Capital Projects Contract Administration, Capital Planning & Development
Oregon State University3015 SW Western Blvd, Corvallis, Oregon 97333
T 541-737-9635 | **F** 541-737-4810

June 3, 2014

Oregon State University
Capital Projects Contract Administration
Goss Stadium Expansion

ADDENDUM NO. 2

THIS ADDENDUM IS BEING ISSUED for clarification and/or revisions of the drawings and specifications as noted. This document is hereby made a part of the Contract Documents to the extent as though it was originally included herein.

The following changes shall be made to the TECHNICAL SPECIFICATIONS:

Item 1 — Replace Bid Form in its entirety with the attached "Revised 6/2/14" Bid Form. Note the change in bid due date and time, as well as the addition of Alternate No. 1.

Item 2 — Add Section 012300, Alternates.

Item 3 — Add Section 055000 as shown on Attachment PL-1.

Item 4 — Replace Section 064023 with Attachment PL-2.

Item 5 — Add Section 072100 as show on Attachment PL-7.

Item 6 — Add Section 074500 as shown on Attachment PL-3.

Item 7 — Section 088000 – Glazing, 2.7, add the following:
"G. Per Section 072726 – Fluid-Applied Membrane Air Barriers (paragraph 2.4.N), provide preformed silicone-sealant extrusion at all openings. Manufacturer must be the same manufacturer that also provides the fluid-applied membrane air barrier system."

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Item 8 Section 088000, at 2.8.B.3: delete "(tempered in lieu of heat strengthened at aluminum storefronts and exterior doors next to door openings)" and replace with "(tempered in lieu of heat strengthened at all aluminum storefronts and exterior doors on north side of building)".

Item 9 Section 088000, 2.8.C, add the following:
"5. At Window Type S2 exterior glazing shall be ceramic frit glass (tempered). Coordinate with Owner on application of graphics for ceramic frit glass at this window."

Item 10 Section 092900, 2.2.E – delete "bottom 8' in Locker Room 113" and replace with "bottom 7' in Locker Room 113".

Item 11 Section 092900, 2.3, add the following:
"B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Certain Teed Corporation
b. James Hardie Building Products
c. National Gypsum Company
d. USG Corporation
2. Thickness: 5/8 inch
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
4. Location: At Shower in Toilet 105 and Shower Room 112."

Item 12 Add Section 093000 as shown on Attachment PL-4.

Item 13 Replace Section 096813 with Attachment PL-5.

Item 14 Delete Section 096816 in its entirety.

Item 15 Section 109000, 2.1, add the following:
"C. Outdoor Bench Seating (field side, adjacent to entry, as indicated on drawings). Basis of Design: Plexus II Collection as manufactured by landscapeforms (431 Lawndale Ave., Kalamazoo, MI 49048, ph: (800) 521-2546; http://www.landscapeforms.com) or approved equal.
1. Components:
a. Straight four-unit group (2 units total), 96" in length for each

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group.
b. Backless seat.
c. Powder Coated, Silver color
d. Surface Mounted."

Item 16 Section 144200, at 2.2.E.1, delete "Standard 37-1/4 inches (947mm) by 54 inches (1370mm)." and replace with "Large: 45-1/2 inches (1155mm by 56-7/8" (1446mm)."

Item 17 Add Section 221323 as shown on Attachment PL-6.

Item 18 Section 270500: delete this section and replace with new section as shown on Attachment PM-1.

Item 19 Replace the OSU Division 27 Master Specification for Information Transport Systems and Spaces with the most current version, dated May 1, 2014, as attached.

Item 20 Section 270510: delete this section and replace with new section as shown on Attachment PM-2.

Item 21 Section 270528: delete this section and replace with new section as shown on Attachment PM-3.

Item 22 Section 270529: delete this section and replace with new section as shown on Attachment PM-4.

Item 23 Section 270533: delete this section and replace with new section as shown on Attachment PM-5.

Item 24 Section 270543: delete this section and replace with new section as shown on Attachment PM-6.

Item 25 Section 271100: delete this section and replace with new section as shown on Attachment PM-7.

Item 26 Section 271300: delete this section and replace with new section as shown on Attachment PM-8.

Capital Projects Contract Administration, Capital Planning & Development
Oregon State University3015 SW Western Blvd, Corvallis, Oregon 97333
T 541-737-9635 | **F** 541-737-4810

Item 27 Section 271500: delete this section and replace with new section as shown on Attachment PM-9.

Item 28 Section 274133: delete this section and replace with new section as shown on Attachment PM-10.

Item 29 Section 280500: delete this section and replace with new section as shown on Attachment PM-11.

Item 30 Section 280513: delete this section and replace with new section as shown on Attachment PM-12.

Item 31 Section 312000, revise part 3.6.G to read as follows:

"G. Vapor Barrier Installation: Vapor Barrier installation shall be compatible with proposed flooring and method of slab curing and installation shall be per manufacturer's recommendations and Architect's approval."

Item 32 Section 331000, 1.6.B, add the following:

"2. Submit buoyancy calculations for backflow preventer vault. Use a factor of safety of 1.5 and assume groundwater level at finished grade as per Geotechnical Report."

The following changes shall be made to the DRAWINGS:

Item 33 Drawing C3.0 – Site Grading Plan: revise grades at building entrance per attached Revision Sheet C1.

Item 34 Drawing C4.0 – Site Utilities Plan: add 4" downspout connection per attached Revision Sheet C2.

Item 35 Drawing C5.0 – Paving Plan: revise accessible stall width from 11' to 9' and show isolation joint at new HVAC pad location per attached Revision Sheet C3.

Item 36 Drawing A2.1 – Enlarged Plan – Ground Floor: delete Sheet A2.1 in its entirety and replace with Attachment A1.

Item 37 Drawing A3.1 – Reflected Ceiling Plans:

A. At Legend Notes, delete "9Wood Suspended Ceiling" and replace with "Linear Wood Ceiling System".

Capital Projects Contract Administration, Capital Planning & Development
Oregon State University3015 SW Western Blvd, Corvallis, Oregon 97333
T 541-737-9635 | **F** 541-737-4810

B. Drawing A3.1 – Reflected Ceiling Plans: revise Reflected Ceiling Plan – Ground Floor Plan as show on Attachment A2.

Item 38 Drawing A5.1 – Building Elevations:

A. Add keynote 27 as follows: "Match arch radius with existing arches on north side. Coordinate with Architect."
B. Revise detail 22 as shown on Attachment A3.
C. Revise detail 41 as show on Attachment A4.

Item 39 Drawing A7.1 – Wall Section:

A. Revise details 53 and 54 as shown on Attachment A5.
B. Revised detail 57 as shown on Attachment A6.
C. At details 31, 32, 51, and 52, delete "119'-1" as called out for top parapet elevation and replace with revised top of parapet elevation of "119'-2".
D. At detail 52, add the following text: "Note: At exterior metal stud framing, provide permeable membrane air barrier, or Tyvek, or equal."

Item 40 Drawing A8.1 – Vertical Circulation:

A. Revise detail 32 as shown on Attachment A7.
B. Revise detail 45 as shown on Attachment A8.

Item 41 Drawing A9.1 – Door & Frame Types & Details: at detail 14, delete window section cut tags "51E/A7.1" and replace with new window section tags, "33/A9.1".

Item 42 Drawing A10.1 – Building Details:

A. At detail 11, delete note "Cont. 2x6 Mtl Stud" and replace with " Cont. Mtl. Stud, see plan for wall type, u.n.o".
B. Revise detail 45 as shown on Attachment A9.

Item 43 Drawing A10.2 – Building Details: delete sheet A10.2 in its entirety and replace with Attachment A10.

Item 44 Drawing A11.1 – Interior Elevations, Finish Plans, Details: delete sheet A11.1 in its entirety and replace with Attachment A11.

Item 45 Drawing S0.1 – General Structural Notes: add detail 11/S0.1, as shown on attachment sketch S1.

Capital Projects Contract Administration, Capital Planning & Development
Oregon State University3015 SW Western Blvd, Corvallis, Oregon 97333
T 541-737-9635 | **F** 541-737-4810

Item 46 Drawing S2.1 – Concourse Level Framing Plan: show angle framing on plan and revise Legend Note 8, as shown on attachment sketch S2.

Item 47 Drawing S2.2 – Canopy Level Framing Plan: show lift tieback support brace on plan and add Legend Note 2, as shown on attachment sketch S3.

Item 48 Drawing S4.2 – Structural Details:

A. Modify detail 43/S4.2, as shown on attachment S4.
B. Modify detail 44/S4.2, as shown on attachment S5.

Item 49 Drawing M1.1 – Mechanical Plan – Ground Level: relocated outdoor unit HP-1 from east side of building to west side near the electrical room. Refrigerant piping rerouted accordingly.

Item 50 Drawing P1.1 – Plumbing Plan – Ground Level:

A. Removed Strom Drain Piping
B. Added Storm Drain piping connection downspouts from roof.
C. Added Storm Drain piping connecting floor drain at vertical lift, gridline A2.5.
D. Revised Storm Drain pipe size at building exist to 4” at gridline C5.

Item 51 Drawing P1.1 – Plumbing Plan – Ground Level:

A. Removed Storm Drain piping.
B. Added Storm Drain piping connection downspouts from roof.
C. Added Storm Drain piping connecting floor drain at vertical lift, gridline A2.5.
D. Revised Storm Drain pipe size at building exist to 4” at gridline C5.

Item 52 Drawing P1.2 – Plumbing Plan – Concourse Level:

A. Added FD-2 at vertical lift, gridline A2.5.
B. Added coordination note for HW, CW, and W.
C. Added Storm Drain piping up to gutter at roof.
D. Added and clarified Grease Vent for FD-2 (typ.3 places).

Item 53 Drawing P4.2 – Plumbing Risers: clarified Sanitary Waste and Vent Riser Diagram 2/P4.2.

Item 54 Drawing E0.0: change description for quantity of voice and data jacks from 1 voice and 2 data to 1 voice and 3 data jacks and cables.

Capital Projects Contract Administration, Capital Planning & Development
Oregon State University3015 SW Western Blvd, Corvallis, Oregon 97333
T 541-737-9635 | **F** 541-737-4810

Item 55 Drawing E0.1:

A. In the comments column for fixture type M03 delete "UTILITY POLE" and add "FIELD LIGHTING POLE".
B. Fixture Type X02: delete "EVENLITE PL SERIES" from the lighting fixture schedule

Item 56 Drawing E0.2:

A. Change panel A2 to 225 amps with a 200 amp Main Circuit Breaker.
B. Change panel A3 to 225 amps, 4W, with a 200 amp Main Circuit Breaker.
C. Change the 50/2 circuit breaker in Panel A2, position 26, 28 to 60/2.
D. Add the following to Lighting Control Schedule Note 3 – Provide a relay and control circuit from the existing Field Lighting Controller to the new Lighting Control Panel. Exterior lights to be energized upon input from both the field lighting controller and from the photocell. Photocell to be located so the performance is not to be impacted by the field lights.
E. Add the following work which is to be completed as part of Bid Alternate #1: Provide (5) 3" conduits from electrical room 102 to an existing in-grade pull box that is located in the sidewalk, directly on the outside wall of the stadium, approximately 40' west of the existing field lighting pole at the east end of the stadium along the 3rd baseline. The existing pull box is shown on sheet 1 of the Topographic Survey. The conduits shall be direct bored, underneath the existing sidewalk, from the existing pull box to a new pull box, located in the sidewalk outside of mechanical room 101. The new pull box is to match the existing box. Three of the conduits are to be stubbed up on the north wall of the electrical room and two of the conduits are to be stubbed up on the south wall of the electrical room. Sidewalk panels disturbed by boring activities shall be replaced as full panels to match the existing joint layout. Minimum conduit depth to be 30". See the topographic plan for other existing below grades utilities that need to be avoided.

Item 57 Drawing E1.0:

A. Add drawing Attachment E1.
B. Add drawing Attachment E2.
C. Add the following to flag note 4: "Provide a new cross arm on existing field light pole directly above existing bracket supporting existing emergency lights."
D. Provide a 120 volt, 20 amp circuit from panel A2, located in electrical room 105, for a new ADA door operator for the southernmost door in Hall of Fame Room 108. Provide connection from the door operator to an

Capital Projects Contract Administration, Capital Planning & Development
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interior and exterior push pad.

Item 58 Drawing E2.1: add a grounding bus bar in electrical room 102. Locate adjacent to wall mounted telecom racks. See detail 1/E6.0.

Item 59 Drawing E2.2:

A. Add a telephone outlet for the Platform Lift PL-1. Verify exact location with Architect and platform lift vendor.
B. Locate the 2 data outlets and adjacent duplex receptacles on the north side of the concourse as directed by OSU during construction for the concession stand cash registers.
C. Provide the following for the concessions equipment to be located on top of the concourse level:
    a. (14) 120 volt, 20 amp circuits and (16) 20 amp duplex GFCI receptacles.
    b. (1) 208 volt, single phase, 20 amp circuit and (1) 20 amp receptacle.
    c. (1) 120/208, single phase, 60 amp circuit and (1) 60 amp receptacle.
    d. All circuits to be fed from spare circuit breakers located in panels A3. Some of the equipment is presently shown on the panel schedule and others are not. Contractor is responsible for assigning circuits and documenting the changes on the as-built drawings.
    e. Contractor to coordinate with owner during construction for location of devices and equipment.

Item 60 Drawing E3.1:

A. The 2 light fixtures in Electric Room 102 are to be fed from LS2-7, the room lights are not to be controlled through the lighting control panel, only through the local wall mounted switch.
B. Remove the fixture type “L01” located in the canopy soffit at the main entrance to the building on the north side. Replace with a type “F08” fixture on both walls perpendicular to the entrance door. Coordinate location with Architect prior to rough-in. Connect to same relay and circuit of the other fixtures on the north exterior.

Item 61 Drawing E3.2:

A. Type M02 fixture to east side of concessions canopy alongside the other type M02 fixture located just east of gridline “L” and south of gridline “4”. Add to relay R10. Center the two fixtures on the walkway leading to exiting

Capital Projects Contract Administration, Capital Planning & Development
Oregon State University3015 SW Western Blvd, Corvallis, Oregon 97333
T 541-737-9635 | **F** 541-737-4810

stairs. Aim so fixture covers first half of walkway. Provide with baffling to minimize glare.

B. Remove from Relay R11 and add to relay R10 for Fixture type M02 located just east of gridline "L" and south of gridline "4". Aim so fixture covers second half of walkway. Provide with baffling to minimize glare.

Item 62 Drawing E5.0:

A. Add drawing Attachment E3.
B. Add drawing Attachment E4.

CLARIFICATIONS/QUESTIONS:

Item 63 Addendum No. 2 includes an Alternate (No. 1). See the change to Sheet E0.2 as noted above.

Item 64 Question: Wall stud size at east wall vestibule 108 unclear? Wall type 4 says 8" stud, dimension on plan near door 108A 7 5/8", section cut 11/A10.1 at soffit opening into locker room says 6" studs.
Response: Wall type 4 would apply at the soffit in question. See revision to 11/A10.1 in this addendum.

Item 65 Question: Where does transition occur between ceramic tile in toilet room 110 verse gypsum board in locker room? Please clarify.
Response: See revision to sheet A11.1 as noted in the attachment to this addendum.

Item 66 Question: Section 092900 gypsum board 2.2E abuse resistant bottom 8' in locker room 113. The lockers are 7ft tall, do you want abuse board behind the lockers and 1ft up on soffit?
Response: No, the abuse resistant board shall not exceed the height of the lockers. See revision note to Section 092900 in this addendum.

Item 67 Question: The reflected ceiling plan A3.1 shows a gypsum board ceiling at 10ft and wood ceiling at 9'6". Compare to section 34 and 35/A7.1 does not show the wood ceiling and section 21/A10.1 shows the wood ceiling attaching to a wall or soffit, please clarify is wood ceiling floating per 9'6" verse 10ft or attaching to wall?

Capital Projects Contract Administration, Capital Planning & Development
Oregon State University3015 SW Western Blvd, Corvallis, Oregon 97333
T 541-737-9635 | **F** 541-737-4810

Response: Ceiling plan determines elevation for gypsum board and linear wood ceiling system. See revised ceiling plan attached to this addendum for corrected elevations.

Item 68 Question: A3.1 Please clarify bold black line +/- 6 inches from face of lockers?
Response: The black line references the linear light fixture that is shown on the electrical lighting plan. See sheet E3.1.

Item 69 Question: Section cut 57/A7.1 shows window sill detail 42/A9.1 above lockers and this shows gypsum board on metal furring over cone wall compare to floor plan A2.1 does not show any gyp board or furring at CMU walls in room 113, please clarify wall behind lockers and cubbies in room 113.
Response: See revision to57/A7.1 and the addition of detail 56/A11.1, as shown in the attachments to this addendum.

Item 70 Question: Please provide spec section for ceramic tile.
Response: See attachment to this addendum.

Item 71 Question: Please provide specification for “wood laminate flooring”.
Response: There isn’t any wood laminate flooring in this project. There is, however, wood flooring. See section 096400 in Project Manual as well as clarification to sheet A11.1, as shown in attachment A11 to this addendum.

Item 72 Question: Re: A11.1 Material Schedule. Schedule has size of Flor Carpet Tile as 24” x 24” but Flor standard size is 50cm x 50cm. Is a special size to be manufactured?
Response: No, the standard size applies. 24” x 24” is the approximate dimensional match using imperial measurements.

Item 73 Question: There are several mistakes in the sanitary waste and vent riser diagram shown on DWG P4.2, detail P4.2/2. The floor drains appear to be above the floor. Shouldn't the drains be below the floor? Also, the same diagram shows 5 vents through the roof, but the plumbing DWG P1.2 only shows two vents going through the roof and those are the 2-1/2" vent on gridline D and the 3" vent on gridline H. Please confirm which one is correct? The riser diagram or the planview drawing?
Response: Drawings clarified in revised plumbing drawings attached to this addendum.

Capital Projects Contract Administration, Capital Planning & Development
Oregon State University3015 SW Western Blvd, Corvallis, Oregon 97333
T 541-737-9635 | **F** 541-737-4810

Item 74 Question: Please confirm if the pressure reducing valve detail provided in drawing P4.1 is what we should be installing on the gas line at every pressure reducing valve? It seems some of these plug valves and gauges will not provide any benefit to the owner. See attached marked up sketch and if this is acceptable or if you want us to install per the detail at each PRV.
Response: PRV shown in detail 22/P4.1 is intended for Domestic Water installations only. Please reference gas connection detail 24/P4.1 for gas connections.

Item 75 Question: Please confirm whether or not p-traps are required for the 3 floor drains that come up through floor at the concourse level. The sanitary waste and vent riser diagram does not show them. Also for the drains on drawing P1.2, please confirm whether or not these required p-traps since the piping is missing on the sanitary waste and vent riser diagram.
Response: Traps are required. Drawings clarified in revised plumbing drawings attached to this addendum. Drains on the south are Roof Drains as called out in plan and the plumbing schedule. Traps not required as roof drains are of the Storm Drainage system and omitted from riser diagrams.

Item 76 Question: Please look at the attached marked up drawing P1.1. Branch 1 looks like it serves the EUH-1 unit, but it does not connect to a main, please advise we are to connect this line to the 3" storm drain leading out of the building. Branch 2, looks like it serves the XT-1 unit, but once again this line does not connect to anything, please confirm if this is also a line that we should connect to the 3" storm drain leading out of the building. Branch 3 shows a drain coming from a wall and it ties-in to the 3" storm drain line, but we do not know what it serves, please advise where this drain is coming from and what equipment it serves as it does not show up on the riser diagram drawing or the 2nd floor drawings.
Response: Drawings clarified in revised plumbing drawings attached to this addendum.

SUBSTITUTION REQUESTS/APPROVALS

The approval of the substitution requests noted below is contingent upon the requested manufacturer meeting all aspects of the performance of the originally specified products. Post-bid discovery that the requested manufacturer cannot provide a product of equal performance or cannot provide a product with all of the identified features and hence the rejection of the product, shall not result in a change in contract to the Owner. In no case are models being

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T 541-737-9635 | **F** 541-737-4810

approved at this time, regardless of whether that information was included in the substitution request or not – only manufacturers are being reviewed and approved at this time.
Neither DLR Group nor Oregon State University warrant that all Substitution Requests submitted will be reviewed. Additionally, incomplete, unclear, or untimely requests were not considered.

The following are approved:

Specification Section		Approved Substitution
074113	Standing-Seam Metal Roof Panels	TBC – Superseam (for paragraph 2.2.D)
074113	Standing-Seam Metal Roof Panels	Taylor Metal MS200 (for paragraph 2.2.D)
074113	Standing-Seam Metal Roof Panels	Magna-Loc by Metal Sales Mfg. Corp. (for paragraph 2.2.D)
092216	Non-Structural Metal Framing	Scafco Deflection track (for paragraph 2.3.B.3.a)
092216	Non-Structural Metal Framing	Scafco VerticClip SLD (for paragraph 2.3.B.3.a.1)
220548	Vibration and Seismic Controls for Plumbing Piping and Equipment	Vibro Acoustics (for paragraph 2.1.A)
230548	Vibration and Seismic Controls for HVAC Piping and Equipment	Vibro Acoustics (for paragraph 2.1.A)
233713	Diffusers, Registers, and Grilles	Nailor (for paragraph 2.1.A)

Approved Lighting Substitution Requests

a. Fixture Type L01 – Add Gotham Evo Series to Alternate Manufacturers Column.
b. Fixture Type L02 – Add Gotham Evo Series to Alternate Manufacturers Column.
c. Fixture Type L03 – Add Zumtobel Slotlight SSR2 Series and Lumenpulse Lumenline 2 LL12R Series to Alternate Manufacturers Column.
d. Fixture Type L04 – Add Traxon Cove Light AC HE Series to Alternate Manufacturers column.
e. Fixture Type L05 – Add Nulite RF6 Series to Alternate Manufactures column.
f. Fixture Type L07 – Add Primus ALX1 Series to Alternate Manufacturers column.
g. Fixture Type M01 – Add Arida WT500 Series to Alternate Manufacturer column.
h. Fixture Type M02 – Add Arida WT500 Series to Alternate Manufacturer column. Note to manufacturer to provide with Baffling per Addendum Sheet E3.2 noted below.
i. Fixture Type X02 – Add Isolite 2040 Series

Capital Projects Contract Administration, Capital Planning & Development
Oregon State University3015 SW Western Blvd, Corvallis, Oregon 97333
T 541-737-9635 | **F** 541-737-4810

The following are **NOT** approved:

Specification Section		**Not Approved Substitution**
072726	Fluid-Applied Membrane Air Barriers	Sto Guard Systems Vapor Seal (for paragraph 2.3.)
237200	Air-To-Air Energy Recovery Equipment Plumbing, Piping and Equipment	Daikin Applied (formerly Mcquay) model DPS "Rebel" Rooftop Unit (for paragraph 2.1.A)
237200	Air-To-Air Energy Recovery Equipment Plumbing, Piping and Equipment	Venmar (CES Group) VHC-36 (for paragraph 2.1.A)

END OF ADDENDUM NO. 2

OREGON UNIVERSITY SYSTEM

STANDARD PUBLIC IMPROVEMENT CONTRACT

BID FORM

OUS CAMPUS: OREGON STATE UNIVERSITY

PROJECT: GOSS STADIUM EXPANSION

BID CLOSING: JUNE 10, 2014 2:00PM

BID OPENING: JUNE 10, 2014 2:00PM

FROM: _____
Name of Contractor

TO: The State of Oregon, acting by and through the Oregon State Board of Higher Education, on behalf of Oregon State University ("Owner")
Capital Projects Contract Administration
3015 SW Western Blvd.
Corvallis, Oregon 97333

1. The Undersigned (*check one of the following and insert information requested*):

____a. An individual doing business under an assumed name registered under the laws of the State of _____; or

____b. A partnership registered under the laws of the State of _____; or

____c. A corporation organized under the laws of the State of _____; or

____d. A limited liability corporation/company organized under the laws of the State of _____;

hereby proposes to furnish all material and labor and perform all work hereinafter indicated for the above project in strict accordance with the Contract Documents for the Basic Bid as follows:

_____ Dollars ($_____)

and the Undersigned agrees to be bound by the following documents:

- Notice of Public Improvement Contract Opportunity
- Instructions to Bidders
- Supplemental Instructions to Bidders
- Public Improvement Agreement Form
- Performance Bond and Payment Bond
- OUS Public Improvement General Conditions
- Supplemental OUS Public Improvement General Conditions
- Prevailing Wage Rates
- Payroll and Certified Statement Form
- Plans and Specifications
- Drawings and Details
- ADDENDA numbered ____ through____, inclusive *(fill in blanks)*

2. The work shall be completed within the time stipulated and specified in Division 1, Section 01 11 00, of the Specifications.

3. The Undersigned proposes to add to or deduct from the Base Bid indicated above the items of work relating to the following Alternate(s) as designated in the Specifications:

ALTERNATE 1: Provide five 3" conduits from electrical room 102 to an existing in-grade pull box located in the sidewalk direction on the outside wall of the stadium.

ADD: $_____

4. The Undersigned certifies that: (1) This Bid has been arrived at independently and is being submitted without collusion with and without any agreement, understanding, or planned common course of action with any other vendor of materials, supplies, equipment or services described in the invitation to bid designed to limit independent bidding or competition; and (2) The contents of the Bid have not been communicated by the Undersigned or its employees or agents to any person not an employee or agent of the Undersigned or its surety on any Bond furnished with the Bid and will not be communicated to such person prior to the official opening of the Bid.

5. The undersigned **HAS, HAS NOT** (*circle applicable status*) paid unemployment or income taxes in Oregon within the past 12 months and **HAS, HAS NOT** (*circle applicable status*) a business address in Oregon..

6. The Undersigned agrees, if awarded a contract, to comply with the provisions of ORS 279C.800 through 279C.870 pertaining to the payment of the prevailing rates of wage.

7. Contractor's CCB registration number is _____. As a condition to submitting a bid, a Contractor must be registered with the Oregon Construction Contractors Board in accordance with ORS 701.035 to 701.055, and disclose the registration number. Failure to register and disclose the number will render the bid unresponsive and it will be rejected, unless contrary to federal law.

8. The successful Bidder hereby certifies that all subcontractors who will perform construction work as described in ORS 701.005(2) were registered with the Construction Contractors Board in accordance with ORS 701.035 to 701.055 at the time the subcontractor(s) made a bid to work under the Contract.

9. The successful Bidder hereby certifies that, in compliance with the Worker's Compensation Law of the State of Oregon, its Worker's Compensation Insurance provider is _____, Policy No. _____, and that Contractor shall submit Certificates of Insurance as required.

10. Contractor's Project Manager for this project is: _____,
Office Phone: _____ Cell Phone: _____.

11. The Undersigned certifies that it has not discriminated against minority, women, or emerging small businesses in obtaining any subcontracts for this project.

12. The Undersigned agrees, if awarded the Contract, to execute and deliver to Owner, within twenty (20) calendar days after receiving the Contract Documents, an Agreement Form and a satisfactory Performance Bond and Payment Bond, each in an amount equal to one hundred (100) percent of the Contract sum, using forms provided by the Owner. The surety requested to issue the Performance Bond and Payment Bond will be: _____.

(name of surety company - not insurance agency)

The Undersigned hereby authorizes said surety company to disclose any information to the Owner concerning the Undersigned's ability to supply a Performance Bond and Payment Bond each in the amount of the Contract.

By signature below, Contractor agrees to be bound by this Bid.

NAME OF FIRM _____

ADDRESS _____

_____

FEDERAL TAX ID _____

TELEPHONE NO _____

FAX NO _____

SIGNATURE 1) _____
Sole Individual - Signature

_____
Sole Individual - Printed Name

or 2) _____
Partner

or 3) _____
Authorized Officer of Corporation - Signature

_____
Authorized Officer of Corporation Printed Name

(SEAL)

_____
Attested: Secretary of Corporation

Payment information will be reported to the IRS under the name and taxpayer ID # provided above. Information not matching IRS records could subject Contractor to 31 percent backup withholding.

***** *END OF BID* *****

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The alternates described in this Section may be exercised at the option of the Owner within 60 days of the execution of the Contract.

B. It is generally the practice of the Owner to exercise alternates in numerical order.

C. The Owner reserves the right to accept the alternates without regard to order or sequence; but, such acceptance shall not impair the selection of a low, responsible and responsive bidder to whom the Contract may be awarded under an equitable bid procedure.

1.02 QUALITY ASSURANCE

A. For each alternate which is accepted, coordinate the work of the various trades involved, and modify surrounding work as required to complete the project as intended.

B. In the change-in-price figure for each alternate, include incidental costs which are attributable to adjustments in the work of other trades which may be required to achieve the contemplated and final conditions.

C. Questions:
   1. If there is a question regarding the extent, scope, nature, or intent of the alternates, contact the Owner's Authorized Representative for clarification.
   2. Failure on the part of the Contractor to clarify any unclear items shall not relieve the Contractor of the responsibility for performing the selected alternates in accordance with the intent and requirements of the Project Manual and Drawings.
   3. The description of the alternates hereinafter is qualitative and not quantitative; the Contractor shall determine the quantities of labor and materials and the extent of same required to execute the selected alternates in accordance with the intent and requirements of the Project Manual and Drawings.
   4. The applicable Sections of the Specifications apply to the work under each alternate.

1.03 LIST OF ALTERNATES

A. Alternate 1: Provide (5) 3" conduits from electrical room 102 to an existing in-grade pull box that is located in the sidewalk, directly on the outside wall of the stadium, approximately 40' west of the existing field lighting pole at the east end of the stadium along the 3rd baseline. The existing pull box is shown on sheet 1 of the Topographic Survey. The conduits shall be direct bored, underneath the

existing sidewalk, from the existing pull box to a new pull box, located in the sidewalk outside of mechanical room 101. The new pull box is to match the existing box. Three of the conduits are to be stubbed up on the north wall of the electrical room and two of the conduits are to be stubbed up on the south wall of the electrical room. Sidewalk panels disturbed by boring activities shall be replaced as full panels to match the existing joint layout. Minimum conduit depth to be 30". See the topographic plan for other existing below grades utilities that need to be avoided.

END OF SECTION

SECTION 055000 - METAL FABRICATIONS

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. Steel framing and supports for countertops.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Metal bollards.
5. Metal Downspout Boots
6. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 051200 "Structural Steel Framing."

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves,

concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Prefabricated building columns.
3. Metal nosings and treads.
4. Paint products.
5. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

D. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallically bonded to steel.

E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

F. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1 (A1).

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

2.7 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

2.8 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel.

1. Cap bollards with 1/4-inch-thick steel plate.

B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

C. Prime bollards with zinc-rich primer.

D. Number of bollards: 4

E. Location of bollards: Adjacent to outdoor mechanical equipment, east of new building. Final location to be coordinated with Architect and Owner.

2.9 METAL DOWNSPOUT BOOTS

A. Provide downspout boots made from cast **iron** in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.

1. Outlet: Vertical, to discharge into pipe.

B. Prime cast-iron downspout boots with zinc-rich primer.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.11 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

2.12 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.13 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.14 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions, overhead doors securely to, and rigidly brace from, building structure.

3.3 INSTALLING METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete or in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inchtoward bollard.

C. Fill bollards solidly with concrete, mounding top surface to shed water.

D. "Joint Sealants" to provide a watertight installation.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

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. This Section includes the following:

1. Wood Lockers and shop finishing of wood lockers.
2. Plastic-laminate cabinets.
3. Solid-surfacing-material counter tops and benches
4. MDF, medium density fiberboard.

B. Related Sections include the following:

1. Division 06 Section "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

2. Division 09 Section “Staining and Transparent Finishing”.

1.3 REFERENCES

A. Architectural Woodwork Institute: AWI - Quality Standards Illustrated.

1.4 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated, including cabinet hardware and accessories and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.

2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers and other items installed in architectural woodwork.
4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

C. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. Plastic laminates.

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
2. Lumber with or for transparent finish, not less than 5 inches (125 mm) wide by 24 inches (600 mm) long, for each species and cut, finished on 1 side and 1 edge.
3. Veneer-faced panel products with or for stained finish, 8 by 10 inches (200 by 250 mm), for each species and cut. Include at least one face-veneer seam and finish as specified.
4. Veneer-faced panel products with or for stained finish, 8 by 10 inches (200 by 250 mm), for each species and cut. Include at least one face-veneer seam and finish as specified.
5. Solid-surfacing materials, 6 inches (150 mm) square.
6. Exposed cabinet hardware and accessories, one unit for each type and finish.
7. MDF, 12 inch square with opaque finish.

