHING LESS THAN 400 POUNDS AND HAVE CENTER OF MASS LOCATED 4 FEET OR LESS ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT.
 - COMPONENTS WEIGHING LESS THAN 20 POUNDS, OR IN THE CASE OF DISTRIBUTED SYSTEMS, LESS THAN 5 POUNDS PER FOOT, WHICH ARE SUSPENDED FROM A ROOF OR FLOOR OR HUNG FROM A WALL.
- FOR THESE ELEMENTS THAT DO NOT REQUIRE DETAILS ON THE APPROVED DRAWINGS, THE INSTALLATION SHALL BE SUBJECT TO THE APPROVAL OF THE STRUCTURAL ENGINEER OF RECORD AND THE DSA DISTRICT STRUCTURAL ENGINEER. THE PROJECT INSPECTOR WILL VERIFY THAT ALL COMPONENTS AND EQUIPMENT HAVE BEEN ANCHORED IN ACCORDANCE WITH ABOVE REQUIREMENTS.
- PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEM BRACING NOTE:**
- PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS SHALL BE BRACED TO COMPLY WITH THE FORCES AND DISPLACEMENTS PRESCRIBED IN ASCE 7-05 SECTIONS 13.3 AS DEFINED IN ASCE 7-05 SECTION 13.6.8, 13.6.7, 13.6.5.6. AND 2010 CBC, SECTIONS 1615A.1.20, 1615A.1.21 AND 1615A.1.22.
- THE BRACING AND ATTACHMENTS TO THE STRUCTURE SHALL BE DETAILED ON THE APPROVED DRAWINGS OR THEY SHALL COMPLY WITH ONE OF THE OSHPD PRE-APPROVALS (OPA #) AS MODIFIED TO SATISFY ANCHORAGE REQUIREMENTS OF ACI 318, APPENDIX D.
- COPIES OF THE MANUAL SHALL BE AVAILABLE ON THE JOBSITE PRIOR TO THE START OF HANGING AND BRACING OF THE PIPE, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS.
- THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE STRUCTURE TO SUPPORT THE HANGER AND BRACE LOADS.

EO.1	SYMBOLS LIST, SHEET INDEX & GENERAL NOTES
EO.2	LIGHTING FIXTURE SCHEDULE & NOTES
EO.3	TITLE 24 - ADMINISTRATION BUILDING
EO.4	TITLE 24 - CLASSROOM BUILDING
EO.5	TITLE 24 - ASB BUILDING
EO.6	TITLE 24 - THEATER BUILDING
EO.7	TITLE 24 - OUTDOOR
EA.1D	DEMO SITE POWER PLAN
EA.1	SITE POWER PLAN
EA.2D	DEMO SITE SIGNAL PLAN
EA.2	SITE SIGNAL PLAN
EA.3D	DEMO SITE LIGHTING PLAN
EA.3	SITE LIGHTING & TEMPORARY LV SERVICE BUILDING PLAN
EA.3A	COURTYARD LIGHTING PLAN
EA.2.1	POWER PLAN - ADMINISTRATION BUILDING - 1ST FLOOR
EA.2.2	POWER PLAN - ADMINISTRATION BUILDING - 2ND FLOOR
EA.2.3	SIGNAL PLAN - ADMINISTRATION BUILDING - 1ST FLOOR
EA.2.4	SIGNAL PLAN - ADMINISTRATION BUILDING - 2ND FLOOR
EA.3.1	LIGHTING PLAN - ADMINISTRATION BUILDING - 1ST FLOOR
EA.3.2	LIGHTING PLAN - ADMINISTRATION BUILDING - 2ND FLOOR
EA.4.1	ROOF ELECTRICAL PLAN - ADMINISTRATION BUILDING
EA.2.1	POWER PLAN - CLASSROOM BUILDING - 1ST FLOOR
EA.2.2	POWER PLAN - CLASSROOM BUILDING - 2ND FLOOR
EA.2.3	SIGNAL PLAN - CLASSROOM BUILDING - 1ST FLOOR
EA.2.4	SIGNAL PLAN - CLASSROOM BUILDING - 2ND FLOOR
EA.3.1	LIGHTING PLAN - CLASSROOM BUILDING - 1ST FLOOR
EA.3.2	LIGHTING PLAN - CLASSROOM BUILDING - 2ND FLOOR
EA.4.1	ROOF ELECTRICAL PLAN - CLASSROOM BUILDING
EA.2.1	POWER & SIGNAL PLANS - ASB & SPECIAL BUILDINGS - 1ST FLOOR
EA.3.1	LIGHTING PLANS - ASB & SPECIAL BUILDING - 1ST FLOOR
EA.4.1	ROOF ELECTRICAL PLAN - ASB & SPECIAL BUILDING
EA.2.0	OVERALL ELECTRICAL PLAN - THEATER BUILDING
EA.2.1	POWER PLAN - PARTIAL THEATER BUILDING - 1ST FLOOR
EA.2.2	POWER PLAN - PARTIAL THEATER BUILDING - 2ND FLOOR
EA.2.3	POWER PLAN - PARTIAL THEATER BUILDING - 2ND FLOOR
EA.2.4	SIGNAL PLAN - PARTIAL THEATER BUILDING - 1ST FLOOR
EA.2.5	SIGNAL PLAN - PARTIAL THEATER BUILDING - 1ST FLOOR
EA.2.6	SIGNAL PLAN - PARTIAL THEATER BUILDING - 2ND FLOOR
EA.2.7	POWER PLAN - THEATER KITCHEN BUILDING
EA.3.1	LIGHTING PLAN - PARTIAL THEATER BUILDING - 1ST FLOOR
EA.3.2	LIGHTING PLAN - PARTIAL THEATER BUILDING - 1ST FLOOR
EA.3.3	LIGHTING PLAN - PARTIAL THEATER BUILDING - 2ND FLOOR
EA.3.4	STAGE LIGHTING PLAN - STAGE LEVEL
EA.3.5	STAGE LIGHTING PLAN - MEZZANINE LEVEL
EA.3.6	STAGE LIGHTING PLAN - CATWALK LEVEL
EA.3.7	STAGE LIGHTING PLAN - LOADING GALLERY
EA.4.1	ROOF ELECTRICAL PLAN - PARTIAL THEATER BUILDING
EA.4.2	ROOF ELECTRICAL PLAN - PARTIAL THEATER BUILDING
EA.4.3	ROOF ELECTRICAL PLAN - PARTIAL THEATER BUILDING
EA.1D	DEMO SINGLE LINE DIAGRAM
EA.1	SINGLE LINE DIAGRAM
EA.2	SINGLE LINE DIAGRAM - THEATER KITCHEN BUILDING
EA.3	SINGLE LINE DIAGRAM & DETAILS - CLASSROOM BUILDING
EA.4	PANEL SCHEDULES - ADMIN BUILDING
EA.5	PANEL SCHEDULES - CLASSROOM BUILDING
EA.6	BATTERY INVERTER SPEC SHEET
EA.7	PANEL SCHEDULES - THEATER BUILDING
EA.8	PANEL SCHEDULES - THEATER KITCHEN BUILDING
EA.9	DIMMER SCHEDULES - THEATER BUILDING
EA.10	ENLARGED ELECTRICAL ROOMS
EA.1D	DEMO SIGNAL RISER DIAGRAMS
EA.1	SIGNAL RISER DIAGRAMS
EA.7.1	ANCHORAGE DETAILS

NOTE: RETURN TO EO.2 FOR LIGHT FIXTURES SYMBOLS. REFER TO FA001 FOR FIRE ALARM SYMBOLS.

MECHANICAL OR PLUMBING EQUIPMENT CALL OUT REFER TO MECHANICAL DRAWINGS FOR EXACT LOCATION AND FULL LOAD RATING.

PLAN NOTE REFERENCE. SEE NOTES FOR REQUIREMENTS

TRANSFORMER, RATINGS AS NOTED ON THE DRAWINGS.

FUSED DISCONNECT SWITCH - HP RATED WITH FUSES SIZED PER EQUIPMENT MANUFACTURER.

NON FUSED DISCONNECT SWITCH - HP RATED

MOTOR STARTER, NUMERICAL INDICATES NEMA SIZE.

COMB. MOTOR STARTER, H.P. RATED, FUSED DISCONNECT SWITCH. NUMERICAL ADJACENT TO STARTER INDICATES NEMA SIZE, FUSE SIZE PER MANUFACTURER.

EXHAUST FAN

MOTOR

INDICATES FLEXIBLE CONNECTION TO EQUIPMENT.

SPEAKER/BACK BOX CEILING MOUNTED, MATCH DISTRICT STANDARD

FEEDER DESIGNATION; SEE FEEDER SCHEDULE

70AMP FUSE AND 100AMP SWITCH, FUSE TYPE AS SPECIFIED

EMERGENCY PA CALL BUTTON, +48"A.F.F. PROVIDE LV CABLE PER SCHOOL DISTRICT STANDARD.

SYSTEM CLOCK, +9'-0"A.F.F. PROVIDE LV CABLE PER SCHOOL DISTRICT STANDARD.

SYSTEM SPEAKER, +9'-0"A.F.F. PROVIDE LV CABLE PER SCHOOL DISTRICT STANDARD.

CCTV CAMERA, PROVIDE LV CABLE PER SCHOOL DISTRICT STANDARD.

P.I.V. VALVE OR REFER TO FIRE ALARM EQUIP. SCHEDULE

JUNCTION BOX, MTD ON WALL, FIELD VERIFY MOUNTING HEIGHT

JUNCTION BOX, ABOVE CEILING, OR AS REQUIRED TO SUIT THE APPLICATION

JUNCTION BOX, FLUSH WITH CEILING

ELECTRICAL PANEL BOARD AS DESIGNATED, FLUSH MOUNTED

ELECTRICAL PANEL BOARD, SURFACE MOUNTED

DISTRIBUTION SWITCHBOARD

TELEPHONE TERMINAL BACKBOARD. PROVIDE 3/4"C. - 1 #6 GROUND CONNECT TO COLD WATER PIPE.

"X" INDICATES PANELBOARD OR EQUIPMENT DESIGNATION

EXIT SIGN, SINGLE FACE, W/DIRECTIONAL ARROW AS INDICATED, MOUNTED ON RECESSED CEILING OUTLET BOX.

EXIT SIGN, DOUBLE FACE, W/DIRECTIONAL ARROWS AS INDICATED, MOUNTED ON RECESSED CEILING OUTLET BOX

LOW LEVEL EXIT SIGN, FLUSH MOUNTED ON WALL

FLUSH CEILING MOUNTED RECEPTACLE.

FLUSH FLOOR RECEPTACLE DEVICE.

"X" SUBSCRIPT/SUPERSCRIPIT:

"C" INDICATES FLUSH IN CONCRETE;

"P" INDICATES FIRE RATED POKE-THRU DEVICE.

DUPLEX RECEPTACLE, WALL MOUNTED +15" TO CENTER OF BOTTOM DEVICE.

QUADPLEX RECEPTACLE, WALL MOUNTED +15" TO CENTER OF BOTTOM DEVICE.

SPECIAL RECEPTACLE. REFER TO PLAN NOTES

GF1-TYPE RECEPTACLE, WALL MOUNTED 6" ABOVE COUNTER OR SPLASH.

GF1-TYPE RECEPTACLE, WALL MOUNTED +18" TO CENTER OF BOTTOM DEVICE U.O.N.

CONVENIENCE RECEPTACLE, WALL MOUNTED HORIZONTALLY 6" ABOVE COUNTER OR SPLASH

HALF SWITCHED DUPLEX RECEPTACLE, WALL MOUNTED +15" TO CENTER OF DEVICE U.O.N.

TELEPHONE OUTLET, WALL MTD, +54" AFF W/1"C.O. STUB TO CEILING SPACE. PROVIDE LV CABLE PER SCHOOL DISTRICT STANDARD.

TELEPHONE OUTLET IN WALL, PLASTER RING, +18" OR AS NOTED, 1" CONDUIT STUB TO CEILING SPACE, W/PULL STRING (NOT USED).

COMBINATION VOICE/DATA OUTLET, +18" OR AS NOTED, 1" CONDUIT STUB TO CEILING SPACE. PROVIDE LV CABLE PER SCHOOL DISTRICT STANDARD.

COMBINATION VOICE/DATA OUTLET, 1" CONDUIT STUB TO CEILING SPACE, W/ PULL STRING. +6" ABOVE COUNTER SPLASH.

DATA OUTLET BOX, +18" OR AS NOTED, 1" CONDUIT STUB TO CEILING SPACE. PROVIDE LV CABLE PER SCHOOL DISTRICT STANDARD.

DATA OUTLET BOX, 1" CONDUIT STUB TO CEILING SPACE, W/PULL STRING. +6" ABOVE COUNTER SPLASH.

FLUSH FLOOR VOICE/DATA DEVICE.

"X" SUBSCRIPT/SUPERSCRIPIT:

"C" INDICATES FLUSH IN CONCRETE;

"P" INDICATES FIRE RATED POKE-THRU DEVICE.

FLUSH FLOOR DATA DEVICE.

"X" SUBSCRIPT/SUPERSCRIPIT:

"C" INDICATES FLUSH IN CONCRETE;

"P" INDICATES FIRE RATED POKE-THRU DEVICE.

FLUSH CEILING MOUNTED DATA OUTLET.

WALL MOUNTED SLIDE DIMMER, INCANDESCENT 1800 WATT RATING MINIMUM, +48".

WALL MOUNTED SLIDE LOW VOLTAGE DIMMER, 2000 WATT RATING, VERIFY VOLTAGE W/ON/OFF SWITCH MTD +48".

WALL MOUNTED SLIDE FLUORESCENT DIMMER, 4000 WATT RATING, 277 VOLT, VERIFY W/ON/OFF MTD +48".

CEILING MOUNTED OCCUPANCY SENSOR.

WALL MOUNTED OCCUPANCY SENSOR.

WALL SWITCH, +48" OR AS NOTED: SUBSCRIPTS AT SYMBOL INDICATE THE FOLLOWING:

2 - DOUBLE POLE P - PILOT LIGHT
3 - THREE WAY R - REMOTE CONTROL SWITCH
4 - FOUR WAY M - MOTOR STARTING SWITCH
K - KEY OPERATED RL - ROTARY LOCK KEY TYPE SWITCH

a, b, c, ETC.-IDENTIFICATION OF OUTLETS CONTROLLED AND NUMBER OF SWITCHES AT LOCATION. NOTE: ALL WALL SWITCHES CONTROLLING EMERGENCY CIRCUITS SHALL BE "RED".

THERMOSTAT OUTLET BOX, +48" OR AS NOTED, PROVIDE 3/4" C.O. TO CEILING SPACE W/PULL CORD. CONFIRM ALL THERMOSTAT LOCATION WITH MECHANICAL.

BRANCH CIRCUIT WIRING. NUMBER OF HATCH MARKS INDICATES NUMBER OF #12 WIRES IN CODE SIZE CIRCUITS.

BRANCH CIRCUIT WIRING, 2 #12 IN 3/4" MIN. CONDUIT OR AS NOTED OR SYMBOLIZED

3/4"C-3#12 3/4"C-4#12 3/4"C-5#12
1/2" 3/4"C-5#12 1/2" 3/4"C-5#12

TELEPHONE CONDUIT RUN, 3/4" SIZE OR AS SYMBOLIZED OR NOTED

1" C.O. 1 1/4" C.O.
"D" INDICATES CONDUIT FOR DATA, SAME SIZING AS ABOVE.

HOME RUN TO PANEL. LETTER DESIGNATES PANEL, NUMERALS DESIGNATE CIRCUITS.

CONDUIT RUN CONCEALED IN WALL OR ABOVE FINISHED CEILING OR AS NOTED

SIGNAL CONDUIT IN OR UNDER FLOOR, OR UNDERGROUND, 3/4" MINIMUM

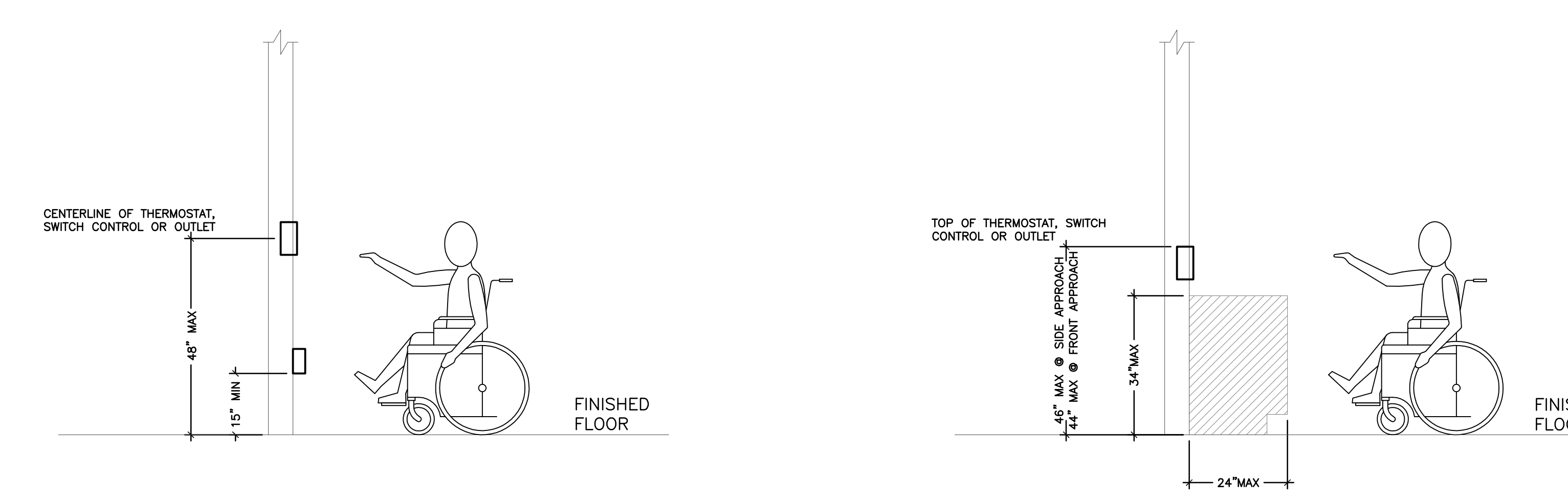
SIGNAL CONDUIT IN OR UNDER FLOOR, OR UNDERGROUND, 3/4" MINIMUM

DISCONNECT AND REMOVE EXISTING CONDUIT AND WIRES.

(E) EXISTING CONDUIT AND WIRES TO REMAIN.

ABBREVIATIONS

AIC	SHORT CIRCUITING RATING IN SYMMETRICAL AMPS
AHU	AIR HANDLING UNIT
AFF	ABOVE FINISHED FLOOR
A	AMPS
BC	BARE COPPER
BATT.	BATTERY
CP	CIRCULATING PUMP
CDP	CONDENSATE PUMP
CU	CONDENSING UNIT
CO	CONDUIT ONLY
(D)	DEMOLISH
(E)	EXISTING EQUIPMENT, CONDUIT OR DEVICE.
EB	FIXTURE PROVIDED WITH EMERGENCY BATTERY BACK-UP
EMH	ELECTRIC WATER HEATER
EMS	ENERGY MANAGEMENT SYSTEM
EM	EMERGENCY FIXTURE
EF	EXHAUST FAN
(E)	EXISTING DEVICE TO REMAIN
FT	FOOT OR FEET
GND	GROUND
GF1	GROUND FAULT CIRCUIT INTERRUPTER
HP	HORSE POWER
HV	HIGH VOLTAGE
K	DEGREES KELVIN
KVA	KILOVOLT AMPS
MAU	MAKE UP AIR UNIT
MLO	MAIN LUGS ONLY
MH	MOUNTING HEIGHT
NO OR #	NUMBER
(N)	NEW DEVICE
NL	24/7 NIGHT LIGHT
NL	NIGHT LIGHT
Ø	PHASE
PFF	PROVISION FOR FUTURE
PB	PULL BOX
PHL	PANEL
PROVIDE	FURNISH, INSTALLED AND CONNECTED
RS	RAPID START
(R)	REMOVE DEVICE
REL	RELOCATE EXISTING DEVICE
RTU	ROOF TOP UNIT
TBB	TELEPHONE BACKBOARD
TBL	TELEPHONE
TYP	TYPICAL
UG	UNDERGROUND
U.O.N.	UNLESS OTHERWISE NOTED
V	VOLTAGE
WW	WARM WHITE
WP	WEATHERPROOF



MOUNTING HEIGHT OVER OBSTRUCTION DETAIL

SCALE NONE 1

- 1" CABLE 4 PAIR #24 UTP CAT 6 CABLE
--- T1 --- 3/4" C WITH ONE 1" CABLE
- DATA OUTLET BOX, +18" OR AS NOTED, 1" CONDUIT STUB TO CEILING SPACE, W/ CAT 6 TO IDF ROOM, 2 INDICATE NUMBER OF OUTLET & CABLES.
- TELEPHONE OUTLET, WALL MTD, +54" AFF W/1"C. STUB TO CEILING SPACE WITH CAT 6 CABLE TO IDF ROOM
- COMBINATION VOICE/DATA OUTLET, +18" OR AS NOTED, 1 1/2" CONDUIT STUB TO CEILING SPACE, W/ VGA & HDMI CABLES TO IDF ROOM.
- PVM-220 INSTALLED IN T-BAR CEILING W/ 120 VOLT. PROVIDE CABLES PER SPEC 11 00 00.
- SECURITY DOOR ALARM SWITCH. PROVIDE CABLES 5#22 AWG OVERALL SHIELD CMR.
- SECURITY CEILING MOUNTED MOTION DETECTOR 360'. PROVIDE CABLES 5#22 AWG OVERALL SHIELD CMR
- AUDIO/VISUAL SPEAKER AND CABLES PER SPEC 11 00 00.
- WALL CLOCK, PROVIDE CAT 6.
- EMERGENCY PA CALL BUTTON, +48"A.F.F. PROVIDE CABLES UTP #24.
- TV OUTLET IN 5" SQ BOX AND I-GANG RING. PROVIDE HDMI CABLES.
- TELEPHONE BACKBOARD W/ #6 GROUND WIRE TO NEAREST ELECTRICAL PANEL GROUND LUG.
- SPEAKER/BACKBOX, CEILING MOUNT AND CABLES PER SPEC 11 00 00.