E. Product Certificates: for each type of product, signed by product manufacturer.

F. Qualification data: for Installer.

1.6 QUALITY ASSURANCE

A. Manufacturer/Fabricator Qualifications: Manufacturer/fabricator with not less than 5 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities, and personnel to produce required work.

B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers and wood doors with face veneers that are sequence matched with woodwork and transparent-finished wood doors that are required to be of same species as woodwork.

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

E. Forest Certification: Provide interior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

F. Mockups: Provide mockup of one standard locker and one ADA locker for review by Architect and Owner on site. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:
1. Particleboard: ANSI A208.1, Grade M-2.
2. Wood Veneer ¾ inch A Grade plain sliced veneer on MDF core, wood species and finish listed below:
a. Typical Wood Species: Cherry. Assume owner may select an alternate species from the following list:
1) Maple
2) Red Oak
3) Walnut
4) Mahogany

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Manufacturer: Subject to compliance with requirements, provide the following:

a. Wilsonart International.
b. Formica.
c. Nevamar

D. Solid-Surfacing Material (SS-1): Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

1. Manufacturers: Subject to compliance with requirements, provide products by the basis of design manufacturer listed on the color and materials schedule or a comparable product of one of the following:

a. Avonite Surfaces; Aristech Acrylics LLC.
b. E. I. du Pont de Nemours and Company.
c. Formica Corporation.
d. LG Solid Source, L.L.C.
e. Nevamar Company, LLC; Decorative Products Div.
f. Wilsonart International; Div. of Premark International, Inc.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.

1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 843.

1. Product: Subject to compliance with requirements, provide “Medite FR” by SierraPine Ltd.; Medite Div.

2.3 MDF, MEDIUM DENSITY FIBERBOARD

A. Grade: Custom.

B. Wood Paneling Product: Medium density fiberboard.

C. Fire-Retardant-Treated Paneling: Provide panels consisting of wood veneer and fire-retardant particleboard or fire-retardant medium-density fiberboard. Panels shall have flame-spread index of 25 or less and smoke-developed index of 450 or less per ASTM E 84.

2.4 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Butt Hinges: 2-3/4-inch (70-mm), 5-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:

1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.

C. Continuous piano hinge.

D. Wire Pulls: Unless noted otherwise, back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.

E. Catches: Magnetic catches, BHMA A156.9, B03141.

F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

G. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

H. Drawer Slides: BHMA A156.9, B05091.

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
2. Box Drawer Slides: Grade 1; for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.
3. File Drawer Slides: Grade 1HD-100; for drawers more than 6 inches (150 mm) high or 24 inches (600 mm) wide.

I. Door Locks: BHMA A156.11, E07121.

J. Drawer Locks: BHMA A156.11, E07041.

K. Grommets for Cable Passage through Countertops: 2-inch (51-mm) OD, satin chrome grommets no flip top satin chrome slot for wire passage. (**no plastic**)

1. Product: Subject to compliance with requirements, provide "TG series" by Doug Mockett & Company, Inc.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

N. Standoff Hardware: Multipurpose stand-off by Mockett 5/8” diameter cap size, MPB7.

O. Flap stay with brake: Stablius, Lift-O-Mat

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.6 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.7 COUNTERTOPS

A. Countertops, General: Provide smooth, clean exposed tops and edges in uniform plane free of defects. Provide front and end overhang of 1 inch (25 mm) over base cabinets.

B. Solid-Surfacing-Material Tops (SS): 1/2-inch- thick, solid-surfacing material with front edge built up with same material.

1. Front: 1/2-inch bullnose, 1 ½-inch total built up front edge height.

2. Backsplashes: 1/2-inch- thick, solid-surfacing material; slightly eased at edge.

3. Type: Corian.

4. Colors and Patterns: Anthracite

2.8 BENCH AT TOILET ROOM 105

A. Remanufactured Stone (RS): ¾ inch (2 cm) thick solid material with front edge built up with same material.
1. Front: ¾-inch bullnose

2. RS-1:
   a. Type: Silestone

   b. Color and Pattern (RS-1): Cielo Series, Silver Nube 5005.

3. Support on bench mount by Raaks as shown on the drawings.

2.9 LOCKERS

A. Locker Frame: Wood veneer ¾ inch A Grade plain sliced veneer on MDF core, wood species and finish as described on drawings and in 2.1.B.

B. Locker Edges: All exposed edges of locker are edge banded using the following method:

1. Wood veneer edge banded with matching wood species and finish to the rest of the locker.

C. Stain Finish: Stain choices to include Clear, Amber, Hazelnut, Chestnut, Pecan, Coffee Bean, Espresso, or a custom-formulated project-specific finish. Final finish to be confirmed by Owner prior to manufacturing of mockup.

D. Wood Finish: All wood surfaces are to be sealed with 100% solid UV cured sealer, with less than 1% Volatile Organic Compounds (VOCs) and then finished with a water-borne UV cured clear anti-microbial topcoat, with less than 1% VOCs, applied in the desired sheen (10, 35, or 50 degrees).

E. Bottom Unit: Functions as storage and seating as indicated on project drawings. The standard configurations is as follows:
1. Integrated pull out drawer unit with grill for ventilation as described in the drawings.

F. Seating: Seating areas will be topped with the following:
1. Wood Veneer finished to match locker interior with solid chamfered edge.

G. Hardware:
1. Hinges: Ferrari concealed hinge.
2. Locks: Built-in combination lock.
3. Drawer Glides: Full extension, side mounted, cold rolled steel material, and 150 lbs load capacity each.
4. See drawings for additional notes on hardware at each locker.
5. Name Plate Holder: 2x12 inch brushed chrome with blank insert.
6. Coat Hooks: Doug Mockett coat hook (see drawings).

H. Fabrication:
1. Lockers shall be fabricated using doweled and glued & screwed assembly process.
2. Fabricate lockers square, rigid and without warp, with the finished faces flat and free of scratches and chips.
3. Machine all parts and attachment holes accurately and without chips and defects.

2.10 CUBBIES AND BAT STORAGE IN LOCKER ROOM

A. Cubbies and Bat Storage frame: Interior constructed 5/8" inch high-industrial grade particle board core with .030 inch High Pressure Laminate with a Class II-B fire retardant. HP Laminate product to match in finish and stain the wood veneer selected for the lockers.
   1. Available Manufactures.
      a. Wilsonart
      b. Formica
      c. Nevamar

B. Cubbies and Bat Storage Edges: All exposed edges of locker are edge banded using the following method:

   1. 1.5 – 2 mm PVC edge banded to match rest of locker.

C. Fabrication:
   1. Cubbies and Bat Storage shall be fabricated using doweled and glued & screwed assembly process.
   2. Fabricate Cubbies and Bat Storage square, rigid and without warp, with the finished faces flat and free of scratches and chips.
   3. Machine all parts and attachment holes accurately and without chips and defects.

2.11 PLASTIC-LAMINATE CABINETS

A. Grade: Custom.

B. AWI Type of Cabinet Construction: Flush Overlay.

C. Reveal Dimension: 1/2 inch (13 mm).

D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

   1. Horizontal Surfaces Other Than Tops: Grade HGL.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade VGS.
   4. Edges: Provide surface of high pressure decorative laminate, Grade HGS.

E. Materials for Semiexposed Surfaces:

   1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.

      a. Edges of Plastic-Laminate Shelves: Provide surface of high-pressure decorative laminate, Grade VGS.
      b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.

   2. Drawer Sides and Backs: Thermoset decorative panels.
   3. Drawer Bottoms: Thermoset decorative panels.

F. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

G. Colors, Patterns, and Finishes: Provide surface of high pressure decorative laminate, Grade HGS:

1. PL-1: Wilsonart 961-58 Fog

H. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.12 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

H. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

SECTION 072100 - THERMAL INSULATION

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. Foam-plastic board insulation.
2. Mineral Wool board insulation
3. Unfaced Glass-fiber blanket insulation (for wall insulation at north entrance front)
4. Vapor retarders.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

A. 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. 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:

    a. DiversiFoam Products.
    b. Dow Chemical Company (The).
    c. Owens Corning.
    d. Pactiv Building Products.
2. Type IV, 25 psi.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope indicated on drawings.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.2 MINERAL-WOOL BOARD INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fibrex Insulations Inc.
2. Isolatek International.
3. Owens Corning.
4. Roxul Inc.
5. Thermafiber.

B. Unfaced, Mineral-Wool Board Insulation: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Nominal density of 4 lb/cu. ft. at inner layer, 6 lb/cu.ft. at outer layer, Types IVB, thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.3 GLASS-FIBER BLANKET INSULATION

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. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.4 VAPOR RETARDERS

A. Reinforced-Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft., with maximum permeance rating of 0.0507 perm.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Raven Industries Inc.; DURA-SKRIM 6WW.
b. Reef Industries, Inc.; Griffolyn T-65.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

D. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Mineral Wool Board Insulation: Install with closely fitting joints using adhesive pad or serrated trowel attachment method according to manufacturer's written instructions.

3.5 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

3.6 INSTALLATION OF INSULATION FOR HORIZONTAL SUBSTRATES

A. Install mineral wool board insulation and faced glass fiber blanket insulation on horizontal substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to horizontal substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
3. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.7 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
2. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-

retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

3. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.8 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.9 INSULATION SCHEDULE

A. For all continuous insulation at exterior cavity walls, as shown on the drawings, provide Mineral Wool Insulation. Insulation shall have a minimum R-10 value.

B. For all extruded and tapered insulation at the Concourse, as shown in the drawings, use extruded-polystyrene board insulation. Taper insulation as shown on sheet A4. Concourse insulation (not including the tapered insulation) shall have a minimum R-10 value.

C. For all metal stud framed walls, as shown in the wall types on the drawings, provide acoustic insulation (unfaced, glass-fiber blanket insulation).

D. At metal stud soffit and wall at entrance to north side of building, as shown in detail 52/A7.1, provide vapor barrier and Unfaced, Glass-Fiber Blanket Insulation.

E. Use extruded-polystyrene board insulation, minimum R-10, for all below-grade insulation.

END OF SECTION 072100

SECTION 074500 – METAL CLAD PANEL SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Provide all labor, materials, equipment and accessories necessary for compliance with this section and installation direction of the manufacturer.
   1. Metal clad panel system (applies to fascia panels and ceiling soffits).

1.2 RELATED SECTIONS

A. Division 06 – Wood and plastics and rough carpentry.

B. Section 072100 – Insulation

C. Section 079200 – Sealants, caulking and seals

1.3 REFERENCES

A. ASTM E 72, Standard Test Methods of Constructing Strength Tests of Panels for Building Construction

B. ASTM E 330, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

C. ASTM E 84, Standard Test Method of Surface Burning Characteristics of Building Materials

D. ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750ºC

1.4 SUBMITTALS

A. Manufacturer’s technical product information.

B. Shop drawings showing method of installation, installation instructions and recommendations and full detailing at each varying site condition.
   1. Include fastener types, sizes, quantities and spacing for each substrate indicated.
   2. Engineered calculations for alternative stand-off brackets.

C. Texture, Color and accessory product list

1.5 Quality Assurance

A. Mock-up: Provide a complete system sample approximately 100 square feet, using workmen, equipment, and techniques proposed for use on the project. The approved mock-up shall become the standard of comparison for finished work for the project.
   1. Coordinate with other disciplines for masonry, steel, concrete, weather barrier, flashing, and window openings to generate a single mock up to verify water proof integrity of the entire assembly.

B. All work shall be performed by installation firms experienced in this type of work and who have completed three projects of similar size and scope and, if recommended by manufacturer, authorized and qualified by manufacturer prior to installation.

1.6 WARRANTY

A. 50 Year Limited Warranty: The Product shall: not incur structural cracking, rot or delaminate under normal use and wear; resist damage caused by termites; and resist damage caused by hail (except for hail associated with winds exceeding 60 miles per hour), for a period of 50 years from the original date of installation.

B. 15 Year Limited Warranty: The Standard Product finish shall not significantly (a) peel; (b) incur structural cracking, or (c) chip, for a period of 15 years from the original date of installation.

C. Warranty shall be issued to the owner via installer after a final close out inspection has been conducted by the manufacturer to confirm installation meets manufacturer's specifications.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufactured materials in original unopened packages or containers, with manufacturer's labels intact and legible

B. Protect all materials from damage

C. Store Siding panels horizontally and under cover. Keep siding panels dry and off the ground prior to installation to avoid moisture conditions that could affect the quality of the work. Siding panels are not to be stack more than 2 pallets high. Panels should be carried mid span and on edges for ease of handling and to avoid breakage.

D. Siding panels contain silica. When Drilling, cutting, or abrading siding panels during installation or handling, observe the following precautions: a) work outdoors when feasible in a well ventilation indoors, b) wear a dust mask or use a respirator, c) warn other workers and building occupants in the area, and/or, d) advise building occupants to close windows in the immediate are of work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Basis of Design: Alpolic HD ACM Rainscreen System (A Mitsubishi Plastic Composites America, Inc. Product) – an aluminum composite material composed of 2 sheets of aluminum bonded to a thermoplastic core. The aluminum skin shall have a fluoropolymer paint finish. .

B. Panels
1. Thickness: 6 millimeter.
2. Color: Custom.

C. All necessary supporting components required for a full and completely functional rain screen system compliant with the manufacturer's warranty.

D. Mounting: Basis of Design is the Exo-Tec Manufacturing, Inc. Stand-Off MPV Bracket – an adjustable bracket meeting requirements for continuous insulation barriers and eliminating thermal bridging.

PART 3 - EXECUTION

3.1 PREPARATION

A. All work shall be performed by skilled craftsmen, experienced in this type of work.

B. Examine substrate to ensure that finished surfaces will be true, level, and plumb without requiring additional steps. Notify the proper authority in writing of any discrepancies found in the substrate. Beginning of installation indicates acceptance of existing conditions.

3.2 INSTALLATION

A. General: Install products in accordance with the latest installation guidelines of the manufacturer and all applicable building codes and other laws, rules, regulations and ordinances. Review all manufacturer installation, maintenance instructions and other applicable documents.

B. Substrate:
1. Arrange siding panels so that they are symmetrically balanced from the center of the building module.

C. Starter Bar:
1. Mark a level line for the starter clips to end up with approximately ½" ventilation gap between the bottom of the siding panels and the sill flashing.
2. Fasten the starter bars securely along the mark with the clip screws. The starter clip ends must reach the outside corner edge.
3. Maximum distance between screws must not exceed 16"

D. Installation of First Panel:
   1. Begin installing the first panel by working from the left hand joiner. The leading edge of the panels, which is the edge with the concealed groove, should sit squarely on the lower lip of the starter bar.

E. Installation of Panels.
   1. Fit panels tightly together on both horizontal and vertical joints ensuring that panel edges are properly seated in the clips.
   2. Continue using appropriate panels clip on the top edge of panel as the work proceeds from the bottom of the wall to the top. Correct installation of siding panels into clips will create the desired air cavity gap which allows for the circulation of air
   3. Install panels working left to right; bottom to top.
   4. Apply sealer to field cut joints.

F. Outside Corner Installation:
   1. Follow manufacturer's recommendations to construct corners.

G. Inside Corner Installation
   1. Follow manufacturer's recommendations to construct corners.

H. Panel lengths
   1. At fascia panels per detail 34 on sheet A10.1, provide 10 foot panels, with 2 panels between each guard rail stanchion.

3.3 MAINTENANCE

A. Review Maintenance Manual for detailed instructions on care and maintenance of aluminum panels.

B. Cleaning:
   1. Wipe off dirt with a cloth dampened with diluted neutral mild detergent. Do not use a solvent, such as thinner, or scrub the panels with a steel wool pad, which damages the coated surfaces. Do not use a steam cleaner or power washer, which can also damage the surfaces.
   2. If the nailed or screwed sections become cracked replace the cracked panels with new ones.

END OF SECTION 074500

SECTION 093000 - TILING

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. Ceramic tile.

2. Metal edge strips.

B. Related Sections:

1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Division 09 Section "Gypsum Board" for tile backing units.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Metal edge strips in 6-inch (150-mm) lengths.

E. Qualification Data: For qualified Installer.

F. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

G. Product Certificates: For each type of product, signed by product manufacturer.

H. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.

1.5 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each color or finish from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Waterproof membrane.
2. Joint sealants.
3. Metal edge strips.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Tile Type CT-1: Glazed wall tile.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Crossville, Glazed Wall Tile or approved equal.
2. Module Size: 4 by 12 inches.
3. Thickness: 1/4 inch.
4. Face: Plain with modified square edges or cushion edges.
5. Installation: Vertical Installation.
6. Tile Color and Pattern: As indicated by manufacturer’s designations.

a. Manufacturer: Crossville.
b. Pattern: Glazed Wall Tile.
c. Colors:

1) CT-1: WT02 Tea for Two.

7. Grout Color: 011 Silver Grey by Ardex Flex.
8. Mounting: Factory, back mounted.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

a. Base for Thin-Set Mortar Installations: Straight, module size 4 by 12 inches (152 by 152 mm).
b. External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining flat tile.
c. Internal Corners: Field-butted square corners. For cap use angle pieces designed to fit with stretcher shapes.

B. Tile Type CT-2: Unglazed floor tile.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Royal Mosa, Global Collection or approved equal
2. Composition: Porcelain.
3. Face Size: 6 by 6 inches.
4. Thickness: 9/32 inch.
5. Face: Plain with square or cushion edges.
6. Tile Color and Pattern:

a. Manufacturer: Royal Mosa.
b. Pattern: Global Collection.
c. Color:

1) CT-2: 76250V.

7. Grout Color: 47 Charcoal by Mapei.

C. Tile Type CT-3: Unglazed floor tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Royal Mosa, Greys or approved equal
2. Composition: Porcelain.
3. Face Size: 12 by 12 inches.
4. Thickness: 13/32 inch.
5. Face: Plain with square or cushion edges.
6. Tile Color and Pattern:

    a. Manufacturer: Royal Mosa.
    b. Pattern: Greys.
    c. Color:

        1) CT-3: 226V.

7. Grout Color: 47 Charcoal by Mapei.

D. Tile Type CT-4: Unglazed floor tile.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Royal Mosa, 30Thirty or approved equal
2. Composition: Porcelain.
3. Face Size: 12 by 12 inches.
4. Thickness: 13/32 inch.
5. Face: Plain with square or cushion edges.
6. Tile Color and Pattern:

    a. Manufacturer: Royal Mosa.
    b. Pattern: 30Thirty.
    c. Color:

        1) CT-4: 203V.

7. Grout Color: 47 Charcoal by Mapei.

E. Tile Type CT-5: Unglazed floor tile.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Royal Mosa, Global Collection or approved equal
2. Composition: Porcelain.
3. Face Size: 6 by 6 inches.
4. Thickness: 9/32 inch.
5. Face: Plain with square or cushion edges.
6. Tile Color and Pattern:

    a. Manufacturer: Royal Mosa.
    b. Pattern: Global Collection.
    c. Color:

        1) CT-5: 16980 (orange).

7. Grout Color: 47 Charcoal by Mapei.

F. Tile Type CT-6: Cove base tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Royal Mosa, Global Collection or approved equal
2. Composition: Porcelain.
3. Face Size: 6 by 6 inches.
4. Thickness: 9/32 inch.
5. Face: Plain with square or cushion edges.
6. Tile Color and Pattern:

    a. Manufacturer: Royal Mosa.
    b. Pattern: Global Collection.
    c. Color:

        1) CT-6: 75200 SP.

7. Grout Color: 011 Silver Grey by Ardex Flex.

G. Tile Type CT-7: Cove base tile.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Royal Mosa, Global Collection or approved equal
2. Composition: Porcelain.
3. Face Size: 6 by 6 inches.
4. Thickness: 9/32 inch.
5. Face: Plain with square or cushion edges.
6. Tile Color and Pattern:

    a. Manufacturer: Royal Mosa.
    b. Pattern: Global Collection.
    c. Color:

        1) CT-7: 76250 SP.

7. Grout Color: 011 Silver Grey by Ardex Flex.

H. Tile Type CT-8: Unglazed floor tile.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Royal Mosa, Mix & Mosaics or approved equal
2. Composition: Porcelain.
3. Face Size: 2.3cm x 2.3cm in 30cm x 30cm sheet
4. Thickness: 8mm
5. Face: Plain with square or cushion edges.
6. Tile Color and Pattern:

    a. Manufacturer: Royal Mosa.
    b. Pattern: Mix & Mosaics.
    c. Color:

        1) CT-8: 216MZVV030030.

7. Grout Color: 47 Charcoal by Mapei.

2.3 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Boiardi Products; a QEP company.
   b. Bonsal American; an Oldcastle company.
   c. Bostik, Inc.
   d. C-Cure.
   e. Custom Building Products.
   f. Jamo Inc.
   g. Laticrete International, Inc.
   h. MAPEI Corporation.
   i. Mer-Kote Products, Inc.
   j. Southern Grouts & Mortars, Inc.
   k. Summitville Tiles, Inc.
   l. TEC; a subsidiary of H. B. Fuller Company.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.4 GROUT MATERIALS

A. Polymer-Modified Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ardex Flex
   b. Boiardi Products; a QEP company.
   c. Bonsal American; an Oldcastle company.
   d. Bostik, Inc.
   e. C-Cure.
   f. Custom Building Products.
   g. Jamo Inc.
   h. Laticrete International, Inc.
   i. MAPEI Corporation.
   j. Southern Grouts & Mortars, Inc.
   k. Summitville Tiles, Inc.
   l. TEC; a subsidiary of H. B. Fuller Company.

2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
3. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.

2.5 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."

1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; Dow Corning 786.
b. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
c. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
d. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
e. Tremco Incorporated; Tremsil 600 White.

D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bostik, Inc.; Chem-Calk 550.
b. Degussa Building Systems; Sonneborn Sonolastic SL 2.
c. Pecora Corporation; Dynatrol II-SG.
d. Sika Corporation; Sikaflex-2c SL.
e. Tremco Incorporated.; THC-900.

2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; white zinc alloy, nickel silver, or stainless-steel, ASTM A 666, 300 Series exposed-edge material.

C. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bonsal American; an Oldcastle company; Grout Sealer.
b. Bostik, Inc.; CeramaSeal Grout & Tile Sealer.
c. C-Cure; Penetrating Sealer 978.
d. Custom Building Products; Surfaceguard Sealer.
e. Jamo Inc.; Penetrating Sealer.
f. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout.
g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
i. TEC; a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone Grout Sealer.

2.7 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors in wet areas.

b. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
2. Paver Tile: 1/8 inch.
3. Glazed Wall Tile: 1/16 inch (1.6 mm).
4. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

H. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

I. Grout Sealer: Apply grout sealer to grout joints and walls in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.5 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Tile Installation F113: Thin-set mortar; TCA F113.

   a. Tile Types: CT-1, CT-3, and CT-4.
   b. Thin-Set Mortar: Latex- portland cement mortar.
   c. Grout: Standard unsanded cement grout.

2. Tile Installation F122: Thin-set mortar on waterproof membrane; TCA F122.

   a. Tile Type: CT-2.
   b. Thin-Set Mortar: Latex- portland cement mortar.
   c. Grout: Polymer-modified unsanded grout.

B. Interior Wall Installations, Masonry or Concrete:

1. Tile Installation W202: Thin-set mortar; TCA W202.

   a. Tile Type: CT-5, CT-6, CT-7, and CT-8.
   b. Thin-Set Mortar: Latex- Medium-bed, latex- portland cement mortar.
   c. Grout: Standard unsanded cement grout.

C. Interior Wall Installations, Metal Studs or Furring:

1. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.

   a. Tile Type: CT-5, CT-6, CT-7 and CT-8.
   b. Thin-Set Mortar: Latex- portland cement mortar.
   c. Grout: Standard unsanded cement grout.

2. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment over cleavage membrane; TCA W244.

   a. Tile Type: CT-5, CT-6, CT-7, and CT-8.
   b. Thin-Set Mortar: Latex- portland cement mortar.
   c. Grout: Standard unsanded cement grout.

END OF SECTION 093000

SECTION 096813 - TILE CARPETING

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 modular carpet tile.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Type of subfloor.
3. Type of installation.
4. Pattern of installation.
5. Pattern type, location, and direction.
6. Pile direction.

C. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.9 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

1.10 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period. The following must be addressed in the warranty:
   1. Meets EPA indoor environmental quality “GSA Antimicrobial Certification”.
   2. Defects in material 15 years.
   3. Wear warranty-limiting wear to not more than 10% over a ten-year period.
   4. Warranty shall not be prorated, and shall cover all costs related to repairing or replacing the carpet.
   5. No edge ravel at edges and seams.
   6. 20 pound tuft bind guaranteed throughout the Warranty period.
   7. Guaranteed not to delaminate.
   8. Will not mildew.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Basis-of-Design Product: Subject to compliance with requirements, provide the following: 1) CPT-1: Interface, Entry Level, Black 7187, 24”x24” or approved equal; random installation or approved equal; 2) CPT-2: Interface, Flor, 603059 Anthracite, 24”x24”; quarter-turn installation or approved equal; CPT-3: Interface, Super Flor, 609164 Pacific Sunset, 24”x24”; quarter-turn installation or approved equal; CPT-4: Interface, Flor, 603192 Berber Beige, 24”x24”; quarter-turn installation or approved equal;

B. Colors: See previous paragraph.

C. Adhesion: Self-adhering carpet tile on flat surfaces. Glued tile is unacceptable.

D. Environmental: Intercept antimicrobial permanently incorporated into backing system. Treated or applied antimicrobial systems are not acceptable.

E. Construction:
   1. Tufted Textured Loop for CPT-1.
   2. Hair Tile (Needlepunch) for CPT-2, 3, and 4.

F. Pile Thickness: 0.150 in for CPT-1; 0.165 in. for CPT-2, 3, and 4.

G. Pile Density: 6,720 for CPT-1; 8,945 for CPT-2, 3, and 4.

H. Backing System: GlasBac Tile for CPT-1; Graphlar Tile for CPT-2, 3, and 4.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Self-adhering XL Brand 2300 pressure sensitive adhesive.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Preparation: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

E. Installation: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

F. Installation Method: As recommended in writing by carpet tile manufacturer.

G. Maintain dye lot integrity. Do not mix dye lots in same area.

H. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

I. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

J. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

K. Install pattern parallel to walls and borders.

L. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

M. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

END OF SECTION 096813

SECTION 221323 - SANITARY WASTE INTERCEPTORS

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. Grease interceptors.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. PP: Polypropylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of concrete interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.

1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from Installers of the items involved:

1. Interceptors.
2. Piping connections. Include size, location, and elevation of each.
3. Interface with underground structures and utility services.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:

1. Notify Architect and Owner no fewer than seven days in advance of proposed interruption of service.
2. Do not proceed with interruption of sewer services without Architect's and Owner's written permission.

PART 2 - PRODUCTS

2.1 GREASE INTERCEPTORS

A. Grease Interceptors: Precast concrete complying with ASTM C 913.

1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.
2. Structural Design Loads:

a. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).

3. Resilient Pipe Connectors: ASTM C 923, cast or fitted into interceptor walls, for each pipe connection.
4. Steps: ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of interceptor to finished grade is less than 60 inches.
5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
6. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch-diameter cover.

a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
c. Include indented top design with lettering cast into cover, using wording equivalent to "GREASE INTERCEPTOR."

7. Capacities and Characteristics: As indicated.

B. Accessories:

1. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch- diameter cover.

a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
b. Include indented top design with lettering cast into cover, using wording equivalent to “GSHP MANIFOLD”.

c. Capacities and Characteristics: As indicated.

2. Precast-Concrete Manhole Risers: ASTM C 478, with rubber-gasket joints.
   a. Structural Design Loads:
      1) Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
   b. Length: From top of underground concrete structure to grade.
   c. Riser Sections: 3-inch minimum thickness and 36-inch diameter.
   d. Top Section : Eccentric cone, unless otherwise indicated. Include top of cone to match grade ring size.
   e. Gaskets: ASTM C 443, rubber.
3. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 INSTALLATION

A. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.

B. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

C. Set tops of manhole frames and covers flush with finished surface in pavements. Set tops 3 inches above finish surface elsewhere, unless otherwise indicated.

D. Set tops of grating frames and grates flush with finished surface.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.4 IDENTIFICATION

A. Identification materials and installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.

1. Use warning tapes or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.5 COMMISSIONING

A. Commissioning Authority

1. The commissioning authority (CA) has been contracted directly with the owner for this project. The CA has overall responsibility for planning and coordinating the commissioning process. However commissioning involves all parties involved with the design and construction process, including the mechanical (Division 22 & 23) contractor, and all specialty sub-contractors within Division 23, such as sheet metal, piping, refrigeration, water treatment, TAB and controls, plus major equipment suppliers as required.

END OF SECTION 221323

SECTION 270500 – COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. OSU Division 27 Master Specifications for Information Transport Systems and Spaces May 1, 2014

1.2 SUMMARY

A. This section includes general requirements for all Division 27 work and is supplemental and in addition to the requirements of Division 1.

B. It is the intention of this Division of the Specifications and the Contract Drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and fully operational condition all equipment, materials, devices and necessary appurtenances to provide a complete communication system. Provide all materials, appliances and apparatus not specifically mentioned herein or shown on the drawings, but which are necessary to make a complete, fully operational installation of all communications systems shown on the contract drawings or described herein. Connect equipment and devices furnished and installed under other Divisions of this specification (or the Owner) under this Division.

C. Workmanship shall be of the best quality and competent and experienced technicians shall be employed and shall be under the supervision of a competent and experienced foreman.

D. The drawings and specifications are complementary and what is called for (or shown) in either is required to be provided as if called for in both. Where conflicting information occurs within the drawings and specifications or between the drawings and specifications, the more expensive alternative shall be used as a basis for bidding and construction.

1.3 WORK IN OTHER DIVISIONS

A. See all other specifications for other work which includes but is not limited to:
Cutting and Patching
Door Hardware
Electronic Safety and Security
Equipment Wiring
Fire Protection
Mechanical Control Wiring
Mechanical Equipment
Painting, Refinishing and Finishes
Temporary Power

1.4 CODES, PERMITS, INSPECTION FEES

A. The following codes and standards are referenced in the Division 27 specifications. Perform all work and provide materials and equipment in accordance with the latest referenced codes and standards of the following organizations:
1. American National Standards Institute (ANSI)
2. National Electrical Manufacturer's Association (NEMA)
3. National Fire Protection Association (NFPA)
4. Underwriter's Laboratories (UL)
5. American Society for Testing and Materials (ASTM)
6. Bicsi (A Telecommunications Association)
7. International Building Code (IBC)
8. Insulated Cable Engineers Association (ICEA)
9. Institute of Electrical and Electronic Engineers (IEEE)
10. Federal Communications Commission Rules and Regulations (FCC)
11. National Electrical Code (NFPA Article 70) (NEC)
12. National Electrical Safety Code (NESC)
13. Occupational Safety and Health Administration (OSHA)
14. Rural Utilities Service (RUS)
15. Telecommunications Industry Association/Electronics Industries Alliance (TIA/EIA)
16. Uniform Building Code (UBC)

B. Install the communications systems based on the following:

NFPA 70 National Electrical Code as adopted and amended by the Local Jurisdiction.

IBC International Building Code as adopted and amended by the Local Jurisdiction.

C. Communications Specific:
1. TIA/EIA-455: Fiber Optic Test Standards
2. TIA/EIA-526: Optical Fiber Systems Test Procedures
3. TIA/EIA-568-C: Commercial Building Telecommunications Cabling Standard
4. TIA-569-C: Commercial Building Standard for Telecommunications Pathways and Spaces
5. TIA/EIA-606-B: Administration Standard for Commercial Telecommunications Infrastructure
6. J-STD-607-B: Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
7. TIA/EIA-758-A: Customer-owned Outside Plant Telecommunications Infrastructure Standard
8. TIA-942: Telecommunications Infrastructure Standard for Data Centers
9. TIA/EIA: Technical Service Bulletins (TSBs) (related to the above TIA/EIA standards)
10. IEEE 802.11 Wireless Local Area Network Standard, including the IEEE 802.11a, 802.11b, 802.11g, and 802.11n standards
11. IEEE 241 – IEEE Recommended Practice for Electrical Power Systems in Commercial Buildings, pertaining to communications systems.
12. BICSI: BICSI Customer Owned Outside Plant Design Manual
13. BICSI: BICSI LAN and Internetworking Design Manual
14. BICSI: BICSI Telecommunications Distribution Methods Manual
15. BICSI: BICSI Telecommunications Cabling Installation Manual
16. NEC: NFPA 70

17. FCC Part 68: Connection of Terminal Equipment to Telephone Network.

D. The referenced codes establish a minimum level of requirements. Where provision of the various codes conflict with each other, the more stringent provision shall govern. If any conflict occurs between referenced codes and this specification, the codes are to govern. Compliance with code requirements shall not be construed as relieving the Contractor from complying with any requirements of the drawings or specifications which may be in excess of requirements of the governing codes and rules and not contrary to same.