ARCHITECTS

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DIV. OF THE STATE ARCHITECT
OFFICE OF REGULATION SERVICES

APPL03-115771

FILE:19-1H4

KEY PLAN

REVISION SCHEDULE

NO	DATE	DESCRIPTION
02/17/2014		100% DESIGN DEVELOPMENT
05/08/2014		90% CD PROGRESS
05/29/2014		DSA SUBMITTAL
04/08/2015		DSA BACK CHECK
12/12/2015		ADDENDUM 1
04/08/2016		ADDENDUM 2
05/08/2016		ADDENDUM 5

DRWN: JP CHKD: PA/RO
DATE: 04/08/2015 SCALE:
PROJECT NUMBER: 1310700

SYMBOL LIST & NOTES

DRAWING NUMBER: **E0.1**

S:\PROJECTS\2013 Jobs\13.021 Rowland Heights HS-Renovations\CAD\VE-ED-1-ED-1-SYMBOL LIST AND NOTES.dwg

GENERAL NOTES

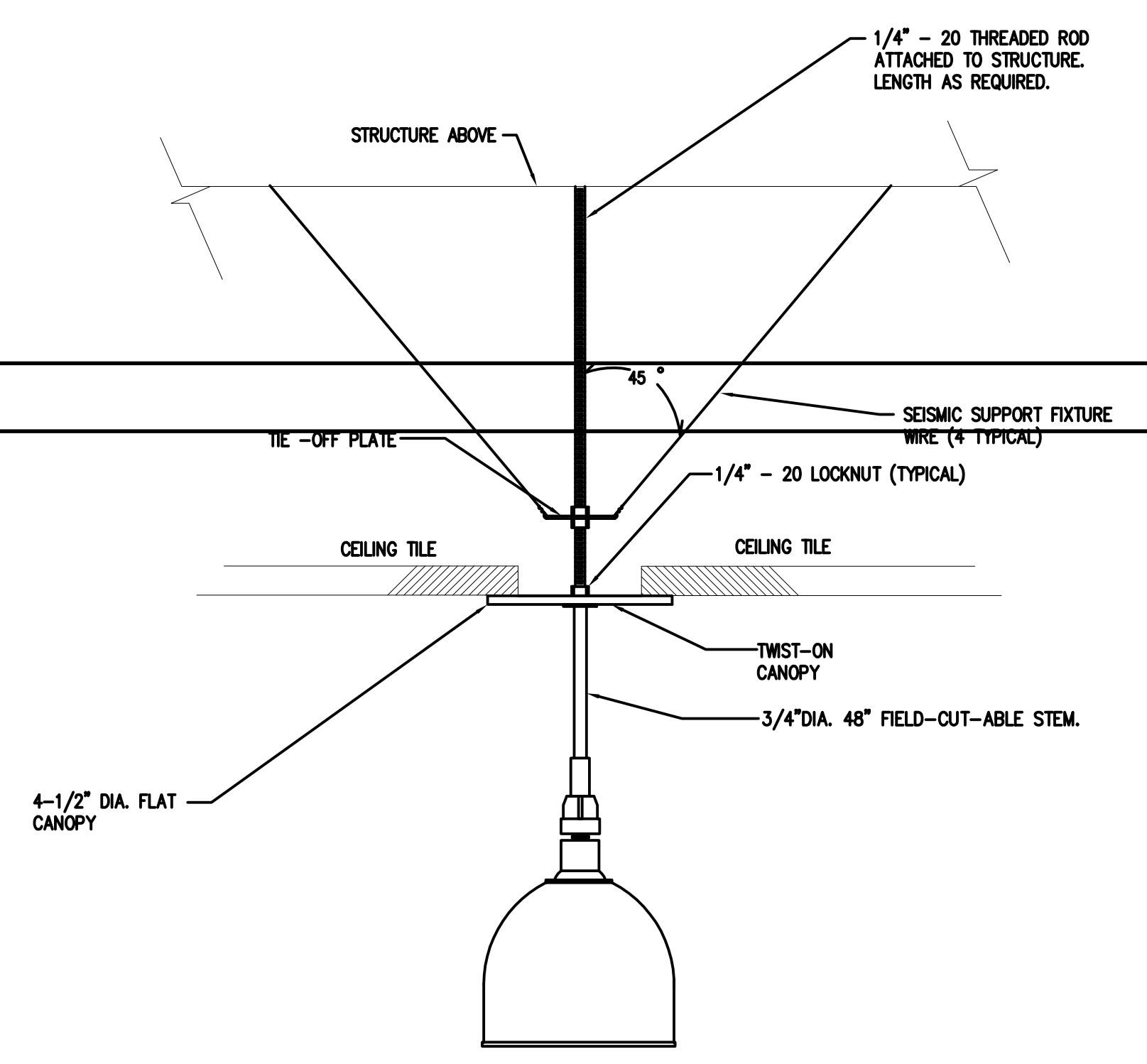
1. FIXTURES SHALL HAVE APPROPRIATE UL LABEL, DAMP, OR WET AS REQUIRED BY LOCAL CODES.
2. FIXTURES SHALL INCLUDE ACCESSORIES FOR INSTALLATION ACCORDING TO LOCAL AND NATIONAL CODES.
3. LAMP TYPES, INCLUDING LUMEN OUTPUT, COLOR RENDERING INDEX, DISTRIBUTION, AND COLOR TEMPERATURE SHALL BE ORDERED AND INSTALLED.
4. CONTRACTOR SHALL VERIFY FINAL VOLTAGES PRIOR TO RELEASE OF ORDER.
5. CONTRACTOR SHALL VERIFY AND / OR CONFIRM CEILING MATERIAL COMPATIBILITY PRIOR TO RELEASE OF FIXTURE ORDER.
6. CEILING THICKNESS IN EXCESS OF 3/4" SHALL BE IDENTIFIED IN WRITING BY CONTRACTOR OR ARCHITECT.
7. FIXTURES SHALL BE ORDERED WITH THE APPROPRIATE BALLASTS THAT HAVE UL AND CBM LABELS. BALLASTS SHALL CONFORM TO LOCAL ENERGY CODE, IF ANY, REQUIREMENTS FOR PERFORMANCE, SWITCHING, AND WIRING (E.G. TANDEM).
8. RESPONSIBILITY FOR EMERGENCY LIGHTING, CALCULATIONS, AND CIRCUITING TO MEET CODE CONFORMANCE REMAINS WITH THE ARCHITECT AND ELECTRICAL ENGINEER AS REQUIRED BY LAW.
9. ALL FLUORESCENT BALLASTS ARE TO BE ELECTRONIC, PROGRAMMED-START WITH <10% THD (MAXIMUM) U.O.N.
10. ALL LAMP SOCKETS SHALL BE PERMANENCY LABELED IN FACTORY WITH DESIGNED WATTAGES (PER THIS DOCUMENT), NOT MAXIMUM WATTAGES.

LIGHT FIXTURE SCHEDULE

TYPE	SYMBOL	DESCRIPTION	MANUFACTURER AND CATALOG #	NUMBER OF LAMPS AND TYPE	SYSTEM WATTS	VOLT	MOUNTING	REMARKS
A		RECESSED 2'x4' LIGHT FIXTURE	LITHONIA 2FSL4 SERIES OR APPROVED EQUAL-LSI	LED	52	277	RECESSED	OFFICES, CLASSROOMS
AE		SAME AS TYPE "A" EXCEPT ON EMERGENCY CIRCUIT (INVERTER)	LITHONIA 2FSL4 SERIES OR APPROVED EQUAL-LSI	LED	52	277	RECESSED	OFFICES, CLASSROOMS
AS		SAME AS TYPE "A" EXCEPT 120V	LITHONIA 2FSL4 SERIES OR APPROVED EQUAL-LSI	LED	52	120	RECESSED	SPECIAL EDUCATION BUILDING
ASE		SAME AS TYPE "AS" EXCEPT PROVIDE SELF CONTAINED WITH EMERGENCY BATTERY PACK (1400 LUXEN)	LITHONIA 2FSL4 SERIES OR APPROVED EQUAL-LSI	LED	52	120	RECESSED	SPECIAL EDUCATION BUILDING
B		6" RECESSED DOWNLIGHT	LITHONIA EVO 35/18 6AR SERIES OR APPROVED EQUAL-PEACHTREE	LED	37	277	RECESSED	CORRIDORS AND OTHER COMMON AREAS
C		4" RECESSED DOWNLIGHT	LITHONIA EVO 35/18 6AR SERIES OR APPROVED EQUAL-PEACHTREE	LED	29	277	RECESSED	ADMIN COUNTERS
D		PENDANT MOUNTED DIRCT/INDIRECT STACK LIGHT FIXTURE. FINISH SELECTED BY ARCHITECTURE	PEERLESS R04M 220/40 ASO SERIES OR APPROVED EQUAL-METALUMEN	LED	60	277	PENDANT, LENGTH AS SHOWN ON PLANS	LIBRARY BOOK STACKS
E		6" RECESSED VANDAL RESISTANT DOWNLIGHT FIXTURE. FINISH SELECTED BY ARCHITECTURE	GOTHAM EVO VR 35/18 PCU SERIES OR APPROVED EQUAL-PEACHTREE	LED	38	277	RECESSED	SEE DETAIL 1/E0.2
EE		SAME AS TYPE "E" EXCEPT PROVIDE ON EMERGENCY CIRCUIT (INVERTER)	GOTHAM EVO VR 35/18 PCU SERIES OR APPROVED EQUAL-PEACHTREE	LED	38	277	RECESSED	EXTERIOR CANOPIES
ES		SAME AS TYPE "E" EXCEPT 120V	GOTHAM EVO VR 35/18 PCU SERIES OR APPROVED EQUAL-PEACHTREE	LED	38	120	RECESSED	EXTERIOR CANOPIES
ESM (NOT USE)		SAME AS TYPE "ES" EXCEPT PROVIDE SELF CONTAINED WITH EMERGENCY BATTERY PACK	GOTHAM EVO VR 35/18 PCU SERIES OR APPROVED EQUAL	LED	38	120	RECESSED	EXTERIOR CANOPIES
F		SURFACE MOUNTED 1'x4' (NOMINAL) VOLUMETRIC FIXTURE. WHITE FINISH	LITHONIA STL4 48L D40 LP835 SERIES LED-80 OR APPROVED EQUAL-LSI	LED	40	277	SURFACE CEILING	SUPPORT SPACES
FS		SAME AS TYPE "F" EXCEPT 120V	LITHONIA STL4 48L D40 LP835 SERIES LED-80 OR APPROVED EQUAL-LSI	LED	40	120	SURFACE CEILING	SUPPORT SPACES
G		SURFACE MOUNTED 2'x4' WRAPAROUND FIXTURE. CURVED PRISMATIC DIFFUSER. WHITE FINISH.	LITHONIA LBL4LP835 SERIES OR APPROVED EQUAL-LSI	LED	50	277	SURFACE OR PENDANT MOUNTED AS INDICATED ON PLANS	SUPPORT SPACES
H		PENDANT MOUNTED HIGH-BAY FIXTURE WHITE PRISMATIC GLASS REFRACTOR, 18.9 DIA., 24.1: HT.	WILA LIGHTING P6608441680 OR APPROVED EQUAL-DELRAY	LED	32	277	PENDANT	MULTI-PURPOSE HIGH CEILING
J		8'-0" LED STRIP WITH WIRE GUARD	LITHONIA #ZLN 8" TANDEM MVOLT OR APPROVE EQUAL-LSI	LED	82	MVOLT		UTILITY
K		SAME AS TYPE "J" EXCEPT 4'-0"		LED	41	MVOLT		UTILITY
L		SAME AS TYPE "J" EXCEPT 2'-0"		LED	32	MVOLT		UTILITY
M		2'x4' RECESSED LED TROFFER	LITHONIA LTO #20TL4 OR APPROVED EQUAL-LSI	LED	44.4	277		KITCHEN
N		TRI-BAND LOUVERED SCONCE. DIRECT/INDIRECT ILLUMINATION	PROGRESS LIGHTING P7103, BLACK	INCANDESCENT	100	120	WALL	THEATER
P2		2 HEAD (180 DEGREE) PARKING LOT LIGHTING FIXTURE. ON 25'-0" STRAIGHT ROUND STEEL POLE DISTRIBUTION TYPE AS SHOWN ON PLANS. FINISH SELECTED BY ARCHITECT.	LITHONIA MR2 LED 60C 1000-40K-13M OR APPROVED EQUAL-LSI	LED	412	277	25' POLE ON 30" HIGH CONCRETE POLE BASE. SEE DETAIL 5/E7.1.	PARKING LOT
P4		4 HEAD (90 DEGREE) PARKING LOT LIGHTING FIXTURE. ON 25'-0" STRAIGHT ROUND STEEL POLE DISTRIBUTION TYPE AS SHOWN ON PLANS. FINISH SELECTED BY ARCHITECT.	LITHONIA MR2 LED 60C 1000-40K-13M OR APPROVED EQUAL-LSI	LED	824	277	25' POLE ON 30" HIGH CONCRETE POLE BASE. SEE DETAIL 5/E7.1.	PARKING LOT
X		LED EDGE LIT EXIT SIGN WITH RED LETTERS. PROVIDE SINGLE OR DOUBLE FACE WITH DIRECTIONAL CHEVRONS AND MOUNTING AS INDICATED ON PLANS	LITHONIA LRP SERIES OR APPROVED EQUAL-EMERG-LITE	LED	18,3.4	277	SURFACE CEILING OR WALL AS INDICATED ON PLANS	EXIT EGREES PATHS
XL		LOW LEVEL EXIT SIGN NON POWERED						CORRIDORS AND OTHER COMMON AREAS
WA		FLUOR WITH ANGLED LENS FACE	LITHONIA VDC 232 GEB101S OR APPROVE EQUAL-NEWSTAR	2 (32) T8	100	MVOLT	WALL	STAGE THEATRE
WB		FLUOR STRIP LIGHT	LITHONIA EJS232 GEB101SWGL-MVOLT OR APPROVE EQUAL-LSI	2 (32) T8	60	MVOLT	SURFACE	CATWALK
WC		VAPORPROOF LED JELLY JAR W/CAST GUARD	RAB LIGHTING VXBRLD130G MVOLT OR APPROVE EQUAL-LSI	LED	15	MVOLT	WALL	CORRIDOR
WD		ROUGH SERVICE LENS LINEAR FLUOR	LITHONIA VWC 232GEB101S OR APPROVE EQUAL-NEWSTAR	2 (32) T8	60	MVOLT	SURFACE	STAGE
WE		ROUGH SERVICE DEEP CUT-OFF WALL PACK W/ BLUE INCANDESCENT LAMP	BETA LIGHTING BSPRCHDS 060INC208K	40A19 BLUE	60	120	WALL	THEATER
WF		TRACK MOUNTED HALOGEN ACCENT LIGHT	HALO LT62 ACCESSORY L1962 BARN DOORS OR APPROVE EQUAL-AMERLUX	50PAR20H FL25	50	120	SURFACE	AUDIO ROOM
HA		RECESSED DMX ROM CONTROLLED LED DOWNLIGHT	AQUARI AX7530 9018RMB40	LED	75	120	RECESSED	THEATER
HB		DMX/ROM CONTROLLED LED DOWNLIGHT	GOTHAM EVO 30/10 6AR-WD-LD-EDG8-CR90 11.8W, MVOLT	LED	14.1	MVOLT	SURFACE	AUDITORIUM SIDE-WALKWAYS
WG		SURFACE MOUNTED INCANDESCENT STRIP LIGHT W/ SOCKET 12" ON CTR.	CELESTIAL LIGHTING BOL 1000MB25 APPROVE EQUAL-AIRY THOMPSON	INCANDESCENT	25PLT	120	SURFACE	DRESSING ROOM
HC		DEEP CUT-OFF LED DOWNLIGHT	GOTHAM EVO 30/10 6AR-WD-LD-ECO S2-CR90 11.8W, 120V	LED	100	MVOLT	RECESSED	SOUND/LIGHT LOOKS VESTIBULES
HD		VOLTAIRE ARCHITECTURAL LIGHT	WILLIAMS OUTDOOR LIGHTING VF1-LED-30/750-STR-PC	LED	34	MVOLT	SURFACE	THEATER FIRST FLOOR
HE		LUMIERE EON WALL MOUNTED	LUMIERE LIGHTING 303-W2-LED23000-UNV-14-12-12-12-12-12-12-12	LED	15.5	UNIV	WALL MOUNTED	ELEVATOR TOWER A001
CYH		12' POLE FIXTURE	USA ARCHITECTURE LTD. #VPR-R-WLED-VSQ-PC-277 OR APPROVE EQUAL-LSI	LED	70	277	12' POLE	COURTYARD FINISH BY ARCHITECT
CYL		12' POLE FIXTURE	USA ARCHITECTURE LTD. #VPR-R-WLED-VSQ-PC-120 OR APPROVE EQUALFINISH OR APPROVE EQUAL-LSI	LED	70	120	12' POLE	COURTYARD FINISH BY ARCHITECT
CY1		GROUND MOUNT FLOOR LUMINAIRE	LITHONIA LTG D-SERIES SIZE 3# DSX3 LED-BP1-40K-WF-THK-VG OR APPROVE EQUAL-LSI	LED	129	MVOLT	GROUND MOUNT	BLDG. SIGN LETTERING (THEATER BUILDING)
CY2		GROUND MOUNT FLOOR LUMINAIRE	LITHONIA LTG D-SERIES SIZE 2#DSX2-LED-4A530/40K-NSP-THK-VG OR APPROVE EQUAL-LSI	LED	74	MVOLT	GROUND MOUNT	WALL WASHER (BUILDING A)
CY3		WALL MOUNT LUMINAIRE	LITHONIA LTG #1W61-1-50K-MVOLT-PE OR APPROVE EQUAL-LSI	LED	35	MVOLT	WALL MOUNT	SE BUILDING
"LE"		SURFACE	GAMMALUX#GB6602-1S0LED40-UNV-DVR-4'6'8'10'12'SF-ASLMD-FIN. BY ARCH-20KT	LED	4'-38W 6'-42W 8'-64W 10'-80W 12'-96W	UNIV	SURFACE IN CEILING ALCOVE	LOBBY THEATER

LIGHT FIXTURE SCHEDULE (CONTINUATION)

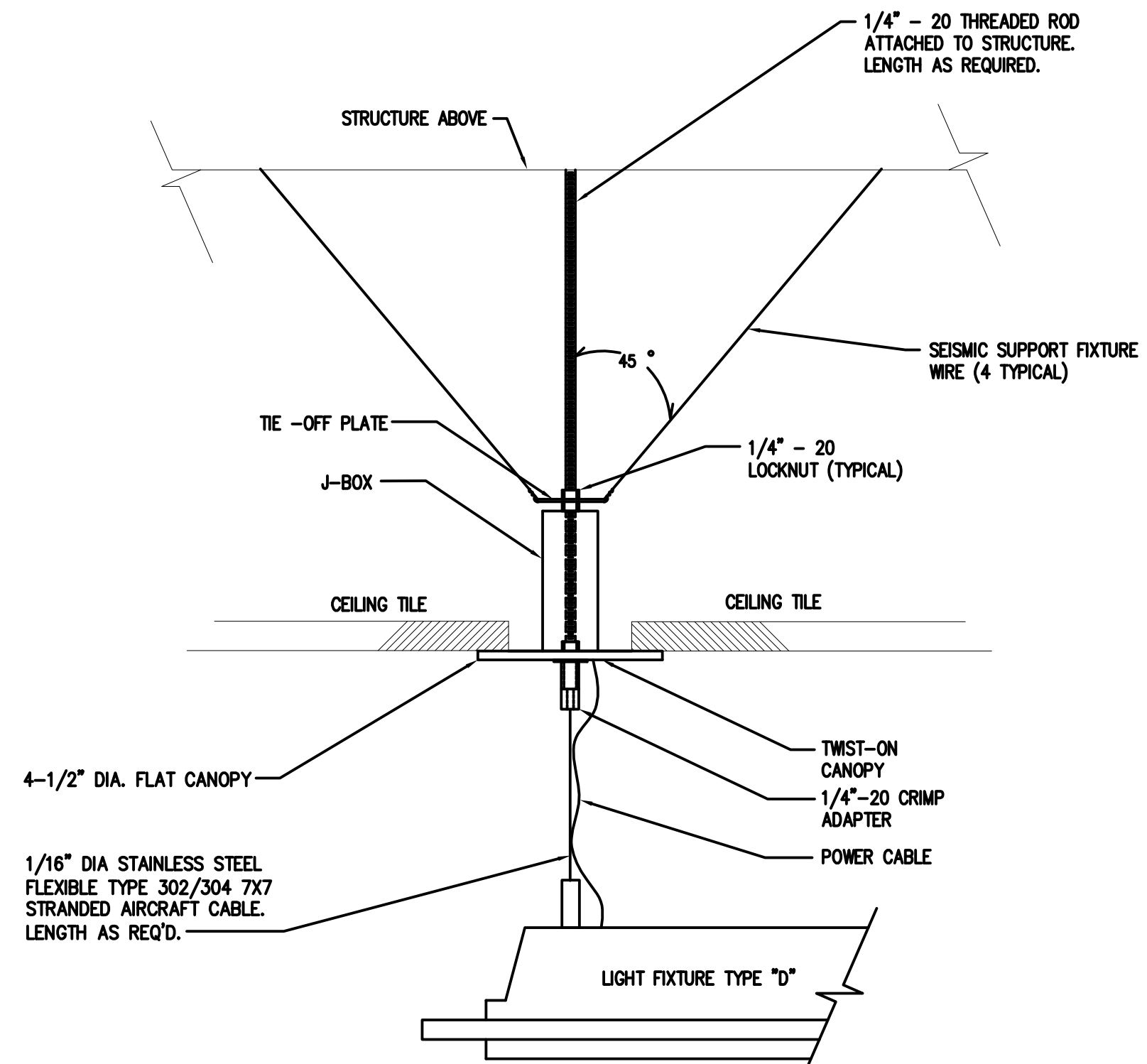
TYPE	SYMBOL	DESCRIPTION	MANUFACTURER AND CATALOG #	NUMBER OF LAMPS AND TYPE	SYSTEM WATTS	VOLT	MOUNTING	REMARKS
V		4' FIXTURE, 8 LAMP HOLDERS, 6" O.C.	AIRY-THOMPSON RM SERIES DECORATIVE STRIP LIGHTING CANDELABRA BASE LAMPS	8 (60W)	480	120	WALL	THEATRE-VANITY
BB		6" LED PENDANT CYLINDER	WILA LIGHTING CAT # P608-869-CFP-FIN BY ARCHITECT	LED	55W	277	PENDANT + 7'-6" FROM THE BOTTOM OF FIXTURE TO FIN. FLOOR	MOUNTING ELEVATION SHOULD BE ADJUSTED IN FIELD TO FLUSH WITH THE SURFACE OF METAL CEILING-READING AREA



- NOTES:
1. ATTACH ROD/HANGER WIRES TO STRUCTURE AS PER STRUCTURAL & ARCHITECTURAL DETAILS.
 2. PROVIDE ROD STIFFENER AS REQUIRED FOR SEISMIC BRACING.
 3. PROVIDE FACTORY SUPPLIED MOUNTING SUPPORT AND ACCESSORIES.

PENDANT MOUNTING TYPE "H" FIXTURE

NOT TO SCALE 2



- NOTES:
1. ATTACH ROD/HANGER WIRES TO STRUCTURE AS PER STRUCTURAL & ARCHITECTURAL DETAILS.
 2. PROVIDE ROD STIFFENER AS REQUIRED FOR SEISMIC BRACING.
 3. PROVIDE FACTORY SUPPLIED MOUNTING SUPPORT AND ACCESSORIES.

PENDANT MOUNTING TYPE "D" FIXTURE

NOT TO SCALE 1

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KEY PLAN

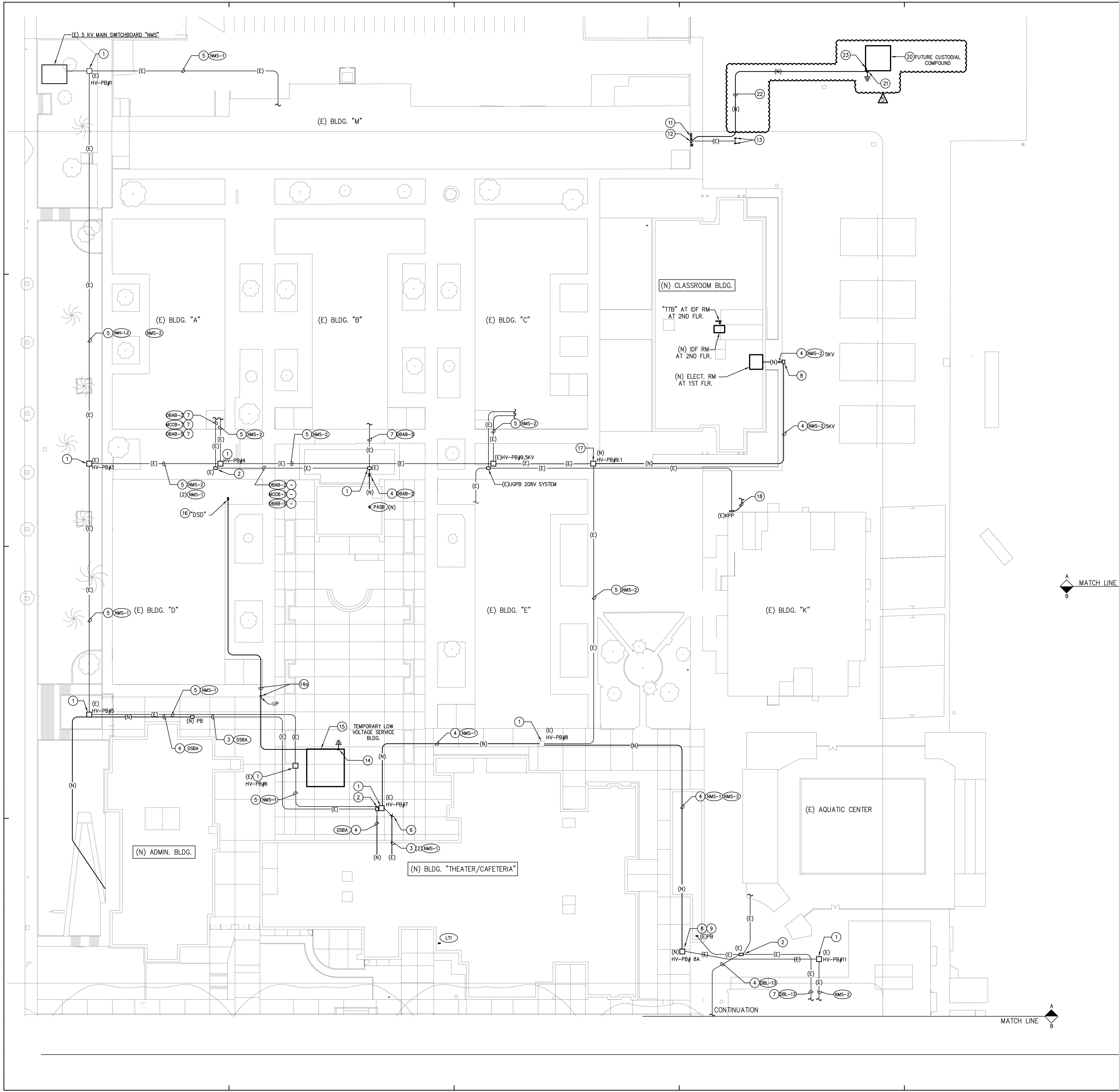
REVISION SCHEDULE

NO	DATE	DESCRIPTION
02/17/2014		100% DESIGN DEVELOPMENT
05/08/2014		90% CD PROGRESS
05/29/2014		DSA SUBMITTAL
04/08/2015		DSA BACK CHECK
12/12/2015		ADDENDUM 1
04/08/2016		ADDENDUM 2
05/08/2016		ADDENDUM 5

DRWN: JP CHKD: PA/RO
DATE: 04/08/2015 SCALE:
PROJECT NUMBER: 1310700

LIGHTING FIXTURE SCHEDULE AND NOTES

DRAWING NUMBER: **E0.2**

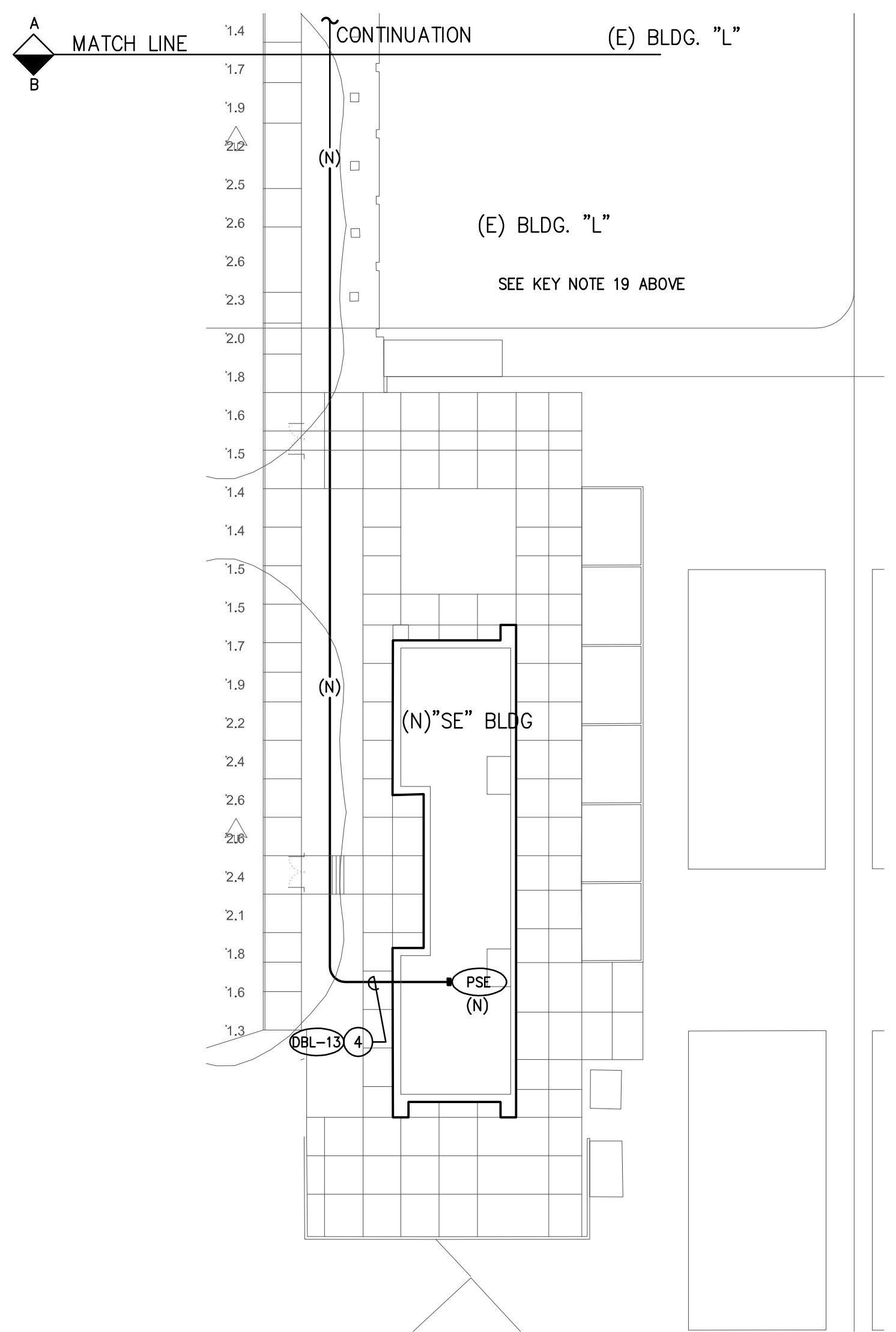


GENERAL PLAN NOTES:

1. ARCHITECTURAL SITE LEGEND REFER TO SHEET A1.1.
2. PATCH AND REPAIR ALL NEW TRENCHING TO MATCH EXISTING.
3. RUN ALL NEW UNDERGROUND CONDUIT BELOW FOUNDATION.

POWER PLAN NOTES:

1. EXISTING SKV UNDERGROUND PULL BOX TO REMAIN. SEE DETAIL (E) 7/ET1.
2. EXISTING 208 POWER SYSTEM UNDERGROUND PULL BOX TO REMAIN AND TO BE USED FOR NEW 480V POWER SYSTEM. RESET BOXES TO MATCH NEW GRADE.
3. EXISTING CONDUIT WITH NEW CONDUCTORS.
4. NEW 4" C, 3#4/0 + 1#2 GROUND (SKV).
5. (E) 4" C, - 3#4/0, 1#2 GROUND (SKV).
6. EXISTING CONDUIT(S) & CONDUCTORS TO BE REMOVED TO BE CLEAR OF CONSTRUCTION. "X" INDICATES APPROXIMATE LOCATION TO CLEAR NEW CONSTRUCTION AND SHALL BE VERIFIED AT TIME OF CONSTRUCTION. EXISTING CONDUIT(S) SHALL BE EXTENDED, SEE E1.1.
7. EXISTING CONDUIT AND CONDUCTORS TO REMAIN.
8. NEW SKV UNDERGROUND PULL BOX, PROVIDE AS REQUIRED MATCH EXISTING.
9. INTERCEPT EXISTING UNDERGROUND CONDUITS AT THIS POINT, VERIFY EXACT LOCATION IN FIELD AND PROVIDE AS REQUIRED.
10. NEW 480V POWER SYSTEM UNDERGROUND PULL BOX, MATCH EXISTING.
11. EXISTING OUTDOOR SERVICE BOARD TO REMAIN 400A, 120/240V, 3PHASE, 3W WITH 400A/3P MCB & (6) 100A/2P BRANCHES, FEEDING EXISTING PORTABLE P21-P26.
12. EXISTING OUTDOOR DISTRIBUTION BOARD TO REMAIN 400A, 120/208V, 3PHASE, 4W WITH 400A/3P MCB & (2) 70A/3P, (1) 100A/3P, (2) 200A/3P BRANCHES, FEEDING EXISTING PORTABLE P13-P20.
13. EXISTING PANELBOARD TO REMAIN, PROVIDE REQUIRED MOUNTING SUPPORT. MAINTAIN CONTINUITY OF ALL PORTABLE TO REMAIN SEE DEMO PLAN E1.2D.
14. PROVIDE NEW PNL "TP" IN TEMPORARY LV BUILDING. REFER TO SINGLE LINE DIAGRAM ON E5.1 7 PANEL SCHEDULE ON E5.4.
- 14a. PROVIDE NEW 12" X 12" X 4" WP PULBOX, RUN CONDUIT IN CANOPY AS SHOWN TO (E) DIST. BOARD "DSB".
15. REFER TO ENLARGED PLAN ON E1.3.
16. EXISTING DISTRIBUTION BOARD "DSD" IN ELECTRIC ROOM BLDG. D, REFER TO SINGLE LINE DIAGRAM ON E5.1.
17. PATCH SURFACES AT HV/PB #9.1.
18. PROVIDE POWER FOR TEMPORARY FOOD SERVICE AS SHOWN, VERIFY LOCATION AND ELECTRICAL REQUIREMENTS WITH THE DISTRICT AND PROVIDE AS REQUIRED.
19. PROVIDE POWER FOR TEMPORARY ADMIN RESTROOM TRAILERS SOUTH OF GYM FEED IT FROM EXISTING "DBL". VERIFY LOCATION AND ELECTRICAL REQUIREMENTS WITH THE DISTRICT AND PROVIDE AS REQUIRED.
20. COORDINATE EXACT LOCATION OF FUTURE CUSTODIAL BUILDING WITH SCHOOL DISTRICT ARCHITECT.
21. PROVIDE 125A/3P OUTDOOR TYPE MAIN DISCONNECT BREAKER AT 208/120V, 3PHASE, 4WIRE, 22KAC AND 3/4" C, 1 #6 GROUND WIRE BOND TO 3/4" X 10' LONG COPPER CLAD GROUND ROD.
22. PROVIDE 2" UNDERGROUND CONDUIT WITH 4 #1/0 + 1 #6 GROUND AND 125A/3P BREAKER (MATCH EXISTING AIC) TO EXISTING SERVICE BOARD (SEE NOTE 12 ABOVE).
23. PROVIDE NEW 42 CIRCUIT PANEL WITH 125A/3P MAIN CIRCUIT BREAKER, SURFACE MOUNT, 22KAC RATINGS.



SITE POWER PLAN
1
1" = 30'-0"

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KEY PLAN

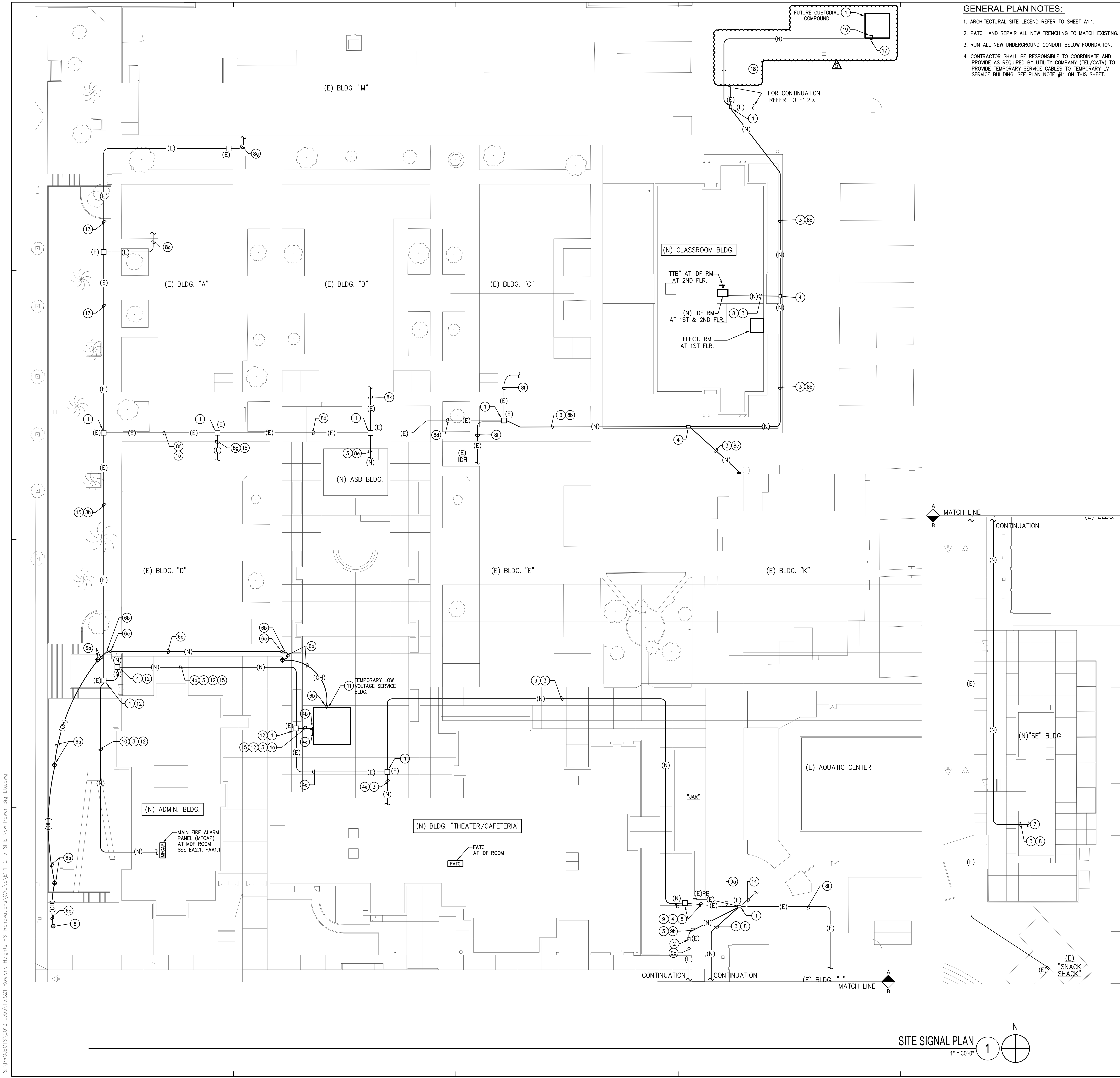
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05/08/2016	ADDENDUM 5	

DRWN: JP CHKD: PA/RO
DATE: 04/08/2015 SCALE:
PROJECT NUMBER: 1310700

SITE POWER PLAN
E1.1

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GENERAL PLAN NOTES:

1. ARCHITECTURAL SITE LEGEND REFER TO SHEET A1.1.
2. PATCH AND REPAIR ALL NEW TRENCHING TO MATCH EXISTING.
3. RUN ALL NEW UNDERGROUND CONDUIT BELOW FOUNDATION.
4. CONTRACTOR SHALL BE RESPONSIBLE TO COORDINATE AND PROVIDE AS REQUIRED BY UTILITY COMPANY (TEL/CATV) TO PROVIDE TEMPORARY SERVICE CABLES TO TEMPORARY LV SERVICE BUILDING. SEE PLAN NOTE #11 ON THIS SHEET.

SIGNAL PLAN NOTES:

1. EXISTING "SIGNAL" UNDERGROUND PULL BOX TO REMAIN. SEE DETAIL (7/ET.1)
2. EXISTING "CCTV" UG PB AND CONDUIT TO "SNACK SHACK" TO REMAIN (1" C, #8+1#10G).
3. NEW UNDERGROUND CONDUIT WITH NEW CABLING.
4. NEW "SIGNAL" UNDERGROUND PULL BOX, PROVIDE AS REQUIRED MATCH EXISTING.
- 4a. (1)2" C.O. (SPARE), 4" C (DATA) W/ (14)12strand SMFO + (14)RG11 4" C (TEL) W/ (9)150, 2" C (FA) CABLES REFER SHEET FA0.6, 3" C (CATV) W/ 12strand SMFO, 2" C (CCTV) W/ 12strand SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 4 #12 & 4 PAIR #22 SHELDED.
- 4b. NEW 24" x 36" x 6" NEMA 3R, WALL MOUNT SIGNAL PULL BOX.
- 4c. NEW 16" x 16" x 6" NEMA 3R, WALL MOUNT FA PULL BOX.
- 4d. EXISTING UG CONDUIT TO REMAIN WITH NEW CABLES U.N.O.:
- 4e. (1)4" C.O. (SPARE), 4" C (TEL) W/ 12strand SMFO, 2" C (FA) CABLES REFER SHEET FA0.6, 3" C (CATV) W/ 12strand SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 4 #12, 4" C (DATA) W/ (1) 12strand SMFO + (5) RG11.
5. INTERCEPT EXISTING UNDERGROUND CONDUITS AT THIS POINT, VERIFY EXACT LOCATION IN FIELD AND PROVIDE AS REQUIRED.
6. EXISTING UTILITY POLE WITH CATV SERVICE TO REMAIN, AND TO BE RE-ROUTED OVERHEAD & RECONNECTED TO TEMPORARY ADMINISTRATION OFFICE. CONTRACTOR SHALL REMOVE POLE AND OVERHEAD CATV SERVICE CONDUCTORS COMPLETE AFTER TEMPORARY ADMINISTRATION BUILDING IS FULLY OPERATIONAL. REFER TO PLAN NOTE 4 ON DEMO PLAN SHEET E1.2D.
- 6a. PROVIDE NEW OH LINES PER UTILITY STANDARD ON NEW 30FT WOODEN POLE. COORDINATE INSTALLATION WITH UTILITY COMPANY (CATV/TEL). SEE GEN. NOTE 4.
- 6b. PROVIDE NEW 4" SERVICE HEAD (CATV/TEL) WITH MOUNTING SUPPORT AS REQUIRED.
- 6c. PROVIDE NEW 30" x 24" x 6" NEMA 3R PULLBOX ON TOP OF THE CANOPY ABOVE CANOPY AS SHOWN.
- 6d. 2" C (CATV) W/ 12STRAND SMFO, 4" C (TEL) W/ 3/25 & 2" C (TEL) W/ 12STRAND SMFO RUN ABOVE CANOPY.
- 6e. REFER TO ENLARGED PLAN ON ES.4.
7. FOR CONTINUATION REFER TO SHEET ES.2.1.
8. (1)4" C.O. (SPARE), 4" C (TEL) W/ 1150, 2" C (FA) CABLES REFER SHEET FA0.6, 3" C (CATV) W/ 12strand SMFO, 2" C (CCTV) W/ 12strand SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 4 #10 & 4 PAIR #22 SHELDED, 2" C (DATA) W/ (1) 12strand SMFO + (1)RG11.
- 8a. 2" C (TEL) W/ (1)150, 2" C (FA) CABLES REFER SHEET FA0.6, 2" C (CATV) W/ RG11, 2" C (CCTV) W/ (5) 4 PAIR #24 UTP CAT 6, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 4 #10 & 2 PAIR #22 SHELDED, 2" C (DATA) W/ (1) 12strand SMFO + (1)RG11.
- 8b. (1)4" C.O. (SPARE), 4" C (DATA) W/ (3)12strand SMFO + (3)RG11, 4" C (TEL) W/ (3)150, 2" C (FA) CABLES REFER SHEET FA0.6, 3" C (CATV) W/ 12strand SMFO & RG11, 2" C (CCTV) W/ 12strand SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 4 #10.
- 8c. (1)3" C.O. (SPARE), 2" C (DATA) W/ (1) 12SMFO + (1)RG11, 4" C (TEL) W/ (1)150, 2" C (FA) CABLES REFER SHEET FA0.6, 2" C (CATV) W/ 12SMFO & RG11, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 8 #10.
- 8d. EXISTING UG CONDUIT TO REMAIN WITH NEW CABLES U.N.O.:
- 8e. (1)4" C.O. (SPARE), 4" C (DATA) W/ (7)12SMFO + (7)RG11, 4" C (TEL) W/ (7)150, 2" C (FA) CABLES REFER SHEET FA0.6, 3" C (CATV) W/ 12SMFO & RG11, 2" C (CCTV) W/ 12SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 4 #12.
- 8f. (1)3" C.O. (SPARE), 2" C (TEL) W/ 1150, 2" C (FA) CABLES REFER SHEET FA0.6, 2" C (CATV) W/ 12SMFO, 2" C (CCTV) W/ 12SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 4 #10, 3" C (DATA) W/ (1) 12SMFO + (1)RG11.
- 8g. EXISTING UG CONDUIT TO REMAIN WITH NEW CABLES U.N.O.:
- 8h. (1)4" C.O. (SPARE), 4" C (DATA) W/ (8)12SMFO + (8)RG11, 4" C (TEL) W/ (8)150, 2" C (FA) CABLES REFER SHEET FA0.6, 3" C (CATV) W/ 12SMFO & RG11, 2" C (CCTV) W/ 12SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 8 #10, 3" C (SPARE) W/ 12SMFO.
- 8i. EXISTING UG CONDUIT TO REMAIN WITH NEW CABLES U.N.O.:
- 8j. (1)4" C.O. (SPARE), 4" C (DATA) W/ (9)12SMFO + (9) RG11, 4" C (TEL) W/ (9)150, 2" C (FA) CABLES REFER SHEET FA0.6, 3" C (CATV) W/ 12SMFO & RG11, 2" C (CCTV) W/ 12SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 8 #10.
- 8k. EXISTING UG CONDUIT TO REMAIN WITH NEW CABLES U.N.O.:
- 8l. 3" C (DATA) W/ (1) 12SMFO + (1) RG11, 2" C (TEL) W/ (1)150, 2" C (FA) CABLES REFER SHEET FA0.6, 2" C (CATV) W/ 12SMFO & RG11, 2" C (CCTV) W/ 12SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 10 #12, 3" C (SPARE)
- 8m. EXISTING UG CONDUIT TO REMAIN WITH NEW CABLES U.N.O.:
- 8n. 2" C (TEL) W/ (1)150, 3" C (DATA) W/ (1) 12SMFO + (1) RG11, 2" C (FA) CABLES REFER SHEET FA0.6, 2" C (CATV) W/ 12SMFO, 2" C (CCTV) W/ 12SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 10 #12, 3" C (SPARE)
- 8o. EXISTING UG CONDUIT TO REMAIN WITH NEW CABLES U.N.O.:
- 8p. 4" C (SPARE), 4" C (TEL) W/ (3)150, 2" C (FA) CABLES REFER SHEET FA0.6, 3" C (CATV) W/ 12strand SMFO, 4" C (CCTV) W/ (3)12strand SMFO + (3) RG11.
- 8q. EXISTING UG CONDUIT TO REMAIN WITH NEW CABLES U.N.O.:
- 8r. 3" C (SPARE), 2" C (TEL) W/ (1)150, 2" C (FA) CABLES REFER SHEET FA0.6, 2" C (CATV) W/ 12SMFO & RG11, 2" C (CCTV) W/ 12SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 8 #10, 3" C (DATA) W/ 12strand SMFO + (2) RG11.
- 8s. (1) 2" C.O. (SPARE), 2" C (DATA) W/ 12strand SMFO, 2" C (TEL) W/ (1)150, 2" C (FA) CABLES REFER SHEET FA0.6, 2" C (CATV) W/ 12SMFO & RG11, 2" C (CCTV) W/ 12strand SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 4 #10.
- 8t. EXISTING UG CONDUIT TO REMAIN WITH NEW CABLES U.N.O.:
- 8u. 2" C (DATA) W/ 12strand SMFO, 2" C (TEL) W/ (1)150, 2" C (FA) CABLES REFER SHEET FA0.6, 2" C (CATV) W/ 12strand SMFO & RG11, 2" C (CCTV) W/ 12strand SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 4 #12, 2" C (SPARE).
- 8v. (1)4" C.O. (SPARE), 4" C (TEL) W/ 12strand SMFO CABLE, 4" C (DATA) W/ (24) 12 strand FO CABLE, 3" C (FA) CABLE REFER TO SHEET FA0.6, 3" C (CATV) W/ 12strand FO CABLE, 2" C (EMS) W/ 2 #18 WIRES, 2" C (CLOCK) W/ 8 #10, 4" C (DATA) W/ (24) RG11.
11. TEMPORARY LOW VOLTAGE (LV) BUILDING, REFER TO ENLARGED PLAN ON SHEET E1.3.
12. PROVIDE ADEQUATE LENGTH OF 12STRAND SMFO CABLES (DATA) FROM TEMPORARY LV PORTABLE BUILDING MDF TO BE USED TO RE-CONNECT TO NEW PERMANENT MDF AT NEW ADMIN BLDG.
13. EXISTING UG CONDUIT TO REMAIN WITH NEW CABLES U.N.O.:
- 13a. (2)3" C (SPARE), 2" C (TEL) W/ (2)150, 2" C (FA) CABLES REFER SHEET FA0.6, 2" C (CATV) W/ RG11, 3" C (CCTV) W/ 12strand SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 8 #10, 3" C (DATA) W/ (2) 12strand SMFO + (2) RG11.
14. EXISTING UG CONDUIT TO REMAIN WITH NEW CABLES U.N.O. TO EXISTING AQUATIC CENTER. VERIFY EXISTING
- 14a. 3" C (SPARE), 2" C (TEL) W/ (1)150, 2" C (FA) CABLES REFER SHEET FA0.6, 2" C (CATV) W/ 12SMFO & RG11, 2" C (CCTV) W/ 12SMFO, 2" C (EMS) W/ 2#18 WIRES, 2" C (CLOCK) W/ 8 #10, 3" C (DATA) W/ (1) 12SMFO + (1) RG11.
15. FOR MAIN PA RACK AT TEMP LV BLDG. PROVIDE 2" C WITH (1) 50PAIR CU, 2 #10 (CLOCK) AND 2 #18 (SPEAKER) TO EXISTING BUILDING "D".
16. COORDINATE EXACT LOCATION OF FUTURE CUSTODIAL BUILDING WITH SCHOOL DISTRICT ARCHITECT.
17. PROVIDE SURFACE MOUNT OUTDOOR TYPE PULLBOX 16" X 16" X 6".
18. PROVIDE UNDERGROUND 2" C WITH (1) 12STRAND FIBER OPTIC CABLE FROM IDF TO MDF AT NEW ADMIN BUILDING.
19. PROVIDE WALL MOUNT IDF, COORDINATE PRODUCT SPECIFICATION WITH SCHOOL DISTRICT.