E. Obtain all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. Arrange for inspection of work by the inspectors and give the inspectors all necessary assistance in their work of inspection.

1.5 COORDINATION

A. Coordinate work with that of the other Contractors and/or other trades doing work on the project. Examine all drawings and specifications of other trades for construction details and coordination. Make every reasonable effort to provide timely notice of work affecting other trades to prevent conflicts or interference as to space requirements, dimensions, openings, block-outs, sleeving or other matters which will cause delays or necessitate work-around methods.

B. Obtain submittals and shop drawings of all equipment with electrical connections furnished under other divisions of the specification and by the Owner. Provide all wiring in accordance with specific equipment requirements. Immediately advise the Architect of any changes which may affect the contract price.

C. Special attention is called to the following items. Coordinate all conflicts prior to installation:
   1. Location of grilles, pipes, sprinkler heads, ducts and other mechanical equipment so that all communications outlets and equipment are clear from and in proper relation to these items.
   2. Location of cabinets, counters and doors so that communications outlets, and equipment are clear from and in proper relation to these items.
   3. Recessing and concealing communications materials in CMU walls, concrete construction and precast construction.
   4. In every telecommunication room with either active or passive equipment the Contractor shall monitor the work of all trades to assure that the space and clearance requirements of code are met.
   5. Review specifications for other Divisions of the work to determine where other Divisions are requiring communication connections. Verify provisions shown on contract drawings by examining shop drawing submittals of other Divisions prior to submission to the owner. Do not proceed with ordering of supporting equipment, until characteristics are verified. Proceed with rough only after verification of shop drawings.

D. Provide digital format communications systems drawings showing all ceiling devices, fixtures, raceways and cable tray locations and routing to mechanical contractor to be used for coordination drawings provided by mechanical contractor. Include dimensions and elevations of devices, fixtures, raceway and cable tray.

E. Furnish, install and place in satisfactory condition all raceways, boxes, conductors and connections and all other materials required for the electrical systems shown or noted in the contract documents to be complete, fully operational and fully tested upon completion of the project. Raceways, boxes and ground connections are shown diagrammatically only and indicate the general character and approximate location. The layout does not necessarily show the total number of raceways or boxes for the circuits required, nor are the locations of indicated runs intended to show the actual routing of the raceways. Where routings of major raceways and telecommunication pathways are indicated on plan sheets, the routing information supplements the information on diagrams. If no routing information is shown, route the systems in a manner that will coordinate with new and existing infrastructure and the work of other trades.

F. Consult the architectural drawings for the exact height and location of all electrical equipment not specified herein or shown on the drawings. Make any minor changes (less than 6'-6" horizontal) in the location of the raceways, outlets, boxes, devices, wiring, etc., from those shown on the drawings without extra charge, where coordination requires or if so directed by the Architect before rough-in.

G. Provide inserts or sleeves for outlet boxes, conductors, cables and/or raceways as required. Coordinate the installation thereof with other trades.

H. The Contractor will not be paid for relocation of work, cuttings, patching and finishing required for work requiring reinstallation due to lack of coordination prior to installation.

1.6 WARRANTY

A. Refer to General Conditions of the Contract.

B. Ortronics/Superior Essex nCompass Limited Lifetime warranty
1. nCompass Category 6+ Cabling, Connectivity Hardware and Patch Cables shall be covered by a, nCompass Limited Lifetime Warranty labor and application assurance warranty. The application assurance portion shall provide coverage for the cabling system to support applications that are designed for systems outlined in ANSI/TIA/EIA 568-C.
2. Corning 25 year Warranty for fiber optic riser and outside plant backbone subsystems.

1.7 APPROVED LOW VOLTAGE CONTRACTOR

A. Must be approved Ortronics Certified Plus (CIP) and certified Corning Cabling Systems NPI Installer.

B. Solicitation responses shall only be accepted from firms certified in both Corning Cabling Systems and Ortronics Installers.

C. Contractor must possess an Ortronics CIP and Corning NPI certifications within the state of Oregon.

D. Contractor with a valid Ortronics CIP cannot engage a subcontractor to perform any work within the project scope.

E. Contractor with a valid Corning NPI cannot engage a subcontractor to perform any work within the project scope.

1.8 CORRECTION OF WORK

A. Within one year after the date of Substantial Completion of the work, the Contractor shall correct any work found to be not in conformance with the Contract Documents promptly after written notice from the owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. This obligation shall survive acceptance of the work under this Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

1.9 SUBMITTALS AND SHOP DRAWINGS

A. OSU Information services must approve submitted items before work can proceed.

B. Submittals and Shop Drawings: Schedule so as not to delay construction schedule and no later than 60 days after award of contract, submit common brochure(s) with index and divider tabs by specification section, containing all required catalog cuts. Allow two weeks for review for each submittal and resubmittal. Incomplete submittals and shop drawings which do not comply with these requirements will be returned for correction, revision and resubmittal.

C. Submit in a three ring binder with hardboard covers. Submittals shall show:
1. Indicate listing by UL or other approved testing agency.
2. Highlight with yellow or blue marker adequate information to demonstrate materials being submitted fully comply with contract documents.
3. Review and check all material prior to submittal and stamp "Reviewed and Approved".
4. Provide Manufacturer and/or lab certification that all product materials are PCB-free.

D. Shop drawings shall show:
1. Ratings of items and systems.
2. How the components of an item or system are assembled, interconnected, function together and how they will be installed on the project.
3. System layout floor plans with complete device layout, point-to-point wiring connection between all components of the system, wire sizes and color coding.
4. Coordinate with other division shop drawings and submittals. Identify interface points and indicate method of connection.
5. Communications Rooms: Submit 1/2" = 1'0" detail plans and wall elevations of each room showing actual size of equipment in place. Identify coordinating elements such as structural beams or mechanical systems. Submittals shall show coordination among all suppliers of equipment, including power components, fire alarm, racks, nurse call, public address, security, etc. Submit room layouts at same time as material submittals, and prior to installation of any equipment.

E. The Contractor agrees:
1. Submittals and shop drawings processed by the Architect are not change orders.
2. The purpose of submittals and shop drawings by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept.

3. Submittals demonstrate equipment and material Contractor intends to furnish and install and indicate detailing fabrication and installation methods Contractor intends to use.
4. To accept all responsibility for assuring that all materials furnished under this Division of the specifications meet, in full, all requirements of the contract documents.

F. The Engineer's review is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Corrections or comments made during this review do not relieve contractor from compliance with the requirements of the drawings and specifications. Contractor is responsible for: Dimensions which shall be confirmed and correlated at the job site; fabrication process and techniques of construction; coordination of his work with that of all other trades; performing his work in a safe and satisfactory manner.

G. Submittals and shop drawings are required per the submittals schedule at the end of this Section.

1.10 PROJECT CLOSE-OUT

A. Coordinate with close-out provisions in Division 01 – Contract Closeout.

B. Request For Final Punchlist
1. To request a final electrical punch list, notify Architect and Owner in writing.
2. Project Punchlist Procedure: Perform the following procedures for project closeout of communications portions of work.
   a. Perform testing, tests and documentation per Section 26 01 26 – Acceptance
   b. Testing of Electrical Systems.
   c. Color code junction boxes per Section 26 05 33 - Raceways and Boxes For Electrical Systems.
   d. Obtain final electrical permit inspection. Include copies in O & M manual.
   e. Provide written warranty in O & M per the General Conditions and Division 1 of the Contract.
   f. Furnish As-Built Drawings per this section.
   g. Furnish O & M Manuals per this section.
   ~~h.~~ Give instruction periods to owner's personnel per this section~~.~~

1.11 COMMUNICATIONS EQUIPMENT OPERATION AND MAINTENANCE (O&M) MANUALS

A. Provide O&M manuals required in Division 01 – Contract Closeout for all equipment furnished under Division 26 - Electrical of the specifications. Submit a preliminary copy, complete except for the bound cover, prior to 75% completion of the project for checking and review. Deliver final bound corrected copies as noted in Division 1 – Contract closeout 30 days prior to scheduled instruction periods.

B. The information included must be the exact equipment installed. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.

C. These O&M manuals shall contain all the information needed to operate and maintain all systems and equipment provided in the project. Present and arrange information in a logical manner for efficient use by the Owner's operating personnel. The information provided shall include but not be limited to the following:

1. Equipment manufacturer, make, model number, size, nameplate data, etc.
2. Description of system configuration and operation including component identification and interrelations. A master control schematic drawing(s) may be required for this purpose.
3. Dimensional and performance data for specific unit provided as appropriate.
4. Manufacturers recommended operation instructions.
5. Complete parts list including reordering information, recommended spares and anticipated useful life (if appropriate). Parts lists shall give full ordering information assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by equipment supplier not acceptable.
6. Shop drawings.
7. Wiring diagrams.
8. Signal equipment submittals shall contain step-by-step circuit description information designed to acquaint maintenance personnel with equipment operation in each mode of operation.
9. A complete list of local (nearest) manufacturer representative and distributor contacts for each type of equipment and manufacturer. Include name, company, address, phone, fax, e-mail address, and web site.

D. Furnish complete wiring diagrams for each system for the specific system installed under the contract. "Typical" line diagrams will not be acceptable unless revised to indicate the exact field installation.

E. Group the information contained in the manuals in an orderly arrangement by specification index. Provide a typewritten index and divider sheets between categories with identifying tabs. Bind the completed manuals with hard board covers not exceeding 3" thick. (Provide two or more volumes if required.) Signal and communication systems shall be in separate volumes. Include on the covers with the name of the job, Owner, Architect, Electrical Engineer, Contractor and year of completion. Include on the back edge with the name of the job, Owner and year of completion. Hard board covers and literature contained may be held together with screw post binding.

1.12 INSTRUCTION PERIODS

A. After substantial completion of the work and 30 days after the O&M manuals have been delivered to the Owner and after all tests and final inspection of the work by the Authority(s) Having Jurisdiction; demonstrate the electrical systems and instruct the Owner's designated operating and maintenance personnel in the operation and maintenance of the various electrical systems. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be superintendents or supervisors knowledgeable in each system and suppliers representatives when so specified.

B. Include in each instruction session an overview of the system, presentation of information in maintenance manuals with appropriate references to drawings. Conduct tours of the building areas with explanations of maintenance requirements, access methods, servicing and maintenance procedures, equipment cleaning procedures and adjustment locations.

C. Include the following scheduled instruction periods: _1st Session

1. Communications System 2 hours

1.13 AS-BUILT DRAWINGS

A. Continually record the actual electrical system(s) installation on a set of prints kept readily available at the project during construction. These prints shall be used for this purpose alone.
1. Mark record prints with red erasable pencil. Mark the set to show the actual installation where the installation varies substantially from the work as originally shown.
2. Accurately locate with exact dimensions all underground and underslab raceways and stub-outs.
3. Note changes of directions and locations, by dimensions and elevations, as utilities are actually installed.
4. Include addenda items and revisions made during construction.
5. Erase conditions not constructed or "X-out" and annotate "not constructed" to clearly convey the actual "as constructed" condition.
6. Organize record drawings sheets in manageable sets, bind and print suitable titles, dates and other identification on the cover of each set.

B. Transmit the As-Built drawing set to the Architect at the completion of the work. Final payment to the contractor will not be authorized until files and prints have been submitted to and accepted by the Architect.

1.14 ABBREVIATIONS AND DEFINITIONS

A. When the following abbreviations and definitions are used in relation to the work for Division 26 they shall have the following meanings:

Item	Meaning
AHJ	Authority Having Jurisdiction.
Boxes	Outlet, Junction or Pull Boxes.
Code	All applicable codes currently enforced at project location.
Compression	Compressed using a leverage powered (hydraulic or equivalent) crimping tool.
Connection	All materials and labor required for equipment to be fully operational.
Exterior Location	Outside of or penetrating the outer surfaces of the building weather protective membrane.
Fully Operational	Tested, approved, and operating to the satisfaction of the AHJ, manufacturer and contract documents.
Install	To enter or attach permanently into the project and make fully operational.
Mfr.	Manufacturer.
NEC	National Electrical Code, National Fire Protection Association, Publication #70.
Noted	Shown or specified in the contract documents.
Provide	Furnish and install.

Required	As required by code, AHJ, contract documents, or manufacturer for the particular installation to be fully operational.
Shown	As indicated on the drawings or details.
Wiring	Raceway, conductors and connections.
Accepted/Acceptable	Work or materials conforming with the intent of the project, and in general, conforming to the pertinent information in the Construction Documents.
Approved/Approval	The written approval of the Engineer or Owner.
Accessible/Easy access	Access attained without requiring extensive removal of other materials to gain access.
Accessible Ceiling	Acoustical tile hanging ceilings ("Hard-lid" ceilings concealed spine or sheetrock/gypsum ceilings, even when provided with access panels, are not considered an Accessible Ceiling.)
Agreement	The contractual agreement between the Owner and the Contractor.
Communications Infrastructure System:	A communications Cabling System combined with a Communications Raceway System.
Concealed	Hidden from sight in interstitial building spaces, chases, furred spaces, shafts, crawl spaces, etc.
Exposed	Not concealed (see above) and not installed underground.
Furnish	To purchase, supply, and deliver to the project materials in new and operable condition, ready for installation.
Governing Requirements	Collective term for regulations, laws, ordinances, codes, rules, standards, requirements, and guidelines that govern the installation and inspection of the work defined in the Contract Documents. See "Part 1 – General, 1.8 Governing Requirements" herein.
Governing Authorities	Entities or their representatives charged with formation and/or enforcement of Governing Requirements, such as the Authority Having Jurisdiction (AHJ).
Install	To place in final position in fully operable, tested condition.
Inside Plant (ISP)	Infrastructure within a building; includes raceways, cabling, termination components and racks/cabinets.
Or Equal	Materials approved for use by the Engineer and which are dimensionally suitable and operationally identical to the specified item.
Outside Plant (OSP)	Infrastructure exterior to a building.
The Project	The total construction of which the Work performed under the Contract Documents may be the whole or a part, and which may include construction by the Owner and/or separate contractors.
Section	An individual section of the Specifications.
Shown on Drawings	Noted, indicated, scheduled, detailed, or any other written reference made on the Drawings .
Specification Section(s)	One or more sections of the Specifications.
Structured Cabling System (SCS)	Alternative term for Communications Cabling System.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials and equipment installed shall have been tested and listed by Underwriters Laboratories or other approved testing organization and shall be so labeled unless otherwise permitted by the Authority Having Jurisdiction (Inspector).

B. All materials to be new, free from defects and not less than quality herein specified. Materials shall be designated to insure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.

C. Each type of materials furnished shall be of the same make, be standard products of manufacturers regularly engaged in production of such materials and be the manufacturer's latest standard design.

D. All materials, equipment and systems furnished that include provisions for storing, displaying, reporting, interfacing, inputting, or functioning using date specific information shall perform properly in all respects regardless of the century. Any interface to other new or existing materials, equipment or systems shall function properly and shall be century compliant, both in regards to information sent and received.

2.2 SUBSTITUTION OF MATERIALS

A. No Substitute: Where a specified product is indicated "no substitute", it is the intent of this specification to require new materials to be compatible with the existing installation or as specifically requested by the owner. To this end certain materials and systems no substitution will be allowed.

B. Prior to Bid Opening: Acceptance of products other than those specified will be issued by addendum to the bid documents only after the following requirements are met and the proposed listed material is determined to meet or exceed the requirements:
   1. Requests for listing to be original material, clearly indicating the product fully complies with contract documents and be neatly marked with yellow felt tip marker to clearly define and describe the product for which listing is requested.
   2. Samples shall be submitted if requested.
   3. Requests containing insufficient information to confirm compliance with contract documents will not be considered.

C. After Award of Contract: Substitution of products will be considered after award of contract only under the following conditions:
   1. The Contractor shall have placed orders for specified materials promptly after contract is awarded and the specified products can not be delivered to the project to meet the Owner's construction schedule.
   2. The reason for the unavailability is beyond the Contractor's control, i.e., due to strikes, bankruptcy, discontinuance of manufacturer, acts of God.
   3. The specified product is no longer manufactured.
   4. There is compelling economic advantage to the Owner.
   5. There is compelling sustainable or environmental advantage.

D. In all cases, should a substituted material result in requiring electrical system or building modifications; the Contractor alone shall pay all costs to provide these modifications including all costs for redesign, and updating of record drawings required to accommodate the required modifications.

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft. Handle all equipment carefully to prevent damage, breakage, denting, and scoring of finishes. Do not install damaged equipment.

B. Store products subject to damage by the elements above ground, undercover in a weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instruction.

3.2 CUTTING BUILDING CONSTRUCTION

A. Obtain permission from the Architect and coordinate with other trades prior to coring or cutting. Locate coring or cuttings so they will not weaken structural components. Core and cut carefully and only the minimum amount necessary.

B. All construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

3.3 FIRESTOPPING

A. Apply firestopping to communications penetrations of fire rated floor and wall assemblies to maintain fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 section "Firestopping".

3.4 PAINTING

A. Items furnished under this Division that are scratched or marred in shipment or installation shall be refinished with touchup paint selected to match installed equipment finish.

3.5 EQUIPMENT CONNECTION

A. For equipment furnished under this or other Divisions of the specifications, or by owner, provide complete all electrical connections necessary to serve such equipment and provide required control connections to all equipment so that the equipment is fully operational upon

completion of the project. Provide disconnect switch as required by code whenever an equipment connection is shown on the drawings.

B. Investigate existing equipment to be relocated and provide new connections as required.

C. Obtain rough-in requirements for equipment furnished under other divisions of this specification prior to roughing-in. Review shop drawings and submittals of other Divisions to determine requirements.

3.6 CLEAN UP

A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by his work. Such clean up shall be done daily and at sufficient frequency to eliminate hazard to the public, others, the building or the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, lighting fixtures, wiring devices, cover plates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.
   1. Wipe surfaces of electrical equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   2. Equipment installed prior to final clean-up shall be cleaned by the contractor. Jacks and patch panels that have construction dirt and dust shall be cleaned to like new condition.

B. Materials recycling and salvage:
   1. Recycle all scrap metal.
   2. Salvage operable equipment removed from site and deliver to local resale organization.

3.7 TESTING AND DEMONSTRATION

A. Demonstrate that all electrical equipment operates as specified and in accordance with manufacturer's instructions. Perform tests in the presence of the Architect, Owner or Engineer. Provide all instruments, manufacturer's operating instructions and personnel required to conduct the tests. Repair or replace any electrical equipment that fails to operate as specified and or in accordance with manufacturer's requirements.

SPARLING SUBMITTAL LIST
Oregon State University – Classroom Building

SECTION	DESCRIPTION	SUBMIT RECEIVE DATE	STATUS
270510	COMMON WORK RESULTS FOR AUDIO-VIDEO SYSTEMS		
270528	CONDUIT AND BACKBOXES FOR AUDIO-VIDEO SYSTEMS		
270529	HANGERS AND SUPPORTS FOR COMMUNICATION SYSTEMS		
270533	CONDUIT AND BACKBOXES FOR COMMUNICATION SYSTEMS		
271100	COMMUNICATIONS EQUIPMENT ROOM FITTINGS		
271300	COMMUNICATIONS BACKBONE CABLING		
271500	COMMUNICATIONS HORIZONTAL CABLING		

274116 AUDIO/VIDEO SYSTEMS EQUIPMENT LIST

END OF SECTION 270500

Division 27 Master Specification for

Information Transport Systems and Spaces

May 1, 2014

Table of Contents

SECTION 27 10 01 STRUCTURED CABLING GENERAL REQUIREMENTS

1.1 SCOPE:

This document describes general products and execution requirements relating to furnishing and installing Telecommunications Cabling for Oregon State University. Backbone and horizontal cabling comprised of Copper and Fiber Optic, and support systems are covered under this document. All installations are warranted and shall be pre-registered with Ortronics/Superior Essex before work begins as does Corning Fiber Systems.

The Horizontal (workstation) Cabling System shall consist of a minimum of (1) Category 3 and (2)

Category 6, 4-pair Unshielded Twisted Pair (UTP) Copper Cables to each work area outlet in office locations unless otherwise noted for specific locations. The cables shall be installed from the Work Area Outlet to the appropriate Telecommunications Room (TR) and routed to the appropriate rack or backboard serving that area and terminated as specified in this document.

All cables and related pathways, supports, terminations, and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor as detailed in this document and required by contract conditions.

Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, communication room details, equipment racks, cable routing and outlet types will be provided as project specific information by bid specification and/or bid drawings. The contractor shall meet or exceed all requirements for any infrastructure system as detailed within this document. This document shall be referenced within a projects specific scope of work.

1.2 APPROVED CONTRACTOR:

The Telecommunications contractor submitting a response regarding an Oregon State University Voice/Data Infrastructure solicitation must be an approved Ortronics Certified Installer Plus (CIP) **and** a certified Corning Cabling Systems NPI Installer. Solicitation responses from a single contractor not certified by Ortronics and Corning Fiber Systems as (CIP/NPI) will not be accepted. Solicitation responses will only be accepted from firms certified by Corning Cable Systems and Ortronics. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with the Ortronics CIP Program and as the Corning Cabling Systems Program dictates.

It is the intent of Oregon State University's Campus Infrastructure Standard to ensure that a contractor is both an Ortronics CIP and a Corning NPI installer. Contractors must possess an Ortronics CIP and a Corning NPI certification within the state of Oregon to qualify for solicitation responses.

A contractor that is a valid Ortronics CIP cannot engage a subcontractor to perform any work within the project scope.

A contractor that is a valid Corning NPI cannot engage a subcontractor to perform any work within the project scope.

1.3 SUBMITTALS:

Submit appropriate cut sheets and samples for all products, hardware and cabling as detailed in project specifications and drawings.

Work shall not proceed without OSU Information Services approval of the submitted items.

1.4 REFERENCES

A. All work shall be performed in accordance with the following Codes and industry Standards, unless noted otherwise:

1. NFPA 70 – National Electrical Code, current version adopted by local or State AHJ.
2. ANSI/TIA/EIA 568-C – Commercial Building Telecommunications Cabling Standard, current version.
3. ANSI/TIA/EIA 569-C – Commercial Building Standard for Telecommunications Pathways and Spaces, current version.
4. ANSI/TIA/EIA 606-B – Administration Standard for Commercial Telecommunications Infrastructure, current version.
5. ANSI/TIA/EIA 607-B – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, current version.
6. IEEE 241 - IEEE Recommended Practice for Electric Power Systems in Commercial Buildings, pertaining to communication systems.

1.5 WARRANTY

A. Ortronics/Superior Essex nCompass Limited Life Time warranty for horizontal subsystem.

1. nCompass Category 6+ Cabling, Connectivity Hardware and Patch Cables shall be covered by a, nCompass Limited Lifetime warranty labor and application assurance warranty. The application assurance portion shall provide coverage for the cabling system to support the applications that are designed for the specifications outlined in ANSI/TIA/EIA 568-C.0-2. These applications include, but are not limited to 10BASE-T, 100BASE-T, 1000BASE-T and 155 Mb/s ATM.

2. Corning 25-year Warranty for fiber optic riser and outside plant backbone subsystems.

1.6 SUMMARY

This Section includes general requirements specifically applicable to Division 27.

A. Work Specifically Excluded from Project:

1. Incoming common carrier services.
2. Private Branch Exchange Systems.
3. Wide Area Network Systems.
4. Materials provided by the owner as identified in the Contract Documents.

B. The Contractor shall be responsible for:

1. Providing all additional materials, and the necessary labor and services required to ensure all components of the system are completely installed in accordance with the intent of the Contract Documents.
2. Furnishing and installing all incidental items not actually shown or specified, but which are required by good practice to provide complete functional systems.
3. Coordinating the details of facility equipment and construction for all specification divisions that affect the work covered under this Division.
   Coordinating all activities with the overall construction schedule.
4. Developing bill of materials, perform material management and efficient use of the materials whether they are issued by the Contractor, the owner or purchased by the Contractor.
5. Ensure materials in excess of those required to complete the project are kept in their original condition and packaging for restocking.
   Ensure project is properly registered for a nCompass warranty.

C. Intent of Drawings**:**

1. Communications plan drawings show only general locations of equipment, devices, raceways, cable trays, boxes, etc. All dimensioned locations and elevations are approximate. The contractor is responsible for the field coordination of communications work with the other trades prior to beginning work.
2. The contractor shall be responsible for the proper placement and routing of equipment, cable, raceways, cable tray, and related components; according to the Contract Documents and subject to prior review by contractor.
3. Refer all conflicts between Contract Documents to owner for resolution.

1.7 SYSTEM DESCRIPTION

A. The owner will implement a comprehensive integrated communications distribution system, as described in paragraph B below, to provide wiring infrastructure which may be used to support one or more of the following services and systems:

1. Telephony and Data telecommunications.
2. Wireless systems.
3. Facilities management systems.
4. Video telecommunications

B. The communications distribution system consists of the following major subsystems, as specified elsewhere:

1. Interbuilding Backbone: The interbuilding subsystem refers to all twisted-pair and fiber optic backbone communications cabling connecting the Main Building Entrance Facility

Room (BEF) to each building Main Distribution Frame room (MDF) in all buildings on the campus. Note: typically outside plant cables.

2. Intrabuilding Backbone: The intrabuilding subsystem refers to all twisted-pair and fiber optic backbone communications cabling connecting the Main Distribution Frame room (MDF) to each Intermediate Distribution Frame Room (IDF) in the buildings.
3. Communication Rooms: Main Distribution Frame (MDF) and Intermediate Distribution Frame (IDF).
4. Horizontal Distribution: The horizontal distribution subsystem refers to all intra-building twisted-pair and fiber optic communications cabling connecting telecommunication rooms (IDF's) to telecommunication outlets (TOs) located at individual work areas.
5. Work Area Distribution Subsystem: Patch cords, adapters, and devices located between the TO and station equipment.

C. The communications distribution system is based on a combination of the following communications transmission technologies as defined by specific project specifications:

1. 100-ohm 4-pair unshielded twisted-pair cable. (Cat 6, Cat 6a)
2. 100-ohm multi-pair unshielded twisted-pair cable. (Cat 3). Note: nCompass warranty does not apply to 100- ohm multi-pair cables.
3. OM3 and OM4 multimode fiber optic cable.
4. 850 nm Laser Optimized 50/125-micron multimode fiber optic cable.
5. 8.3/125-micron singlemode fiber optic cable.
6. 8-position telecommunications jacks.
7. 8-position telecommunications patch panels
8. Insulation displacement connector (IDC) type field terminated wiring blocks
9. Factory Terminated copper patch cords
10. Rack mount fiber optic hardware
11. Wall mounted fiber optic hardware
12. Fiber optic connectors.
13. Factory terminated fiber optic patch cords

D. The work locations and limits of work are shown on the drawings.

1.8 DESIGN/ENGINEERING REQUIREMENTS

A. BICSI RCDD Certification is required for anyone performing infrastructure design, specifications and/or drawings for solicitation and construction. All drawings issued for construction shall have valid RCDD stamp.

B. Compliance by the contractor with the provisions of this specification does not relieve contractor of the responsibilities of furnishing materials and equipment of proper design, mechanically and electrically suited to meet operating guarantees at the specified service conditions.

C. The following are incorporated into the design:

1. Minimum communication room size for BEF room shall be no less than 14'x12'.
2. Minimum communication room size for MDF room shall be no less than 14' x 12'.
3. Minimum communication room size for an IDF room shall be no less than 10' x 12'.
4. All pathways, conduits, cable trays, slots and sleeves shall have no less than 50% future fill capacity when project is completed.
5. All pathways, conduits, cable trays, slots and sleeves shall not have other cabling (fire alarm, Audio Visual, security etc.) routed within or attached to them.
6. The location of communication rooms is intended to restrict the maximum horizontal subsystem wiring length (defined as a channel between a telecommunications room cross-connect termination field and a served TO) to 295 feet (90 meters).
7. All communication rooms shall have cooling calculated at 7KW of power consumption for each open frame communications rack. 12KW of power for each Communication cabinet.
8. It is the intent of this specification to ensure security of communication rooms and sensitive information. Electrical panels, fire alarm panels, and security systems are not to be incorporated into communication room space, racks, cabinets or walls.

1.9 PROJECT RECORD DOCUMENTS

A. Provide detailed project record documentation within 30 days of substantial completion of the work.

1. Maintain separate sets of red-lined record drawings for the communications work which show the exact placement and identification of as-built system components.
2. Provide communication pathway record drawings which indicate exact placement and routing for all components, e.g., maintenance holes, handholes, conduit, wireway, cable tray, pull boxes, enclosures, telecommunications outlet boxes, etc.
3. Provide communication room record drawings which indicate exact placement for all components; e.g., conduit, wireway, cable tray, backboards, equipment cabinets, equipment racks, cross-connect equipment, etc.
4. Provide communication wiring and cabling record "As-Builds'" drawings and schedules which indicate exact placement, routing, and connection details for all components, e.g., twisted-pair and fiber optic cables, splices, cable cross-connect termination locations, enclosures, telecommunications outlets, cross-connect jumpers, patch cords, etc.
5. Provide network schematics when appropriate.

1.10 APPROVALS AND SUBSTITUTIONS

A. Substitutions are not authorized without written approval from owners authorized representative through addendum.

PART 2 SECTION 27 11 00 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

2.1 SUMMARY

A. The telecommunications spaces will be referred as Building Entrance Facilty (BEF), Equipment Room (ER), Telecommunications Room (TR), Telecommunications Enclosure (TE), and Data Center (DC) in this document is intended to house racks, cabinets and equipment necessary for the support of the communications cabling infrastructure.

2.2 TELECOMMUNICATIONS BACKBOARDS

A. Wall mounted termination block fields shall be mounted on A/C 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with a minimum two coats of white fire retardant paint on all (6) sides. Mounting hardware shall also be painted white for cosmetic purposes.

2.3 FREE STANDING EQUIPMENT RACKS

A. All racks and wire management shall be Ortronics as specified in project specifications and drawings. The equipment rack shall provide vertical and horizontal cable management and support for patch cords and protection for the horizontal cables inside the legs of the rack. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack. Rack shall be black in color.

Equipment Rack as detailed by project specifications and drawings

Approved manufacturers are Ortronics Mighty MO & Mighty MO 6, and misc.

B. Racks shall be securely attached to the concrete floor using minimum *3/8"* hardware or as required by local codes. Earthquake restrictions, requirements, and zoning codes shall be strictly followed.

Racks shall be placed with a minimum of 36-inch clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in

front of the row of racks and from the wall at each end of the row.

All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 2.9 of this document.

Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack

C.. 7 foot high, 19 inches wide, 16.5 inch channel depth, EIA free-standing rack, UL listed, black finish.

1. Ortronics Mighty Mo 6 OR-MM6716

Refer to Ortronics catalog for additional accessories.

2.4 FREE STANDING EQUIPMENT CABINETS

A. Modular Freestanding Server Cabinet, 7 foot tall, 42 RUs, 32 inches wide, 42 inches deep, frame configured with cable opening at rear, frame levelers, two pairs of RU labeled mounting rails with 3/8" square holes, full profile mesh front door, split flat rear mesh rear door, two "L" shaped finger managers on rear rails, vertical PDU mount and lacing bar, divider or side panels, solid top panel in front, cable entry top panel in rear, #12-24 cage nuts (50), #12-24 mounting screws (100), additional adhesive rack unit labels.

B. Modular Freestanding Network Cabinet, 7 foot tall, 32 inches wide, 34 inches deep, frame configured with cable opening at bottom front, frame levelers, two pairs of RU labeled mounting rails, with #12-24 tapped holes, full profile plexiglass front door, full flat sold rear door, two "L" shaped finger managers on front rails, right and left locking side panels, fan top panel in front, cable entry top panel in rear, #12-24 mounting screws (50).

1. Ortronics Mighty Mo Network Cabinet OR-MMC423234-0001I

Refer to Ortronics catalog for additional accessories.

2.5 VERTICAL WIRE MANAGERS FOR FREE STANDING EQUIPMENT RACKS

A. 7 foot high, 10 inches wide, 13 inches deep with dual-hinged door and integral one rack unit high horizontal management, black finish.

1. Ortronics Mighty Mo 6 OR-MM6VMD710

Refer to Ortronics catalog for additional accessories.