SITE SIGNAL PLAN
1" = 30'-0"

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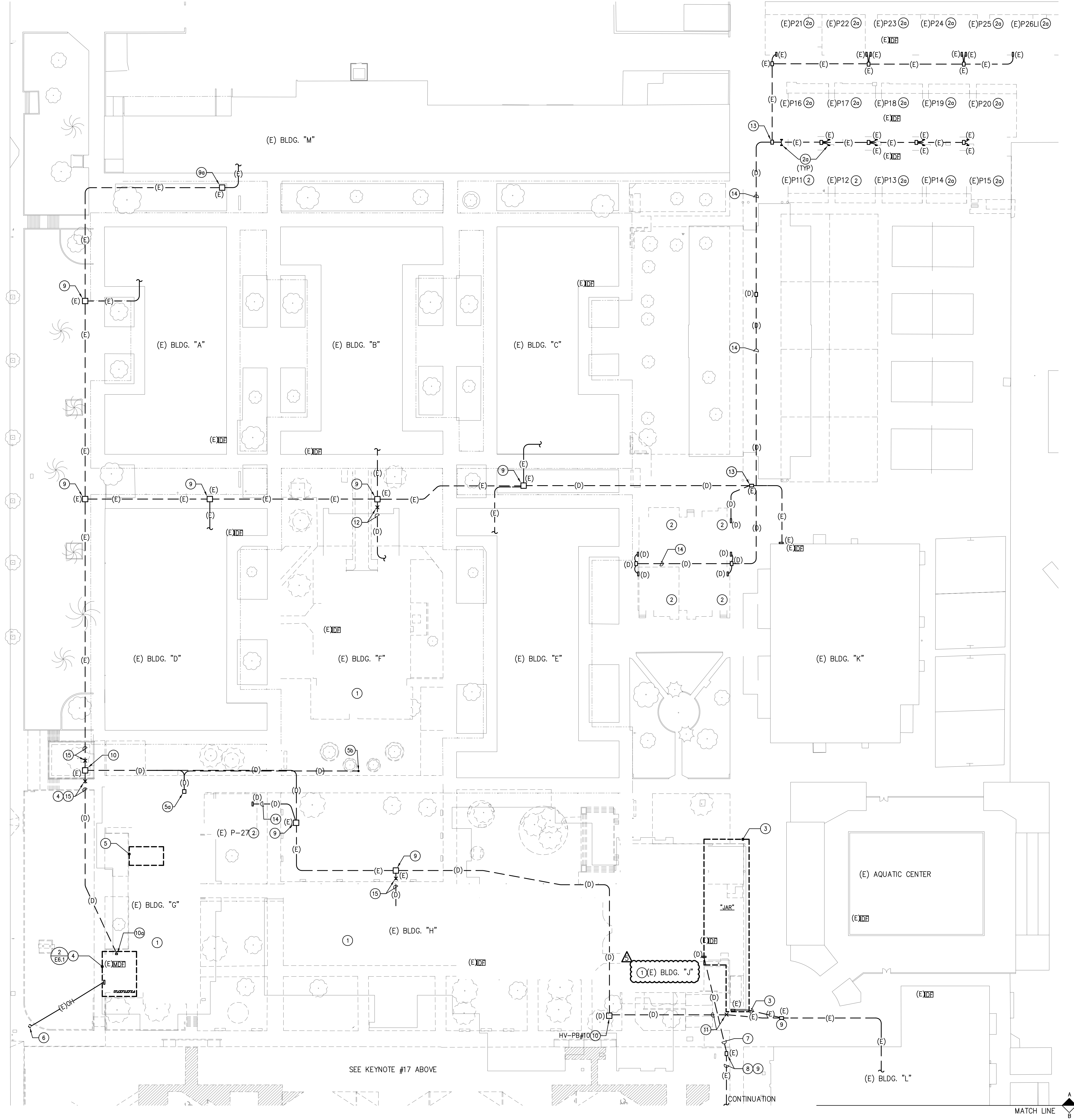
KEY PLAN
[Diagram showing building layout with key plan markers]

REVISION SCHEDULE		
NO	DATE	DESCRIPTION
02/17/2014	100% DESIGN DEVELOPMENT	
05/08/2014	90% CD PROGRESS	
05/29/2014	DSA SUBMITTAL	
04/08/2015	DSA BACK CHECK	
12/12/2015	ADDENDUM 1	
04/08/2016	ADDENDUM 2	
05/08/2016	ADDENDUM 5	

DRWN: JP CHKD: PA/RO
DATE: 04/08/2015 SCALE:
PROJECT NUMBER: 1310700

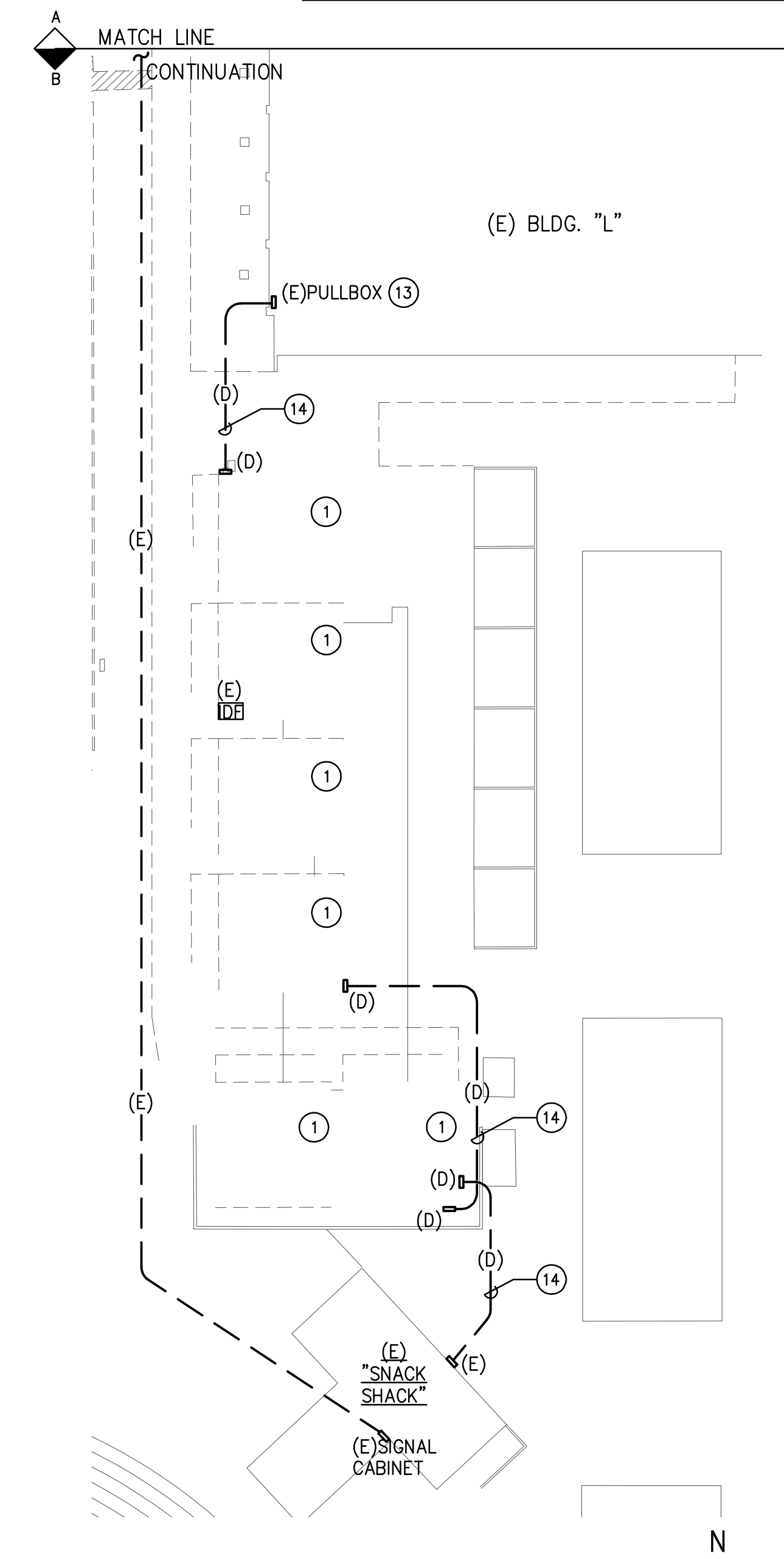
SITE
SIGNAL (LV) PLAN
DRAWING NUMBER: **E1.2**

S:\PROJECTS\2013 Jobs\13.021 Rowland Heights HS-Renovations\CAD\VE\10 SITE DEMO ELECTRICAL.dwg



SIGNAL DEMOLITION NOTES:

- 1 EXISTING BUILDING TO BE DEMOLISHED COMPLETE.
- 2 EXISTING RELOCATABLE BUILDING TO BE REMOVED COMPLETELY. REFER TO SIGNAL RISER DIAGRAM DEMOLITION PLAN ON DETAIL # 1&3 ON SHEET E6.1D.
- 2a EXISTING PORTABLE TO REMAIN. MAINTAIN CONTINUITY OF EXISTING POWER AND SIGNAL CONNECTIONS (P13-P26).
- 3 EXISTING "JAR" BUILDING TO REMAIN. PROTECT IN PLACE ALL EXISTING ELECTRICAL AND SIGNAL SYSTEMS SERVING "JAR".
- 4 EXISTING CAMPUS DATA/FIBER, CLOCK/INTERCOM SYSTEM, CATV SERVICE, TELEPHONE SERVICE, MAIN FIRE ALARM CONTROL PANEL AND SECURITY SYSTEM HEAD END EQUIPMENT. ALL SYSTEMS SHALL REMAIN OPERATIONAL UNTIL A TEMPORARY ADMINISTRATION OFFICE & TEMPORARY SYSTEMS ARE FULLY OPERATIONAL. SEE E1.2.
- 5 EXISTING ADMINISTRATION SERVER. SERVER SHALL REMAIN OPERATIONAL UNTIL A TEMPORARY ADMINISTRATION OFFICE & TEMPORARY SERVER ARE FULLY OPERATIONAL.
- 5a RELOCATE CCTV WITH NEW CONDUIT AND CABLES TO NEW TEMPORARY LV BLDG. SEE E1.2.
- 5b REMOVE CCTV CAMERA AND ASSOCIATED CONDUIT AND CABLES.
- 6 EXISTING UTILITY POLE WITH CATV, TELEPHONE SERVICE TO REMAIN, AND TO BE RE-ROUTED OVERHEAD & RECONNECTED TO TEMPORARY ADMINISTRATION OFFICE. CONTRACTOR SHALL REMOVE POLE AND OVERHEAD CATV SERVICE CONDUITORS COMPLETE AFTER TEMPORARY ADMINISTRATION BUILDING IS FULLY OPERATIONAL. SEE E1.2.
- 7 EXISTING CCTV CONDUIT AND CABLEING TO BE REMOVED WITH EXISTING BUILDING "J" DEMOLITION.
- 8 EXISTING CCTV PULLBOX AND CONDUIT TO "SNACK SHACK" TO REMAIN. REFER TO E1.2.
- 9 EXISTING 4"x4" UNDERGROUND PULLBOX. PROTECT IN PLACE DURING CONSTRUCTION.
- 9a EXISTING 2"x3"x4" UNDERGROUND PULLBOX. PROTECT IN PLACE DURING CONSTRUCTION.
- 10 EXISTING 4"x4" UNDERGROUND PULLBOX TO BE REMOVED TO BE CLEAR OF NEW CONSTRUCTION. REFER TO E1.2.
- 11 EXISTING CONDUITS AND CABLEING TO BE REMOVED TO BE CLEAR OF NEW CONSTRUCTION. "X" INDICATED APPROXIMATE LOCATION TO CLEAR NEW CONSTRUCTION AND SHALL BE VERIFIED AT THE TIME OF CONSTRUCTION. EXISTING CONDUITS SHALL BE EXTENDED, SEE E1.2. CONDUITS AS FOLLOWS:
 (2) 4"C.O. (SPARE), 4"C.(TEL), 2"C (FIRE ALARM), 2"C. (TV), 2"C. (EMS), 2"C. 2"C. (CLOCK).
- 12 EXISTING CONDUITS AND CABLEING TO BE REMOVED TO BE CLEAR OF NEW CONSTRUCTION. "X" INDICATED APPROXIMATE LOCATION TO CLEAR NEW CONSTRUCTION AND SHALL BE VERIFIED AT THE TIME OF CONSTRUCTION. EXISTING CONDUITS SHALL BE EXTENDED, SEE E1.2. CONDUITS AS FOLLOWS:
 (2) 3"C.O. (SPARE), 4"C.(TEL), 2"C (FIRE ALARM), 2"C. (TV), 2"C. (EMS), 2"C. (CCTV), 2"C. (CLOCK).
- 13 REPLACE UG SIGNAL PULL BOX.
- 14 REMOVE EXISTING CONDUIT, CONDUCTORS & ASSOCIATED PULLBOXES COMPLETELY. PATCH SURFACES TO MATCH EXISTING.
- 15 EXISTING CONDUITS AND CABLEING TO BE REMOVED TO BE CLEAR OF NEW CONSTRUCTION. "X" INDICATED APPROXIMATE LOCATION TO CLEAR NEW CONSTRUCTION AND SHALL BE VERIFIED AT THE TIME OF CONSTRUCTION. EXISTING CONDUITS SHALL BE EXTENDED, SEE E1.2.
- 16 EXISTING CONDUITS AND CABLEING TO BE REMOVED TO BE CLEAR OF NEW CONSTRUCTION. "X" INDICATED APPROXIMATE LOCATION TO CLEAR NEW CONSTRUCTION. EXISTING CONDUITS SHALL BE EXTENDED, SEE E1.2.
- 17 RELOCATE EXISTING UNDERGROUND FIRE ALARM COMMUNICATION LINE IN P-Lot SOUTH OF BLDG. "H" 3' OFF THE CURB. PATCH SURFACES TO MATCH EXISTING.



DEMO SITE SIGNAL PLAN
1" = 30'-0"

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KEY PLAN

REVISION SCHEDULE		
NO	DATE	DESCRIPTION
	02/17/2014	100% DESIGN DEVELOPMENT
	05/08/2014	90% CD PROGRESS
	05/29/2014	DSA SUBMITTAL
	04/08/2015	DSA BACK CHECK
▲	12/12/2015	ADDENDUM 1
▲	04/08/2016	ADDENDUM 2
▲	05/08/2016	ADDENDUM 5

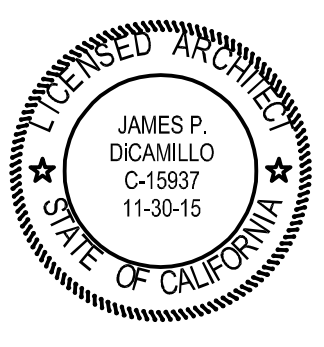
DRWN: JP	CHKD: PA/RO
DATE: 04/08/2015	SCALE:
PROJECT NUMBER: 1310700	

DEMO SITE SIGNAL PLAN

DRAWING NUMBER: **E1.2D**

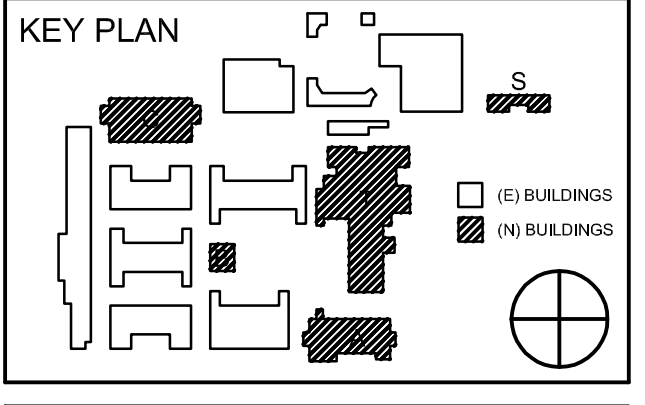
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REVISION SCHEDULE

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05/08/2014	90% CD PROGRESS	
05/29/2014	DSA SUBMITTAL	
04/08/2015	DSA BACK CHECK	
12/12/2015	ADDENDUM 1	
04/08/2016	ADDENDUM 2	
05/06/2016	ADDENDUM 5	

DRWN: JP CHKD: PA/RO
 DATE: 04/08/2015 SCALE:
 PROJECT NUMBER: 1310700

PANEL SCHEDULES
ADMIN BUILDING

DRAWING NUMBER: **E5.4**

PANEL : LA1 Location: Main: Elect Room 300 A Bus Rating Amps 400 Volts/Phase/Wires: 208 / 120 3 / 4 Mounting: SURFACE