2.6 HORIZONTAL WIRE MANAGERS

A. At the top and bottom of every rack or cabinet, install the following:
   1. OR-60400098

Refer to Ortronics catalog for additional accessories.

2.7 TELECOMMUNICATIONS GROUNDING BUSBAR

A. The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the TIAIEIA-607 standard, and shall be installed in accordance with best industry practice. A licensed electrical contractor shall perform installation and termination of the main bonding conductor to the building service entrance ground

B. Solid copper Bus Bar kit, 12.0 inches long x 4.0 inches wide, wall-mounted, with standoffs.

   1. Telecommunications Main Ground Bus Bar Kit OR-GB4X12TGBKIT

Refer to Ortronics catalog for accessories.

2.8 WIRE CABLE TRAY (BASKET TRAY) – COMMUNICATION ROOMS

A. 12 or 24 inches wide, 4 inches deep, black, 10 foot lengths, steel construction.
   1. Cablofil P/N 105/300BL OR P/N 105/600BL

B. Black basket cable tray shall be required in all communication rooms and shall not have a liner.Cable tray installed buildings will have a color determined by A/E to match building paint schemes and tray liners will be required.

C. All trays will be grounded per local Electric Code requirements and ANSI/TIA/EIA-607.

D. All trays shall be cut using the Cablofil tray cutter: COUPFIL or CUTYFIL. All cut cable tray will be filed to remove burrs and painted to match color. All cutting, filing, and painting will be done outside of building.

Refer to Cablofil catalog for additional accessories.

2.9 INSTALLATION PRACTICES

A. All materials shall be installed as per the manufacturers' instructions, unless noted otherwise.

B. Furnish and install telecommunication backboards on wall of communication equipment rooms as indicated. The bottom of the backboards shall be placed approximately twelve inches above finished floor (AFF), and must extend to a minimum height AFF of eight feet. Mount backboards with the smooth side facing away from the wall, and paint the backboard with two coats of fire resistant white paint prior to mounting. A minimum of six appropriate fasteners shall be used for every sixteen square feet of backboard.

C. Free-standing equipment racks shall be fastened to the communications room floor using a minimum of four 3/8 inch concrete anchors.

D. Equipment racks shall be positioned according to drawings with a minimum of 3 feet clearance in front and back. The contractor shall field verify the dimensions of the room prior to installation of racks and report any discrepancies to the owner or owners representative.

E. Vertical wire managers for free-standing racks shall be bolted to the side or front of the rack using the manufacturers recommended hardware.

F. All equipment racks, cabinets, enclosures, cable tray, conduits, and patch panels shall be bonded to the Telecommunications Grounding Busbar (TMG) (one per Telecommunications Room), which shall be bonded to the Telecommunications Main Grounding Busbar (TMGB), which shall be grounded to the main electrical ground in the main electrical room. Coordinate with electrical contractor. Coordinate exact routing and connection points with the electrical work. All surfaces that are used as a bond shall be filed to bare metal before completing connections.

G. Install cable tray as shown in drawing package. The locations shown may need to be adjusted slightly in the field to assure proper placement. Note: Drawings may be in Division 16 Electrical.

H. All tray sections shall be field cut to length as required with a minimum number of splice points. All field cuts shall be made using the manufacturers recommended equipment.

I. All wire basket cable tray's shall be supported from the building structure using threaded rod and FAS type supports and shall be bonded to ground.

2.10 GROUNDING AND BONDING

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks,

cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. Entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG green stranded copper bonding conductor and compression connectors.

D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and busbars shall be identified and labeled in accordance with the System Documentation Section of this specification.

2.11 FIRESTOP

A. All Penetrations through fire-rated building structures (walls and floors) shall be sealed with an approved fire stop system approved by the local fire code. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire-rated structure). Any penetration item, i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.

PART 3 SECTION 27 13 00 COMMUNICATIONS BACKBONE CABLING

3.1 RISER CABLE

A. Voice and Data riser cable shall be plenum rated as detailed within project specifications and drawings. Pair counts shall also be project specific and shall be approved by OSU Information Services.

B. Voice riser cable shall be category 3, 24AWG and manufactured by Superior Essex, General or Berk-Tek.

C. Data riser cable shall be Corning Interlocking Armor plenum rated MTP-MTP, method A, factory pre-terminated fiber optic cable. Field terminated LC connectors shall not be permitted. Each IDF shall have singlemode and LOMMF/OM4 risers installed.

1. Corning, OM4, colored violet for LOMMF Multimode, 12-strands minimum.
2. Corning singlemode, colored yellow for singlemode, 12-strands minimum.
3. Corning Cassettes terminated with shuttered Duplex LC connectors.

D. Fiber optic riser cable shall be labeled every 20 feet with fixed machine-labeled yellow fiber optic ID tags, with labeling information specified by OSU Network Services, installed at patch panel entry and when passing through a conduit, fire sleeve and/or riser in addition to entering or leaving a room, hallway, ceiling or space.

3.2 CAMPUS BACKBONE CABLE

A. UTP cable shall be category 3, Pic-Filled, Black jacketed cable with overall sheath. PE-89. Approved manufacturers are General & Superior Essex.

B. Fiber Cable shall be graded index single mode fiber, non-conductive and be of loose tube construction. Strand counts shall also be project specific. Approved product is Corning ALTOS, minimum 12-strands.

C. Corning duplex LC connectorized pre-polished· pigtail assemblies will be fusion spliced onto all singlemode fiber optic campus backbone cable. Field terminated LC connectors shall not be permitted.

D. Fusion splice all cables that requiring splicing as detailed in project specifications and drawings. Mechanical splices are not acceptable anywhere within the physical system.

E. Cable Jacket shall have a permanently attached label that identifies OSU cable number, strand count and destination at ever termination and/or splice as the cabling enters and/or leaves a splice enclosure, vault, hand hole, building, building floor, and patch panels. The tag shall be engraved with black lettering on yellow background with information provided by OSU Network Services.

1. Example: SM16,1-36 TUNNEL ENTRANCE "D"

2. Example: SM04, 1-12 Plageman Hall, 06-01-2014

3.3 COPPER CABLE PROTECTION UNITS:

A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a #6 AWG green copper bonding conductor between the protector ground lug and the TC ground point.

3.4 TERMINATION BLOCKS

A. Cat 3, 110-Style Blocks
   1. Ortronics OR-30200007

B. Wiring troughs
   1. Vertical backbone managers wall mount 300 pair.
      a. Ortronics OR-806003194

C. 110 block labels
   1. Clear plastic holder for 110 blocks with paper inserts, for blocks with legs
      a. Ortronics P/N OR-70400646

Note: Refer to Ortronics catalog for more complete 110 termination block kits.

3.5 FIBER OPTIC TERMINATION HARDWARE

A. Fiber Optic Termination Hardware
   1. Corning Fiber Optic Patch Panel Assembly
      a. CCH-01U
      b. CCH-04U

Refer to Corning catalog for additional accessories.

3.6 FIBER OPTIC ADAPTER PANELS

A. Corning Pre-terminated Cassette
   1. Corning Universal Play LC Module, shuttered Duplex LC to MTP

Refer to Corning catalog for additional accessories.

3.7 OPTICAL FIBER TERMINATION HARDWARE:

A. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

B. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

C. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

3.8 BACKBONE CABLE INSTALLATION

A. Backbone cables shall be installed separately from horizontal distribution cables.

B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

C. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits.

D. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.

E. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.

F. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.

G. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.

H. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

3.9 COPPER TERMINATION HARDWARE

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA 568-C (C.1, C.2, C.3) document, manufacturer's recommendations and best

industry practices.

B. Copper riser shall be terminated on 110 IDC block separate from OSP protection units.

C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).

D. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

E. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel /block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

F. The cable jacket shall be maintained to within 25 mm (one inch) of the termination point.

G. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

PART 4 SECTION 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

4.1 SUMMARY

A. The horizontal distribution subsystem refers to all intra-building twisted-pair and fiber optic communications cabling connecting Telecommunication Rooms (TR's) to telecommunication outlets (TO's) located at individual work areas.

B. Horizontal cabling may consist of a combination of the following types of cable from the TR to the TO:

1. Enhanced Category 6, (100 Ohm, 4-pair, unshielded twisted pair) cables from the TR's to the TO's.) Port 1 or Port 2
2. Laser Optimized OM4, optical fiber cable.

C. The Horizontal System includes cables, jacks, patch panels, connecting blocks, fiber connectors as well as the necessary support systems, such as cable managers and faceplates.

D. Telecommunications contractor shall furnish and install all materials necessary for a complete system per project documents.

4.2 HORIZONTAL CABLING

A. Voice - Superior Essex grade Cat 3, colored Grey, Plenum

B. Data – Superior Essex DataGAIN Cat 6, colored Green, Plenum

*__NOTE: Berk-Tek Lanmark 1000 Green Plenum is authorized for remodel work within an existing building where Berk-Tek has been previously installed.__

C. Fiber Optic – Corning OM4, colored Violet Plenum, Duplex LC.

4.3 MODULAR JACKS

A. Work area outlet jack

1. Ortronics voice – OR-6373003, 8 POS, Fog White T568B
2. Ortronics data – OR TJ600-25, 8 POS, Green T568B

B. Multimode fiber modular adapter

1. 2-strand fiber optic TracJack modular adapter, Duplex LC type connectors, ceramic alignment sleeves with 180-degree exit
    a. Ortronics OR-63700075
2. 2-strand fiber optic TracJack modular adapter, Duplex LC type connectors, ceramic alignment sleeves with 45-degree exit
    a. Ortronics OR-63700080

4.4 WORK AREA OUTLETS

A. Flush mounted faceplates

1. Work Area Outlet: Six port TracJack faceplate, constructed from high impact thermo-plastic, with recessed label fields, mounts within a single gang wall box.
    a. Ortronics OR-40300545, fog white.
2. Wall Phone: One port TracJack faceplate with mounting lugs for wall phone, constructed from stainless steel, mounts within a single gang wall box, RJ45.
    a. Ortronics OR-403STJ1WP.

B. Dust covers

1. Single port dust cover for modular openings, color to match faceplate.
    a. Ortronics OR-42100002, fog white.

4.5 110 TERMINATION BLOCKS

A. Wiring Troughs

1. Horizontal trough for routing of patch cords and cross-connect wire, with mounting legs.

    a. Ortronics OR-30200140.

B. 110 block labels (Cat 3)

1. Clear plastic holder for 110 blocks with paper inserts, for blocks with legs

    a. Ortronics OR-70400646.

    b. Ortronics OR-70400680.

4.6 PATCH PANELS

A. Category 6 modular patch panels

1. 48 port, 8P8C modular jack panel, high density, 6 port modules, Category 6, IDC terminals, T568A/B wiring scheme.

    a. Ortronics Angled OR-PHA66U48

4.7 EXECUTION: WORK AREA OUTLETS

A. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.

B. Data jacks, unless otherwise noted in drawings, shall be located in the right side posi tion(s) of each faceplate.

C. Voice jacks shall occupy the left position(s) on the faceplate.

4.8 EXECUTION: HORIZONTAL DISTRIBUTION CABLE INSTALLATION:

A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.

B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit. Cable raceways shall not be filled greater than the TIA/EIA-569-B maximum fill for the particular raceway type or 40% (Initial Installations).

C. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

D. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

E. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

F. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48-inch (1.2 meter) intervals. At no point shall cabld(s) rest on light fixtures, acoustic ceiling grids, panels, conduits, sprinkler pipe, water pipe, and/or HVAC system ducting.

G. Horizontal distribution cables shall be bundles in groups of no more than 50 cables when being supported by J-Hook or trapeze systems. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance. An exception to this rule is when cable is installed in cable tray systems.

H. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

I. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.

J. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

K. Cables shall be identified by a self-adhesive machine label in accordance with the System

L. Documentation Section of this specification and ANSI/TIA/EIA-606. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.

M. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.

N. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.

4.9 UNSHIELDED BALANCED TWISTED PAIR CABLE INSTALLATION PRACTICES

A. Cable shall be installed in accordance with Ortronics and Berk-Tek recommendations and best industry practices.

B. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

C. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

D. The cable’s minimum bend radius and maximum pulling tension shall not be exceeded Bend radius for UTP = 4 x Cable OD, FTP = 4 x Cable OD.

E. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.

F. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.

G. Separation from Power Lines:

1. Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:

a. Open or Nonmetal Communications Pathways:

1) 12 inches from electric motors, fluorescent light fixtures, and unshielded power lines carrying up to 3 kVA.

2) 36 inches from electrical equipment and unshielded power lines carrying more than 5 kVA.

3) 48 inches from large electrical motors or transformers.

b. Grounded Metal Conduit Communications Pathways:

1) 2 1/2 inches from electrical equipment and unshielded power lines carrying up to 2 kVA.

2) 6 inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.

3) 12 inches from electrical equipment and unshielded power lines carrying more than 5 kVA.

4) 3 inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.

5) 6 inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.

4.10 UNSHIELDED BALANCED TWISTED PAIR TERMINATION

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.0 document, manufacturer's recommendations and best industry practices.

B. All 4 pair cables shall be terminated on the jack and patch panels using T568-B wiring scheme.

C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).

D. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the UTP cable and 4 times for FTP cables.

E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.

F. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

G. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

H. The cable jacket shall be maintained as close as possible to the termination point. Cable shall not have more than 1.0" removed.

4.11 OPTICAL FIBER CABLE INSTALLATION PRACTICES

A. Place fiber optic cable so as to maintain the minimum cable bend radius limits specified by the manufacturer or ten times the cable diameter, whichever is larger.

B. Use care when handling fiber optic cable. Carefully monitor pulling tension so as not to exceed the limits specified by the manufacturer.

C. There shall be no splicing of Horizontal fiber optic cable.

4.12 TESTING PROCEDURES

A. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA-568-C. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

B. All cables shall be tested in accordance with this document, the ANSI/TIA standards, the Ortronics procedures and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

C. Cables, jacks, connecting blocks, and patch panels shall be in there final position with the building energized.

D. All Unshielded Balanced Twisted Pair cables shall be tested as follows:

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Horizontal cabling shall be tested using an approved Ortronics certification tester (Fluke or Agilent) for category 6a, category 6, and category 5e performance compliance as specified in ANSI/TIA-568-C.
2. Follow the Standards requirements established in ANSI/TIA/EIA-568-C.
3. Testing shall be accomplished with an approved Ortronics certification tester (Fluke)

4. The basic tests required are:

   a. Wire Map
   b. Length (feet)
   c. Insertion Loss (dB) (Formerly Attenuation)
   d. NEXT (Near end crosstalk) (dB)
   e. Return Loss (dB)
   f. ELFEXT (dB)
   g. Propagation Delay (ns)
   h. Delay skew (ns)
   i. PSNEXT (Power sum near-end crosstalk loss) (dB)
   j. PSELFEXT (Power sum equal level far-end crosstalk loss) (dB)

Cat 6 Ortronics NetClear GT2 shall be tested to a Cat 6 auto test to 250 MHz.

ALL TEST RESULTS WILL PROVIDE FOR 5dB OF HEADROOM (NEXT) AS PER THE nCOMPASS 6+ SOLUTION GUARANTEE.

5. All test results shall be provided in the approved certification testers original software format on a CD, with the following minimum information per cable:

   a. Circuit ID
   b. All information from 1.2D.4 above.
   c. Test result, "Pass" or "Fail"
   d. Date and Time of test
   e. Project Name
   f. NVP
   g. Version of software

   Note: No asterisk * will be accepted by Ortronics. These results shall be retested and submitted after a PASS is received.

6. A software copy of the test results, in the original tester software format, shall be provided to the Owner and Ortronics.
7. Contractor shall provide a fully functional version of the tester software for use by the Owner in reviewing the test results.
8. Any failed test results that cannot be remedied through re-termination (as in the case of reversed or split pairs), must be reported in writing to the Owner immediately, along with a copy of the test results.

E. All Optical Fiber shall be tested as follows:

1. Testing procedures shall be in accordance with the following:

a. ANSI/TIA/EIA-568-C
b. ANSI/TIA/EIA-568-C.1
c. ANSI/TIA/EIA-568-C.0
d. ANSI/TIA/EIA-526-7
e. ANSI/TIA/EIA-526-14, Method B
f. Proposed TSB-140 Tier one Fiber Certification, C

2. Test Equipment

a. Certification tester (Fluke).

3. Testing

a. All optical fibers shall be tested at both the 850 nm and 1300 nm wavelengths for multimode, 1310nm and 1550nm wavelengths for Singlemode, end-to-end insertion loss. Telecommunications Room (TR) to Telecommunications outlet (TO).Telecommunications outlet (TO) to Telecommunications Room (TR). Maximum insertion loss for all horizontal fiber optic cables without a consolidation point shall not exceed 2.0 dB.

NOTE: Horizontal fiber runs TR to TO, TO to TR, shall be tested at the wavelength of operation to the desk top applications.

4.13 TESTING AND ACCEPTANCE

GENERAL:

A. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C.1, C.2. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connect ors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

B. All cables shall be tested in accordance with this document, the ANSI-TIA/EIA standards, the Ortronics, Superior Essex and Corning Certification Program Information Manuals and best Industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the owners authorized representative for clarification and resolution.

COPPER CHANNEL TESTING:

A. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Horizontal cabling shall be tested using a level IIe or level III test unit for category 5e or category 6, performance compliance, respectively.

B. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals. Crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

C. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI-TIA/EIA-568-C Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

D. Category 6 and 6E:

1. Follow the Standard requirements established in ANSI/TIA/EIA-568-C.1, C.2:
2. A level III test unit is required to verify category 6 performance and must be updated to include the requirements of ANSI/TIA/EIA-568-C.1.
3. The primary field-test parameters leading to Pass/Fail criteria used to verify installed horizontal cabling are listed below. These parameters are defined in ANSI/EIA/TIA-568-C.1.

Wire Map
Length
Insertion Loss
Near-end cross talk (NEXT) loss
Power sum near-end cross talk (PSNEXT) loss
Equal-Level-far-end cross talk (ELFEXT)
Power sum equal-level-far-end cross talk (PSELFEXT)
Return Loss
Propagation Delay
Delay Skew

Approved test unit manufacturer is Fluke DTX. Other test units are unacceptable. The Fluke DTX shall have the latest Linkware software version installed at time of project testing.

FIBER TESTING:

A. For horizontal and riser cabling system using multimode optical fiber, attenuation shall be measured bi-directionally at both 850.nanometer (nm) and 1300 nm operating windows using an LED light source and power meter.

B. For horizontal and riser cabling system using single mode optical fiber, attenuation shall be measured bi-directionally at both 1310 nanometer (nm) and 1550 nm operating windows, using an LASER light source and power meter.

C. Campus Backbone multimode fiber cabling shall be tested with OTDR at both 850 nm and 1300 nm bi-directionally.

D. Campus Backbone single mode fiber cabling shall be tested with OTDR at both 1310 nm and 1550 nm bi-directionally.

E. Test set-up and performance shall be conducted in accordance with ANSI/TIA/EIA-526-14A, Method B Standard.

F. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. ONLY BASIC LINK TEST IS REQUIRED. The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.

G. Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements.

4.14 SYSTEM DOCUMENTATION

A. Per project contract documents.

4.15 TEST RESULTS:

A. Submit completed test results with close out documentation on CD-ROM. Hard copy printed results are also required to be submitted via 3 ring binder(s), tabbed by EF/MC/IC/TC/ER/TR Binder shall be labeled with Oregon State University Project name and project number. This applies to all Horizontal copper and all fiber optic test results.

B. Horizontal Cat. 3, Cat. 6, and Cat 6E cabling shall be tested with Fluke DTX 1800 Level III tester. Test results produced by other testers WILL NOT be accepted. A summary report will accompany the individual graph format test results. Test results shall have the Technicians

names, correct date and time. Test results without the correct information and not in colored graph format shall not be accepted.

4.16 IDENTIFICAITON AND LABELING:

A. OSP copper labels shall be engraved. OSP copper labels shall be white letters on black background.

B. OSP Singlemode fiber optic labels shall be engraved, black letters on yellow background.

C. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device. Specific labeling information shall be project specific and the information will be given to the contractor by OSU Network Services.

D. All horizontal cables are to be labeled using a machine printed label at each end of the cable approximately 6 inches of the termination point. Handwritten labels shall not be used.

E. All patch panel ports and TO ports shall be labeled with the cable, network, TR room #, and port identifier.

F. All inside building cabling, termination, hardware, protection units, patch panels, and work area outlets shall comply with ANSI/TIA/EIA 606 labeling standard color codes.

G. Labeling scheme information and format to be provided by OSU Network Services.

1. Note all labeling information on the as-built drawings.

4.17 FINAL ACCEPTANCE & SYSTEM CERTIFICATION:

A. Completion of the installation, in-progress inspections, receipt of the test and as-built documentation, and successful performance of the cabling system will constitute completion of the system. Upon successful completion of the installation and subsequent inspection, Oregon State University shall be provided with a numbered certificate, from Ortronics or Superior Essex and/or Corning if applicable, registering the installation.

SECTOION 270510 – COMMON WORK RESULTS FOR AUDIO-VIDEO SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 27 05 28: Conduits and Backboxes for Audio/Video Systems apply to this Section.

C. Section 27 41 16: Audio-Video Systems Basic Material and Methods applies to this Section.

D. Section 27 41 16.10: Audio-Video Equipment List applies to this Section.

E. Section 27 41 16.20: Audio-Video Systems Narrative applies to this Section.

1.2 SCOPE OF WORK

A. It is the intention of this Division of the Specification and the accompanying drawings to describe and provide for the completion of design details, furnishing, installing, testing and placing in satisfactory and fully operational condition all cabling and materials necessary appurtenances to support, a complete and fully operational Audio/Video (AV) systems. AV Systems installation and equipment to be provided by owner.

B. The drawings and specifications are complementary and what is called for (or shown) in either is required to be provided as if called for in both. Where conflicting information occurs within the drawings and specifications or between the drawings and specifications, the more expensive alternative shall be used as a basis for bidding. Prior to execution of the contract, Contractor shall notify the Owner's Representative of all cost modifying conflicts between the drawings and specifications.

C. Work Includes:
1. Preparation of a project management schedule, including a time line for equipment procurement and installation of all AV systems cabling.
2. Provision of complete Audio/Video Systems cabling.
3. The Contractor shall generate shop drawings and information for the complete installation of the system cabling. The Contractor (or sub-contractor for) shall provide the on-site installation of cabling, and shall provide on-going supervision and coordination during the implementation phase.
4. The Contractor shall be responsible for the final adjustment of the systems as herein prescribed and shall provide test equipment for the proof of performance and acceptance tests.

1.3 WORK IN OTHER DIVISIONS

A. See all other divisions of specifications for other work which includes but is not limited to:

1. Cutting and Patching
2. Painting, Refinishing and Finishes
3. Conduits, wire ways, connection boxes, pull boxes, junction boxes, and outlet boxes permanently installed in walls, floors, and ceilings.
4. Room lighting fixtures, dimmers, power receptacle outlets, and interconnecting wiring for these circuits
5. Structural work, wall openings, platforms, railings, stairs, fire prevention and safety devices, rough and finished trim, painting and patching, drapes, carpets, floor coverings, computer floors, glazing, acoustical treatments, and heating, ventilating, and air conditioning systems
6. Moveable furniture, desks, and chairs.

1.4 QUALITY ASSURANCE

A. Quality of Materials and Equipment
   1. Materials and equipment supplied by the Contractor shall be new and shall meet or exceed the latest published specification of the manufacturer in all respects.
   2. At the time of submittal the Contractor shall supply the latest model for each piece of equipment.
   3. Equipment and enclosures shall be UL listed, or equivalent.

B. Substitutions
   1. See Section 01 25 00

C. Alternates:
   1. See Section 01 23 00

1.5 CODES, PERMITS, INSPECTION FEES

A. The following code and standards are referenced in the Division 27 specifications. Perform all work and provide materials and equipment in accordance with the latest referenced codes and standards of the following organizations:
   1. American National Standards Institute (ANSI)
   2. National Electrical Manufacturer's Association (NEMA)
   3. National Fire Protection Association (NFPA)
   4. Underwriter's Laboratories (UL)

B. Install the AV systems based on the following:

NFPA 70	National Electrical Code as adopted and amended by the Local Jurisdiction.
IBC	International Building Code as adopted and amended by the Local Jurisdiction.

C. The referenced codes establish a minimum level of requirements. Where provision of the various codes conflict with each other, the more stringent provision shall govern. If any conflict occurs between referenced codes and this specification, the codes are to govern. Compliance with code requirements shall not be construed as relieving the Contractor from complying with any requirements of the drawings or specifications which may be in excess of requirements of the governing codes and rules and not contrary to same.

D. Owner pays for all permits and fees. Contractor to work with Owner to obtain all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. Arrange for inspection of work by the inspectors and give the inspectors all necessary assistance in their work of inspection.

1.6 CONTRACTOR QUALIFICATIONS

A. All firms responding to this specification shall meet the following minimum qualifications:
   1. Provide proof that they have been in business for at least 5 years.
   2. Have a demonstrated experience installing commercial projects of similar size and scope.
   3. Provide three references for end users for projects of similar size and scope completed within the last year.
   4. Provide a list of all primary and secondary project participants.
   5. Directly employ all primary project participants.
   6. Identify all secondary project participants direct employer.
   7. Provide proof of factory certifications for the following manufacturers:
      a. Crestron – must have a DMC-E and a certified programmer on staff.

B. Subcontract
   1. No subcontract will be permitted for the Contractor's responsibilities, as herein defined, unless specifically identified in the bid submission and approved by the Owner.
   2. The Contractor shall have sole responsibility for the satisfactory implementation of each system, even though the Contractor may have sub-contracted a portion of the installation or had certain manufacturers install their own equipment.

1.7 COORDINATION

A. The Contractor shall continually interface and coordinate the work with the work of other Contractors and/or other trades and shall examine all drawings and specifications of other trades including the mechanical, Architectural, and structural for construction details and coordination.

B. Obtain submittals, shop drawings, and other information for equipment to be furnished by the Owner or under other divisions of the specifications.

C. Special attention is called to the following items for coordination.
   1. Conduit, cable tray, boxes, and other raceway components.
   2. Location of casework, cabinets, counters, doors, and equipment racks so that all equipment is clear of and in proper relation to these items.
   3. Mounting, recessing and concealing video projectors, televisions, speakers and other associated equipment in specially constructed casework and niches.
   4. Structural attachments for projection screens and speaker rigging.

D. At the beginning of the project, meet with Owner and the Owner's Representative to review specified AV Systems cabling and develop a full understanding of each system to be installed as part of this project.

E. Prior to roughing-in, verify the exact location of AV devices with Architect and the Owner's Representative.

F. The Contractor shall schedule its work to prevent conflicts with other activities in the building, and shall execute without claim for extra payment moderate moves or changes as are necessary to accommodate other equipment, or preserve symmetry and pleasing appearance.

G. Equipment Delivery and Storage
1. Equipment delivered prior to installation shall be stored by the Contractor at their place of business. Costs of shipping, and of unusual storage requirements, shall be borne by the Contractor. The Contractor shall inform the Owner seven (7) days in advance of delivery to the site. It shall be the responsibility of the Contractor to make appropriate arrangements, and to coordinate with authorized personnel at the site, for the acceptance, handling, protection, and storage of equipment so delivered.

H. The Contractor shall not be paid for work associated with the relocation of equipment, conduits, cabling, or any other materials requiring removal or reinstallation as a result of a lack of sufficient coordination prior to installation.

I. Status Reports
1. After the award of contract, the Contractor is responsible for providing weekly status reports outlining progress on the project. These reports should include information on the work completed during the week, the work to be completed during the upcoming week and any potential scheduling issues The following should be include in this Status Report
2. Expected date of project submittals, including equipment cut sheets, shop drawings, control system interface designs, etc.
   a. Schedule and percentage complete of on-site wiring and supervision.
   b. Schedule and percentage complete of on-site installation.
   c. Schedule for Systems cabling checkout and turnover to the Owner.

1.8 SUBMITTALS AND SHOP DRAWINGS

A. Provide four (4) sets of all submittals for review by Owner, Architect, and the Owner's Representative. One set will be returned after being reviewed.

B. Submittals: Submit within 30 days of contract award:
1. Equipment list, based on specified equipment and other additional equipment or materials needed for complete systems. Any variations of the proposal from the specifications shall be clearly indicated in the submittal's table of contents.
2. Product data with index and divider tabs by specification section, with brochures and/or catalog cuts for all items of equipment and hardware, in a three ring binder with hardboard cover. If manufacturer cut sheet is not available, list device specifications separately.
3. Where multiple pieces of equipment are shown on a product data sheet, clearly indicate equipment being provided, including finish and all accessories.
4. For each item, indicate listing by UL or other approved testing agency.
5. Wire / cable label format including cable number, signal type, signal source and signal destination.

C. Shop Drawings: Submit shop drawings within 60 days of contract award showing the ratings of items and systems and how the components of an item or system are to be assembled, interconnected, function together and how they will be installed on the project. System layout

drawings shall show floor plans with complete device layout with wiring and connection diagrams between components of the system.

D. Shop Drawings are required for:
   1. Floor plans, showing the layout of devices and cabling and wiring within raceway systems. Include the number of cables, type of cables, and size of raceway for each run.
   2. Wire run lists showing cable numbering and coordinated with the shop drawings signal flows.
   3. Field wiring details.

E. With the Shop Drawings, submit:
   1. Preliminary wire numbering lists.
   2. Provide a detailed description of the proposed wire numbering system, complying with specified requirements.

F. The Contractor agrees that submittals and shop drawings processed by the Owner's Representative are not change orders; that the purpose of submittals and shop drawings by the Contractor is to demonstrate to the Owner's Representative that the Contractor understands the design concept, that the Contractor demonstrates understanding by indicating which equipment and material the Contractor intends to furnish and install, and by detailing the fabrication and installation methods the Contractor intends to use. The Contractor alone accepts responsibility for assuring that materials furnished under this Division of the specifications meet in full requirements of the contract documents. The Owner's Representative's review is for general conformance with the design concept and contract documents. Markings or comments shall not be construed as relieving the Contractor from compliance with the project plans and specifications, nor departures there from. The Contractor remains responsible for details and accuracy for confirming and correlating quantities and dimensions, for selecting fabrication processes and for techniques of assembly.

G. Submittals and shop drawings which are incomplete, copies and or reissue of the Owner's Representative drawings or which contain insufficient information will be returned without review, for resubmission. See Division 1 for format, quantity, etc.

1.9 CONTRACT DOCUMENTS

A. The drawings and specifications are complementary and what is called for (or shown) in either is required to be provided as if called for in both.

B. Equipment racks, connection panels, and all other associated devices are shown diagrammatically only and indicate the general character and approximate location. Furnish, install and place in satisfactory condition, all AV equipment, cabling and all other materials required for the systems shown or noted in the contract documents, so that it is a complete system which is fully operational and fully tested.

1.10 AS-BUILT DRAWINGS

A. Refer to General Condition of the contract.

B. Continually record the actual as-built installation on a set of prints kept readily available at the project during construction. These prints shall be used for this purpose alone. At the completion of the work, Contractor shall furnish the Architect a set of reproducible as-built drawings (Xerox type) and the set of mark-ups. Final payment to the Contractor will not be authorized until these prints have been submitted to and accepted by the Owner's Representative.

C. As-built drawings shall include, at a minimum, updates of all sheets of the Shop Drawings and shall be marked as record drawings.

D. Provide drawings in the following formats and quantities:
1. One set of full-size bond copies.
2. One sets of half-size bond copies.

1.11 CONTRACT CLOSEOUT AND OPERATION AND MAINTENANCE (O&M) MANUALS

A. The Contractor shall prepare two (2) Operations Manuals for each system provided under these specifications.

B. The Contractor shall prepare two (2) Maintenance Manuals for all equipment furnished under these specifications.

C. Operations Manuals and Maintenance Manuals shall be originals as supplied by the manufacturer. Copies will not be accepted.

D. A preliminary copy, complete except for the bound cover shall be submitted prior to 75% completion of the project for checking and review. After checking and review, provide two (2) bound, final, corrected copies. Deliver both copies to Owner five days before instruction is to begin. Obtain a receipt for the manuals and forward copies of the receipt to the Owner Representative.