LOAD INFORMATION	LOAD	CB RATINGS/POLES	VOLTTAMPS	LOAD INFORMATION	LOAD	CB RATINGS/POLES	VOLTTAMPS
ASSEMBLY 1st FLR	L	2,929	1 1 20 A	RECORDS/SECRETARY RECEIPT	4R	20 1 2	532
ASSEMBLY 2nd FLR	L	2,057	1 1 20 B	RECORDS/SECRETARY RECEIPT	4R	20 1 4	518
TRAINING ROOM	L	1,604	2 1 20 C	RECORDS/SECRETARY RECEIPT	4R	20 1 6	1,890
1ST FLR LT	L	1,332	1 1 20 A	HEALTHNURSERRR RECEIPT	4R	20 1 8	638
1ST FLR LT	L	1,484	1 1 20 B	HEALTHNURSERRR RECEIPT	4R	20 1 10	1
CORRIDOR 2nd FLR LTS	L	873	1 1 20 C	HEALTHNURSERRR RECEIPT	4R	20 1 12	1
TOWER LTG	L	53	1 1 20 A	CONFERENCE RECEIPT	4R	20 1 14	1
			15 1 20 B	CONFERENCE RECEIPT	4R	20 1 16	1
			17 1 20 C	CONFERENCE RECEIPT	4R	20 1 18	1
			19 1 20 A	ELEV/CBLT	4R	20 1 20	1
			21 1 20 B	ELEV/VFN	4R	20 1 22	1
			23 1 20 C	ELEV/PT RECEIPT	4R	20 1 24	1
			25 1 20 A	SPARE	4R	20 1 26	1
			27 1 20 B	WH-1A TIMELOCK	4R	20 1 28	1
			29 1 20 C	PANEL "P3M" & VCL	4R	20 1 30	1
			31 1 20 A	PANEL "P3M" SUBFEED	4R	20 1 32	1
			33 1 20 B	PANEL "P3A" SUBFEED	4R	20 1 34	1
			35 1 20 C	PANEL "P3A" SUBFEED	4R	20 1 36	1
			37 3 40 A	PANEL "P3A" SUBFEED	4R	40 3 38	1
			39 1 20 B	PANEL "P3A" SUBFEED	4R	40 3 40	1
			41 1 20 C	PANEL "P3A" SUBFEED	4R	40 3 42	1
			43 1 20 A		4R	40 3 44	1
			45 1 20 B		4R	40 3 46	1
			47 1 20 C		4R	40 3 48	1
			49 1 20 A		4R	40 3 50	1
			51 1 20 B		4R	40 3 52	1
			53 1 20 C		4R	40 3 54	1
			55 1 20 A		4R	40 3 56	1
			57 1 20 B		4R	40 3 58	1
			59 1 20 C		4R	40 3 60	1
			61 1 20 A		4R	40 3 62	1
			63 1 20 B		4R	40 3 64	1
			65 1 20 C		4R	40 3 66	1
			67 1 20 A		4R	40 3 68	1
			69 1 20 B		4R	40 3 70	1
			71 1 20 C		4R	40 3 72	1
			73 1 20 A		4R	40 3 74	1
			75 1 20 B		4R	40 3 76	1
			77 1 20 C		4R	40 3 78	1
			79 1 20 A		4R	40 3 80	1
			81 1 20 B		4R	40 3 82	1
			83 1 20 C		4R	40 3 84	1
			85 1 20 A		4R	40 3 86	1
			87 1 20 B		4R	40 3 88	1
			89 1 20 C		4R	40 3 90	1
			91 1 20 A		4R	40 3 92	1
			93 1 20 B		4R	40 3 94	1
			95 1 20 C		4R	40 3 96	1
			97 1 20 A		4R	40 3 98	1
			99 1 20 B		4R	40 3 100	1
			101 1 20 C		4R	40 3 102	1
			103 1 20 A		4R	40 3 104	1
			105 1 20 B		4R	40 3 106	1
			107 1 20 C		4R	40 3 108	1
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			147 1 20 B		4R	40 3 148	1
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			245 1 20 C		4R	40 3 246	1
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			249 1 20 B		4R	40 3 250	1
			251 1 20 C		4R	40 3 252	1
			253 1 20 A		4R	40 3 254	1
			255 1 20 B		4R	40 3 256	1
			257 1 20 C		4R	40 3 258	1
			259 1 20 A		4R	40 3 260	1
			261 1 20 B		4R	40 3 262	1
			263 1 20 C		4R	40 3 264	1
			265 1 20 A		4R	40 3 266	1
			267 1 20 B		4R	40 3 268	1
			269 1 20 C		4R	40 3 270	1
			271 1 20 A		4R	40 3 272	1
			273 1 20 B		4R	40 3 274	1
			275 1 20 C		4R	40 3 276	1
			277 1 20 A		4R	40 3 278	1
			279 1 20 B		4R	40 3 280	1
			281 1 20 C		4R	40 3 282	1
			283 1 20 A		4R	40 3 284	1
			285 1 20 B		4R	40 3 286	1
			287 1 20 C		4R	40 3 288	1
			289 1 20 A		4R	40 3 290	1
			291 1 20 B		4R	40 3 292	1
			293 1 20 C		4R	40 3 294	1
			295 1 20 A		4R	40 3 296	1
			297 1 20 B		4R	40 3 298	1
			299 1 20 C		4R	40 3 300	1
			301 1 20 A		4R	40 3 302	1
			303 1 20 B		4R	40 3 304	1
			305 1 20 C		4R	40 3 306	1

PANEL :		PASB		Location: Storage Room		Bus Rating Amps		Volts: 208 / 120		Mounting: SURFACE	
LOAD INFORMATION		VOLTAMPS		CB RATINGS/POLES		VOLTAMPS		PHASE/WIRES		LOAD INFORMATION	
ASB RECEIPT	3R	540		1	1	20	A	3	3,984	PH-C	M 1.2 ACASB1 ON ROOF
ASB RECEIPT	3R	540		3	1	20	B	-	3,984	PH-B	M 1.2 ACASB1 ON ROOF
ASB RECEIPT	3R	540		7	1	20	A	6	3,984	PH-A	M 1.2 ACASB1 ON ROOF
ASB RECEIPT	4R	720		9	1	20	B	-	3,240	PH-B	M 1.2 ACASB2 ON ROOF
ASB RECEIPT	4R	720		13	1	20	A	12	3,240	PH-A	M 1.2 ACASB2 ON ROOF
ASB RECEIPT EXT. LTS.	3	152		15	1	20	B	-	1,116	PH-B	SPARE
ASB RECEIPT CEILING LTS.	12L	624		17	1	20	A	18	1,116	PH-A	SPARE
ASB RECEIPT CEILING LTS.	12L	624		19	1	20	A	18	1,116	PH-A	SPARE
ASB RECEIPT EMERG. LTS.	4	164		21	1	20	B	-	2,222	PH-B	SPARE
ASB RECEIPT EMERG. EXT. LTS.	3	152		23	1	20	A	24	1,116	PH-A	SPARE
SPARE				25	1	20	A	24	1,116	PH-A	SPARE
SPARE				27	1	20	B	-	1,116	PH-B	SPARE
SPARE				29	1	20	A	30	1,116	PH-A	SPARE
SPARE				31	1	20	A	30	1,116	PH-A	SPARE
SPARE				33	1	20	B	-	1,116	PH-B	SPARE
SPARE				35	1	20	A	36	1,116	PH-A	SPARE
SPARE				37	1	20	A	36	1,116	PH-A	SPARE
SPARE				39	1	20	B	-	1,116	PH-B	SPARE
SPARE				41	1	20	A	42	1,116	PH-A	SPARE
TOTAL PHASE:		2,784	1,756	2,216					7,404		7,224
TOTAL PHASE:		10,188	8,860	9,440					11,676		11,100

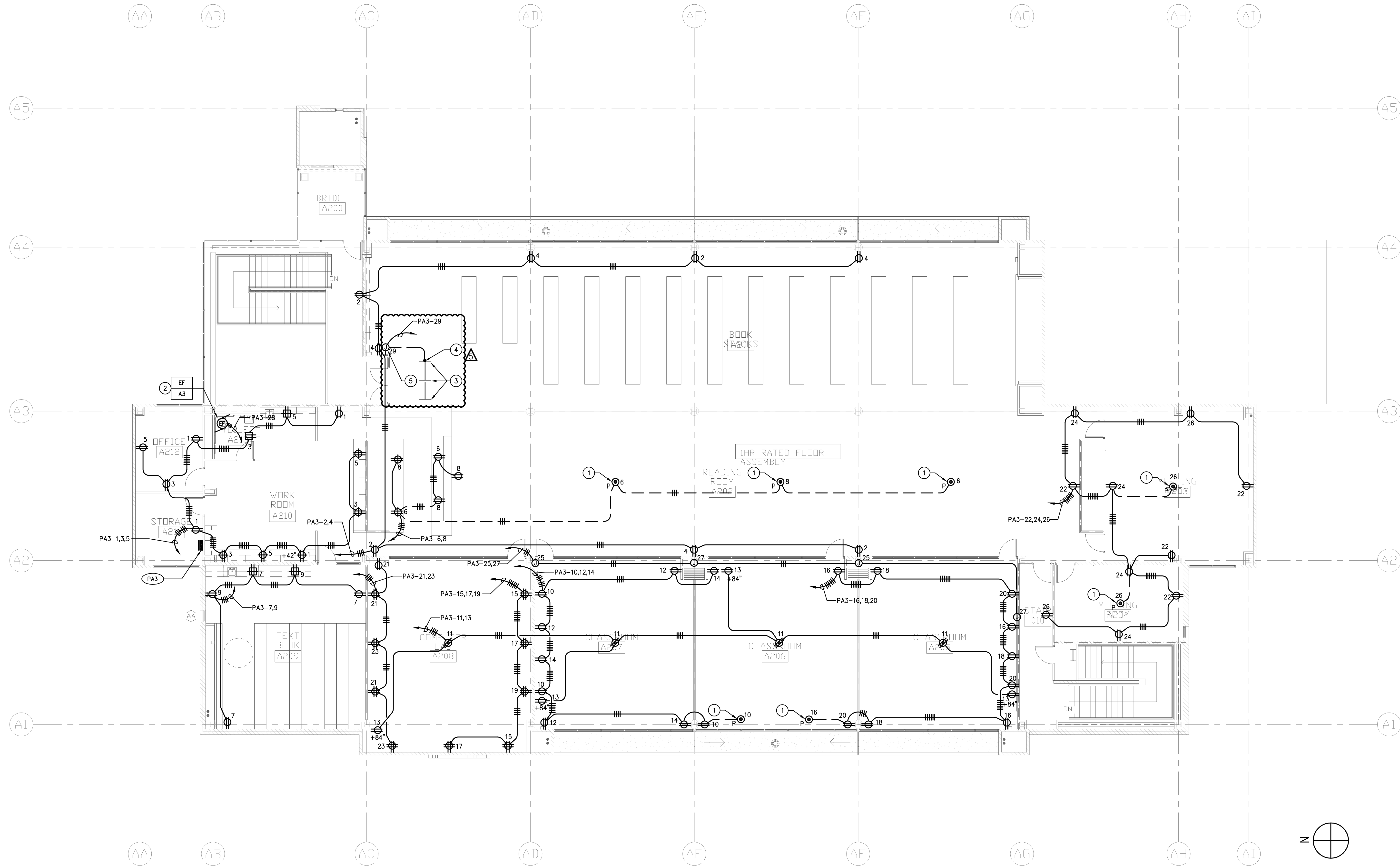
PANEL :		PSE		Location: Work Room		Bus Rating Amps		Volts: 208 / 120		Mounting: SURFACE	
LOAD INFORMATION		VOLTAMPS		CB RATINGS/POLES		VOLTAMPS		PHASE/WIRES		LOAD INFORMATION	
SE CLASSROOM RECEIPT	6R	1,080		1	1	20	A	3	3,984	PH-C	M 1.2 ACSET1 ON ROOF
SE CLASSROOM RECEIPT	6R	1,080		3	1	20	B	-	3,984	PH-B	M 1.2 ACSET1 ON ROOF
SE CLASSROOM RECEIPT	7R	1,260		5	1	20	A	6	3,984	PH-A	M 1.2 ACSET1 ON ROOF
SE CLASSROOM RECEIPT	5R	900		9	1	20	B	-	3,240	PH-B	M 1.2 ACSET2 ON ROOF
SE CLASSROOM RECEIPT	5R	900		13	1	20	A	12	3,240	PH-A	M 1.2 ACSET2 ON ROOF
SE CLASSROOM EXT. CANOPY LTS.	3	152		15	1	20	B	-	1,116	PH-B	SPARE
SE CLASSROOM EMERG. LTS.	4	164		17	1	20	A	18	1,116	PH-A	SPARE
SE CLASSROOM CEILING LTS.	13L	654		19	1	20	A	18	1,116	PH-A	SPARE
SE CLASSROOM CEILING LTS.	13L	654		21	1	20	B	-	1,116	PH-B	SPARE
SE CLASSROOM CEILING LTS.	13L	654		23	1	20	A	24	1,116	PH-A	SPARE
SE CLASSROOM EXT. BLDG. LTS.	4L	170		25	1	20	B	-	2,222	PH-B	SPARE
SPARE				27	1	20	A	24	1,116	PH-A	SPARE
SPARE				29	1	20	B	-	1,116	PH-B	SPARE
SPARE				31	1	20	A	30	1,116	PH-A	SPARE
SPARE				33	1	20	B	-	1,116	PH-B	SPARE
SPARE				35	1	20	A	36	1,116	PH-A	SPARE
SPARE				37	1	20	A	36	1,116	PH-A	SPARE
SPARE				39	1	20	B	-	1,116	PH-B	SPARE
SPARE				41	1	20	A	42	1,116	PH-A	SPARE
TOTAL PHASE:		3,382	2,819	1,880					11,748		11,208
TOTAL PHASE:		15,130	14,027	13,268					17,748		17,208

PANEL :		PT1		Location: Elect Room		Bus Rating Amps		Volts: 208 / 120		Mounting: SURFACE	
LOAD INFORMATION		VOLTAMPS		CB RATINGS/POLES		VOLTAMPS		PHASE/WIRES		LOAD INFORMATION	
TICKET RECEIPT	4R	1,080		1	1	20	A	3	3,984	PH-C	M 1.2 ACSET1 ON ROOF
TICKET RECEIPT	4R	1,080		3	1	20	B	-	3,984	PH-B	M 1.2 ACSET1 ON ROOF
TICKET RECEIPT	4R	1,080		7	1	20	A	6	3,984	PH-A	M 1.2 ACSET1 ON ROOF
TICKET RECEIPT	4R	1,080		9	1	20	B	-	3,240	PH-B	M 1.2 ACSET2 ON ROOF
TICKET RECEIPT	4R	1,080		13	1	20	A	12	3,240	PH-A	M 1.2 ACSET2 ON ROOF
TICKET RECEIPT	4R	1,080		15	1	20	B	-	1,116	PH-B	SPARE
TICKET RECEIPT	4R	1,080		17	1	20	A	18	1,116	PH-A	SPARE
TICKET RECEIPT	4R	1,080		19	1	20	A	18	1,116	PH-A	SPARE
TICKET RECEIPT	4R	1,080		21	1	20	B	-	1,116	PH-B	SPARE
TICKET RECEIPT	4R	1,080		23	1	20	A	24	1,116	PH-A	SPARE
TICKET RECEIPT	4R	1,080		25	1	20	B	-	1,116	PH-B	SPARE
TICKET RECEIPT	4R	1,080		27	1	20	A	30	1,116	PH-A	SPARE
TICKET RECEIPT	4R	1,080		29	1	20	B	-	1,116	PH-B	SPARE
TICKET RECEIPT	4R	1,080		31	1	20	A	36	1,116	PH-A	SPARE
TICKET RECEIPT	4R	1,080		33	1	20	B	-	1,116	PH-B	SPARE
TICKET RECEIPT	4R	1,080		35	1	20	A	36	1,116	PH-A	SPARE
TICKET RECEIPT	4R	1,080		37	1	20	A	36	1,116	PH-A	SPARE
TICKET RECEIPT	4R	1,080		39	1	20	B	-	1,116	PH-B	SPARE
TICKET RECEIPT	4R	1,080		41	1	20	A	42	1,116	PH-A	SPARE
TOTAL PHASE:		6,120	5,840	5,040					17,748		17,208
TOTAL PHASE:		11,676	11,436	11,100					34,212		33,600

PANEL :		PT2		Location: Elect Room		Bus Rating Amps		Volts: 208 / 120		Mounting: SURFACE	
LOAD INFORMATION		VOLTAMPS		CB RATINGS/POLES		VOLTAMPS		PHASE/WIRES		LOAD INFORMATION	
STAFF LOUNGE	5R	900		1	1	20	A	3	3,984	PH-C	M 1.2 ACSET1 ON ROOF
STAFF LOUNGE	5R	900		3	1	20	B	-	3,984	PH-B	M 1.2 ACSET1 ON ROOF
STAFF LOUNGE	5R	900		5	1	20	A	6	3,984	PH-A	M 1.2 ACSET1 ON ROOF
MULTI PURPOSE	7R	1,260		9	1	20	B	-	3,240	PH-B	M 1.2 ACSET2 ON ROOF
MULTI PURPOSE	7R	1,260		13	1	20	A	12	3,240	PH-A	M 1.2 ACSET2 ON ROOF
MULTI PURPOSE	7R	1,260		15	1	20	B	-	1,116	PH-B	SPARE
MULTI PURPOSE	7R	1,260		17	1	20	A	18	1,116	PH-A	SPARE
MULTI PURPOSE	7R	1,260		19	1	20	A	18	1,116	PH-A	SPARE
MULTI PURPOSE	7R	1,260		21	1	20	B	-	1,116	PH-B	SPARE
MULTI PURPOSE	7R	1,260		23	1	20	A	24	1,116	PH-A	SPARE
MULTI PURPOSE	7R	1,260		25	1	20	B	-	1,116	PH-B	SPARE
MULTI PURPOSE	7R	1,260		27	1	20	A	30	1,116	PH-A	SPARE
MULTI PURPOSE	7R	1,260		29	1	20	B	-	1,116	PH-B	SPARE
MULTI PURPOSE	7R	1,260		31	1	20	A	36	1,116	PH-A	SPARE
MULTI PURPOSE	7R	1,260		33	1	20	B	-	1,116	PH-B	SPARE
MULTI PURPOSE	7R	1,260		35	1	20	A	36	1,116	PH-A	SPARE
MULTI PURPOSE	7R	1,260		37	1	20	A	36	1,116	PH-A	SPARE
MULTI PURPOSE	7R	1,260		39	1	20	B	-	1,116	PH-B	SPARE
MULTI PURPOSE	7R	1,260		41	1	20	A	42	1,116	PH-A	SPARE
TOTAL PHASE:		2,540	2,300	2,300					7,716		7,272
TOTAL PHASE:		8,410	7,920	7,920					20,436		19,680

PANEL :		AV1		Location: STORAGE		Bus Rating Amps		Volts: 208 / 120		Mounting: SURFACE	
LOAD INFORMATION		VOLTAMPS		CB RATINGS/POLES		VOLTAMPS		PHASE/WIRES		LOAD INFORMATION	
AUDIO RACK 1 & 2	1R	1,920		1	1	20	A	3	3,984	PH-C	M 1.2 ACSET1 ON ROOF
AUDIO RACK 3	1R	1,920		3	1	20	B	-	3,984	PH-B	M 1.2 ACSET1 ON ROOF
AUDIO RACK 3	1R	1,920		5	1	20	A	6	3,984	PH-A	M 1.2 ACSET1 ON ROOF
AUDIO RACK 3	1R	1,920		7	1	20	B	-	3,240	PH-B	M 1.2 ACSET2 ON ROOF
AUDIO RACK 3	1R	1,920		9	1	20	A	12	3,240	PH-A	M 1.2 ACSET2 ON ROOF
AUDIO RACK 4	1R	1,920		11	1	20	B	-	1,116	PH-B	SPARE
AUDIO RACK 4	1R	1,920		13	1	20	A	14	1,116	PH-A	SPARE
AUDIO RACK 4	1R	1,920		15	1	20	B	-	1,116	PH-B	SPARE
AUDIO RACK 4	1R	1,920		17	1	20	A	18	1,116	PH-A	SPARE
AUDIO RACK 4	1R	1,920		19	1	20	A	18	1,116	PH-A	SPARE
AUDIO RACK 4	1R	1,920		21	1	20	B	-	1,116	PH-B	SPARE
AUDIO RACK 4	1R	1,920		23	1	20	A	24	1,116	PH-A	SPARE
AUDIO RACK 4	1R	1,920		25	1	20	B	-	1,116	PH-B	SPARE
AUDIO RACK 4	1R	1,920		27	1	20	A	30	1,116	PH-A	SPARE
AUDIO RACK 4	1R	1,920		29	1	20	B	-	1,116	PH-B	SPARE
AUDIO RACK 4	1R	1,920		31	1	20	A	36	1,116	PH-A	SPARE
AUDIO RACK 4	1R	1,920		33	1	20	B	-	1,116	PH-B	SPARE
AUDIO RACK 4	1R	1,920		35	1	20	A	36	1,116	PH-A	SPARE
AUDIO RACK 4	1R	1,920		37	1	20	A	36	1,116	PH-A	SPARE
AUDIO RACK 4	1R	1,920		39	1	20	B	-	1,116	PH-B	SPARE
AUDIO RACK 4	1R	1,920		41	1	20	A	42	1,116	PH-A	SPARE
TOTAL PHASE:		5,760	3,840	3,840					17,748		17,208
TOTAL PHASE:		7,680	5,760	5,760					23,232		22,560

PANEL :		LT1		Location: Elect Room		Bus Rating Amps		Volts: 480 / 277		Mounting: SURFACE	



ADMINISTRATION BUILDING SECOND FLOOR POWER PLAN 1
1/8" = 1'-0"

PLAN NOTES:

- 1 COORDINATE EXACT LOCATION WITH ARCHITECT PRIOR TO ROUGH-IN.
- 2 INTERLOCK WITH LIGHT SWITCH VIA RELAY IN OCCUPANCY SENSOR. PROVIDE AS REQUIRED.
- 3 LIBRARY DETECTION SYSTEM MANUFACTURED BY 3M MODEL #3802.
- 4 STUB UP TO ELECTRONIC CHASSIS, CONNECT TO DETECTION SYSTEM AS REQUIRED BY DETECTION SYSTEM MANUFACTURER.
- 5 POWER J-BOX FOR DETECTION SYSTEM- 5A, 120V.

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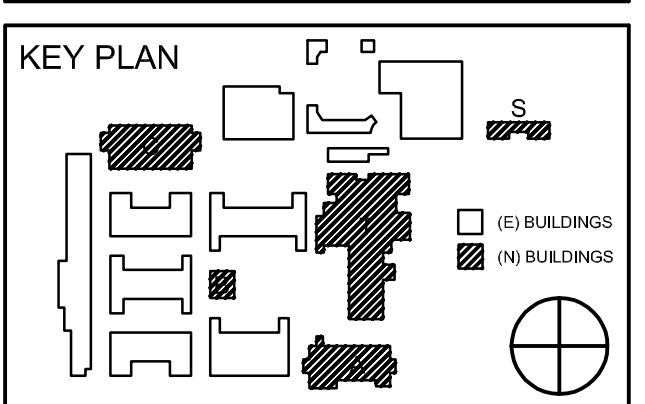
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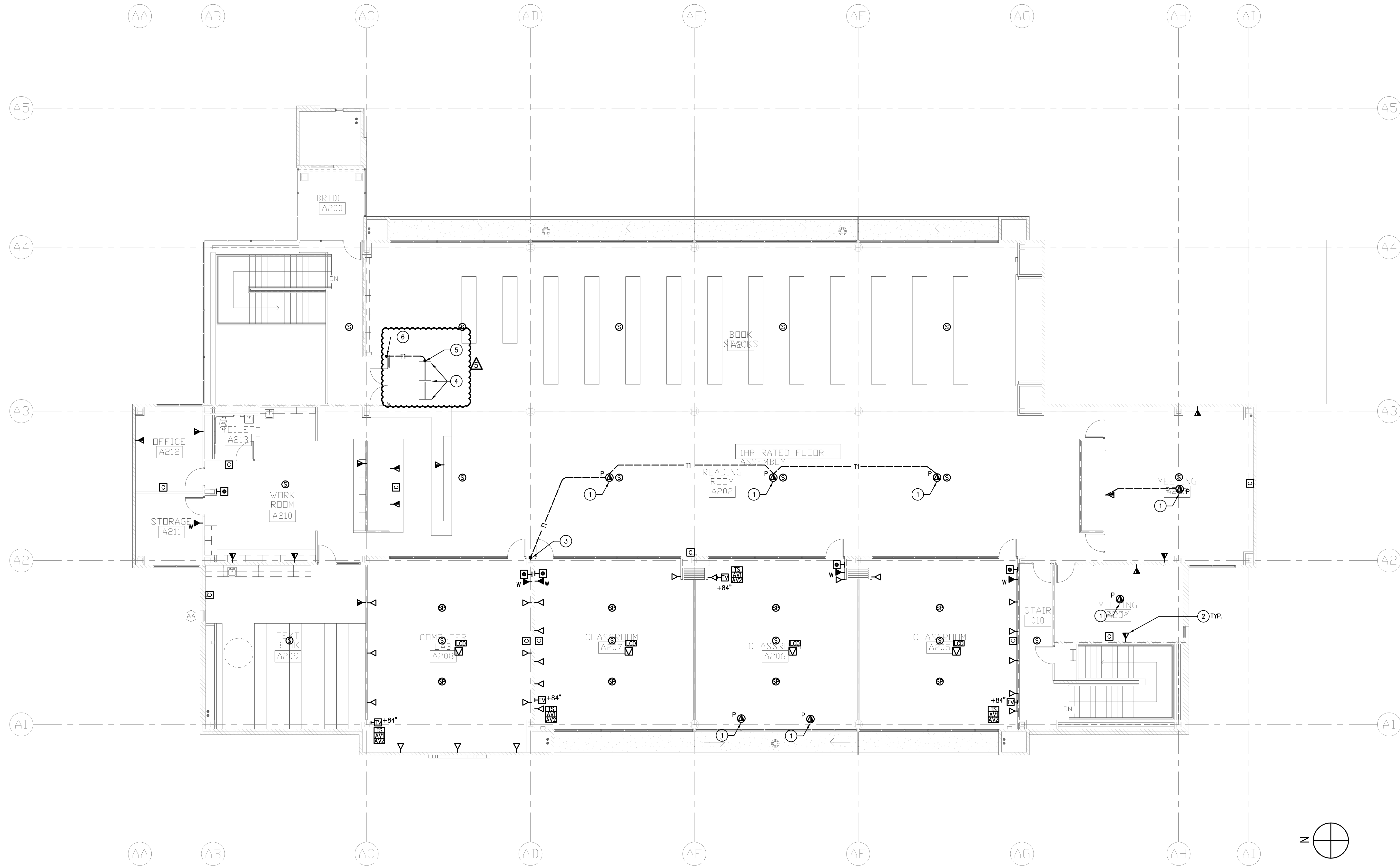


REVISION SCHEDULE		
NO	DATE	DESCRIPTION
	02/17/2014	100% DESIGN DEVELOPMENT
	05/08/2014	90% CD PROGRESS
	05/29/2014	DSA SUBMITTAL
	04/08/2015	DSA BACK CHECK
▲	12/12/2015	ADDENDUM 1
▲	04/08/2016	ADDENDUM 2
▲	05/08/2016	ADDENDUM 5

DRWN: JP CHKD: PA/RO
DATE: 04/08/2015 SCALE:
PROJECT NUMBER: 1310700

**ADMINISTRATION
BUILDING SECOND
FLOOR POWER PLAN**

DRAWING NUMBER: **EA2.2**



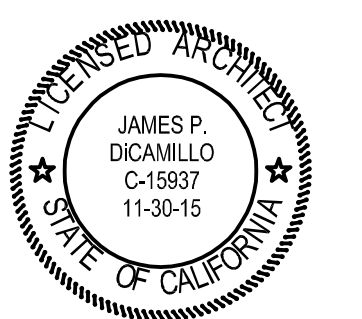
ADMINISTRATION BUILDING SECOND FLOOR SIGNAL PLAN 1
1/8" = 1'-0"

PLAN NOTES:

- ① COORDINATE EXACT LOCATION WITH ARCHITECT PRIOR TO ROUGH-IN.
- ② REFER TO SYMBOL LIST FOR ALL SIGNAL DEVICES INCLUDING CONDUIT SIZES.
- ③ STUB UP INTO CEILING SPACE. VERIFY POINT OF STUB UP LOCATION.
- ④ LIBRARY DETECTION SYSTEM MANUFACTURED BY 3M MODEL #3802.
- ⑤ STUB UP TO ELECTRONIC CHASSIS AND CONNECT TO DETECTION SYSTEM AS REQUIRED BY DETECTION SYSTEM MANUFACTURER.
- ⑥ UP TO IDF ROOM.

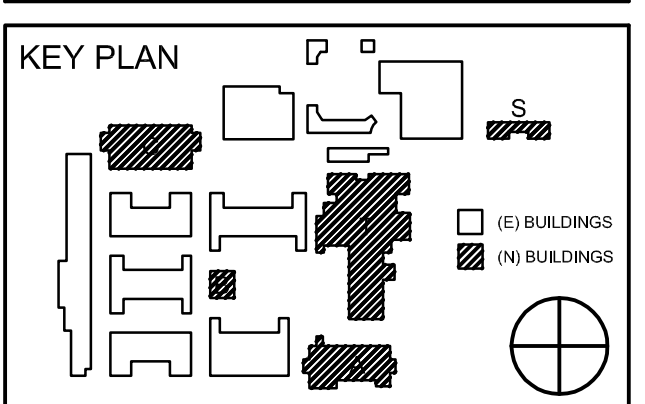
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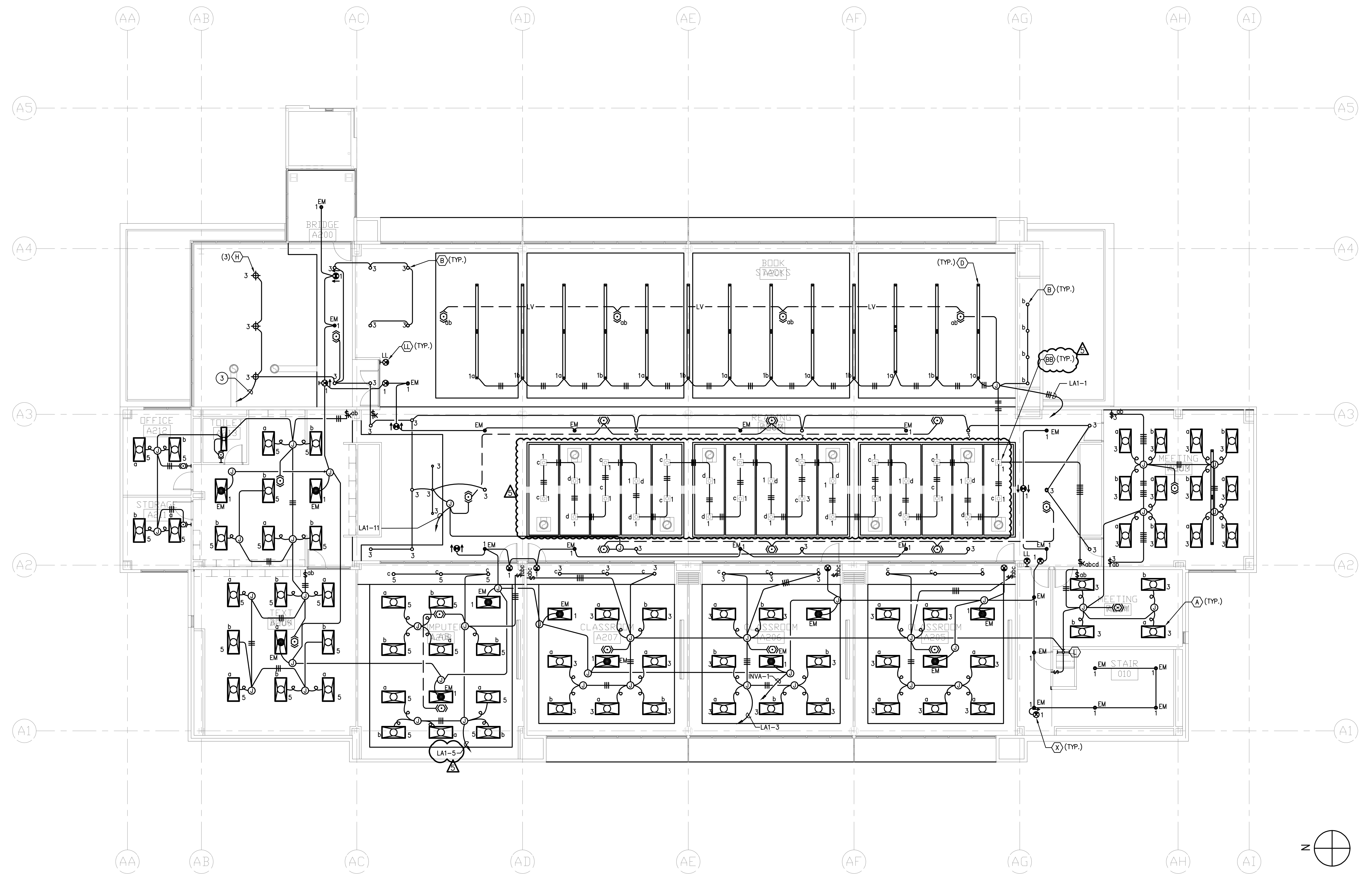


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△	12/12/2015	ADDENDUM 1
△	04/08/2016	ADDENDUM 2
△	05/08/2016	ADDENDUM 5

DRWN: JP CHKD: PA/RO
DATE: 04/08/2015 SCALE:
PROJECT NUMBER: 1310700

ADMINISTRATION BUILDING SECOND FLOOR SIGNAL PLAN

DRAWING NUMBER: **EA2.4**



ADMINISTRATION BUILDING SECOND FLOOR LIGHTING PLAN 1
1/8" = 1'-0"

PLAN NOTES:

- 1 PROVIDE CEILING MOUNTED OCCUPANCY SENSOR WITH 2000 SQ.FT. 360° COVERAGE HUBBELL # OWNID2000BP1277V. PROVIDE POWER PACKS AS REQUIRED. FIELD VERIFY EXACT LOCATION AND ORIENTATION FOR COMPLETE COVERAGE AND OPERATION.
- 2 PROVIDE MANUAL "ON" MULTI-TECHNOLOGY WALL SWITCH OCCUPANCY SENSOR WITH DUAL CIRCUIT SWITCHING HUBBELL #LHMTD2-W WITH WHITE FINISH.
- 3 TO WALL SWITCH. SEE SHEET EA3.1.

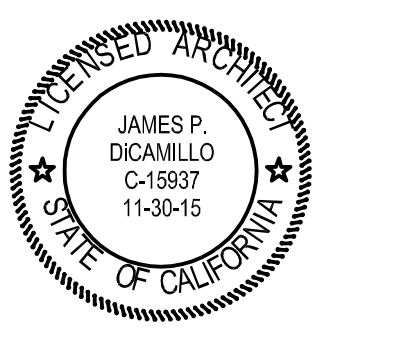
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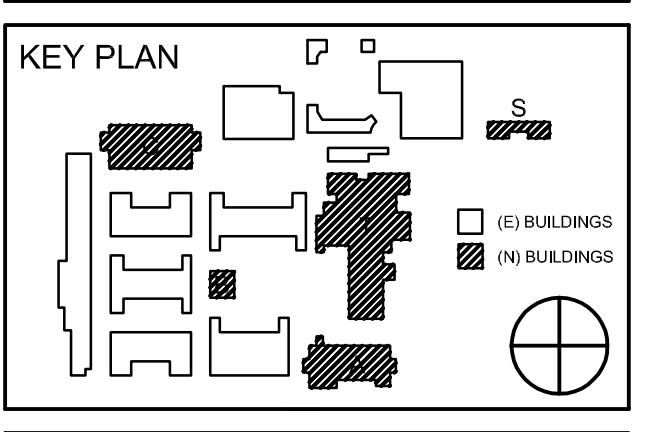
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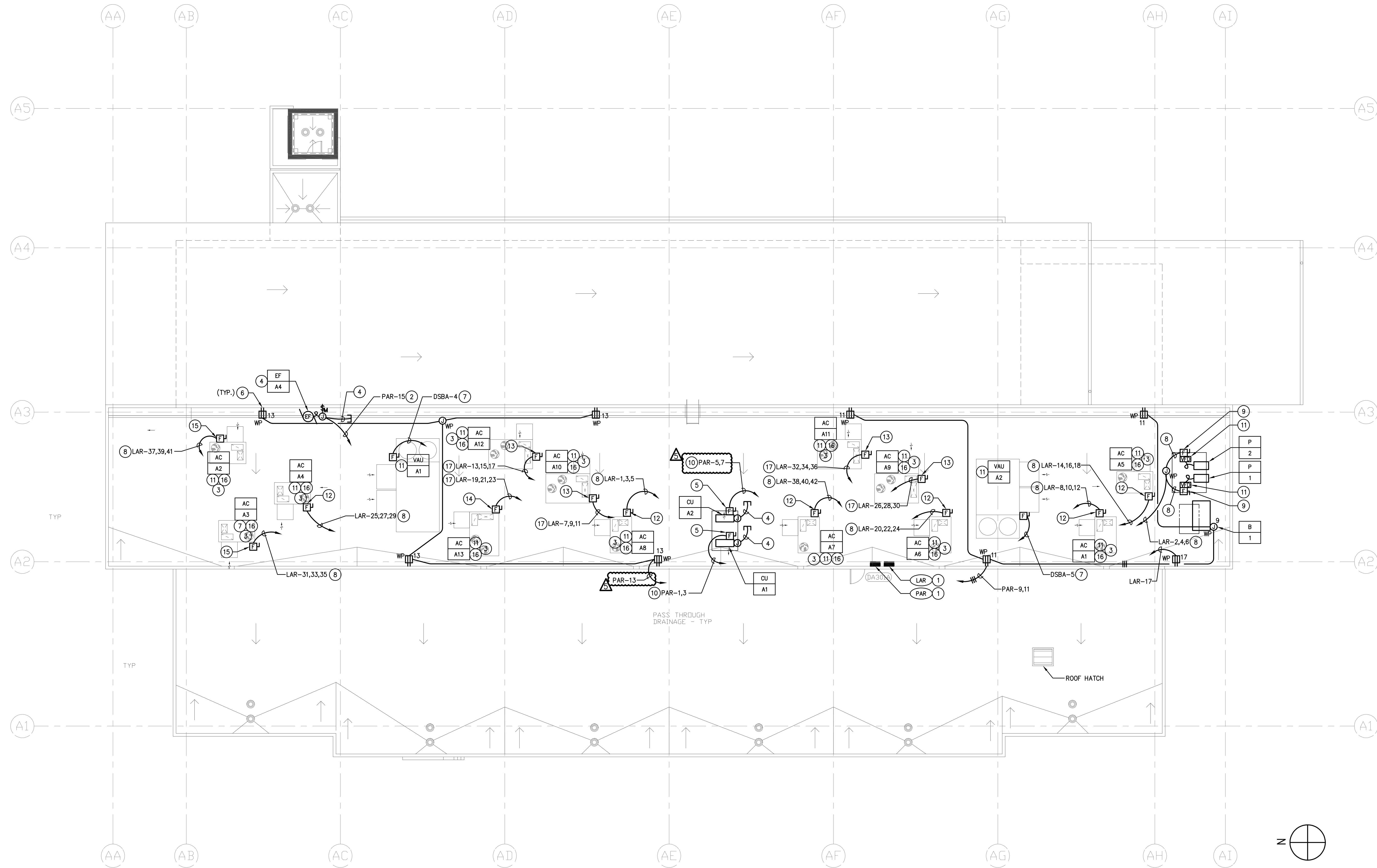


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▲	12/12/2015	ADDENDUM 1
▲	04/08/2016	ADDENDUM 2
▲	05/08/2016	ADDENDUM 5

DRWN: JP	CHKD: PA/RO
DATE: 04/08/2015	SCALE:
PROJECT NUMBER: 1310700	

**ADMINISTRATION
BUILDING SECOND
FLOOR LIGHTING PLAN**

DRAWING NUMBER: **EA3.2**



ADMINISTRATION BUILDING ROOF ELECTRICAL PLAN 1
1/8" = 1'-0"

PLAN KEYNOTES:

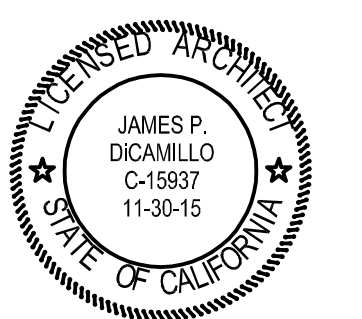
- 1 REFER TO SINGLE LINE DIAGRAM SHEET E5.3 FOR FEEDER REQUIREMENTS.
- 2 ROUTE CIRCUIT THROUGH SWITCHPACK CONTROLLED BY RESPECTIVE ROOM'S OCCUPANCY SENSOR. REFER TO RESPECTIVE LIGHTING PLAN.
- 3 MONITORED BY EMS. COORDINATE EXACT REQUIREMENTS WITH MECHANICAL.
- 4 PROVIDE 3/4" C.O. STUBBED INTO ACCESSIBLE CEILING SPACE FOR CONTROLS. VERIFY EXACT REQUIREMENTS WITH MECHANICAL.
- 5 PROVIDE 30AS/25AF, 2P FUSED DISCONNECT SWITCH HEAVY DUTY AND HP RATED. (240V)
- 6 PROVIDE WEATHERPROOF GFI RECEPTACLE WITHIN 25 FEET OF MECHANICAL EQUIPMENT.
- 7 REFER TO SINGLE LINE DIAGRAM #1 ON SHEET E5.3 FOR FEEDER SIZE AND DISCONNECT SWITCH.
- 8 3/4" C. - 3#12, 1#12 GROUND.
- 9 PROVIDE 30AS/15AF, 3P FUSED DISCONNECT SWITCH HEAVY DUTY AND HP RATED. (600V)
- 10 3/4" C. - 2#10, 1#10 GROUND.
- 11 VFD PROVIDED BY MECHANICAL CONTRACTOR. CONDUIT, CONDUCTORS & CONNECTIONS PROVIDED BY ELECTRICAL CONTRACTOR.
- 12 PROVIDE 30AS/20AF, 3P FUSED DISCONNECT SWITCH HEAVY DUTY AND HP RATED. (600V)
- 13 PROVIDE 30AS/25AF, 3P FUSED DISCONNECT SWITCH HEAVY DUTY AND HP RATED. (600V)
- 14 PROVIDE 30AS/30AF, 3P FUSED DISCONNECT SWITCH HEAVY DUTY AND HP RATED. (600V)
- 15 PROVIDE 30AS/15AF, 3P FUSED DISCONNECT SWITCH HEAVY DUTY AND HP RATED. (600V)
- 16 CONTROLLED BY LINE VOLTAGE THERMOSTAT. COORDINATE THERMOSTAT LOCATION AND EXACT REQUIREMENTS WITH MECHANICAL.
- 17 3/4" C. - 3#10, 1#10 GROUND.

GENERAL ROOF NOTES

1. ALL MULTI-WIRE BRANCH CIRCUITS AND HOME RUNS SHALL MEET NEC ARTICLE 210.4.
2. PROVIDE 4" MIN SLEEPERS TO SUPPORT CONDUITS FOR ALL EXPOSED CONDUIT RUNS ON ROOF.
3. ALL ELECTRICAL EQUIPMENT MOUNTED ON THE ROOF SHALL BE WEATHERPROOF (NEMA-3R).
4. VERIFY EXACT LOCATION OF HVAC AND PLUMBING EQUIPMENT WITH MECHANICAL AND PLUMBING PLANS.
5. PROVIDE FUSE PER NAMEPLATE RATING IF DIFFERENT FROM FUSE SIZE INDICATED. COMPLY WITH CODE.

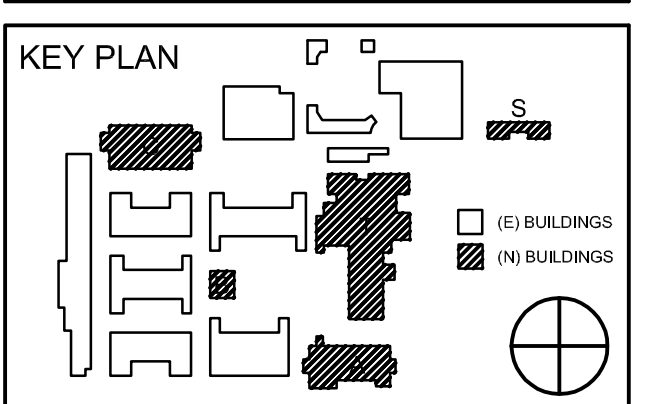
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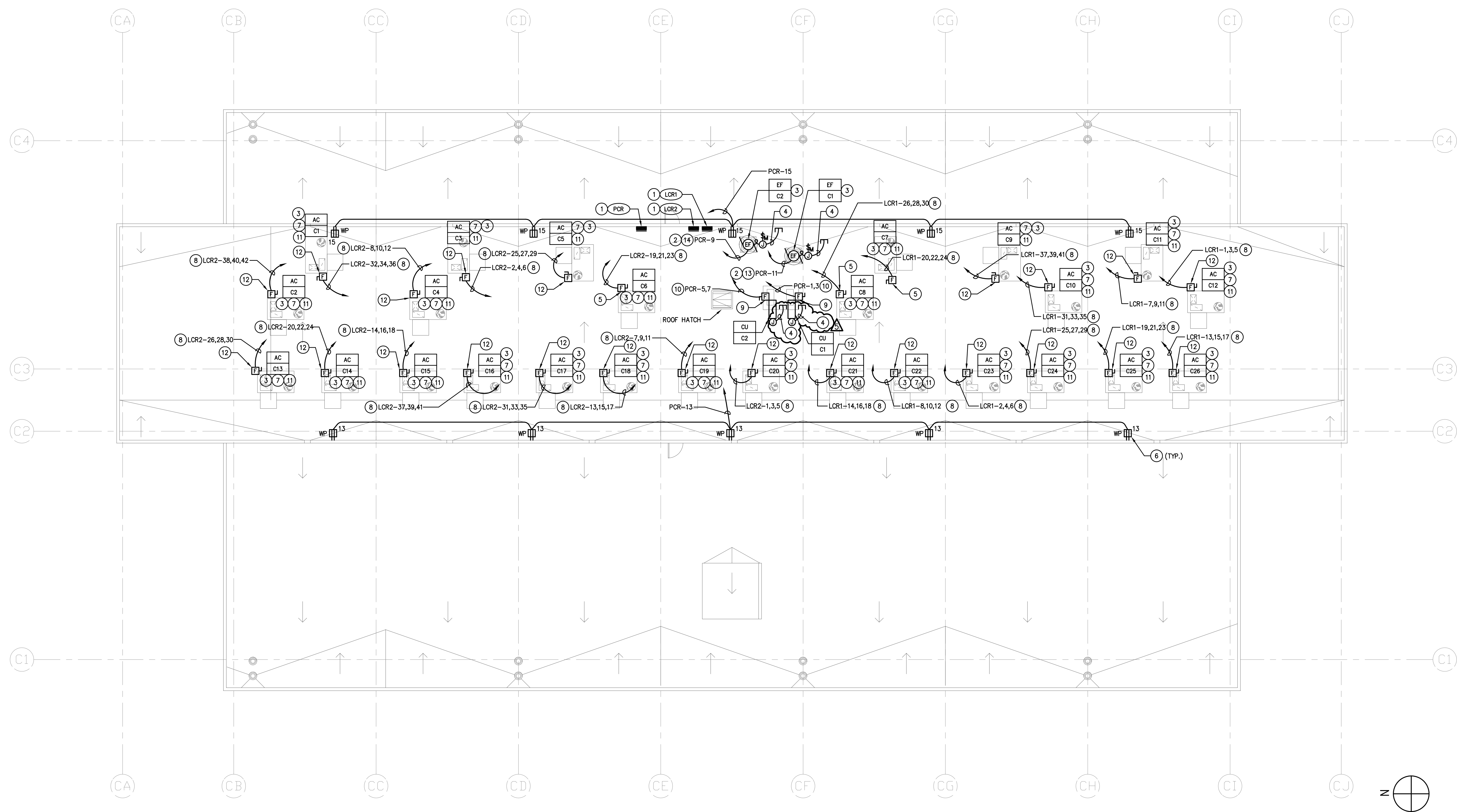