E. These O & M Manuals shall contain all the information needed to operate and maintain all systems and equipment provided in the project. It shall be presented and arranged in a logical manner for efficient use by the Owner's operating personnel. The information included must be the exact equipment installed, not the complete "line" of the manufacturer. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets. The information provided shall include but not be limited to the following:
1. Equipment manufacturers, makes, model numbers, serial numbers, sizes, etc. Include addresses and telephone numbers for each manufacturer. List loose items separately.
2. Warranty Information, including but not limited to:
    a. An overall Statement of Warranty from the AV Contractor for the complete Systems cabling.
    b. A copy of the Manufacturers' warranties for each item of equipment so covered.
    c. Instructions for obtaining warranty service from the AV Contractor, and from each Manufacturer.
3. Owner manuals for each item of equipment as published by the manufacturers, and other manufacturers’ servicing data.
4. Complete parts list including reordering information, recommended spares and anticipated useful life (if appropriate). Parts lists shall give full ordering information

assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by equipment supplier not acceptable.

5. "Finished As-built" Shop Drawings, including point to point wiring diagrams.
6. "Finished As-built" Wire-Run Lists.
7. Copies of all test results. Include the names of the individuals performing and witnessing the tests, and the manufacturer and model of each item of test equipment which was used. Include block diagrams of the test setup for tests which involve more than one item of test equipment.

F. The information contained in the manuals shall be grouped in an orderly arrangement by specification index. The manuals shall have a typewritten index and divider sheets between categories with identifying tabs. The completed manuals shall be bound in heavy-duty slant-ring binders (3 “D” rings), or with hardboard covers and screw-post bindings O & M manuals shall not exceed 3” thickness. Provide two or more volumes if required. Provide O & M manuals per the requirements of Section 01 77 00 Demonstration and Acceptance Testing.

G. Prior to performing testing, submit proposed formatting of test results for review by the Owner and Owner's Representative.

H. The Contractor shall demonstrate system operation and verification of test results to the Consultant. The Consultant may choose to observe a random sampling of test results or if the sampling does not match the test results, the Contractor may be asked to perform all testing again.

I. The Contractor shall have the following test equipment, as needed, available on-site during the installation and testing:
   1. Dual-trace, triggered oscilloscope with calibrated settings
   2. Sine wave oscillator with balanced output and distortion below 0.1%
   3. AC voltmeter with 100 millivolt full-scale sensitivity and 50 to 10,000 Hertz frequency response
   4. Software to adjust remotely controlled signal processors, with necessary computer and related hardware. Provide sufficient cabling to permit controlling computer to be located in loudspeaker service areas while signal processors remain in equipment cabinets
   5. Non-professional test equipment or "home-built kit" equipment is not acceptable.

J. Have available on site installation, servicing, and alignment manuals for all items of equipment, include this information in the O&M manuals.

K. Provide on-site personnel who have participated in the installation and testing.

L. Assist the Owner's Representative in making any final proof of performance tests, equalization, and other adjustments. This shall include listening and viewing tests, including subjective tests by observers at various positions, under various operating conditions.

M. Make any adjustments, including but not limited to re-wiring changes in shielding or grounding, and minor changes in wiring and termination, which are deemed necessary by the Owner's Representative during proof of performance. Such work shall be included in the base bid contract amount.

1.12 TESTING REQUEST

A. When the work is complete and ready for acceptance testing, submit report to the Owner's Representative for review and approval. Submit copies to the Architect, the Owner's Representative Include copies of final inspection certificates to the Owner.

B. Include:
1. Letters from the Cabling Contractor and all Cabling Subcontractors, on their respective letterheads, certifying that the AV systems are complete, fully tested and adjusted, fully operational, and ready for inspection, final testing, and tuning. The results of all tests, measurements, and adjustments which are specified within this section and related sections.
2. List of personnel and test equipment used.
3. List of discrepancies and corrective action taken.

1.13 ADDITIONAL SITE VISITS BY THE OWNER'S REPRESENTATIVE

A. Additional site visits may be deemed necessary by the Owner's Representative if any of the following conditions are found during the (initial) site visit:
1. Items of equipment which are missing or non-operational.
2. Items of equipment which do not meet the specifications or the manufacturers published performance criteria.
3. Hum, buzz, or noise which degrades the signal to noise ratio of any circuit by more than 5 decibels from the manufacturers' rated signal-to-noise ratios for the upstream components.
4. Any other conditions which are not in accordance with the specifications, drawings, or Contractor's submittals.

B. The Contractor shall make every possible effort, and the Owner's Representative will render reasonable assistance which does not hamper the other work of the site visit or extend the site visit, to correct the deficiencies during the site visit to avoid additional site visits.

C. If additional site visits are deemed necessary:
1. The Owner's Representative will submit a written notification of the reasons with descriptions of the deficiencies to be corrected.

1.14 WARRANTY

A. Refer to General Conditions and Division 1of the Contract.

B. The Contractor shall guarantee all work installed under this specification. The Contractor shall make good, repair or replace, at the contractor's own expense, any defective work, materials, parts, or equipment which may show themselves within one (1) year after Substantial Completion, if in the opinion of the Architect or the Owner's Representative said defect is due to imperfection in material, design or workmanship. Such guarantee shall include all travel, shipping, or other related costs associated with performing the warranty work at the job site.

C. The warranty shall include all provisions of the standard manufacturer’s backed warranty for each particular piece of equipment, and remain in effect for a period as stated by the

manufacturer. AV systems Contractor shall be an authorized service representative for all equipment supplied as part of this project unless appropriate approval from Owner has been granted prior to equipment procurement or installation. The warranty shall also cover the accuracy of technical documentation, and signal quality as specified and documented during the testing process of this project.

1.15 PUBLICATION

A. No information relative to this job may be released for publication without prior written approval from the Owner.

1.16 ABBREVIATIONS AND DEFINITIONS

A. When the following abbreviations and definitions are used in relation to the work for Division 27 they shall have the following meanings:

Item	Meaning
AHJ	Authority Having Jurisdiction.
Boxes	Outlet, Junction or Pull Boxes.
Code	All applicable codes currently enforced at project location.
Compression	Compressed using a leverage powered (hydraulic or equivalent crimping tool.
Provisions of complete audiovisual systems	All MATERIALS and LABOR required for equipment to be fully operational.
Exterior Location	Outside of or penetrating the outer surfaces of the building weather protective membrane.
Fully Operational	Tested, approved, and operating to the satisfaction of the AHJ, manufacturer and contract documents.
Furnish	Deliver to the job site
Install	To enter permanently into the project and make fully operational.
Kcml	Thousand circular mils (formerly MCM).
Mfr.	Manufacturer.
NEC	National Electrical Code, National Fire Protection Association, Publication #70.
Noted	Shown or specified in the contract documents.
Provide	Furnish and install.
Required	As required by code, AHJ, contract documents, or manufacturer for the particular installation to be fully operational.
Shown	As indicated on the drawings or details.
Wiring	Raceway, conductors and connections.

PART 2 - PRODUCTS

2.1 CLOSEOUT

A. Provide As-Built Drawings

B. Provide Operation and Maintenance (O&M) Manuals

PART 3 - EXECUTION

3.1 JOB CLOSEOUT PROCEDURE

A. Perform the following procedures for project closeout of the Division 27 AV work:
   1. Perform initial testing, tests and documentation.
   2. Clean up.
   3. Obtain final electrical inspection. Include copies in O & M manual.

B. Following completion of the above, submit written notice to the Owner's Representative, at least 48 hours in advance, so that the Owner's Representative may, at its discretion, furnish representatives to witness and/or participate in the final tests and adjustments.

C. Following the Owner's Representative's response to the above, perform final tests and adjustments as specified, and complete the following procedures.
   1. Submit written certificate of one-year warranty in O & M Manuals.
   2. Submit and obtain acceptance of As-Built Drawings.
   3. Submit and obtain acceptance of O & M Manuals.

D. Assist the Owner's Representative in performing final acceptance testing and observing completion of the work. At the Owner's Representative's option, any or all of the specified tests or adjustments, or additional tests or adjustments that may be deemed necessary by the Owner's Representative, shall be repeated for observation.

END OF SECTION 270510

CONDUITS AND BACKBOXES FOR AUDIO-VIDEO SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Other References

EIA/TIA-569A	Commercial Building Standard for Telecommunications Pathways and Spaces

1.2 SUMMARY

A. Section Includes:
1. Electrical work related to Audio/Video (AV) systems, as shown on AV drawings.
2. Raceway systems, including cable tray, conduits, boxes, cover plates, enclosures, terminal cabinets, and terminal boards.
3. Installation of special back-boxes and plaster rings for control panels and loudspeakers.
4. Branch circuits and special grounding conductors for electronics equipment cabinets, video projectors, televisions, and other AV equipment.
5. Branch power circuitry and interfacing for low-voltage control for motorized projection screens.
6. Coordination with the work of the Owner Provided AV Installation.

1.3 SYSTEM DESCRIPTION

A. Audio/Video systems include:
1. Audio/Video (AV) equipment and conductors (wire and cabling) are not included in this Section, and will be provided under another Section of Division 27.

1.4 COORDINATION

A. Under this Section, coordinate with Owner Provided AV Installer, including coordination for wiring methods, locations for back-boxes and outlet/terminal boxes for AV equipment, locations for conduit/junction boxes, routing of conduits and power conductors for audio, video, computer video, control, and power to AV equipment.

1.5 SUBMITTALS

A. General: make submittals in accordance with Section 27 05 10. Submit product data and other submittals for work of this Section separately from submittals of other Sections of Division 27, to allow review by the Owner's Representatives.

PART 2 - PRODUCTS

2.1 GENERAL

A. Except as otherwise specified in this Section, provide products and materials for AV infrastructure in accordance with Division 26.

2.2 CONDUITS

A. All conduits for AV infrastructure shall be Electrical Metallic Tubing (EMT) as specified in Division 26.

B. Provide as described below, except where otherwise shown on the drawings.

C. Provide an individual raceway from each outlet to within 6" of a designated AV cable tray or AV equipment rack, at an accessible location.

2.3 OUTLET BOXES

A. One- and Two-gang AV outlet boxes: 4" square, 3-1/2" deep box with single-gang and double-gang plaster rings, respectively.

B. AV outlet boxes (three-gang and larger): gang box with common gang box cover or masonry boxes, 3 inches deep (minimum).

C. AV outlet boxes not listed above: as shown on drawings, or a minimum size of 4" square, 3-1/2" deep box with single-gang or double-gang plaster ring.

D. Surface wall outlets shall be 4" square, (2 gang), 2-3/4" deep (minimum) and shall match and be manufactured by the surface metal raceway manufacturer.

2.4 SPECIAL BACK-BOXES

A. Control Panel Backboxes.
   1. Description: backboxes for wall-mounted control panels.

B. Input/Output (IO) Panel Boxes.
   1. Description: recessed wall enclosures for wall-mounted AV jack panels in classrooms and meeting rooms.
   2. Custom casework recessed in the wainscot. Refer to details on architectural drawings.

3. Stub conduits into interior of enclosure, as shown on drawings. Locate stub-outs so that the area behind each jack panel is clear; conduits shall be above or below the ends of the panels or at least 3 inches behind the panels.

C. Speaker Back-boxes.

2.5 FLUSH FLOOR BOXES

A. As specified in Section 26 05 33.10.

2.6 CABLE TRAY

A. Description: cable tray in service corridor for cables running home to main AV equipment room, from conduits from ballrooms, meeting rooms, etc.

B. Specifications:
1. Open ladder type.
2. Width: at least 24 inches.
3. Depth: at least 4 inches.
4. Rung spacing: no greater than 9 inches.

C. Manufacturer: As specified in Section 26 05 33.

2.7 PLATES

A. Provide blank stainless steel plates for gang boxes.

2.8 PULL WIRES

A. Plastic, with minimum tensile strength of 200-pounds.

2.9 TERMINAL BOARDS

A. Plywood backboard 8 feet high. APA interior grade, Douglas Fir, A-C, 3/4 inch. Fire retardant with flame spread rating not more than 25 when tested according to ASTM E84.

PART 3 - EXECUTION

3.1 GENERAL

A. Except as otherwise specified in this Section, comply with other Sections of Division 27 for installation of AV infrastructure.

B. Provide and install accessories as required to form complete systems for raceway, special grounding, and power branch circuitry.

C. The locations of the outlet boxes and other devices shown on the AV Drawings are approximate. Refer to the Architectural Drawings (such as wall elevations, reflected ceiling plans, dimensioned floor plans, and details) for exact locations. For devices not shown on Architectural Drawings, verify exact location with Architect prior to roughing-in.

3.2 OUTLET BOXES AND SPECIAL BACK-BOXES

A. Install back-boxes to be exactly centered in ceiling tile or building element, with sides of box (or lines between fastener holes for round enclosures) exactly parallel to ceiling grid or building lines.

B. All outlet boxes shall be mounted flush with finished surface unless indicated otherwise.

3.3 RACEWAYS

A. Install AV raceway to comply with NEC chapters 1-3, regardless of the class of wiring to be installed.

B. Install AV system raceway to maintain at least 24 inches of separation from conduits and wiring of power, lighting, and Class 1 signaling. Maintain at least 48 inches of separation from dimmed lighting circuits. Where runs are adjacent for less than 50 feet, the required spacing may be halved (12 inches, or 24 inches from dimmed lighting circuits). Where runs are adjacent for less than 6 feet, or where conduits cross at right angles, separations of 2 inches may be used.

C. Do not combine conduit runs which are shown separately on the drawings.

D. Do not alter the topology (routing pattern) of conduits from that shown on the drawings without the prior, written consent of the Owner's Representative. Show final routing on the Record Documents.

E. Install accessible pull boxes as required so that no conduit pull is longer than 100 feet, and that no conduit run contains more than a cumulative total of 270 degrees of bends (count each offset as 45 degrees of bending).

F. Clearly document the exact locations of pull boxes, and provide documentation to the AV Contractor. Show exact locations on the Record Drawings.

G. Provide an insulated bushing on each end of all conduits, including conduit stubs.

H. Where conduits stub out to cable tray, install so that the bushing on the end of the conduit is easily accessible, and within 12 inches of the edge of the cable tray horizontally, and within 24 inches of the cable tray vertically, but does not extend over the cable tray. Do not provide a down-turning bend at the cable tray. Bond the conduit to the cable tray at the point of stub out above the tray, using a grounding wire or other approved means.

3.4 RACEWAY RISER SLEEVES

A. Install riser raceways through floors with tops 6 inches above each floor to give continuous cable riser capability. Stuff sleeves with an approved non-combustible material such as rock wool to maintain floor fire separation.

3.5 GROUNDING

A. Provide a continuous #6 AWG insulated copper grounding conductor from the main switchboard ground bus to the main terminal board in the main equipment room, and from there to each equipment rack. Terminate in lower right hand corner of terminal board. Leave 8 feet of slack within each equipment rack for termination by the Division 27 AV installer.

B. For raceway connected to AV equipment cabinets, use a short length of non-conductive raceway (PVC) to insulate the raceway from the cabinet. Bond the equipment cabinet to ground only via the insulated, isolated grounding conductor of the branch circuit(s) feeding the cabinet. Refer to paragraphs 250-74 (Exception 4) and 250-75 (Exception) in Chapter 2 of the NEC.

C. Where mounted within AV equipment cabinets, use isolated-ground receptacles.

3.6 PULL WIRES

A. Install pull wire in all raceways over 4 feet long. Leave at least 18 inches of slack in the pull wire at each end of the conduit run, and within each pull box.

3.7 IDENTIFICATION

A. Label each conduit and other raceway at each end with the purpose (e.g. "AV" and destination (e.g. "to Classroom 147").

B. Label each outlet box, back-box, and pull box with purpose and device number (e.g. "AV Control Panel #1").

C. Provide labeling which is clear and permanent, such as black permanent-ink marker.

END OF SECTION 270528

SECTION 270529 – HANGERS AND SUPPORTS 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes discrete J-hooks, slings and related accessories for supporting communications and other low voltage cables above accessible ceilings and below accessible raised floor systems.

B. Related Requirements:
1. Section 27 05 00 - Common Works Results For Communication
2. Section 27 15 00 - Communications Horizontal Cabling

1.3 REFERENCES

A. American National Standards Institute (ANSI)/ Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)
1. ANSI/TIA/EIA 568 - Commercial Building Telecommunications Cabling Standard
2. ANSI/TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces
3. ANSI/NFPA 70 - National Electrical Code

B. Underwriter's Laboratories, Inc. (UL)
1. UL 2043 Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
2. UL 2239 Conduit, Tubing and Cable Support Hardware

1.4 DEFINITIONS

1. Pathway A series of supports and accessories for placement of communications and other low voltage systems cable
2. Main Pathway A pathway where the cable aggregate for routing to the telecommunications rooms for termination and administration.

1.5 ACTION SUBMITTALS

A. Provide submittal information in accordance with Section 27 05 00 - Common Work Results For Communications and supplementary requirements described in this specification.

B. Product Data: Provide the following:
   1. Product data on all cable support devices and accessories. Indicate materials, finishes, load ratings, dimensions, listings, approvals and attachment methods.

C. Shop Drawings: Provide the following:
   1. Plan view showing pathway coordination with mechanical components, lighting components, sprinkler head components, plumbing components and electrical components
   2. Elevations and sections to indicate space allocations and coordination with work of other trades
   3. Details to describe the different support configurations, accessories, attaching means and cable groupings

D. Closeout Submittals – Provide the following:
   1. Approved submittal documentation with the O&M Manuals.
   2. As-built drawings of main pathways.

1.6 QUALITY ASSURANCE

A. Hangars, supports and accessories shall be listed to Underwriter's Laboratories, Inc Standard 2239.

B. Hangars, supports and accessories shall have the manufacturers name and part number stamped on the part for identification.

C. Pre-Installation Meetings: Contractor shall set up a pre-installation meeting to discuss communication and other low voltage cable support layout work and installation guidelines. Contractor shall organize meeting a minimum of 30 days prior to initiating hangars and support installation work. Attendees shall include general contractor, cable tray contractor, cable contractor(s), mechanical contractor, sprinkler contractor, low voltage system vendors, Owner, Architect and Engineer. Purpose of meeting shall be to coordinate work between the parties to have a consistent layout for all communications and low voltage system cables, minimize interferences and to make cable system accessibility for future owner modifications and maintenance high priority issue for all installers.

1.7 COORDINATION

A. Coordinate installation of hangars and support components with other construction elements to ensure adequate headroom, working clearance and access. Revise locations and elevations for those indicated as required to suit field conditions and as approved by Engineer.

PART 2 - PRODUCTS

2.1 CABLE TRAY, SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cooper B-Line, Inc.; Flex Tray
   b. ERICO International Corporation.
   c. GS Metals Corp.
   d. Thomas & Betts Corporation.
   e. Unistrut; Tyco International, Ltd.
   f. Wesanco, Inc.
2. Finishes:
   a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3. Fitting and accessories - hot-dip galvanized or stainless steel where hot-dip galvanized is not available.
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be heavy-duty malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

2.2 WIDE BASE CABLE SUPPORTS

A. J hooks - Galvanized loop with integrated cable retainers, complies with EIA/TIA 568-C.0 and 569-B structured cabling system requirements,

B. Accessories: Provide applicable accessories to independently support "J" hooks from structure. This includes extender bracket for mounting multiple J hooks on a single support, fasteners and clamps for connecting to wall, beams, rods, dedicated support wires and *C* and *Z* Purlins as required for specific construction.

C. Manufacturer.
1. ERICO Caddy CableCat™ series
2. Chatsworth RapidTrak™ series
3. Or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Support all cables not supported in conduits and cable tray with J-Hooks. Space J-Hooks at a maximum of 48 inches apart and at each change of direction of the cables. Maintain maximum sag of 12-inches between supports

B. Install J-Hooks to route cables parallel and perpendicular to building lines. Hang cable supports from 3/8" all thread rods, dedicated #8 galvanized ceiling drop wire or wall brackets connected directly to structure. Do not support from the ceiling grid or ceiling wire system.

C. Provide the appropriate sized J- hooks as required. Minimum 1" width and flared edges where cables enter and leave support. 2-inch diameter loop for (25) 4-pair UTP cables and 4-inch diameter loop for (50) 4-pair UTP cables.

D. Provide multiple hooks at each hanger location as required by cable count and cable segregation requirements.

E. Install cable bundles no less than 5-inches in all directions from ballasted light fixtures.

F. Do not tie wrap cables to the J-hooks. Provide cable retainers at each J-hook.

G. Provide applicable accessories to independently support J-hooks from structure, including extender bracket for mounting multiple J hooks on a single support, fasteners and clamps for connecting to wall, beams, rods, dedicated support wires and *C* and *Z* Purlins as required for specific construction.

H. Do not tie wrap cables to the J-hooks. Provide cable retainers at each J-hook.

I. At a minimum, brace multiple J-hook assemblies from structure with diagonal braces at each change of direction.

J. Interface with Other Work: Coordinate installation of supports with mechanical ductwork, piping and sprinkler system piping so that supports remain accessible after installation.

K. Coordinate the allocation of ceiling space and the mounting elevations of various systems to allow maintenance and accessibility for future modifications. Cable supports shall be as close to the ceiling as possible while allowing ceiling tiles to be removed. Supports shall be located to avoid interference with maintenance access to other equipment.

L. Cable installation and supports shall comply with applicable provisions of EIA/TIA 569-B and ANSI/NFPA 70.

END OF SECTION 270529

SECTION 270533 – CONDUITS AND BACKBOXES 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 1 Specification Sections, apply to this Section.

B. Related Sections
1. Section 27 05 00 - Common Works Results For Communication Systems
2. Section 26 05 33 - Raceways and Boxes for Electrical Systems
3. Section 27 15 00 - Communications Horizontal Cabling.

C. Other References

EIA/TIA-569-B	Commercial Building Standard for Telecommunications Pathways and Spaces
TIA/EIA/ANSI-J-STD-607-A	Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

1.2 DESCRIPTION

A. Provide raceway systems for the installation of the telephone cables and computer wiring. Installation shall include raceways, outlet boxes, plaster rings, outlet box cover plates and terminal back boards.

PART 2 - PRODUCTS

2.1 WALL OUTLETS

A. Shall consist of a 4-11/16" square, 2-1/8" deep (minimum) box, with knockouts for 3/4", 1", and 1-1/4" conduits, as manufactured by Steel City, OZ/Gedney or equal.

B. Surface wall outlets shall be 4" square, 2-3/4" deep (minimum) and shall match and be manufactured by the surface metal raceway manufacturer.

2.2 FLOOR OUTLETS

A. See Section 26 05 33.10 - Flush Floor Outlets for floor box devices.

2.3 OUTLET DEVICE RING

A. Provide single gang device ring where the quantity of cable connectors is 4 or less.

B. Provide two gang device ring where the quantity of cable connectors is 5 or more.

C. Coordinate device ring requirements with the telecom and AV drawings.

2.4 DEVICE PLATES

A. Provide device cover plates for all unwired or "future" outlets. Plates shall match device plates specified in Section 26 27 26 - Wiring Devices except with no device openings.

2.5 PULL WIRE

A. Shall be plastic having not less than 200-pound tensile strength.

PART 3 - EXECUTION

3.1 WALL OUTLETS IN UNINSULATED INTERIOR WALLS WITH ACCESSABLE CEILINGS

A. Provide an individual conduit from each telecommunication outlet back box location to a pull box in an accessible ceiling space.

3.2 WALL OUTLETS IN UN-INSULATED INTERIOR WALLS WITH NON-ACCESIBLE CEILINGS, EXTERIOR WALLS OR INSULATED INTERIOR WALLS

A. Provide an individual conduit from each telecommunication outlet back box location to a pull box in an accessible ceiling space.

3.3 FLOOR MOUNTED OUTLETS

A. All conduits from floor outlets shall terminate in a space on the same floor as the outlet unless otherwise noted on the drawings.

B. Provide an individual conduit from each telecommunication outlet floor box location to a pull box in an accessible ceiling space.

3.4 FLOOR OUTLETS/ BOXES IN SLAB ON GRADE

A. Provide an individual conduit from each telecommunication outlet floor box to a consolidation point enclosure/pull box interior to the building within 25 feet of the point where the conduit exits the slab.

3.5 SYSTEM FURNITURE CONNECTIONS

A. Provide an individual conduit from each wall connection back box location to a pull box in an accessible ceiling space.

B. Provide an individual conduit from each system furniture module floor box location to a pull box in an accessible ceiling space.

C. Provide an individual conduit from each furniture system communication/power pole location to pull box in an accessible ceiling space.

3.6 SURFACE METAL RACEWAY CONNECTIONS

A. Provide an individual conduit from each surface raceway to an accessible ceiling space.

B. Provide an individual conduit from each surface raceway at cable tray or to a telephone terminal backboard.

3.7 CONDUIT SIZING TABLE

A. Provide conduits for communications outlets sized as follows:

Wall Phones	3/4"
Wall Outlets (except wall phones)	1"
Single Gang Floor Mounted Outlets/Boxes	1"
Multiple Gang Recessed Floor Outlets/Boxes	1"
System Furniture - per every (2) workstations	1"
System Furniture - per every (3) workstations	1-1/4"
Surface Metal Raceway - per 12 ft of SMR	1-1/4"
Surface Metal Raceway - per 20 ft of SMR	1-1/2"

3.8 RACEWAYS

A. Shall conform to specification Section 26 05 33 - Raceways and Boxes for Electrical Systems with the additional requirement that no length of run shall exceed 100 feet and shall not contain more than two 90-degree bends or the equivalent without a code size pull box. Provide pull boxes where necessary to comply with these requirements. Locate pull boxes in straight runs only, not as a replacement for an elbow.

B. Conduits with an internal diameter of two inches or less shall have a bend radius at least 6 times the internal conduit diameter. Conduits greater than two inches shall have a bend radius at least 10 times the internal conduit diameter.

C. Provide an insulated bushing on all conduits terminated in a cabinet and/ or pullboxes.

D. Terminate conduits stubbed out above accessible ceiling space so that the conduit is parallel with the ceiling and provide an insulating bushing.

E. Terminate conduit at cable trays at an accessible location within 6" of tray with an insulated bushing and provide bonding jumper or terminate conduit to the cable tray with an insulated bushing.

3.9 PULL BOXES

A. Pull boxes shall be sized per the following table:

PULL BOX SIZING (inches)

Conduit Trade Size	Width	Length	Depth	Width increase for additional conduit
1	4	16	3	2
1-1/4	6	20	3	3
1-1/2	8	24	4	4
2	8	24	4	5
2-1/2	10	24	5	6
3	12	24	5	6
3-1/2	12	24	6	6
4	15	36	8	8

3.10 PULL CORDS

A. Nylon type shall be included in all raceways over 10 feet long. Leave not less than 12 inches of slack at each end of the pull wire.

3.11 RACEWAY RISER SLEEVES

A. Riser raceways to be installed through floors with tops 6 inches above each floor to give continuous cable riser capability. Stuff sleeves with an approved non-combustible material such as rock wool to maintain floor fire separation.

END OF SECTION 270533

SECTION 270543 – UNDERGROUND COMMUNICATIONS PATHWAYS

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. This Section includes the following:
1. Conduit, ducts, and duct accessories for direct-buried, concrete-encased duct banks, and in single duct runs.
2. Handholes and pull boxes.
3. Vaults.
4. Environmental Enclosure

1.3 DEFINITIONS

A. ANSI: American National Standards Institute

B. ASTM**:** American Society for Testing and Materials

C. EPC: Electrical Polyvinyl Chloride

D. IEC: International Electrotechnical Commission

E. IP: Ingress Protection

F. ISO: International Organization for Standardization

G. MPD: Multiple Plastic Duct

H. NEMA: National Electrical Manufacturers Association

I. NFPA**:** National Fire Protection Association

J. PE: Polyethylene

K. PVC: Polyvinyl Chloride

L. RNC: Rigid nonmetallic conduit.

M. SCTE: Society of Cable Telecommunications Engineers

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
1. Duct-bank materials, including separators and miscellaneous components.
2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Accessories for vaults, handholes and pull boxes.
4. Warning tape.
5. Warning planks.

B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
1. Duct entry provisions, including locations and duct sizes.
2. Reinforcement details.
3. Frame and cover design and vault frame support rings.
4. Ladder and Step details.
5. Grounding details.
6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
7. Joint details.

C. Shop Drawings for Factory-Fabricated Handholes and Pull Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
1. Duct entry provisions, including locations and duct sizes.
2. Cover design.
3. Grounding details.
4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.5 INFORMATIONAL SUBMITTALS

A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
2. Drawings shall be signed and sealed by a qualified professional engineer.

B. Product Certificates: For concrete and steel used in precast concrete vaults, pull boxes and handholes, as required by ASTM C 858.

C. Qualification Data: For professional engineer and testing agency.

D. Source quality-control test reports.

E. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.8 COORDINATION

A. Coordinate layout and installation of ducts, vaults, handholes, and pull boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into vaults, handholes, and pull boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to vaults and handholes, and as approved by Architect Owner or Authorized Representative.

PART 2 - PRODUCTS

2.1 CONDUIT/DUCT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. Conform to NEMA standard TC-6 for encased buried and direct buried conduit:
1. EB-20
2. DB-60

C. Conform to NEMA standard TC-8 for encased buried and direct buried conduit:
1. EB-35
2. DB-120

D. Conform to NEMA standard TC-2 for:
1. Schedule 40 - Ridged Nonmetallic conduit
2. Schedule 80 - Ridged Nonmetallic conduit

E. Conform to NEMA standard TC-3 and UL 514B for:
1. EPC 40 PVC
2. EPC 80 PVC

2.2 APPROVED CONDUIT/DUCT IMPLEMENTATION

A. Approved conduit types for encasement in concrete are:
1. EB-20
2. EB-35

B. Approved conduit types for direct buried or encasement in concrete are:
1. DB-60
2. DB-100
3. DB-120
4. Schedule 40 - Ridged Nonmetallic conduit
5. Schedule 80 - Ridged Nonmetallic conduit
6. Rigid Metallic Conduit
7. Intermediate Metallic Conduit

C. Approved pathway types for direct buried or installation in conduit are:
1. Multiple Plastic Duct
2. Fiberglass Duct
3. Polyethylene Innerduct
4. Polyvinyl Chloride Innerduct

D. Conduit Type To Be Used
1. Install the following types of circular communications raceway in the locations listed unless otherwise indicated on the Drawings.
   a. Interior Dry Locations, Exposed: EMT with set screw fittings.
   b. Interior Dry Locations, Concealed (Not Embedded in Concrete): EMT with set screw fittings.
   c. Interior Wet Locations: EMT with compression fittings.
   d. Exterior, Exposed Including Roof: Rigid steel conduit.
   e. Concrete-Encased or Buried Duct Banks:
   f. PVC Schedule 40 conduit.
   g. Rigid steel conduit when additional protection is required.
   h. Flexible Conduit (Interior Exposed):
   i. Liquid tight flexible metal conduit for use with copper cable.
   j. Liquid tight flexible nonmetallic conduit for use with fiber optic cable.
   k. Conduits that are to be used for service entrance conductors shall be either:
   l. Concrete encased PVC schedule 40 or
   m. Rigid or Intermediate metallic conduit (RMC or IMC)

2.3 RIGID METAL CONDUIT AND FITTINGS

A. Conduit:
1. Type RGS: Rigid galvanized steel.
2. Type CRS: PVC externally coated conduit; rigid steel conduit with external PVC coating and internal galvanized surface.

B. Fittings and Conduit Bodies: In-line straight-through, threaded, galvanized steel fittings and Type C conduit bodies only; do not use bends or tees, e.g., Lbs.

C. Bonding and Grounding Locknuts and Wedges: Malleable iron with set screws and lug screws.

D. Insulated Bushing: Malleable iron with integral insulated throat, rated for 150 degrees C.

E. Bonding and Grounding Bushing: Malleable iron with integral insulated throat, rated for 150 degrees C, with solder-less lugs or lug screws.

F. Sealing Fittings: Threaded type conduit seal fittings and sealing compound suitable for hazardous location installations in accordance with NEC:
1. Crouse-Hinds retrofit sealing fitting EYSR.
2. Crouse-Hind CHICO A sealing compound.

2.4 ELECTRICAL METALLIC TUBING AND FITTINGS

A. Type EMT: Electro-galvanized steel tubing.

B. Fittings and Conduit Bodies:
1. General: in-line straight-through steel or malleable iron fittings and Type C conduit bodies only; do not use bends or tees, e.g. LBs.
2. Wet Areas: steel compression-type couplings and nipples.
3. Dry Areas: set screw-type couplings and nipples.

C. Bonding Locknuts: Malleable iron with set screws and lug screws.

D. Insulated Bushing: Malleable iron with integral insulated throat, rated for 150 degrees C.

E. Bonding and Grounding Bushing: Malleable iron with integral insulated throat, rated for 150 degrees C, with solderless lugs or lug screws.

2.5 RACEWAY COATING

A. Acceptable Manufacturers:
1. Koppers Bitumastic.
2. Scotchwrap.

B. Bitumastic material or plastic tape.

2.6 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.

B. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type DB-60-PVC and Type DB-120-PVC, ASTM F 512, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.

C. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacing, indicated while supporting ducts during concreting or backfilling.
   a. Nonmetallic base and intermediate duct spacers with locking keyways designed specifically for use with nonmetallic conduit; e.g., Carlon SNAP-LOC duct spacers for 4-inch (100 mm) diameter conduit with 1-1/2-inch (38 mm) separation.
      1) Base Spacer: S288NHN.
      2) Intermediate Spacer: S289NHN.
2. Expansion/Deflection Fittings: Similar to Crouse-Hinds XD expansion/deflection coupling or Appleton DF Series deflection and expansion coupling.
3. Duct Plugs:
   a. Aboveground Conduit Openings: Tapered PVC plugs with tab for pull tape; e.g., Carlon 4-inch (100 mm) PVC plugs with pull tab, P258NT.
   b. Underground or Under slab Conduit Openings: Removable screw tight compression type duct plugs with wing-nut and corrosion resistant hardware; e.g., Pacific Plastics No. 5900514, George-Ingraham 0605, or Vikimatic P4000WT.
4. Duct Water Seal: Products suitable for closing underground and entrance duct openings, where innerduct or cable is installed, to prevent entry of gases, liquids, or rodents into the structure; e.g., SEMCO PR 851.
5. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."
6. Concrete Warning Planks: Nominal 12 by 24 by 3 inches (300 by 600 by 76 mm) in size, manufactured from 6000-psi (41-MPa) concrete.
   a. Color: Red dye added to concrete during batching.
   b. Mark each plank with "COMMUNICATIONS" in 2-inch- (50-mm-) high, 3/8-inch- (10-mm-) deep letters.

2.7 INNERDUCT

A. Outdoor Innerduct: 1-inch (25 mm) and 1-1/4-inch (32 mm) inside diameter corrugated, ribbed, or smooth walled, semi rigid PVC or heavy-wall polyethylene tubing.

B. Plenum-Listed Indoor Innerduct: 1-inch (25 mm) and 1-1/4-inch (32 mm) inside diameter corrugated walled innerduct for use in plenum air handling spaces.

2.8 INNERDUCT FITTINGS

A. Couplings: Metallic or nonmetallic quick-connect, reverse threaded, and Schedule 40 couplings for connecting sections of installed innerduct.

B. Conduit Plugs: Compression-type conduit plugs with locking nuts for sealing and securing the outside walls of one or more innerduct ends to the inside wall of 4-inch (100 mm) inside diameter conduits, e.g.:
   1. Four 1-inch (25 mm) innerduct configuration.
   2. Three 1-1/4-inch (32 mm) innerduct configuration.

C. Innerduct Plugs: 1-inch (25 mm) and 1-1/4-inch (32 mm) compression-type innerduct plugs for sealing innerducts, with wing nut for hand tightening and eyebolt for securing pull tape.

D. Innerduct Caps: Removable push-in caps for plugging 1-inch (25 mm) and 1-1/4-inch (32 mm) innerduct.

2.9 PRECAST CONCRETE HANDHOLES AND PULL BOXES

A. Comply with ASTM C 858 for design and manufacturing processes.

B. Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A153 (ASTM A153M) and ASTM A123 (ASTM A123M).

C. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or pull box.
1. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing stainless-steel bolts.
   a. Cover Hinges: Concealed, with hold-open ratchet assembly.
   b. Cover Handle: Recessed.
2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
3. Cover Legend: Molded lettering, “COMMUNICATIONS”
4. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
5. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
   a. Extension shall provide increased depth of 12 inches (300 mm).
   b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
6. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
   a. Type and size shall match fittings to duct or conduit to be terminated.
   b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.10 PRECAST VAULTS

A. Comply with ASTM C 858, with structural design loading as specified in Part 3 "Underground Enclosure Application" Article and with interlocking mating sections, complete with accessories, hardware, and features.
1. Duct Entrances in Vault Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
   a. Type and size shall match fittings to duct or conduit to be terminated.
   b. Fittings shall align with elevations of approaching ducts and be located near interior corners of vaults to facilitate racking of cable.

B. Concrete Knockout Panels: 1-1/2 to 2 inches (38 to 50 mm) thick, for future conduit entrance and sleeve for ground rod.

C. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.11 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Non-concrete Handhole and Pull-Box Prototype Test: Test prototypes of vaults and pull boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
   1. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
   2. 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 CORROSION PROTECTION

A. Aluminum shall not be installed in contact with earth or concrete.

3.2 UNDERGROUND DUCT APPLICATION

A. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40 or EB-20-PVC, in concrete-encased duct bank, unless otherwise indicated.

B. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EPC-40, DB-60, DB-120-PVC, in direct-buried duct bank, unless otherwise indicated.

C. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EB-20-PVC, in concrete-encased duct bank, unless otherwise indicated.

D. Underground Ducts Crossing Paved Paths, Walks and Driveways or Roadways RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

E. Vault: Precast concrete.
   1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
   2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.3 EARTHWORK

A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary top soiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Sections "Turf and Grasses" and "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."

3.4 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1/8" per foot down toward vaults and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two vaults to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1220 mm) 12.5 feet (4 m) and 25 feet (7.5 m), both horizontally and vertically, at other locations, unless otherwise indicated.
   1. Curves and bends of non-metallic conduits shall be concrete-encased at least 4 feet prior to or after each bend in the underground ductbank.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Vaults and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) O.C. for 5-inch (125-mm) ducts, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
   2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to vault or handhole.
   3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

G. Pull tape: Measuring and pulling tape constructed of synthetic fiber with plastic jacket, printed with accurate sequential footage marks; e.g., George-Ingraham 1/2-inch (13 mm) tape 9216-JK.
1. Following conduit installation, install pull tape (mule tape) with preprinted foot markers in each empty conduit containing a bend or over 10 feet (3000 mm) in length, except sleeves, nipples, and runs with openings in clean room areas. Tie the pull tapes securely to duct plug or wall racking at each end.
2. Immediately after pull tape installation, for conduit openings on conduits underground, install screw tight, removable, watertight, and dust-tight duct plugs in conduit ends.
3. Verify lengths at the time of installation and provide as-built documentation.

H. Direct-Buried Duct Banks:
1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6 inches (150 mm) in nominal diameter.
4. Install backfill as specified in Division 31 Section "Earth Moving."
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
6. Install ducts with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches (900 mm) below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
10. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried ducts and duct banks, placing them 24 inches (600 mm) O.C. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional planks 12 inches (300 mm) apart, horizontally.

3.5 CONDUIT BENDS AND SWEEPS

A. Make changes in direction of communications conduit runs with sweeps of the longest possible radius.

B. Make sweeps in parallel or banked runs of conduits, 2 inches (50 mm) and larger in diameter, from the same center or centerline so that sweeps are parallel and of neat appearance.

C. Field-Made Bends and Sweeps:
1. Use an acceptable hickey or conduit-bending machine.
2. Do not heat metal raceways to facilitate bending.
3. Before installing 4-inch (100 mm) field-made sweeps in duct banks, pull a 3-1/2-inch (89 mm) diameter by 12-inch (300 mm) long mandrel through duct sections to verify circularity and sweep radius.

D. The angular sum of the bends between pull points and/or pull boxes to not exceed 180 degrees.

E. Minimum Inside Bend Radius for Communications Conduit Bends, Sweeps, Boxes, and Fittings:
1. Underground or Under slab 4-inch (100 mm) Conduit: 60 inches. (1.5 m)
2. Other Conduit Runs:
   a. One-inch (25 mm) conduit, 11 inches (275 mm).
   b. Two-inch (50 mm) conduit, 21 inches (525 mm).
   c. Three-inch (75 mm) conduit, 31 inches (775 mm).
   d. Four-inch (100 mm) conduit, 40 inches (1000 mm).
   e. Other sizes, 10 times the inside diameter of the conduit.

F. Do not install boxes, bends, elbows, tees, conduit bodies, and other conduit fittings, which do not provide for the minimum inside cable bend radius specified in paragraph E above.
1. Conduit Bodies: in-line straight-through Type C conduit fittings can be used as pull boxes for conduit up to a maximum of 2 inches (50 mm) ID. Other conduit fittings, which include direction changes such as E, L, LB, LR, LL, LRT, TA, TB, and X, are not allowed.
2. Refer any design or installation conflicts with these requirements to the Owner.

3.6 PENETRATIONS

A. Seal conduit entering structures at the first box or outlet to prevent the entrance of gases, liquids, or rodents into the structure.
1. Empty Conduits: Removable screw tight duct plugs.
2. Innerduct Installed: Suitable duct water seal between conduit and innerduct. Manufactured seals in empty innerduct.
3. Cable Installed: Suitable duct water seal between conduit and cable, or between innerduct and cable.

B. Concrete Sleeves: Conduits routed perpendicular through floors, walls, or other concrete structures to pass through cast-in-place conduit sleeve openings wherever possible, or appropriate size holes to be bored to accommodate the installation of conduit sleeves. The size and location of the holes to not impair the structure's integrity.
1. Concrete Boring: Bore a hole in the concrete with a diameter of 1/2 to 1 inch (13 to 25 mm) larger than the conduit sleeve to be installed. Grout around the conduit sleeve and finish to match existing surroundings.
2. Conduits that rise vertically through a slab to be stubbed 6-inches (150 mm) above the floor and capped pending future use.

C. Drywall Sleeves: Install insulating throat bushings on both ends of conduit sleeves placed in fire-rated walls using drywall construction.

D. Where conduit enters a structure through a concrete roof or membrane waterproofed wall or floor:
   1. Provide a watertight seal.
   2. With Concrete Encasement: Install watertight entrance seal device on the accessible side.
   3. Securely anchor malleable iron body of watertight entrance seal device into construction with one or more integral flanges.
   4. Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.

E. Where raceways penetrate fire-rated walls, floors, or ceilings, fire stop openings around communications penetrations to maintain the fire-resistance rating as specified in Firestopping section.

3.7 ABOVE-GROUND CONDUIT INSTALLATION

A. Support conduit installed in aboveground interior and exterior locations at a maximum of 7 feet (2.1 m) on center.

B. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps.

C. Securely attach aboveground conduit under the provisions of this Section.

D. Conceal conduit in finished areas, leave exposed in unfinished areas and where not possible to conceal. In finished areas, the Owner will make the final decision on conduit concealment.

E. Run exposed and concealed conduits parallel or perpendicular to walls, structural members, or intersections of vertical planes to maintain headroom and provide a neat appearance. Follow surface contours as much as possible.

F. No section of conduit located within buildings to exceed 100 feet (30 m) in length between pull points and/or pull boxes. Pull points in conduits 2” and larger shall not be conduit bodies, but rather boxes or wireway.

G. Expansion/Deflection Joints:
   1. Where indicated on the Drawings, provide specific purpose expansion/deflection fittings for conduit crossing building expansion/deflection joints in structures or concrete slabs. Expansion fittings to have copper bonding jumper.
   2. For PVC conduit, provide expansion/deflection joints for 25 degrees F maximum temperature variation. Install in accordance with manufacturer’s instructions.
   3. For rigid steel conduit located in exterior areas, provide expansion/deflection joints for maximum site temperature variation, installed in accordance with manufacturer’s instructions.

H. Provide each conduit passing from a nonhazardous or noncorrosive area to a hazardous area and each conduit entering an enclosure within a hazardous area with a sealing fitting in accordance

with NEC Article 500. The sealing fitting to be UL listed and to be filled with approved sealing compound of the same manufacture.

I. Hubs, Bushings, and Insulating Sleeves:
   1. Wet and Hazardous Box and Cabinet Connections: Use watertight threaded conduit sealing hubs with insulated throat and bonding type locknuts for fastening rigid steel conduit to cast or sheet metal pull boxes.
   2. Exposed Conduit Terminations: Cap exposed steel communication conduit ends with bushings or smooth collars to protect cable sheath.

3.8 INNERDUCT TO BE USED

A. Under-slab and Underground Conduit Installation: Outdoor or Plenum-listed innerduct.

B. Aboveground, Exterior, and Interior Conduit Installations: Plenum-listed innerduct.

C. Non-Plenum Areas: Plenum-listed innerduct.

D. Plenum Areas: Plenum-listed innerduct.

3.9 INNERDUCT INSTALLATION

A. Pull innerduct through conduit and wireways, or place innerduct in cable trays using continuous un-spliced lengths of innerduct between pull boxes, and/or section termination points as indicated on the Drawings.

B. Cut innerduct square. Debur cut ends.

C. Bring innerduct to the shoulder of fittings and couplings and fasten securely.

D. Wipe innerduct and fittings clean and dry before joining. Apply full, even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum.

E. Provide suitable innerduct slack in pull boxes, and at turns to ensure that there is no kinking or binding of the tubing.

F. Make changes in direction of communications innerduct runs with sweeps of the longest possible radius and at least 10 times the inside diameter of the innerduct.

G. During innerduct pulling, care to be taken to avoid excessive tension, which can cause deformation of the innerduct. Inspect innerduct following placement and replace any damaged sections.

H. Following installation, visually inspect innerduct, remove any burrs at openings, and, if necessary, clean innerduct interior.

3.10 PULL TAPE INSTALLATION

A. All conduit runs longer than 10ft shall have pull tape with pre-printed footage markers installed.

B. Following conduit or innerduct installation, install pull tape (mule tape) with preprinted foot markers in all sections longer than 10ft, except runs with openings serving clean room areas. Tie the pull tape securely to wall racking at each location.

C. Verify lengths at the time of installation and provide as-built documentation.

3.11 INSTALLATION OF CONCRETE VAULTS, HANDHOLES, AND PULL BOXES

A. Precast Concrete Handhole and Vault Installation:
1. Comply with ASTM C 891, unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:
1. Vault Roof: Install with rooftop at least 15 inches (380 mm) below finished grade.
2. Vault Frame: In paved areas and traffic ways, set frames flush with finished grade. Set other vault frames 1 inch (25 mm) above finished grade.
3. Install handholes with bottom below the frost line, below grade.
4. Handhole Covers: In paved areas and traffic ways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains in bottom of vaults where indicated. Coordinate with drainage provisions indicated.

D. Waterproofing: Apply waterproofing to exterior surfaces of vaults and handholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Division 07 13 00 "Elastomeric Sheet Waterproofing or Thermoplastic Sheet Waterproofing." After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of vault chimneys after mortar has cured at least three days.

E. Damp proofing: Apply damp proofing to exterior surfaces of vaults and handholes after concrete has cured at least three days. Damp proofing materials and installation are specified in Division 07 Section "Bituminous Damp proofing." After ducts have been connected and grouted, and before backfilling, damp proof joints and connections and touch up abrasions and scars. Damp proof exterior of vault chimneys after mortar has cured at least three days.

F. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, as required for installation and support of cables and conductors and as indicated.

G. Field-Installed Bolting Anchors in Vaults and Concrete Handholes: Do not drill deeper than 3-7/8 inches (98 mm) for vaults and 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

H. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each vault cover.

3.12 INSTALLATION OF HANDHOLES AND PULL BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and pull boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use pull box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.7-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and traffic ways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.

D. 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 the enclosure.

E. Field-cut openings for ducts and 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.

F. For enclosures installed in asphalt paving and subject to occasional, non deliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
   1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete," with a troweled finish.
   2. Dimensions: 10 inches wide by 12 inches deep (250 mm wide by 300 mm deep).

3.13 GROUNDING

A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.14 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
3. Test vault and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.15 IDENTIFICATION

A. Label each conduit and other raceway at each end with the purpose (e.g. destination (e.g. "Telecom Room TR-1112").

B. Label each pull box with purpose and destination (e.g. "TR-1112 to BTR-1118").

C. Provide labeling which is clear and permanent, such as black permanent-ink marker.

3.16 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of vaults, including sump. Remove foreign material.

END OF SECTION 270543

SECTION 271100 – 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 270500 - Common Works For Communication Systems
2. Section 270533 - Conduit And Back Boxes For Communication Systems
3. Section 271300 - Communications Backbone Cabling
4. Section 271500 - Communications Horizontal Cabling

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 cabinet for all cable termination equipment and equipment.
3. Wall elevations for all mounted equipment, devices and pathway components.

4. 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 RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.
4. Have a demonstrated experience installing commercial projects of similar size and scope.
5. Must be approved Ortronics Certified Plus (CIP) and certified Corning Cabling Systems NPI Installer.
6. Solicitation responses shall only be accepted from firms certified in both Corning Cabling Systems and Ortronics Installers.
7. Contractor must possess an Ortronics CIP and Corning NPI certification within the state of Oregon.
8. Contractor with a valid Ortronics CIP cannot engage a subcontractor to perform any work within the project scope.

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 are to be installed on (4) walls in the telecom room.

B. Fire-retardant treated plywood, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."
   1. Backboards are to start 12" AFF and extend to a height of 9'.
   2. Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.
   3. Painted with two (2) coat of paint. Painted finish in the room will be White to enhance room lighting.
   4. One (1) fire-retardant stamp is to be left unpainted on the bottom of each individual piece of fire-retardant plywood.
   5. Mounting Hardware shall be painted white for cosmetic purposes.

2.3 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements provide products by the following.

B. 36” of clearance is required front and rear of all equipment racks and cabinets. Contractor shall field verify dimensions of the room and racks prior to installation and report any discrepancies to the Architect, Owner or Owners Representative.

C. Basis-of-Design Product: Subject to compliance with requirements, provide product by the following:
   1. Ortronics Mighty MO
   2. Mighty MO 6

D. Floor-Mounted AV Cabinets:
   1. Manufacturer: Middle Atlantic
   2. Secured to floor with 3/8” hardware or as called out by AHJ.
   3. Part number: WRK-44SA-27

E. Floor-Mounted Racks: Modular-type, aluminum construction:
   1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug.
   2. Black Baked-polyester powder coat finish.
   3. Secured to floor with 3/8” hardware or as called out by AHJ.
   4. Part number: OR-MM6716

F. Modular Freestanding Server Cabinets:
   1. 84”x32”x42”
   2. Frame configured:
      a. (2) pairs of RU labeled mounting rails with 3/8” square holes.
      b. Cable opening bottom front
      c. Frame levelers
      d. Full profile mesh hinged front door
      e. Split flat mesh rear door.
      f. Side panels
      g. (2) “L” shaped finger managers on rear rails

h. Vertical PDU mount
i. Lacing Bar
j. Secured to floor with 3/8” hardware or as called out by AHJ.
k. Solid front top panel. Cable entry top rear panel rear
l. #12-24 cage nuts (50)
m. #12’24 mounting screws (100)
n. Spare screws and nuts to be left in bag at bottom of cabinet

G. Modular Freestanding Network Cabinets:
1. 84”x32”x34”
2. Ortronics Mighty Mo 6: OR-MMC423234-00011
3. Frame configured:
a. (2) pairs of RU labeled mounting rails with #12-24 tapped holes.
b. Cable opening bottom front
c. Frame levelers
d. Full profile Plexiglas hinged front door
e. Full flat solid rear door.
f. Locking Side panels
g. (2) “L” shaped finger managers on front rails
h. Vertical PDU mount
i. Lacing Bar
j. Secured to floor with 3/8” hardware or as called out by AHJ.
k. Top front fan panel. Cable entry top rear panel rear
l. #12’24 mounting screws (50)
m. Spare screws and nuts to be left in bag at

H. Vertical Cable Management for Equipment Frames:
1. Metal, with integral wire retaining fingers.
2. 10” wide and 13” deep with dual hinged door
3. Black Baked-polyester powder coat finish.
4. For free standing racks; Vertical wire managers shall be bolted on to the sides or front of the rack using manufactures recommended hardware
5. Vertical cable management panels shall have front and rear channels, with covers.
6. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.
7. Part number: MM6VMD710

I. Horizontal Cable Management for Equipment Frames:
1. Located at the top and bottom of each rack
2. Part number: OR-60400098

2.4 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical 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 with 9/32-inch holes spaced 1-1/8 inches apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
4. Part number: OR-GB4X12TGBKIT

C. Comply with J-STD-607-B.

2.5 BASKET TYPE CABLE TRAY WITH SIDE WALLS

A. 12” or 24” wide with 4” side walls

B. All tray cuts shall be made with Cablofil Tray Cutter (COUPFIL OR CUTYFIL)

C. All tray cuts shall be filed for to remove burrs and painted. The for mentioned painting an filing shall be done outside of the building.

D. Cable tray shall be supported with treaded rod to building structure.

E. Manufacturer.
1. Cablofil - Refer drawing for tray widths
2. Part Number: 105/300BL OR 105/600BL

2.6 LABELING

A. Comply with TIA/EIA-606-B 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 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.

3.2 FIRESTOPPING

A. Comply with TIA-569-B, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.3 EQUIPMENT INSTALLATION

A. Install equipment racks with manufacturer approved installation hardware. All equipment racks shall be securely bolted to the floor with four bolts. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Equipment racks shall be supported at the top of the rack using cable tray, cable runway or supports attached to the wall. These supporting devices shall add rigidity to the rack for ease in working on equipment mounted in the rack.

C. All equipment cabinets and racks shall be bonded to the grounding bus bar with individual #6 AWG grounding conductors. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

D. Label all equipment racks and cabinets to meet the requirements of TIA/EIA-606-B

3.4 CABLE TRAY

A. Install cables in the AV/IT rooms as shown on the drawings. Attach the cable trays to wall and support from the structure above. Do not use wall brackets to support the cable trays from walls.

3.5 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-B.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch 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-B. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

B. 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-B for Class 4 level of administration.

D. Labels shall be preprinted or computer-printed type.

END OF SECTION 271100

SECTION 271300 – 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.

B. OSU Division 27 Master Specifications for Information Transport Systems and Spaces

1.2 SUMMARY

A. Section Includes:
1. Twisted pair copper cable
2. Multi-mode optical fiber cable
3. Single-mode optical fiber cable
4. Cable connecting hardware, patch panels and cross-connects.
5. Cabling identification products.

B. Related Sections:
1. Section 270500 - Common Works For Communication Systems
2. Section 270533 - Conduit And Back Boxes For Communication Systems
3. Section 271500 - Communications Horizontal Cabling

1.3 DEFINITIONS

- BICSI: Building Industry Consulting Service International.
- BDF: Building Distribution Frame
- Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- EMI: Electromagnetic interference.
- ICEA: Insulated Cable Engineers Association
- IDC: Insulation displacement connector.
- IDF: Intermediate Distribution Frame
- LAN: Local area network.
- MDF: Main Distribution Frame
- NRTL: Nationally Recognized Testing Laboratory

- OFNR: Optical Fiber Nonconductive Riser
- RCDD: Registered Communications Distribution Designer.
- 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-C, when tested according to test procedures of this standard.

1.6 ACTION SUBMITTALS

OSU Information services must approve submitted items before work can proceed.

A. Example Product Data: For each type of product indicated.
   1. Nominal OD.
   2. Minimum bending radius.
   3. Maximum pulling tension.

B. Shop Drawings:
   1. Cabling administration drawings and printouts.
   2. Wiring diagrams to show typical wiring schematics including the following:
      a. Cross-connects.
      b. Patch panels.
      c. Patch cords.
         1) Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
   1. Vertical and horizontal offsets and transitions.
   2. Clearances for access above and to side of cable trays.
   3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
   4. 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 Installer, 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. Test Results for All Cables and Cable Types.

1.9 QUALITY ASSURANCE

A. 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.

B. Flame-Spread Index: 25 or less.

C. 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-C.

F. Grounding: Comply with ANSI-J-STD-607-B.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

B. Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set.

C. 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.

1.11 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.

1.12 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-C.

B. Cable Support: NRTL labeled for support of communications cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

C. Support brackets with cable tie slots for fastening cable ties to brackets.

D. Lacing bars, spools, J-hooks, and D-rings.

E. Straps and other devices.

F. Cable pathways are not to exceed 40% fill capacity. To allow for future growth

2.2 TWISTED PAIR CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Superior Essex Inc
2. General Cable
3. Berk-Tek

B. Description: 100-ohm, multiple pair UTP, formed into 25-pair binder groups covered with ASP sheath with 24 AWG solid copper.

C. Comply with ICEA S-90-661 for mechanical properties.

D. Comply with TIA/EIA-568-C for performance specifications.

E. Comply with TIA/EIA-568-C, CAT-3.

F. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
1. Communications, Riser Rated: Type CMR, complying with UL 1666.

2.3 TERMINATION BLOCKS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   1. Ortronics
   2. Superior Essex Inc
   3. Or Approved Manufacturer

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-C, 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 CAT-3 at the service provider entrance. 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.
   1. Part Number: OR-30200007

D. Wire Troughs
   1. 300 Pair Vertical backbone wall mount managers
      a. Part Number: OR-806003194

E. 110 Block Labels
   1. Clear plastic with paper inserts
      a. Part Number: OR-70400646

F. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

G. Number of Terminals per Field: One for each conductor in assigned cables.

2.4 OPTICAL FIBER CABLE

A. Manufacturers:
   1. Corning

B. Subject to compliance with requirements, provide products by one of the following:
   1. Corning outdoor rated Multimode fiber Corning plenum armor coated cable
   2. Corning outdoor rated Singlemode fiber armor coated cable
   3. Corning Interlock Armor MTP-MTP method A Multimode fiber plenum rated cable
   4. Corning Interlock Armor MTP-MTP method A Singlemode fiber plenum rated cable

C. Description: LOMMF/OM4 50/125-micron, 12 strands minimum, see strand count per Plans, fiber, nonconductive, tight buffer, optical fiber cable.

D. Color: Violet

E. Fiber terminated with shuttered Duplex LC type connectors.

F. Comply with ICEA S-87-640 for outside plant applications.

G. Comply with ICEA S-83-596 for mechanical properties.

H. Comply with TIA/EIA-568-C for performance specifications.

I. Comply with TIA/EIA-492AAAA-B for detailed specifications.

J. 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:
1. Plenum Rated, Nonconductive: Type MTP-MTP method A
2. Outdoor Rated, Nonconductive
3. Maximum Attenuation: 3.0 dB/km at 850 nm; 1.3 dB/km at 1300 nm.
4. Minimum Modal Bandwidth: 2,000 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

K. Description: Singlemode fiber 12 strands minimum, see strand count per Plans, fiber, nonconductive, tight buffer, optical fiber cable.

L. Corning-ALTOS for Backbone fiber

M. Color: Yellow

N. Fusion Spliced all fiber optic terminations.

O. 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:
1. Plenum Rated, Nonconductive: Type MTP-MTP method A
2. Outdoor Rated, Nonconductive

P. Individual fiber strands shall be color coded per telecommunications industry practice.

Q. Fiber strands shall have the following characteristics:
1. Fiber Type - Singlemode, glass core, glass cladding.
2. Core Diameter 8.0 to 9.0 ?m
3. Core/Clad Concentricity Error ? 0.8 ?m
4. Cladding diameter 125 ?m ± 1?m.
5. Cladding Noncircularity ? 1%
6. Maximum attenuation at 1350 nanometers (nominal) 0.5 dB/km.
7. Fiber shall be labeled every 20’ with fixed machine-labeled yellow fiber ID tags.

R. Contact OSU Network services for labeling information.

2.5 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers:
1. Corning - Premium Edge

B. Subject to compliance with requirements, provide products by one of the following:
1. Corning for Multimode fiber
2. Corning for Singlemode fiber

C. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
   1. Quick-connect, duplex, Type LC cassettes
   2. Corning 4CH Patch Panels

D. Innerduct:
   1. No innerduct required with armor cable.
   2. Plenum innerduct with MTP cable.

E. 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-C.
   2. Quick-connect, duplex, Type LC cassettes
   3. Corning 4CH Patch Panels

F. Corning Fiber Optic Patch Panels:
   1. Part Number;
      a. CCH-01U
      b. CCH-04U

2.6 OPTICAL FIBER CABLE LABELING

A. Cable jacket shall have a permanently attached label that identifies;
   1. Cable Number
   2. Strand Count
   3. Destination

B. Cable will be labeled at every termination, splice point, entrances and exits to splice enclosures, vaults, hand hole, building, building floor and patch panel.

C. Labeling Examples:
   1. Example: SM16, 1-36 Tunnel Entrance D
   2. Example: SM04, 1-6 Plageman Hall

2.7 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.8 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-C.

C. Factory test UTP cables according to TIA/EIA-568-C.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-C.

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 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.

B. Install plenum cable in environmental air spaces, including all ceilings

C. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

D. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

E. 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.

3.2 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-C.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA/EIA-569-C for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Section 270533 Raceway and Boxes for Telecommunication 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.

3.3 INSTALLATION OF CABLES

A. Provide 24 strands of Multimode fiber from BDF in Goss Stadium to New IDF room. Follow OSU standards for installation.

B. Provide 100 pair copper backbone from BDF in Goss Stadium to New IDF room. Follow OSU standards for installation.

C. Comply with NECA 1.

D. General Requirements for Cabling:
1. Comply with TIA/EIA-568-C.
2. Comply with BICSI ITSIM, "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.

E. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

F. In the communications equipment room and at the workstation outlet, install a 10-foot (3-m) long service loop on each end of cable. At the workstation end, the service loop shall be at the last cable support before entering the conduit to the wall box.

G. Pulling Cable: Comply with BICSI ITSIM, "Pulling Cable." Monitor cable pull tensions.

H. UTP Cable Installation:
1. Comply with TIA/EIA-568-C.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

I. Voice terminations MDF to service provider wall: The CAT-3 backbone cable will be terminated on 110 style blocks mounted on the wall. The voice field will be 25 pair CAT-3 cables terminated on the wall next to the backbone voice field.

J. Optical Fiber Cable Installation:
1. Comply with TIA/EIA-568-C.
2. Terminate cables on rack mounted patch panels.

K. 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 48 inches (1220 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
4. Group connecting hardware for cables into separate logical fields.

L. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-C recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment as a minimum requirement in addition to the requirements below.
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.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
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.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
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.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 FIRESTOPPING

A. Comply with TIA/EIA-569-C Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

B. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

C. Comply with ANSI-J-STD-607-B.

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-B. Comply with requirements for identification specified in Section 260553 Identification for Electrical Systems.

B. Administration Class: 4.

C. For painting backboards: For fire-resistant plywood, do not paint over manufacturer's label

D. See Section 271500 "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion about TIA/EIA standard as it applies to this Section.

E. Paint and label colors for equipment identification shall comply with TIA/EIA-606-B for Class 4 level of administration including optional identification requirements of this standard.

F. Comply with requirements in Section 271500 "Communications Horizontal Cabling" for cable and asset management software.

G. 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.

H. 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 entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

I. 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 each 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.

5. Label each unit and field within distribution racks and frames.

J. 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.

K. 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-B, for the following:

L. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.7 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. See Section 271500 "Communications Horizontal Cabling" for additional testing requirements.
2. 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-C.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components
4. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, wire map and polarity between conductors. Test cables after termination and after cross-connection.
   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C. 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-C. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
6. Link End-to-End Attenuation Tests:
   a. Multimode backbone link measurements: Test at 850 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
   b. Singlemode backbone link measurements: Test at 1310 nm in one direction according to TIA/EIA-526-7, Method A.1, One Reference Jumper.
7. 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-C.

8. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to the Table in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
9. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
10. End-to-end cabling will be considered defective if it does not pass tests and inspections.
11. Prepare test and inspection reports.

END OF SECTION 271300

SECTION 271500 – 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 1 Specification Sections, apply to this Section.

B. OSU Division 27 Master Specifications for Information Transport Systems and Spaces May 1, 2014

1.2 SUMMARY

A. This section includes the following items for wiring systems used as signal pathways for voice and high speed data transmission:
1. Unshielded twisted-pair cabling
2. Termination hardware
3. Workstation outlets
4. Cable supports
5. Cable management hardware

B. It is the intent of this section for the Contractor to provide a complete workable cabling system ready for the Owner's use in accordance with EIA/TIA 568-C standards to support high speed data applications up to and in excess of 1000Mbs including IEEE system standards based on Twisted Pair Distributed Data Interface (TPDDI), Ethernet, Fast Ethernet, Gigabit Ethernet and Asynchronous Transmission Mode (ATM).

C. Related Sections
1. Section 270500 - Common Works For Communication Systems
2. Section 270533 - Conduit And Back Boxes For Communication Systems
3. Section 271300 - Communications Backbone Cabling

D. Related Work to be Provided by Owner or their Authorized Representative
1. Installation of workstation devices: computers, terminals, telephones, and similar equipment.
2. The installation of patch cords or cross connect wire to connect workstation devices to network equipment and backbones.