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04/08/2016		ADDENDUM 2
05/08/2016		ADDENDUM 5

DRWN: JP CHKD: PA/RO
DATE: 04/08/2015 SCALE:
PROJECT NUMBER: 1310700

ADMINISTRATION BUILDING ROOF ELECTRICAL PLAN

DRAWING NUMBER: **EA4.1**



CLASSROOM BUILDING ROOF ELECTRICAL PLAN 1
1/8" = 1'-0"

PLAN NOTES:

- 1 REFER TO SINGLE LINE DIAGRAM SHEET ES.3 FOR FEEDER REQUIREMENTS.
- 2 ROUTE CIRCUIT THROUGH SWITCHPACK CONTROLLED BY RESPECTIVE ROOM'S OCCUPANCY SENSOR. REFER TO RESPECTIVE LIGHTING PLAN.
- 3 MONITORED BY EMS. COORDINATE EXACT REQUIREMENTS WITH MECHANICAL AND PROVIDE AS REQUIRED.
- 4 PROVIDE 3/4" C.O. STUBBED INTO ACCESSIBLE CEILING SPACE FOR EMS CONTROLS. VERIFY EXACT REQUIREMENTS WITH MECHANICAL.
- 5 PROVIDE 30AS/15AF, 3P FUSED DISCONNECT SWITCH HEAVY DUTY AND HP RATED. (600V)
- 6 PROVIDE WEATHERPROOF GFI RECEPTACLE WITHIN 25 FEET OF MECHANICAL EQUIPMENT.
- 7 CONTROLLED BY LINE VOLTAGE THERMOSTAT. COORDINATE THERMOSTAT LOCATION AND EXACT REQUIREMENTS WITH MECHANICAL.
- 8 3/4" C. - 3#12, 1#12 GROUND.
- 9 PROVIDE 30AS/25AF, 2P FUSED DISCONNECT SWITCH HEAVY DUTY AND HP RATED. (240V)
- 10 3/4" C. - 2#10, 1#10 GROUND.
- 11 VFD PROVIDED BY MECHANICAL CONTRACTOR. CONDUIT, CONDUCTORS & CONNECTIONS PROVIDED BY ELECTRICAL CONTRACTOR.
- 12 PROVIDE 30AS/20AF, 3P FUSED DISCONNECT SWITCH HEAVY DUTY AND HP RATED. (600V)
- 13 EF-C1 SERVING 3 ROOMS (C122, C123 & C124).
- 14 EF-C2 SERVING 3 ROOMS (C222, C223 & C224)

GENERAL ROOF NOTES

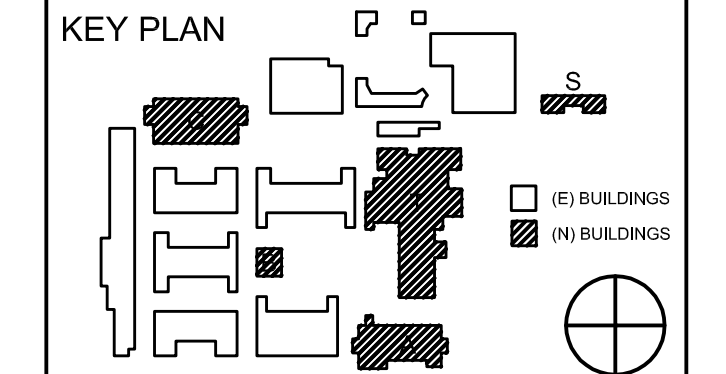
- 1. ALL MULTI-WIRE BRANCH CIRCUITS AND HOME RUNS SHALL MEET NEC ARTICLE 210.4.
- 2. PROVIDE 4" MIN SLEEPERS TO SUPPORT CONDUITS FOR ALL EXPOSED CONDUIT RUNS ON ROOF.
- 3. ALL ELECTRICAL EQUIPMENT MOUNTED ON THE ROOF SHALL BE WEATHERPROOF (NEMA-3R).
- 4. VERIFY EXACT LOCATION OF HVAC AND PLUMBING EQUIPMENT WITH MECHANICAL AND PLUMBING PLANS.
- 5. PROVIDE FUSE PER NAMEPLATE RATING IF DIFFERENT FROM FUSE SIZE INDICATED. COMPLY WITH CODE.

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CLASSROOM BUILDING ROOF ELECTRICAL PLAN

DRAWING NUMBER: **EC4.1**

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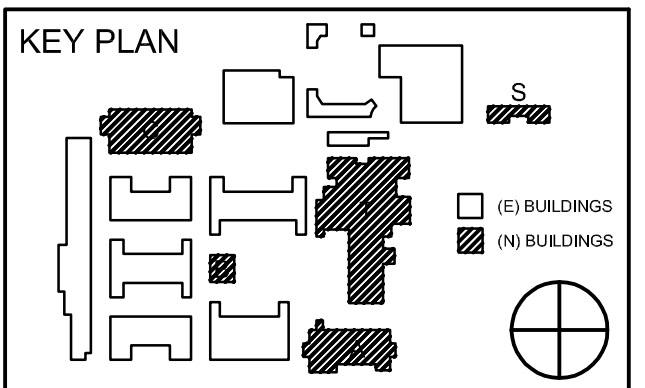
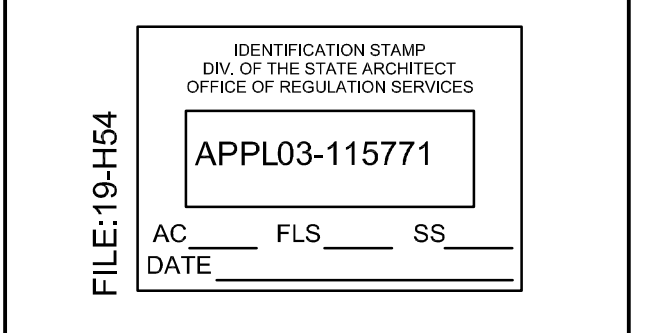
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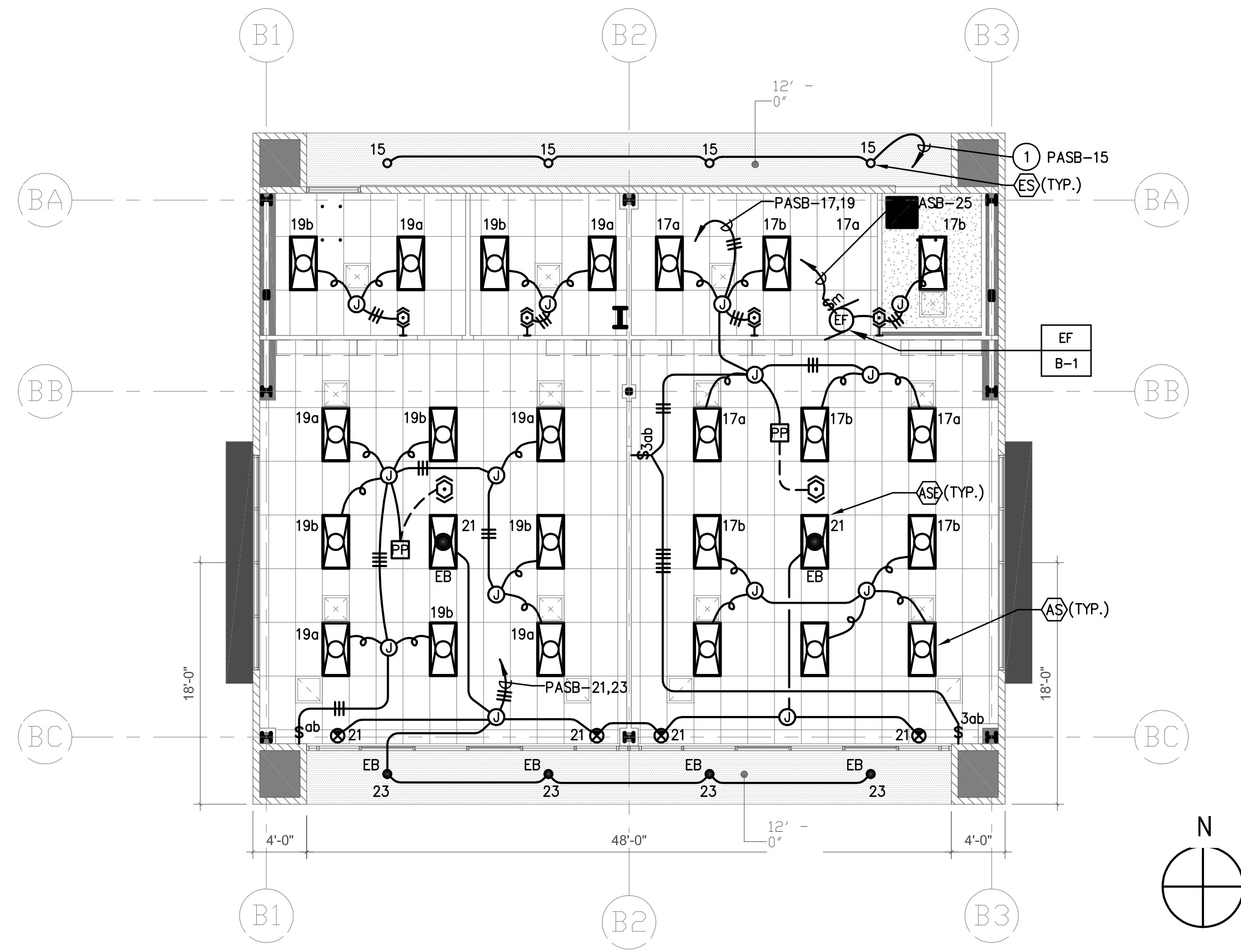


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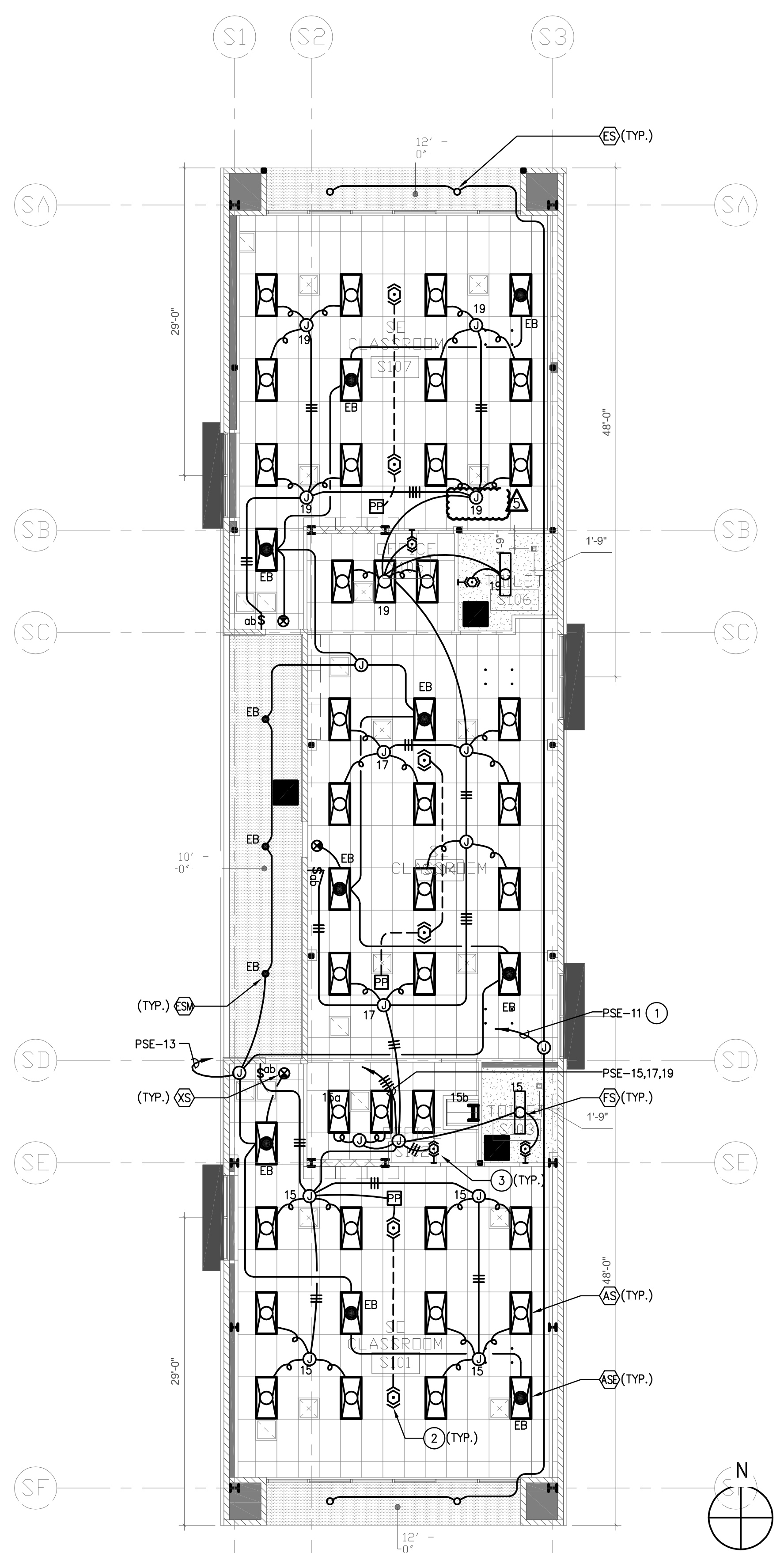
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ASB & SPECIAL ED BUILDINGS LIGHTING PLANS

DRAWING NUMBER: **ES3.1**

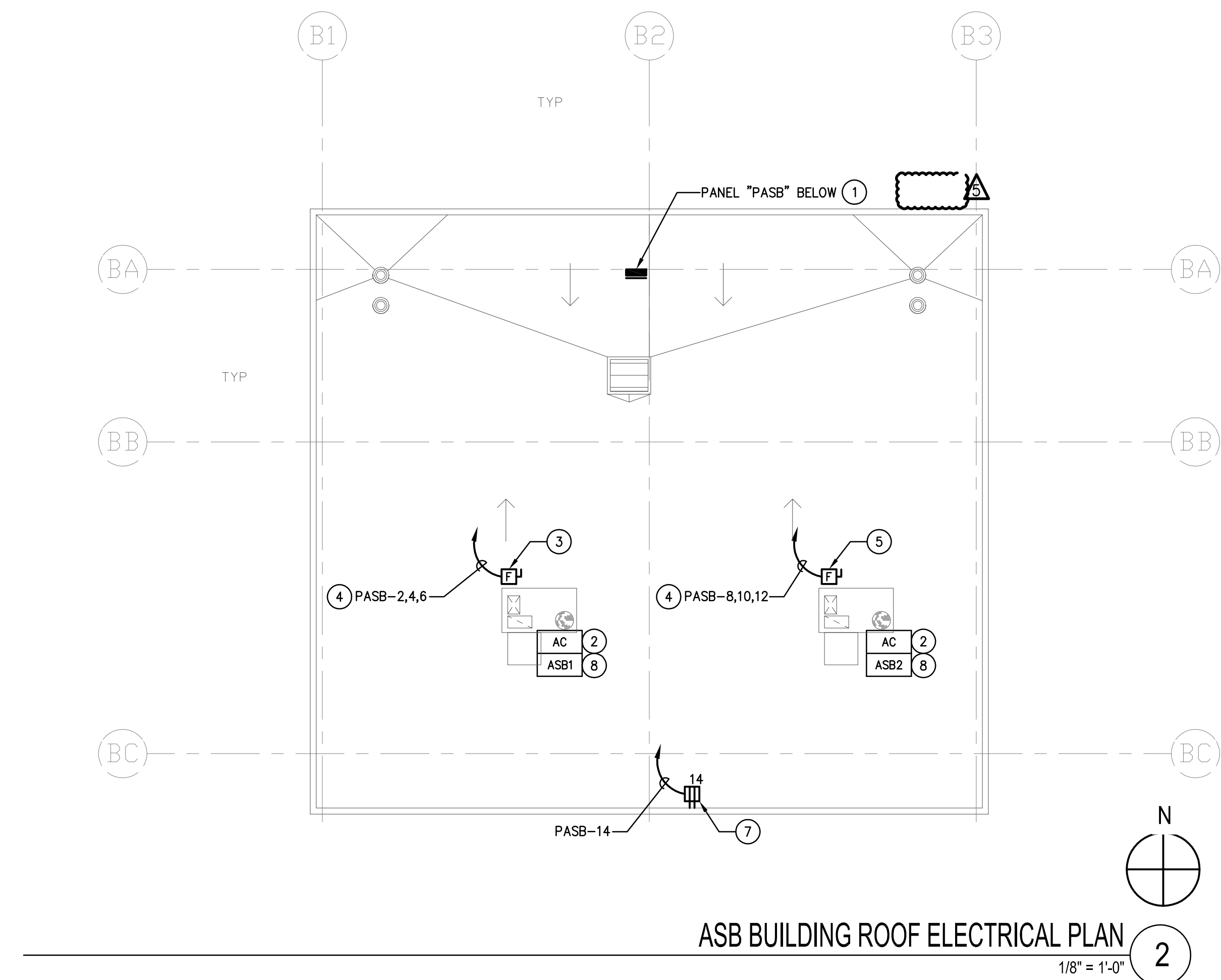


ASB BUILDING LIGHTING PLAN 2
1/8" = 1'-0"

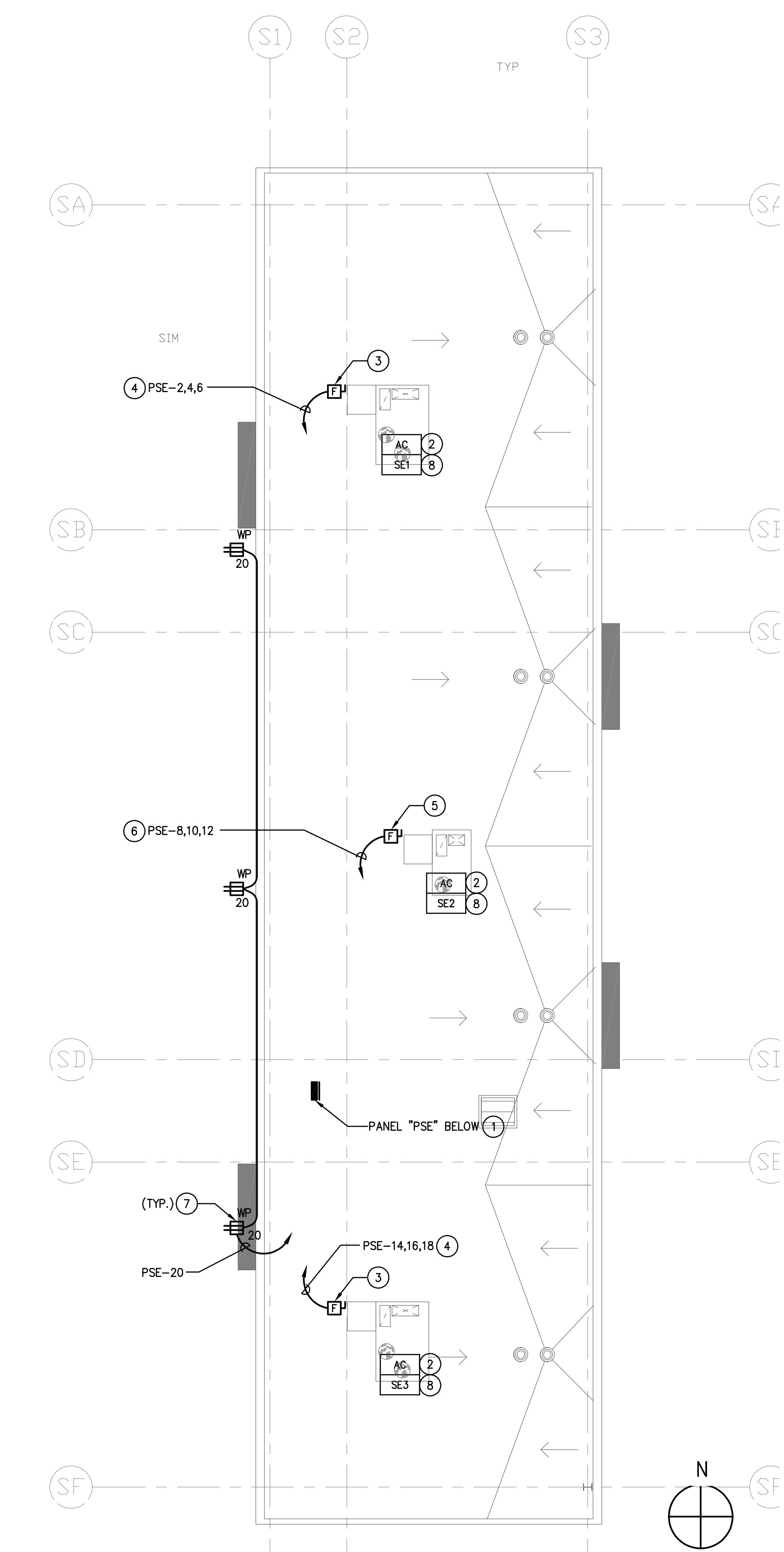


SPECIAL ED BUILDING LIGHTING PLAN 1
1/8" = 1'-0"

- PLAN NOTES:**
- 1 PROVIDE PHOTOCELL CONTROL, LOCATE ON ROOF. VERIFY IN FIELD.
 - 2 PROVIDE CEILING MOUNTED OCCUPANCY SENSOR WITH 2000 SQ.FT. 360° COVERAGE HUBBELL # QWMD1200RFP127V. PROVIDE POWER PACKS AS REQUIRED. FIELD VERIFY EXACT LOCATION AND ORIENTATION FOR COMPLETE COVERAGE AND OPERATION.
 - 3 PROVIDE MANUAL "ON" MULTI-TECHNOLOGY WALL SWITCH OCCUPANCY SENSOR WITH DUAL CIRCUIT SWITCHING HUBBELL #LIMT2-W WITH WHITE FINISH.



ASB BUILDING ROOF ELECTRICAL PLAN
1/8" = 1'-0" 2



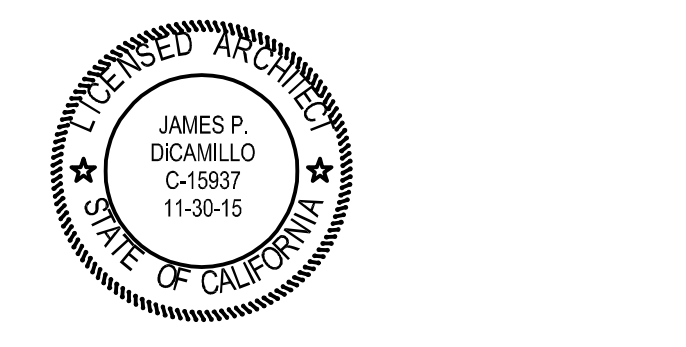
SPECIAL ED BUILDING ROOF ELECTRICAL PLAN
1/8" = 1'-0" 1

- PLAN NOTES:**
- REFER TO SINGLE LINE DIAGRAM SHEET ES.1 FOR FEEDER REQUIREMENTS.
 - CONTROLLED BY LINE VOLTAGE THERMOSTAT. COORDINATE THERMOSTAT LOCATION & EXACT REQUIREMENTS WITH MECHANICAL.
 - PROVIDE 60AS/60AF, 3P FUSED DISCONNECT SWITCH HEAVY DUTY AND HP RATED, (240V)
 - 1 1/4" C. - 3#6, 1#8 GROUND.
 - PROVIDE 60AS/45AF, 3P FUSED DISCONNECT SWITCH HEAVY DUTY AND HP RATED, (240V)
 - 1" C. - 3#8, 1#10 GROUND.
 - PROVIDE WEATHERPROOF GFI RECEPTACLE WITHIN 25 FEET OF MECHANICAL EQUIPMENT.
 - VFD PROVIDED BY MECHANICAL CONTRACTOR. CONDUIT, CONDUCTORS & CONNECTIONS PROVIDED BY ELECTRICAL CONTRACTOR.

- GENERAL ROOF NOTES**
- ALL MULTI-WIRE BRANCH CIRCUITS AND HOME RUNS SHALL MEET NEC ARTICLE 210.4.
 - PROVIDE 4" MIN SLEEPERS TO SUPPORT CONDUITS FOR ALL EXPOSED CONDUIT RUNS ON ROOF.
 - ALL ELECTRICAL EQUIPMENT MOUNTED ON THE ROOF SHALL BE WEATHERPROOF (NEMA-3R).
 - VERIFY EXACT LOCATION OF HVAC AND PLUMBING EQUIPMENT WITH MECHANICAL AND PLUMBING PLANS.
 - PROVIDE FUSE PER NAMEPLATE RATING IF DIFFERENT FROM FUSE SIZE INDICATED. COMPLY WITH CODE.

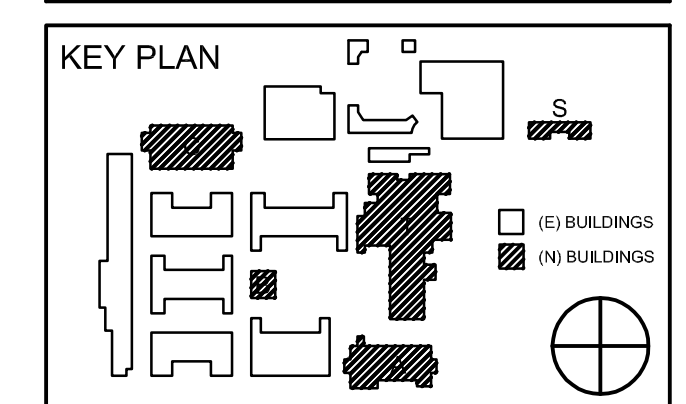
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ASB & SPECIAL ED BUILDINGS ROOF ELECTRICAL PLANS

DRAWING NUMBER: **ES4.1**

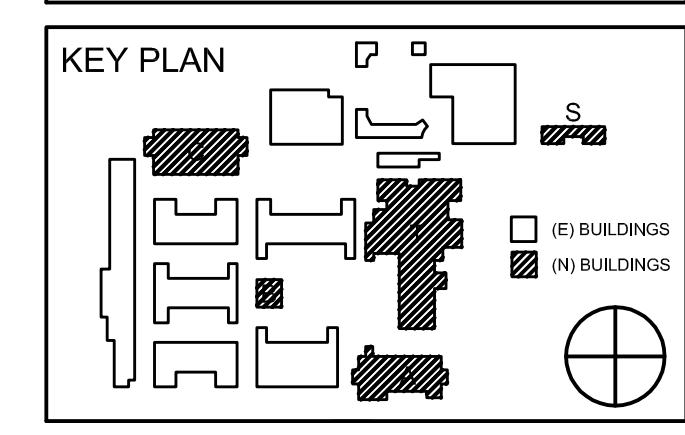
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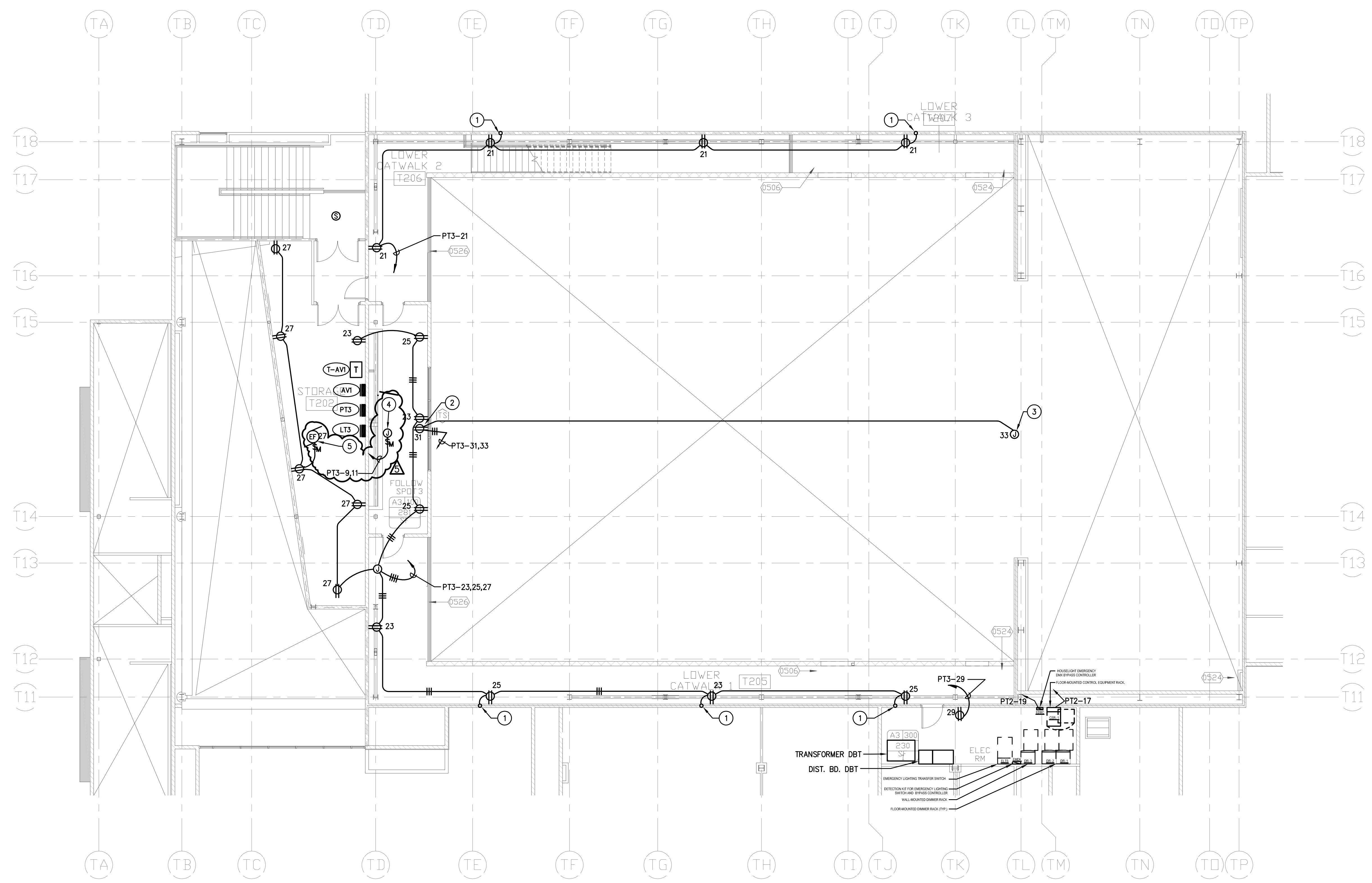


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DRWN: JP CHKD: PA/RO
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THEATER BUILDING SECOND FLOOR POWER PLAN

DRAWING NUMBER: **ET2.3**



GENERAL PLAN NOTES:

- REFER TO AUDIO EQUIPMENT CONSULTANT (AV) DRAWINGS FOR ADDITIONAL ELECTRICAL WORK NOT SHOWN ON POWER PLANS.
- REFER TO THEATRICAL EQUIPMENT CONSULTANT (TRK) DRAWINGS FOR ADDITIONAL ELECTRICAL WORK NOT SHOWN ON POWER PLANS.

PLAN NOTES:

- DOWN TO FIRST FLOOR, SEE ET2.1 FOR CONDUIT CONTINUATION.
- VIDEO PROJECTOR, VERIFY EXACT LOCATION WITH AV CONSULTANT.
- PROJECTOR SCREEN, VERIFY EXACT LOCATION WITH AV CONSULTANT.
- INDOOR UNIT (1HP-T1).
- CEILING EXHAUST FAN (EF-9), INTERLOCK WITH LIGHT SWITCH SENSOR RELAY AND PROVIDE AS REQUIRED.

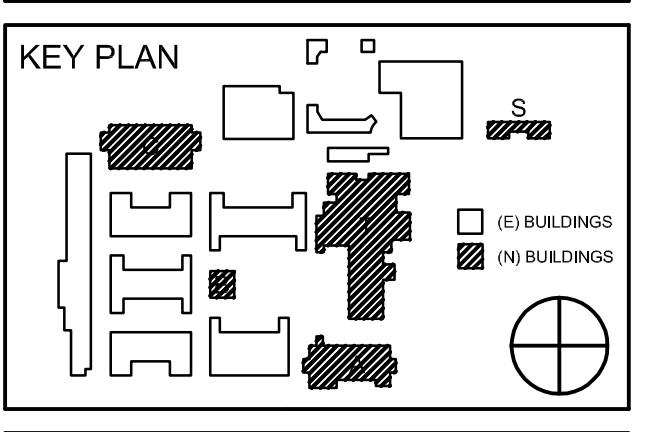
THEATER BUILDING SECOND FLOOR POWER PLAN 1/8" = 1'-0" 1

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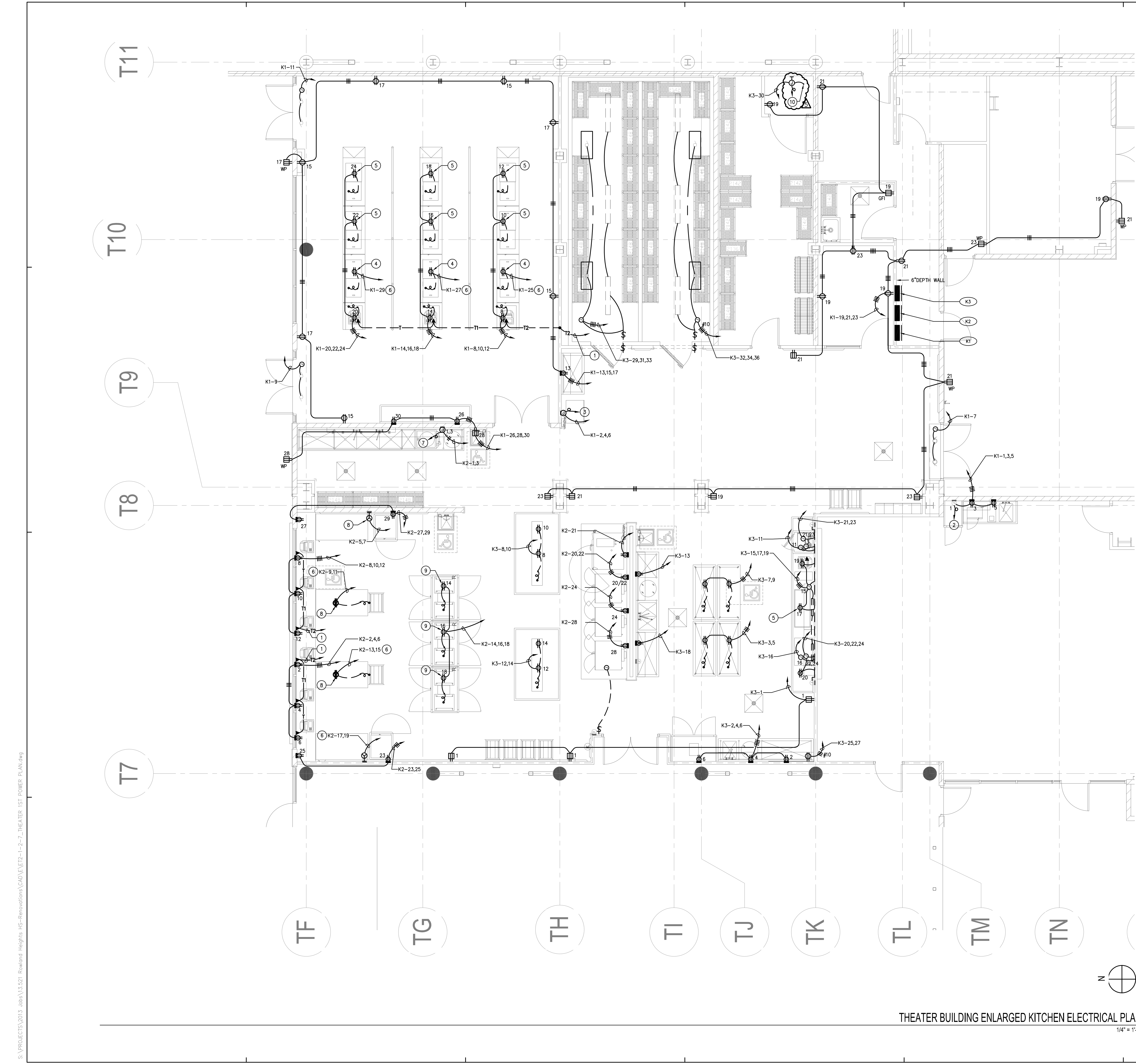
DRWN: JP CHKD: PA/RO
 DATE: 04/08/2015 SCALE:
 PROJECT NUMBER: 1310700

**THEATER BUILDING
 ENLARGED KITCHEN
 ELECTRICAL PLAN**

DRAWING NUMBER: **ET2.7**

- PLAN KEY NOTES:**
- TO "IDF-11" IN DATA ROOM T126.
 - CONNECT AS REQUIRED TO REFRIGERATOR. COORDINATE EXACT LOCATION AND ELECTRICAL REQUIREMENTS WITH KITCHEN EQUIPMENT DRAWINGS.
 - CONNECT AS REQUIRED TO ICE MAKER. COORDINATE EXACT LOCATION AND ELECTRICAL REQUIREMENTS WITH KITCHEN EQUIPMENT DRAWINGS.
 - PROVIDE NEMA 5-30P RECEPTACLE.
 - PROVIDE NEMA 5-15P RECEPTACLE.
 - 1/2" C. - 2#10, 1#10 GROUND.
 - CONNECT AS REQUIRED TO FOOD COLLECTOR. COORDINATE EXACT LOCATION AND ELECTRICAL REQUIREMENTS WITH KITCHEN EQUIPMENT DRAWINGS.
 - PROVIDE NEMA L14-30 RECEPTACLE.
 - PROVIDE NEMA 5-20P RECEPTACLE.
 - CONNECT TO GAS WATER HEATER & CIRCULATING PUMP PROVIDE AS REQUIRED.

- KITCHEN GENERAL NOTES:**
- REFER TO KITCHEN EQUIPMENT CONSULTANT (K.E.C.) DRAWINGS FOR ADDITIONAL ELECTRICAL WORK NOT SHOWN ON POWER PLANS. BUT INCLUDED IN THE ELECTRICAL CONTRACT SUCH AS:
 - CONDUIT, WIRE, JUNCTION BOXES AND RECEPTACLES LOCATED IN SERVICE AND COOLING AREA COUNTERS, CONNECTIONS TO K.E.C. FURNISHED LIGHTS, SWITCHES, BALLASTS, JUNCTION BOXES, ETC. AS REFERENCED ON K.E.C. DRAWINGS.
 - CORDS, CAPS AND RECEPTACLES FOR MISCELLANEOUS KITCHEN EQUIPMENT. SEE K.E.C. ELECTRICAL ROUGH-IN SCHEDULE.
 - REFRIGERATED BASE WIRING. REFER TO K.E.C. DRAWINGS FOR EXTENT OF WORK AND ELECTRICAL ROUGH-IN SCHEDULE TO DETERMINE WHERE REFRIGERATED BASES OCCUR.
 - REFER TO K.E.C. DRAWINGS AND PROVIDE PVC CONDUITS, PVC SLEEVES AND PULLBOXES FOR REFRIGERATION AND DRINK DISPENSING LINES. ELECTRICAL CONTRACTOR SHALL COMPLY WITH ALL DETAILS AND INSTALLATION INSTRUCTIONS.
 - DEVICE PLATES IN KITCHEN SHALL BE STAINLESS STEEL ENGRAVE PLATES WHERE INDICATED. ENGRAVING SHALL BE 1/8" HIGH BLACK FILLED AND SHALL BE DONE BY PLATE MANUFACTURER.
 - PROVIDE MISCELLANEOUS 20A, 125V, 3W GROUNDING RECEPTACLES WHERE INDICATED ON K.E.C. DRAWINGS AND 125V, 3W GROUNDING PLUGS WITH 3/4" #12 "SO" CORD IN LENGTH AS REQUIRED BY K.E.C.
 - PROVIDE RECEPTACLES AND SWITCHES IN OUTLET BOXES FURNISHED IN STAINLESS STEEL KITCHEN AND BAR COUNTERS.
 - REFER TO K.E.C. ELECTRICAL ROUGH-IN LOCATIONS OF ITEMS DENOTED WITH FOOD SERVICE EQUIPMENT ROUGH-IN CALLOUT.
 - VERIFY RECEPTACLE TYPES AND CONNECTION REQUIREMENTS WITH SELECTED KITCHEN EQUIPMENT.
 - PROVIDE CONDUIT SEALS AT ALL CONDUITS ENTERING OR LEAVING REFRIGERATORS AND FREEZERS IN ACCORDANCE TO N.E.C. 300-7.

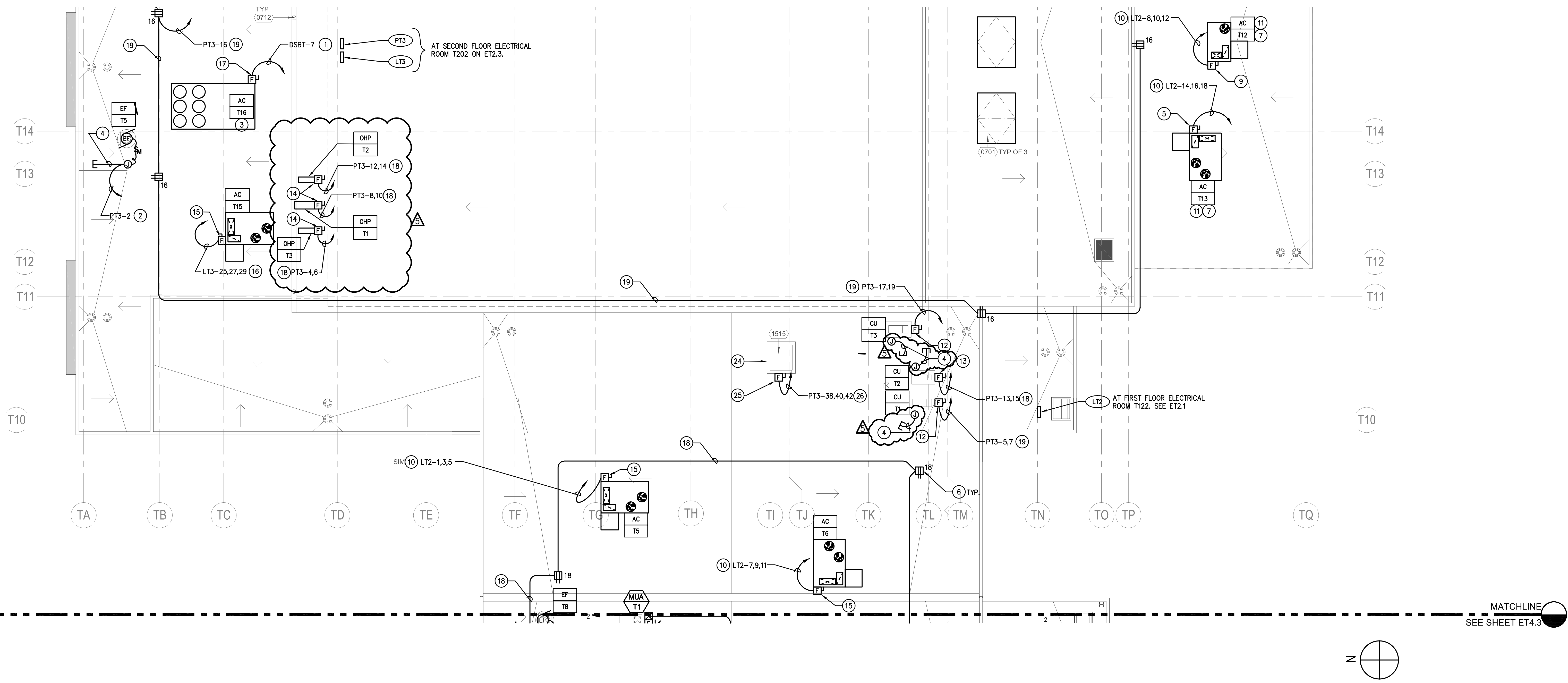


THEATER BUILDING ENLARGED KITCHEN ELECTRICAL PLAN

1/4" = 1'-0"

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THEATER BUILDING ROOF PARTIAL ELECTRICAL PLAN 1
1/8" = 1'-0"

PLAN KEY NOTES:
1. PLAN KEYNOTES (⊕), REFER TO SHEET ET4.1.

GENERAL ROOF NOTES

- ALL MULTI-WIRE BRANCH CIRCUITS AND HOME RUNS SHALL MEET NEC ARTICLE 210.4.
- PROVIDE 4" MIN SLEEPERS TO SUPPORT CONDUITS FOR ALL EXPOSED CONDUIT RUNS ON ROOF.
- ALL ELECTRICAL EQUIPMENT MOUNTED ON THE ROOF SHALL BE WEATHERPROOF (NEMA-3R).
- VERIFY EXACT LOCATION OF HVAC AND PLUMBING EQUIPMENT WITH MECHANICAL AND PLUMBING PLANS.
- PROVIDE FUSE PER NAMEPLATE RATING IF DIFFERENT FROM SIZE INDICATED. COMPLY WITH CODE.

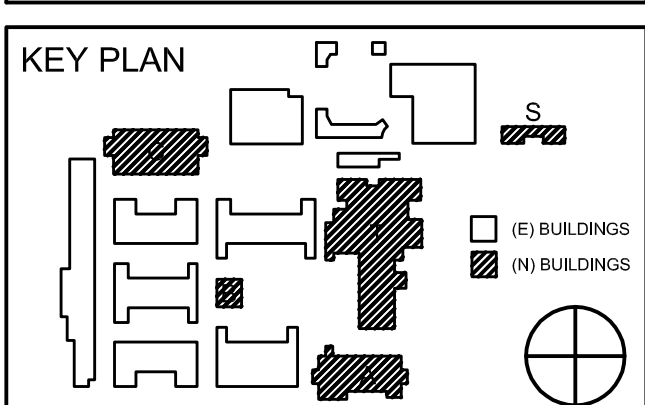
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THEATER BUILDING ROOF PARTIAL ELECTRICAL PLAN

DRAWING NUMBER: **ET4.2**

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