1.3 REFERENCES

A. American National Standards Institute (ANSI)

B. Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)

C. ANSI/TIA/EIA 568-C Commercial Building Telecommunications Cabling Standard or current version.

D. ANSI/TIA/EIA 569-C Commercial Building Standard for telecommunications Pathways and spaces or current version.

E. ANSI/TIA/EIA 606-B Administrative Standard for Commercial Telecommunications Infrastructure or current version.

F. ANSI/TIA/EIA 607-B Commercial Building Grounding and Bonding requirements for Telecommunications or current version.

G. Building Industry Consulting Services International (BICSI)

H. Federal Communications Commission (FCC)

I. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE 241 - IEEE Recommended Practice for Electrical Power Systems in Commercial Buildings, pertaining to communications systems.

J. National Fire Protection Association (NFPA)

K. Underwriter's Laboratories, Inc. (UL)

1.4 APPLICABLE CODES AND STANDARDS

A. Provide the system in compliance with the following:

NFPA 70	National Electrical Code as adopted and amended by the Local Jurisdiction.
IBC	International Building Code as adopted and amended by the Local Jurisdiction.
Other Codes	
	Local fire code, building code, mechanical code, electrical code, rules and interpretations required by the Authority Having Jurisdiction.

1.5 DEFINITIONS

A. As Directed: as directed by the Architect, Owner or Authorized Representative.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. EMI: Electromagnetic interference.

D. Cable: Telecommunication conductors and sheaths.

E. Cabling, Cabling System: Cables between and including the telecommunications outlet/connector and the cross connect including all fittings, conductors, connector strips, connections, termination and all other items necessary and/ or required in connection of such work.

F. Telecommunications Outlet: Connectivity point for telecommunications services, including but not limited to telephony, network, wireless access point and AV Systems.

G. Concealed: embedded in masonry or other construction, installed behind wall furring or within wall partitions, or installed within hung ceilings.

H. Exposed: not installed underground or "Concealed" as defined above.

I. Furnish: Deliver to the jobsite.

J. Install: To enter permanently into the project and make fully operational including testing.

K. Permanent Link: the end-to-end cable media transmission path including the cable and termination equipment on each end.

1.6 SUBSTITUTION OF MATERIALS

A. No Substitute:
1. Where a specified product is indicated "no substitute" it is the intent of this specification to require new materials to be compatible with the existing installation. To this end certain materials and systems no substitution will be allowed.

B. Approved Manufacturer
1. Where a specified product is indicated "or equivalent by Approved Manufacturer", only the manufacturers listed in the Specification for the item are allowed.

C. Prior to Bid Opening:
1. Acceptance of products other than those specified as "or equivalent by Approved Manufacturer" will be issued by addendum to the bid documents only after the following requirements are met and the proposed listed material is determined to meet or exceed the requirements:
    a. Requests for listing to be original material, clearly indicating the product fully complies with contract documents and be neatly marked with yellow felt tip marker to clearly define and describe the product for which listing is requested.
2. Samples shall be submitted if requested.
3. Requests containing insufficient information to confirm compliance with contract documents will not be considered.

D. After Award of Contract:
1. Substitution of products will be considered after award of contract only under the following conditions:
    a. The Contractor shall have placed orders for specified materials promptly after contract is awarded and the specified products cannot be delivered to the project to meet the Owner's construction schedule.

b. The reason for the unavailability is beyond the Contractor's control, i.e., due to strikes, bankruptcy, discontinuance of manufacturer, acts of God.
c. The specified product is no longer manufactured.
d. There is compelling economic advantage to the Owner.

E. In all cases, should a substituted material result in requiring low voltage system or building modifications; the Contractor alone shall pay all costs to provide these modifications including all costs for the Engineer and Owner for redesign, and updating of record drawings required

1.7 SUBMITTALS AND SHOP DRAWINGS

A. Schedule:
1. Schedule so as to allow sufficient time for submittal review and re-reviews before commencement of work, including material procurement. Allow two weeks for review for each submittal and re-submittal. Incomplete submittals and shop drawings which do not comply with these requirements will be returned for correction, revision and re-submittal
2. So as not to delay construction schedule.
3. No later than 60 days after award of contract

B. Provide two (2) copies of all Submittals.

C. Product Submittals:
1. Provide in a three ring binder with hardboard covers.
2. Provide with index and divider tabs by Specification section.
3. Indicate Specification paragraph number on all documents.
4. Review and check all material prior to submittal and stamp "Reviewed and Approved".
5. Submittals shall include:
6. Product Data for all items provided under this Section.
7. Indicate materials, finishes, load ratings, dimensions, listings, approvals and attachment methods.
8. Indicate how the components of an item or system are assembled, interconnected, function together and how they will be installed on the project.
9. Highlight with yellow or blue marker, or indicate with arrow stamp, adequate information to demonstrate materials being submitted fully comply with contract documents.
10. Indicate listing by UL or other approved testing agency.
11. Manufacturers' Cable Installation Instructions

D. OSU Information services must approve submitted items before work can proceed.

E. Shop Drawings
1. Provide detailed elevation views (minimum scale 1"=1'-0") of, equipment racks, termination blocks, patch panels, cable paths and workspace requirements for access to equipment and cable connections.
2. Ratings of items.
3. Coordinate with other division shop drawings and submittals. Identify interface points and indicate method of connection.
4. Provide drawings to show evidence of coordination with other trades.
5. Provide plan drawings of the building showing:
6. Routing for all cables installed under this Work.

a. Pathways of all cable supports with part number, total capacity, and installed capacity for each support or run of supports.

7. Reports and Schedules
   a. Provide Cable Termination Schedules for all cables installed under this work, with the following information:
   b. Workstation cable -corridor number (ceiling mount), outlet ID, cable ID, rack number, termination device number and port/cable pair position.

F. Provide sample reports showing the proposed format for cable test reports.

G. Provide a construction schedule showing the various work tasks, time periods, duration and staffing requirements.

H. Cable Test Reports
   1. Provide Cable Test Reports per Part 3, this Specification

I. The Contractor agrees:
   1. Submittals and shop drawings processed by the Architect or Owner are not change orders.
   2. The purpose of submittals and shop drawings by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept.
   3. Submittals demonstrate equipment and material Contractor intends to furnish and install and indicate detailing fabrication and installation methods Contractor intends to use.
   4. To accept all responsibility for assuring that all materials furnished under this Specification meet, in full, all requirements of the contract documents.

J. The Engineer's review is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Corrections or comments made during this review do not relieve contractor from compliance with the requirements of the drawings and specifications. Contractor is responsible for:
   1. Dimensions which shall be confirmed and correlated at the job site.
   2. Fabrication process and techniques of construction.
   3. Coordination of the work with that of all other trades.
   4. Performing the work in a safe and satisfactory manner.

K. Manufacturers' Cable Installation Instructions

1.8 OPERATION AND MAINTENANCE MANUALS

A. Provide two (2) copies of O&M manuals required for all equipment furnished under this Specification. Submit a preliminary copy, complete except for the bound cover, prior to 75% completion of the project for checking and review.

B. The information included must be the exact equipment installed. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.

C. These O&M manuals shall contain all the information needed to operate and maintain all systems and equipment provided in the project. Present and arrange information in a logical

manner for efficient use by the Owner's operating personnel. The information provided shall include but not be limited to the following:

1. Equipment manufacturer, make, model number, size, nameplate data, etc.
2. Dimensional and performance data for specific unit provided as appropriate.
3. Complete parts list including reordering information, recommended spares and anticipated useful life (if appropriate). Parts lists shall give full ordering information assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by equipment supplier not acceptable.
4. Shop drawings.
5. Wiring diagrams.
6. A complete list of local (nearest) manufacturer representative and distributor contacts for each type of equipment and manufacturer. Include name, company, address, phone, fax, e-mail address, and web site.
7. Provide revised Cable Termination Schedules of all cables installed under the Work. Schedules shall be in printed form and on CD disk and in the version of Microsoft Excel extant at the time of first submission.
8. Cable Test Reports in CD form, including review software.
9. Group the information contained in the manuals in an orderly arrangement by Specification paragraph. Provide a typewritten index and divider sheets between categories with identifying tabs. Bind the completed manuals with hard board covers not exceeding 3" (.75mm) thick. Requirements outlined in Section 017700 must be followed. Requirements outlined in Section 017700 must be followed.

1.9 AS-BUILT DRAWINGS

A. Continually record the actual cabling system installation on a set of prints kept readily available at the project during construction. These prints shall be used for this purpose alone.

B. Mark record prints with red erasable pencil. Mark the set to show the actual installation where the installation varies substantially from the work as originally shown.

C. Include addenda items and revisions made during construction.

D. Erase conditions not constructed or "X-out" and annotate "not constructed" to clearly convey the actual "as constructed" condition.

E. Organize as-built drawings sheets in manageable sets, bind and print suitable titles, dates and other identification on the cover of each set.

F. Transmit the as-built drawing set to the Owner at the completion of the work. Final payment to the contractor will not be authorized until these prints have been submitted to and accepted by the Owner.

1.10 FINAL ACCEPTANCE REQUIREMENTS

A. Certificate of Compliance:
   1. Provide for Owner's documentation, a completion statement in form stipulated by the Owner and signed by the Contractor, stating that the Work was completed in compliance

with the Contract Documents and that the installation was proper for the conditions of application and use.

1.11 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer shall have Commercial Experience with staff personnel certified by BICSI.
   1. Installation Supervision: Installation shall be under the direct supervision of a Level 2 Installer and shall be present at all times when Work of this section is performed at the Project site.
   2. Have a demonstrated experience installing commercial projects of similar size and scope.

B. Source Limitations:
   1. Obtain all products except cables through one source from a single manufacturer.
   2. All Permanent Link components (including cables) of the workstation cable system shall be the products of one manufacturer.

C. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the authority having jurisdiction, and marked for intended use.

1.12 COORDINATION OF THE WORK

A. Carefully check space requirements and the physical confines of the area of work to insure that all material can be installed in the spaces allotted thereto, including conduits and cable supports.

B. Transmit to other trades in a timely manner all information required for work to be provided under their respective Sections in ample time for installation.

C. Wherever work interconnects with or contacts the work of other trades, coordinate with other trades to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment.

D. Due to the type of installation, a fixed sequence of operation is required to properly install the complete systems. Coordinate project and schedule work with the General Contractor in accordance with the construction sequence. Provide progress status of the installation to the General Contractor to allow them to update their project schedules.

E. Contractor shall note that the construction schedule may dictate that work must be carried out simultaneously.

F. Coordinate layout and installation of voice and data communications cabling with Owner's telecommunications and LAN equipment and service suppliers.
   1. Meet jointly with the telecommunications and LAN equipment suppliers and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
   2. Record agreements reached in meetings and distribute to other participants.

3. Adjust arrangements and location of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangements and space requirements of the telephone switch and LAN equipment.

G. Attend all construction meetings, at the project site or other location, as requested by the Owner, Engineer, and/or General Contractor.

H. The Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper compliance with the design intent.

1.13 DELIVERY, STORAGE AND HANDLING

A. Deliver materials (except bulk materials) in manufacturer's unopened containers, fully identified with the manufacturer's name, trade name, type, class, grade, size and color.

B. Store materials suitably sheltered from the elements, but readily accessible for inspection until installed. Store all items subject to moisture damage in dry spaces. Provide space requirements for storage with the submittals. The General Contractor shall assign storage space.

1.14 CERTIFICATION & WARRANTY

A. Refer to General Conditions and Division 1of the Contract.
1. Ortronics/Superior Essex nCompass Limited Lifetime warranty
2. nCompass Category 6+ Cabling, Connectivity Hardware and Patch Cables shall be covered by a, nCompass Limited Lifetime Warranty labor and application assurance warranty. The application assurance portion shall provide coverage for the cabling system to support applications that are designed for systems outlined in ANSI/TIA/EIA 568-C.
3. Corning 25 year Warranty for fiber optic riser and outside plant backbone subsystems.

B. Documentation of cable manufacturer's warranty must be provided to the Architect, Owner or Authorized Representative at completion of the project.
1. All UTP installations are warranted and are required to be pre-register with Ortronics before work begins.
2. All fiber installations are warranted and required to be pre-registered with Corning (Multimode) and Corning (Singlemode).

C. All work and all items of equipment and materials shall be warranted for a minimum period of one year, from the date of Substantial Completion of the work. Where a manufacturer's warranty is longer than one year, the Contractor shall offer the extended warranty. The Contractor shall, upon notification of any defective items, repair or replace such items within 24 hours without cost to the Owner, all to the satisfaction of the Owner/Engineer.

D. Furnish a manufacturer's "Permanent Link" performance warranty of all EIA/TIA 568-C CAT-6+ cables for a minimum period of twenty-five years, from the date of acceptance of the work. Where a manufacturer's warranty is longer than twenty-five years, the Contractor shall offer the longer warranty.
1. Ortronics Clarity 25 year applications assurance warranty
2. The Warranty shall be awarded directly to the Owner by the Manufacturer.

3. The Permanent Link Performance Warranty shall be issued and signed by the component manufacturer and shall list the owner as the holder of the warranty.
4. The Permanent Link Performance Warranty shall cover the testing and replacement of the labor and material for all "Permanent Link" components.
5. The structured cable system shall be a complete certified system as offered by a single manufacturer. The system and all components shall be performance matched, approved for use with a single manufacturer and guaranteed by the manufacturer. The cable must be approved for use with the manufacturer's system.

PART 2 - PRODUCTS

2.1 GENERAL

A. Subject to compliance with requirements, provide products by one of the manufacturers specified herein. Provide telecommunications cable and termination equipment with performance levels and capacities as noted herein.

B. Part numbers provided in this Specification have been coordinated with the manufacturers' latest available product literature. Part numbers are subject to change without notice by the manufacturers. Where a specific part number is invalid, provide product meeting component description.

C. Where specific items are called out in the specification or indicated on the drawings for a specific application, use those products or materials, or approved substitutes. Where no specific call outs are made use premium products and materials.

D. All components used in plenum space must be plenum rated or approved for use in plenum space.

E. Black Velcro tie wraps are to be used for all cable bundling and support. Plastic or Nylon tie wraps are not approved.

F. All cabling is plenum rated per OSU wiring standards

2.2 APPROVED MANUFACTURERS

A. UTP Cables (Permanent Link) - Approved Manufacturers
   1. Ortronics/Superior Essex Inc.

B. Permanent Link Components - Approved Manufacturers
   1. Ortronics/Superior Essex Inc.

C. Cable Management Devices - Approved Manufacturers
   1. Ortronics Mighty MO
   2. Ortronics Mighty MO 6
   3. CPI
   4. Dell

D. Wire Management Hardware - Approved Manufacturers
   1. Cooper B-line Flex Tray
   2. Erico
   3. Chatsworth (CPI)

2.3 UNSHIELDED TWISTED-PAIR CABLES

A. CAT-6- 4-Pair Cable Unshielded Twisted Pair (Permanent Link Component)
   1. Physical specifications: 4 twisted pair 24 AWG, solid copper conductors, 100-Ohm nominal impedance +/ 15%. Comply with UL 444.
   2. Electrical characteristics: Superior to the individual characteristics established in EIA/TIA 568-C for CAT-6 cable performance.
   3. Cable construction: round cable, individually insulated conductors under a common sheath.
   4. NFPA 70 type CMP
   5. Cable Jacket Color: Green

2.4 UTP TERMINATION HARDWARE (PERMANENT LINK COMPONENT)

A. 8-Pin modular Angled Front Patch Panel (Permanent Link Component)
   1. 19-inch rack mounted patch panel, suitable to terminate 24 or 48 UTP 4-pair cables. Comply with EIA/TIA-568-C CAT 6 performance. Wired with T568-B pinning. Complete with wire management bars and designation strips
   2. Manufacturer: Ortronics Clarity.
      a. 48 Ports Angled: Ortronics P/N OR-PHA66U48 (For use as specified when utilizing Ortronics Mighty MO 6 equipment rack and vertical wire managers only).

2.5 OUTLETS (PERMANENT LINK COMPONENT)

A. Jacks: 100-ohm, balanced, twisted pair connector, four-pair, modular, RJ-45. Comply with TIA/EIA- 658-C CAT-6 performance. Outlet wired with standards compliant T568-B.

B. 8-Pin Modular Outlets: Dual jack-connector assemblies mounted in single or multigang faceplate.
   1. Faceplate: type 302 stainless steel
   2. Mounting: Flush, unless otherwise indicated
   3. Faceplate Color: White
   4. Manufacturer: Ortronics TracJack 6 Port faceplate
   5. Ortronics TracJack 6-port P/N OR-40300545
   6. Ortronics TracJack P/N TJ600-25 Green
   7. Ortronics TracJack P/N 63730003-13 White

C. Wall Mounted Telephone Outlet: 8 conductor outlet and face-plate, mounted over a standard electrical j-box.
   1. Stainless steel face-plate with two mounting studs to support wall mounted telephone.
   2. Manufacturer: Specified or equivalent approved manufacturer.

2.6 WIRE MANAGEMENT HARDWARE

A. Shall be installed whenever a patch panel is installed

B. Single Space-Rack Mounted
1. 19-inch rack mount
2. Installed above and below each 24 port patch panel
3. Manufacturer: Ortronics
4. Part #: OR-808004759

C. Double spaced-Rack Mounted
1. 19-inch rack mount
2. Installed above and below each 48 port patch panel
3. Manufacturer: Ortronics
4. Part #: OR-808004818

2.7 CABLE TRAY, SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.; Flex Tray
2. ERICO International Corporation.
3. GS Metals Corp.
4. Thomas & Betts Corporation.
5. Unistrut; Tyco International, Ltd.
6. Wesanco, Inc.

C. Finishes:
1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3. Fitting and accessories - hot-dip galvanized or stainless steel where hot-dip galvanized is not available.
2. Channel Dimensions: Selected for applicable load criteria.

D. Raceway and Cable Supports: As described in NECA 1.

E. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

F. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be heavy-duty malleable iron.

G. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

2.8 IDENTIFICATION LABELS

A. Comply with TIA/EIA-606-B and applicable requirements in this section.

B. Machine printed self-adhesive, smudge resistant labels for cables and face-plates. Labels shall be appropriately sized for cable diameter. Labels shall be appropriately colored for face-plate color contrast. Submit sample labels for approval.

PART 3 - EXECUTION

3.1 GENERAL

A. Follow manufacturers' instructions for installing components and adjusting all equipment and telecommunications cables. Where no instructions are included with the equipment, follow accepted industry practices and workmanlike installation standards.

B. Keep all items protected before and after installation, with dust and water proof barrier materials as necessary. The Contractor shall be responsible to ensure the integrity of the protective measures throughout the life of the project.

C. The Contractor shall protect all telecommunications equipment from damage, at all times during the construction. Do not install equipment in the telecommunications areas until the other trades have completed their work in the areas so that the equipment will not be moved or damaged.

D. Ensure that safe ingress and egress, from all work areas, are maintained during movement and installation of materials.

E. Clean up and remove all debris generated by installation activities. Keep the telecommunications areas free of debris at all times.

F. Deliver to Owner two sets of all special tools specifically needed for proper operation, adjustment and maintenance of cable and cable termination hardware installed under this Contract.

G. Pair untwist at each termination shall not exceed 1/2 inch (12mm).

H. All horizontal cabling on the 4th floor will pull to the Telecom Room on the 3rd floor. Conduit will go down through the floor to accessible ceiling on the 3rd floor and then be route with J-hooks or cable tray to the 3rd floor telecom room.

3.2 INSTALLATION STANDARDS

A. Comply with BICSI TCI, TIA/EIA-568-C, and TIA/EIA-569-C.

3.3 INSTALLER QUALIFICATIONS

A. Craft personnel shall be qualified to perform the work activities and be knowledgeable of the following:
   1. Color coding of standard UTP cables.
   2. Color coding of optical fiber cables.
   3. Bonding and grounding of cable tray and equipment cabinets
   4. Testing conductors for electrical continuity.
   5. Testing of copper conductors for length, wire mapping, attenuation and NEXT, PS-NEXT, ELFEXT, ACR, PS-ACR at all frequencies up to 250MHz (maximum bandwidth certification) for CAT-6 cables.
   6. Testing conductor insulation.
   7. Termination or connection of unshielded twisted pair cable on all specified connectors, electrical protection blocks and termination.
   8. Generally accepted industry standards, as well as manufacturers written installation instructions, will be used for in process quality control and final acceptance of the work installation.
   9. Have a demonstrated experience installing commercial projects of similar size and scope.

3.4 EXAMINATION

A. Verification of Conditions: Examine the areas to receive the work and the conditions under which the Work would be performed. Contractor shall remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

B. Examine pathway elements intended for cables.
   1. Verify proposed routes of pathways. Check raceways, cable trays, and other elements for compliance with space allocations, clearances, installation tolerances, hazards to cable installation, and other conditions affecting installation. Verify that cabling can be installed complying with EMI clearance requirements.
   2. Prepare wall penetrations and verify that penetrations of rated fire walls are made using products labeled for type of wall penetrated.
   3. Identify plan to support cables and raceways in suspended ceilings. Verify weight of individual types and sizes of cables. Verify that load capacity of cable support structures is adequate for each pathway.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 METHODS AND PROCEDURES

A. General
   1. Install all components in accordance with this Specification, the approved Cable Termination Schedule, the manufacturer's recommendations, and the Telecommunications Distribution Drawings.

B. Cable Installation - General
   1. Ensure that all telecommunications cable supports (J-hooks, cable tray, conduits, etc.) are fully installed before proceeding with cable installation. At no times shall cables be installed and left unsupported. At no times shall cables be tie-wrapped to any other

supporting structure in lieu of specified cable supports. Do not bundle or tie-wrap the cables even within the approved cable supports. Do not allow the cable to sag more than 12-inches.

2. Protect all cables at all times during installation, especially on floor(s), including dedicated telecommunication spaces. Provide rigid protection for cables left on floor at any time during construction. Design protection to prevent pressure on cables from walking, equipment placement, or rolled/dragged construction equipment and materials.
3. Maintain manufacturer's recommended minimum bend radius of the cables. Do not stretch, stress, tightly coil, bend or crimp the workstation cables during the installation or when leaving them out of the way of other trades during the staging of the work. The Contractor, at the Contractors expense shall replace all abused or stressed cables.
4. After dressing the cable to its final location, remove only enough jacketing to allow the conductors to be splayed and terminated in a neat and uniform fashion. Every effort will be made to maintain jacketing integrity by removing only as much jacketing as is practical, to accomplish termination. For twisted pair cables, maintain the manufacturers twisting of the wire pairs through to the point of termination.
5. Install cable in continuous runs without splices or mechanical couplers between the cable points of origin and termination for the inter-building and intra-building cable, except as shown on Contract Documents.
6. Terminate all cables neatly, with enough slack to pull off, test and re-terminate each cable as needed.
7. When pulling cables through conduits, leave in-place all drag-lines for future use.

C. Cable Installation
1. Install cables from the telecommunication outlets to the respective serving IT room through the overhead conduit/pull box system.
2. Install cables from the wireless access point outlets to the respective serving IT room through the overhead conduit/pull box system.
3. Modular Furniture Connections: Route the cables down the conduit stub-up to a furniture system in-feed or to a floor box. Where in-feeds are provided, route the cables into and within the raceway of the furniture to the outlet location and terminate the cables. Where a floor-box is provided, terminate the cables and mount within the floor-box.

3.6 CONNECTORS

A. Provide appropriate CAT-6 8-pin modular connectors for the termination of all 4-pair cables. Provide an accompanying faceplate and/or mounting plate at the appropriate outlet location. Install faceplates level and align to adjacent outlet faceplates.

3.7 ANGLED FRONT PATCH PANELS

A. Provide 8-pin modular patch panels as shown in the Contract Documents for the termination of all workstation and Wireless access point cables installed under this Work. Mount the patch panels into the equipment racks. Provide patch panels complete with designation strips.

B. Provide horizontal wire management panels in each equipment rack. Installed above and below each 24and 48 port patch panel.

3.8 IDENTIFICATION

A. Provide on all outlet faceplates installed under this Work, machine-generated labels with the outlet ID, in uppercase lettering. Label shall be of a contrasting color to the faceplate color.

B. Provide on all termination blocks installed under this Work, machine-generated designation strips with the cable ID and pair number, in uppercase lettering.

C. Provide on all patch panels installed under this Work, machine-generated label with the cable ID and port number in uppercase lettering.

D. Provide a machine-generated label on all telecommunications cables installed under this Contract with the cable ID, in black uppercase lettering on a permanent adhesive, white label stock, covered with a permanent water resistant sealer. Labels shall placed on both ends of the cable and no more than 6" from the point at which the cable is broken out into individual copper pairs or strands from the connector on termination block or patch panel. Labels shall be placed parallel with the cable. All labels shall be readily visible.

E. Hand lettered label stock will not be accepted for final installation. Hand lettered stock is only acceptable for use with temporary labeling required during construction phases.

F. All cables shall be labeled in accordance with the approved cable termination schedule.

G. If at any time during the project, the label becomes illegible or removed, the Contractor shall immediately replace it with a duplicate preprinted label.

H. All cable IDs shall be both physically and visually accessible upon completion of the project.

3.9 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. Tester: HP Wirescope 350 Level III is the only tester and test results accepted by the owner.
   2. Channel and permanent link tests shall be performed with a tester that complies with performance requirements in TIA/EIA-568-C, Level III. Include tests for longitudinal or transverse conversion loss.
   3. All tests shall be conducted from 1 to 250 MHz
   4. Provide evidence of testing apparatus calibration at beginning of testing, and for every 1000 channels or links tested.
   5. Provide evidence of replacement of consumable testing apparatus, including modular jacks, per the tester manufacturer's recommendations.
   6. Provide evidence that the testing apparatus software or firmware has been updated to current revision/version.
   7. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
   8. Wire-map test that reports open circuits, short circuits, crossed pairs, reversed pairs, split pairs, and improper terminations.
   9. Channel and permanent link tests for cable length, insertion loss, near-end crosstalk loss, power sum near-end crosstalk loss, equal-level far-end crosstalk loss, power sum equal-

level far-end crosstalk, return loss, propagation delay, and delay skew. Performance shall comply with minimum criteria in TIA/EIA-568-C.

B. Test Reports:
   1. HP Wirescope 350 Level III is the only tester and test results accepted by the owner.
   2. All Wirescope 350 test results will be colored, graph format.
   3. A summary report will accompany the individual graph format test results.
   4. Test results shall have the Technicians names, correct date and time.
   5. Results without the correct information listed above and not colored graph shall not be accepted.
   6. Document data for each measurement.
   7. Provide a printed individual cable report for each UTP cable that tests within the instrument tolerance band for any parameter, i.e., for any parameter that would not pass if the instrument tolerance were taken as worst case.
   8. Provide a CD containing all individual cable reports in the native file structure of the test instrument(s).
   9. Provide software to display and print individual and summary cable test reports from the native test files.

C. Remove and replace cabling where test results indicate that they do not comply with specified requirements. Retest and inspect cabling to determine compliance of replaced or additional work with specified requirements.

D. After review of the completed test results, the Owner/Engineer reserves the right to retest up to 10 of the installed cables, utilizing the Contractor's tester and the Contractor's labor.

E. After the installation is complete, in addition to any other required testing as described herein, and at such times as the Architect, Owner or Authorized Representative directs, the Contractor shall be present while the Owner conducts an operating test for approval. The installation shall be demonstrated to be in accordance with the requirements of this specification. Any defects revealed shall be corrected promptly at the Contractor's expense and the tests performed again.

END OF SECTION 271500

SECTION 274133 - CATV DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. UO Campus Construction Standards - July 2009

C. Related Sections

1. Section 270500- Common Work Results for Communications Systems
2. Section 280500- Common Work Results for Electronic Safety and Security

1.2 SUMMARY

A. Section includes taps, outlets, and distribution cable connected CATV distribution systems.

B. Substitutions:

1. Substitute products will be considered only under the terms and conditions of Section 27 0500 Common Work Results for Communications Systems.
2. Portions of this specification indicate specific manufacturers and models. These products are the reference standards of like quality.

1.3 SYSTEM DESCRIPTION

A. Furnish and install a complete cable-connected CATV signal distribution system. Include all cable, outlets, attenuators, media converters and all other parts necessary for the reception and distribution of the off-the-air television signals.

B. Distribute RG-6 coax cable to all CATV outlets to permit simple connection of EIA standard television receivers.

C. Meet all FCC requirements regarding low radiation of RF signal.

D. All active components shall be of solid state design. The system shall be designed to prevent direct pickup of signals from the building structure.

E. Contractor will connect to the fiber with a media converter and extend the signal to the CATV head end location with RG-500 coax.

F. Providing a complete pathway for CATV signal from the headend to the CATV outlet.

G. Contractor will coordinate installation with Network and Telecom Services responsible for CATV systems for head end equipment location.

H. Contractor will coordinate CATV outlet, power, mounting bracket, backing and elevation with the Architect.

1.4 SUBMITTALS

A. General: Make submittals in accordance with Section 270500 Common Work Results for Communications Systems

B. Product Data: Prepare and submit data sheets for each piece of equipment called out in the specifications for review prior to installation. If more than one product is shown on a page, clearly indicate which device is submitted for approval.

C. Shop Drawings: Prepare and submit for review prior to installation. Include complete system plans showing device layout, routing, wiring, termination, and connection diagrams. Include signal level and loss calculations.

D. Contract Close-out Submittals:
The Owner shall be provided with as-built drawings, included in the O&M manuals, which shall indicate:

1. Actual cable types and routing.
2. Actual system wiring diagrams, connection diagrams, and interface of all components in the system.
3. Levels of each tap used in system and appropriate signal level in dB of each leg off each tap.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Provide all new components.
2. Construct the system following good engineering practices and in accordance with applicable codes and safety precautions.
3. Periodically inspect portions of the system installed by other contractors to minimize potential interference problems.

1.6 WARRANTY

A. Warrant all equipment and materials, including wiring and cabling, for a period of one (1) year from the date of final acceptance of the system. The warranty shall conform to the standard manufacturer's backed warranty for each piece of equipment.

B. Warrant against mechanical or electrical defects except when such defects are caused by misuse.

C. Labor and material shall be covered by the warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Blonder-Tongue, Pico, or equivalent.

B. Cable Manufacturers:

1. CommScope
2. Or Equivalent

2.2 PRODUCTS

A. Provide coaxial cable with a nominal characteristic impedance of 75 ohms throughout the entire frequency spectrum utilized in this system. Each reel of cable shall be sweep-tested and return-loss tested over the entire frequency range from 50MHz to 1GHz by the manufacturer. Provide RG-6 cable as required to achieve the specified signal level in 1.3.G.

B. CATV Horizontal Cable

1. RG-6 coax must have a minimum of 61% overall braid and be rated CL2P.

C. Line Splitters:
Provide low-radiation line splitters with a flat frequency response from 50MHz to 1GHz. Provide units of a hybrid design with a 75 ohm match on input and outputs and a VSWR no greater than 1.4:1.

1. Two way line splitters shall have a signal loss of not more than 3.5dB at each output. Blonder Tongue Model CRS-2.
2. Four way line splitters shall have a signal loss of not more than 7.2dB at each output. Blonder Tongue Model CRS-4.
3. All unused splitter outputs shall be terminated with 75 ohm terminations. Blonder Tongue Model PBT.

D. CATV Outlets

1. Provide outlets at each location shown on the plans. Mount in electrical contractor provided 4-11/16" square, 3" deep minimum flush electrical boxes as indicated on plans.
2. Provisions shall be incorporated in the network to prevent 60 Hz AC or DC feedback into the distribution lines.
3. Outlets shall be designed to cover a frequency range of 10MHz to 1GHz. Insertion loss shall not exceed 1.0 db at any frequency within the designated frequency range for a 17dB isolation network. Outlets shall be back-matched from 10 to 1GHz. Outlets shall have one F-type connector on the front and two F-type connectors on the rear.
4. The minimum isolation value between any two outlets shall be 24 db.

E. CATV Backbone

1. RG-500 coax must have a minimum of 61% overall braid and be rated CL2P.

F. Television Receivers: Not Identified as part of this specification.

PART 3 EXECUTION

3.1 GENERAL

A. Black Velcro tie wraps are to be used for all cable bundling and support. Nylon or Plastic tie wraps are not approved.

3.2 INSTALLATION

A. Provide RG-500 From Goss Stadium BDF head end equipment to New IDF.

B. Install wiring in conduit. Install RG-6 coaxial cables in continuous lengths except for terminations; no splices are permitted. Avoid sharp bends or other physical distortions in the installation of all cable. All cable terminations will be properly installed with no visible sign of cable braid between cable end and the connector.

C. Maintain signal integrity. During installations, correct open grounds, broken shields, and other possible causes of poor RF signal quality.

D. Identify cables terminating at amplifiers or splitters as to function and destination. Labels using self laminating type compatible with Brady DAT-151-292.

E. Use crimp-type cable connectors on all connections, with the appropriate connector for the cable type being used.

F. Terminate all unused ports on splitters, taps, combiners, and amplifiers into 75 ohms with an approved terminator.

G. All components used in plenum spaces will be plenum rated or approved for use in plenum space.

3.3 TESTING

On completion of the system installation, perform the following tests:

A. Sweep test the overall system with a spectrum analyzer from the head-end location to the last outlet in each distribution leg of the system.

B. Use a return loss bridge to verify that the return loss of the system is a minimum of 26dB below signal levels at the room taps. VSWR will not exceed 1.4:1.

C. Certify that no frequency dropouts are present in the system which would affect any of the VHF channels. Using a properly calibrated field strength meter, measure and record at 55.25MHz and 319.25MHz the output levels at each CATV tap in the system. Certify that the system shall deliver a minimum signal level of +10dBmV -4dB at each CATV tap.

D. Notify the Architect, Owner or Authorized Representative a minimum of 48 hours prior to testing so that they may furnish representatives to witness the testing procedure and results if desired.

E. Submit copies of the test results as described above prior to final acceptance and training. Include copies of the test results in the O&M manuals. Include the names of the individuals performing and witnessing the tests, and the manufacturer's name and model number of the test equipment used. Include a block diagram of the test setup for each test.

F. Provide final copies of the O&M manuals to the Architect, Owner or Authorized Representative.

END OF SECTION 274133

SECTION 280500 - COMMON WORK RESULTS FOR ELECTRICAL 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 1 Specification Sections, apply to this Section. .

B. Division 27 Master Specifications for Information Transport Systems and Spaces.

1.2 SUMMARY

A. This section includes general electrical requirements for all Division 28 work and is supplemental and in addition to the requirements of Division 1.

B. It is the intention of this Division of the Specifications and the Contract Drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and fully operational condition all equipment, materials, devices and necessary appurtenances to provide a complete electrical system. Provide all materials, appliances and apparatus not specifically mentioned herein or shown on the drawings, but which are necessary to make a complete, fully operational installation of all electrical systems shown on the contract drawings or described herein. Connect equipment and devices furnished and installed under other Divisions of this specification (or the Owner) under this Division.

C. Workmanship shall be of the best quality and competent and experienced electricians shall be employed and shall be under the supervision of a competent and experienced foreman.

D. The drawings and specifications are complimentary and what is called for (or shown) in either is required to be provided as if called for in both.

1.3 WORK IN OTHER DIVISIONS

A. See all other specifications for other work which includes but is not limited to:
1. Communications
2. Conveying Systems
3. Cutting and Patching
4. Door Hardware
5. Equipment Wiring
6. Fire Protection
7. Mechanical Control Wiring
8. Painting, Refinishing and Finishes

1.4 CODES, PERMITS, INSPECTION FEES

A. The following codes and standards are referenced in the Division 28 specifications. Perform all work and provide materials and equipment in accordance with the latest referenced codes and standards of the following organizations:
1. American National Standards Institute (ANSI)
2. National Electrical Manufacturer's Association (NEMA)
3. National Fire Protection Association (NFPA)
4. Underwriter's Laboratories (UL)

B. Install the electrical systems based on the following:

NFPA 70	National Electrical Code as adopted and amended by the Local Jurisdiction.
IBC	International Building Code as adopted and amended by the Local Jurisdiction.

C. The referenced codes establish a minimum level of requirements. Where provision of the various codes conflict with each other, the more stringent provision shall govern. If any conflict occurs between referenced codes and this specification, the codes are to govern. Compliance with code requirements shall not be construed as relieving the Contractor from complying with any requirements of the drawings or specifications which may be in excess of requirements of the governing codes and rules and not contrary to same.

D. Owner pays for all permits and fees. Contractor to work with Owner to obtain all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. Arrange for inspection of work by the inspectors and give the inspectors all necessary assistance in their work of inspection.

1.5 COORDINATION

A. Coordinate work with that of the other Contractors and/or other trades doing work on the project. Examine all drawings and specifications of other trades for construction details and coordination. Make every reasonable effort to provide timely notice of work affecting other trades to prevent conflicts or interference as to space requirements, dimensions, openings, block-outs, sleeving or other matters which will cause delays or necessitate work-around methods.

B. Obtain submittals and shop drawings of all equipment with electrical connections furnished under other divisions of the specification and by the Owner. Provide all wiring in accordance with specific equipment requirements. Immediately advise the Architect of any changes which may affect the contract price.

C. Special attention is called to the following items. Coordinate all conflicts prior to installation:
1. Location of grilles, pipes, sprinkler heads, ducts and other mechanical equipment so that all electrical outlets and other electrical outlets and equipment are clear from and in proper relation to these items.
2. Location of cabinets counters and doors so that electrical outlets and equipment are clear from and in proper relation to these items.
3. Recessing and concealing electrical materials in CMU walls, concrete construction and precast construction.

D. Furnish, install and place in satisfactory condition all raceways, boxes, conductors and connections and all other materials required for the electronic safety and security systems shown or noted in the contract documents to be complete, fully operational and fully tested upon completion of the project. Raceways, boxes and ground connections are shown diagrammatically only and indicate the general character and approximate location. The layout does not necessarily show the total number of raceways or boxes for the circuits required, nor are the locations of indicated runs intended to show the actual routing of the raceways.

E. Consult the architectural drawings for the exact height and location of all electrical equipment not specified herein or shown on the drawings. Make any minor changes (less than 6'-6" horizontal) in the location of the raceways, outlets, boxes, devices, wiring, etc., from those shown on the drawings without extra charge, where coordination requires or if so directed by the Architect before rough-in.

F. Provide inserts or sleeves for outlet boxes, conductors, cables and/or raceways as required. Coordinate the installation thereof with other trades.

G. The Contractor will not be paid for relocation of work, cuttings, patching and finishing required for work requiring reinstallation due to lack of coordination prior to installation.

1.6 WARRANTY

A. Refer to General Conditions and Division 1 of the Contract.

1.7 CORRECTION OF WORK

A. Within one year after the date of Substantial Completion of the work, the Contractor shall correct any work found to be not in conformance with the Contract Documents promptly after written notice from the owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. This obligation shall survive acceptance of the work under this Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

1.8 SUBMITTALS AND SHOP DRAWINGS

A. Submittals and Shop Drawings: Schedule so as not to delay construction schedule and no later than 60 days after award of contract, submit common brochure(s) with index and divider tabs by specification section, containing all required catalog cuts. Allow two weeks for review for each submittal and resubmittal. Incomplete submittals and shop drawings which do not comply with these requirements will be returned for correction, revision and resubmittal. See Division 1 for format, quantity, etc.

B. Submit in a three ring binder with hardboard covers. Submittals shall show:
   1. Indicate listing by UL or other approved testing agency.
   2. Highlight with yellow or blue marker adequate information to demonstrate materials being submitted fully comply with contract documents.
   3. Review and check all material prior to submittal and stamp "Reviewed and Approved".

C. Shop drawings shall show:
1. Ratings of items and systems.
2. How the components of an item or system are assembled, interconnected, function together and how they will be installed on the project.
3. System layout floor plans with complete device layout, point-to-point wiring connection between all components of the system, wire sizes and color coding.
4. Coordinate with other division shop drawings and submittals. Identify interface points and indicate method of connection.

D. The Contractor agrees:
1. Submittals and shop drawings processed by the Architect are not change orders.
2. The purpose of submittals and shop drawings by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept.
3. Submittals demonstrate equipment and material Contractor intends to furnish and install and indicate detailing fabrication and installation methods Contractor intends to use.
4. To accept all responsibility for assuring that all materials furnished under this Division of the specifications meet, in full, all requirements of the contract documents.

E. The Engineer's review is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Corrections or comments made during this review do not relieve contractor from compliance with the requirements of the drawings and specifications. Contractor is responsible for: Dimensions which shall be confirmed and correlated at the job site; fabrication process and techniques of construction; coordination of the work with that of all other trades; performing the work in a safe and satisfactory manner.

F. Submittals and shop drawings are required per the submittals schedule at the end of this Section.

1.9 PROJECT CLOSE-OUT

A. Coordinate with close-out provisions in Division 01 – Contract Closeout.

B. Request For Final Punchlist
1. To request a final punch list, notify Architect and Owner in writing.
2. Project Punchlist Procedure: Perform the following procedures for project closeout of electrical portions of work.
   a. Provide engraved nameplates on electrical equipment.
   b. Refinish electrical equipment finishes which are damaged.
   c. Obtain final electrical permit inspection. Include copies in O & M manual.
   d. Provide written warranty in O & M per the General Conditions and Division 1 of the Contract.
   e. Furnish As-Built Drawings per this section.
   f. Furnish O & M Manuals per this section.
   g. Give instruction periods to owner's personnel per this section.

1.10 ELECTRICAL EQUIPMENT OPERATION AND MAINTENANCE (O&M) MANUALS

A. Provide O&M manuals required in Division 01 –Contract Closeout for all equipment furnished under Division 28 - Electronic Safety and Security specifications. Submit a preliminary copy,

complete except for the bound cover, prior to 75% completion of the project for checking and review. Deliver final bound corrected copies as noted in Division 1 - General Requirements 20 days prior to scheduled instruction periods.

B. The information included must be the exact equipment installed. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.

C. These O&M manuals shall contain all the information needed to operate and maintain all systems and equipment provided in the project. Present and arrange information in a logical manner for efficient use by the Owner's operating personnel. The information provided shall include but not be limited to the following:
   1. Equipment manufacturer, make, model number, size, nameplate data, etc.
   2. Description of system configuration and operation including component identification and interrelations. A master control schematic drawings(s) may be required for this purpose.
   3. Dimensional and performance data for specific unit provided as appropriate.
   4. Manufacturer's recommended operation instructions.
   5. Manufacturer's recommended lubrication and servicing data including frequency.
   6. Complete parts list including reordering information, recommended spares and anticipated useful life (if appropriate). Parts lists shall give full ordering information assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by equipment supplier not acceptable.
   7. Shop drawings.
   8. Wiring diagrams.
   9. Signal equipment submittals shall contain step-by-step circuit description information designed to acquaint maintenance personnel with equipment operation in each mode of operation.
   10. A complete list of local (nearest) manufacturer representative and distributor contacts for each type of equipment and manufacturer. Include name, company, address, phone, fax, e-mail address, and web site.

D. Furnish complete wiring diagrams for each system for the specific system installed under the contract. "Typical" line diagrams will not be acceptable unless revised to indicate the exact field installation.

E. Group the information contained in the manuals in an orderly arrangement by specification index. Provide a typewritten index and divider sheets between categories with identifying tabs. Bind the completed manuals with hard board covers not exceeding 3" (.75 mm) thick. (Provide two or more volumes if required.) Signal and communication systems shall be in separate volumes. Imprint the covers with the name of the job, Owner, Architect, Electrical Engineer, Contractor and year of completion.

1.11 INSTRUCTION PERIODS

A. After substantial completion of the work and 20 days after the O&M manuals have been delivered to the owner and after all tests and final inspection of the work by the Authority(s) Having Jurisdiction; demonstrate the electrical systems and instruct the Owner's designated operating and maintenance personnel in the operation and maintenance of the various electrical systems. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be superintendents or foremen knowledgeable in each system

and suppliers representatives when so specified. When more than one training session is specified, the second session shall be 30 to 90 days after the first as agreed to by the Owner.

B. Include in each instruction session an overview of the system, presentation of information in maintenance manuals with appropriate references to drawings. Conduct tours of the building areas with explanations of maintenance requirements, access methods, servicing and maintenance procedures, equipment cleaning procedures and adjustment locations.

C. Include the following scheduled instruction periods:

		1st Session	2nd Session
1.	Digital, Addressable Fire-Alarm System	4 hours	4 hours

D. Factory trained suppliers representatives shall provide instruction for each of the sessions listed above.

1.12 AS-BUILT DRAWINGS

A. Continually record the actual electrical system(s) installation on a set of prints kept readily available at the project during construction. These prints shall be used for this purpose alone.
1. Mark record prints with red erasable pencil. Mark the set to show the actual installation where the installation varies substantially from the work as originally shown.
2. Accurately locate with exact dimensions all underground and underslab raceways and stub-outs.
3. Note changes of directions and locations, by dimensions and elevations, as utilities are actually installed.
4. Include addenda items and revisions made during construction.
5. Erase conditions not constructed or "X-out" and annotate "not constructed" to clearly convey the actual "as constructed" condition.
6. Organize As-Built drawings sheets in manageable sets, bind and print suitable titles, dates and other identification on the cover of each set.

1.13 ABBREVIATIONS AND DEFINITIONS

A. When the following abbreviations and definitions are used in relation to the work for Division 28 they shall have the following meanings:

Item	Meaning
AHJ	Authority Having Jurisdiction.
Boxes	Outlet, Junction or Pull Boxes.
Code	All applicable codes currently enforced at project location.
Compression	Compressed using a leverage powered (hydraulic or equivalent) crimping tool.
Connection	All materials and labor required for equipment to be fully operational.
Exterior Location	Outside of or penetrating the outer surfaces of the building weather protective membrane.
Fully Operational	Tested, approved, and operating to the satisfaction of the AHJ, manufacturer and contract documents.
Furnish	Deliver to the jobsite
Install	To enter permanently into the project and make fully operational.
Kcml	Thousand circular mils (formerly MCM).

Mfr.	Manufacturer.
NEC	National Electrical Code, National Fire Protection Association, Publication #70.
Noted	Shown or specified in the contract documents.
Provide	Furnish and install.
Required	As required by code, AHJ, contract documents, or manufacturer for the particular installation to be fully operational.
Shown	As indicated on the drawings or details.
Wiring	Raceway, conductors and connections.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials and equipment installed shall have been tested and listed by Underwriters Laboratories or other approved testing organization and shall be so labeled unless otherwise permitted by the Authority Having Jurisdiction (Inspector).

B. All materials to be new, free from defects and not less than quality herein specified. Materials shall be designated to insure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.

C. Each type of materials furnished shall be of the same make, be standard products of manufacturers regularly engaged in production of such materials and be the manufacturer's latest standard design.

D. All materials, equipment and systems furnished that include provisions for storing, displaying, reporting, interfacing, inputting, or functioning using date specific information shall perform properly in all respects regardless of the century. Any interface to other new or existing materials, equipment or systems shall function properly and shall be century compliant, both in regards to information sent and received.

2.2 SUBSTITUTION OF MATERIALS

A. No Substitute:
Where a specified product is indicated "no substitute", it is the intent of this specification to require new materials to be compatible with the existing installation or as specifically requested by the owner. To this end certain materials and systems no substitution will be allowed.

B. Prior to Bid Opening:
Acceptance of products other than those specified will be issued by addendum to the bid documents only after the following requirements are met and the proposed listed material is determined to meet or exceed the requirements:

1. Requests for listing to be original material, clearly indicating the product fully complies with contract documents and be neatly marked with yellow felt tip marker to clearly define and describe the product for which listing is requested.
2. Include certified laboratory test report for lighting fixtures.
3. Samples shall be submitted if requested.

4. Requests containing insufficient information to confirm compliance with contract documents will not be considered.

C. After Award of Contract:
Substitution of products will be considered after award of contract only under the following conditions:
1. The Contractor shall have placed orders for specified materials promptly after contract is awarded and the specified products cannot be delivered to the project to meet the Owner's construction schedule.
2. The reason for the unavailability is beyond the Contractor's control, i.e., due to strikes, bankruptcy, discontinuance of manufacturer, acts of God.
3. The specified product is no longer manufactured.
4. There is compelling economic advantage to the Owner.

D. In all cases, should a substituted material result in requiring electrical system or building modifications; the Contractor alone shall pay all costs to provide these modifications including for redesign, and updating of As-Built drawings required to accommodate the required modifications.

2.3 NAMEPLATES

A. Provide nameplates per Section 26 05 53 - Identification for Electrical Systems.

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft. Handle all equipment carefully to prevent damage, breakage, denting, and scoring of finishes. Do not install damaged equipment.

B. Store products subject to damage by the elements above ground, undercover in a weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instruction.

3.2 CUTTING BUILDING CONSTRUCTION

A. Obtain permission from the Architect and coordinate with other trades prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills or concrete saws except where space limitations prevent the use of such tools.

B. All construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

3.3 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire rated floor and wall assemblies to maintain fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 section "Firestopping".

3.4 PAINTING

A. Items furnished under this Division that are scratched or marred in shipment or installation shall be refinished with touchup paint selected to match installed equipment finish.

3.5 EQUIPMENT CONNECTION

A. For equipment furnished under this or other Divisions of the specifications, or by owner, provide complete all electrical connections necessary to serve such equipment and provide required control connections to all equipment so that the equipment is fully operational upon completion of the project. Provide disconnect switch as required by code whenever an equipment connection is shown on the drawings.

B. Investigate existing equipment to be relocated and provide new connections as required.

3.6 CLEAN UP

A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by the work. Such clean up shall be done daily and at sufficient frequency to eliminate hazard to the public, other workers, the building or the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, lighting fixtures, wiring devices, cover plates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.
   1. Wipe surfaces of electrical equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

3.7 TESTING AND DEMONSTRATION

A. Demonstrate that all electrical equipment operates as specified and in accordance with manufacturer's instructions. Perform tests in the presence of the Architect, Owner or Engineer. Provide all instruments, manufacturer's operating instructions and personnel required to conduct the tests. Repair or replace any electrical equipment that fails to operate as specified and or in accordance with manufacturer's requirements.

END OF SECTION 280500

SECTION 280513 - 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.

B. OSU Division 27 Master Specifications for Information Transport Systems and Spaces.

1.2 SUMMARY

A. Section Includes:
1. UTP cabling.
2. Optical fiber cabling.
3. Low-voltage control cabling.
4. Control-circuit conductors.
5. Fire alarm wire and cable.
6. Identification products.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. Ler Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

G. 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.

H. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

I. RCDD: Registered Communications Distribution Designer.

J. Solid-Bottom or Non-ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.

K. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

L. UTP: Unshielded twisted pair.

1.4 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: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
   1. Vertical and horizontal offsets and transitions.
   2. Clearances for access above and to side of cable trays.
   3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
   4. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

F. Maintenance Data: For wire and cable to include in maintenance manuals.

1.5 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.

B. 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.

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.

1.6 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 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.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial 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.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
   1. Cable tray
   2. Support brackets with cable tie slots for fastening cable ties to brackets.
   3. Lacing bars, spools, J-hooks, and D-rings.
   4. Straps and other devices.

B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems.
   1. 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 for plywood backing panels in Division 06 Section "Rough Carpentry".

2.3 UTP CABLE

A. Manufacturers:
   1. Superior Essex Inc.

B. Description: 100-ohm, 4-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-C for performance specifications.
3. Comply with TIA/EIA-568-C, 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 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.

C. Description: 100-ohm, multiple pair UTP, formed into 25-pair binder groups covered with a gray thermoplastic jacket .
1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-C for performance specifications.
3. Comply with TIA/EIA-568-C, Category 3.
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. Type requirements in subparagraphs below are minimum requirements and may be revised to suit Project. Retain options if "permitted substitutions," as defined in NFPA 70, are appropriate for this Project.
   b. Communications, General Purpose: Type CM or CMG.
   c. Communications, Plenum Rated: Type CMP complying with NFPA 262.
   d. Communications, Riser Rated: Type CMR, complying with UL 1666.
   e. Communications, Limited Purpose: Type CMX.
   f. Multipurpose: Type MP or MPG.
   g. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
   h. Multipurpose, Riser Rated: Type MPR complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. Manufacturers
1. Ortronics.

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 3. Provide blocks for the number of cables terminated on the block. Integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL FIBER CABLE

A. Manufacturers:
1. Corning Cable Systems.

B. Description: Single mode, 8.3/125-micrometer, fiber count per plans, tight buffer, optical fiber cable.
   1. Comply with ICEA S-83-596 for mechanical properties for indoor rated cable.
   2. Comply with ICEA S-87-640 for mechanical properties for outdoor rated cable.
   3. Comply with TIA/EIA-568-C for performance specifications.
      a. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
      b. Plenum Rated, Conductive: Type OFCP complying with NFPA 262.
   4. Maximum Attenuation: .4 dB/km at 1310 nm; .3 dB/km at 1550 nm.

C. Description: Multimode, 50/125-micrometer LOMM, fiber count per plans, tight buffer, optical fiber cable.
   1. Comply with ICEA S-83-596 for mechanical properties for indoor rated cable.
   2. Comply with ICEA S-87-640 for mechanical properties for outdoor rated cable.
   3. Comply with TIA/EIA-568-C for performance specifications.
   4. Comply with TIA/EIA-492AAAA-B for detailed specifications.
      a. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
      b. Plenum Rated, Conductive: Type OFCP complying with NFPA 262.
   5. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
   6. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

D. Jacket:
   1. Jacket Color:
      a. Aqua for Multimode
      b. Yellow for Singlemode.
   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).

E. Fiber Patch Cords:
   1. Multimode
      a. Jacket Color: Aqua.
      b. Manufacturer: Corning
      c. Termination: LC-LC
   2. Singlemode
      a. Jacket Color: Yellow.
      b. Manufacturer: Corning
      c. Termination: LC-LC

2.6 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers:
   1. Corning Cable Systems.

B. Cable Connecting Hardware: Meet the 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-C.
   1. Quick-connect, simplex and duplex, Type LC connectors. Insertion loss not more than 0.75 dB.
   2. Fiber terminations shall utilize Corning Pigtail P/N CCH-CM12-04-P03RH for Outside Plant Only.

3. Fiber splice enclosure: Corning

2.7 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.8 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM or CMG.
1. Paired, 2 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.

B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, 2 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.

2.9 LOW-VOLTAGE CONTROL CABLE

A. Paired Lock Cable: NFPA 70, Type CMG.
1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.

1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

C. Paired Lock Cable: NFPA 70, Type CMG.
1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

D. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.
1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Plastic jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.10 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.11 FIRE ALARM WIRE AND CABLE

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. Comtran Corp.
2. Draka USA.
3. Genesis Cable Products; Honeywell International, Inc.
4. Rockbestos-Suprenant Cable Corporation.
5. West Penn Wire/CDT; a division of Cable Design Technologies.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair.
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 2-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
   1. Low-Voltage Circuits: No. 16 AWG, minimum.
   2. Line-Voltage Circuits: No. 12 AWG, minimum.

2.12 IDENTIFICATION PRODUCTS

A. Manufacturers:
   1. Ortronics LABLEMO

B. Comply with 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.

2.13 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-C.

C. Factory test optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-C.

D. 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.

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 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.

D. Install manufactured conduit sweeps and long-radius elbows whenever possible.

E. Pathway Installation in 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 (75 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:
1. Comply with TIA/EIA-568-C.
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, and cross-connect 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. 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.
7. 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.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:
1. Comply with TIA/EIA-568-C.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
3. Comply with OSU Standards.

D. Optical Fiber Cable Installation:
1. Comply with TIA/EIA-568-C.
2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
3. Comply with OSU Standards.

E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications 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) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. 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. Coil cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (300 mm) in diameter below each feed point.

G. 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).

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 (600 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 (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).

3.3 CONTROL-CIRCUIT CONDUCTORS

A. 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.

3.4 FIRESTOPPING

A. Comply with TIA/EIA-569-A, Firestopping Annex A.

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

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.

3.7 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 cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-C.
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 meet or exceed applicable requirements in TIA/EIA-568-C. 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.

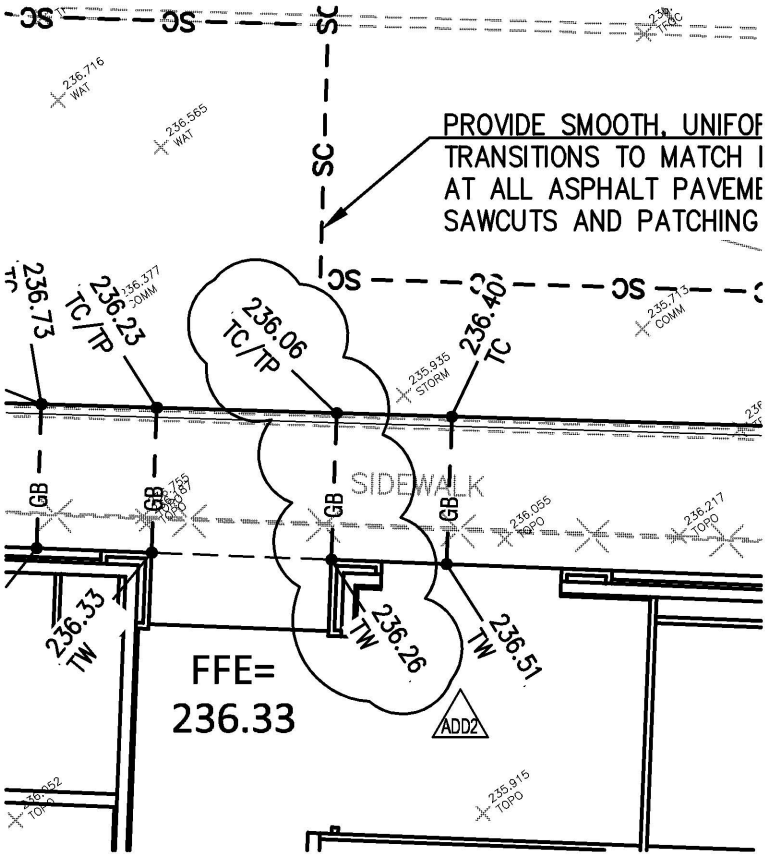
4. Optical Fiber Cable Tests:
   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Link End-to-End Attenuation Tests:
      1) Multimode Link Measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, 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/EIA-568-C.

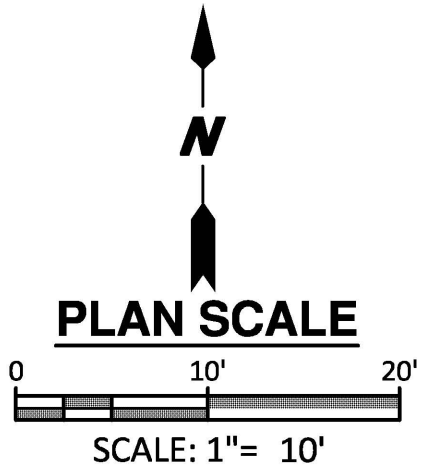
D. Document data for each measurement. Print data for submittals in a summary report that is formatted using BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

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 280513





SHEET NOTES

3. CONTRACTOR IS RESPONSIBLE FOR CORRECTING ANY CROSS-SLOPES EXCEEDING 2.08% WITHIN PEDESTRIAN WALKS, AS DETERMINED BY OSU.

ADD2

REGISTERED PROFESSIONAL ENGINEER
#13,624
DIGITAL SIGNATURE
OREGON
JULY 16, 1987
MONICA B. ANDERSON
EXPIRES 12/31/15

Attachment C1 to
ADDENDUM 2
Dated: 05-29-14

DLR Group
Architecture Planning Interiors

C3.0

74-13115-00
04-29-14

SITE GRADING PLAN

OSU GOSS STADIUM EXPANSION

BID & PERMIT SET

NOTE TO CONTRACTOR

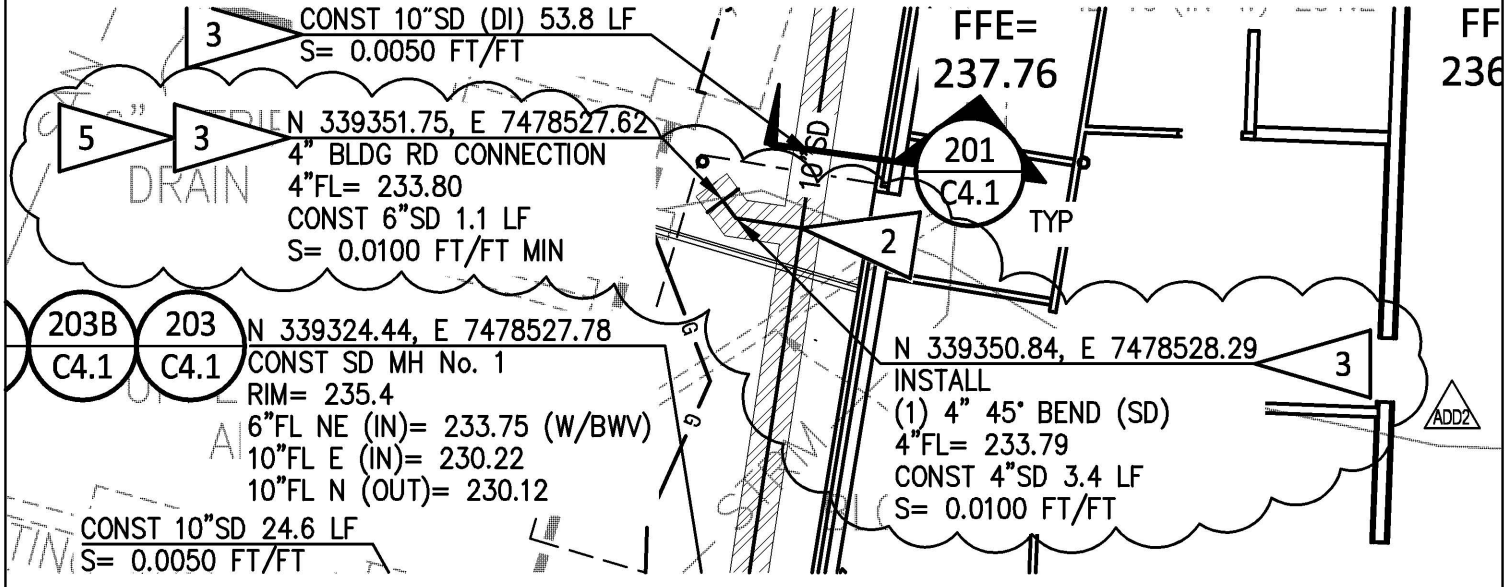
SEQUENCE WORK SO THAT STORM UTILITIES AND MANHOLES LOCATED WITHIN BEARING ZONE OF BUILDING FOUNDATION ARE INSTALLED AND BACKFILLED WITH CDF PRIOR TO FOUNDATION CONSTRUCTION.

N

PLAN SCALE

0 10' 20'

SCALE: 1"= 10'



REGISTERED PROFESSIONAL ENGINEER
#13,624
DIGITAL SIGNATURE
OREGON
JULY 16, 1987
MONICA B. ANDERSON
EXPIRES 12/31/15

Attachment C2 to
ADDENDUM 2
Dated: 05-29-14

DLR Group
Architecture Planning Interiors

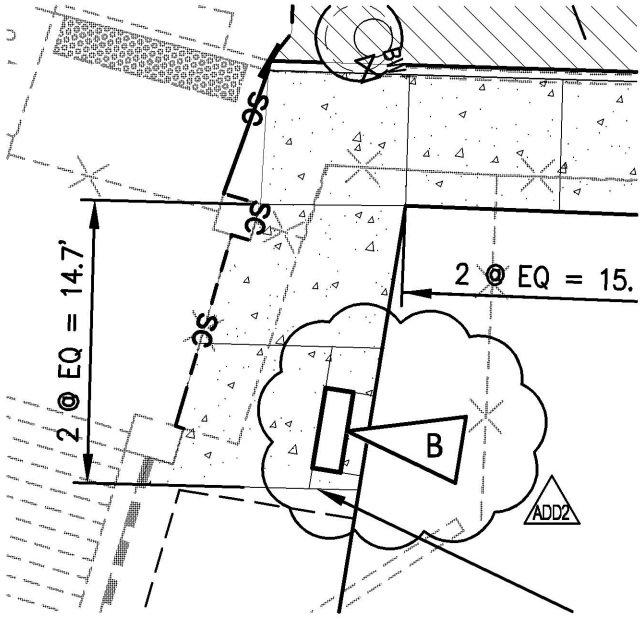
C4.0

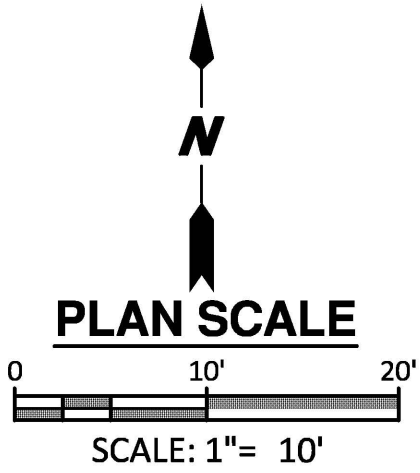
74-13115-00
04-29-14

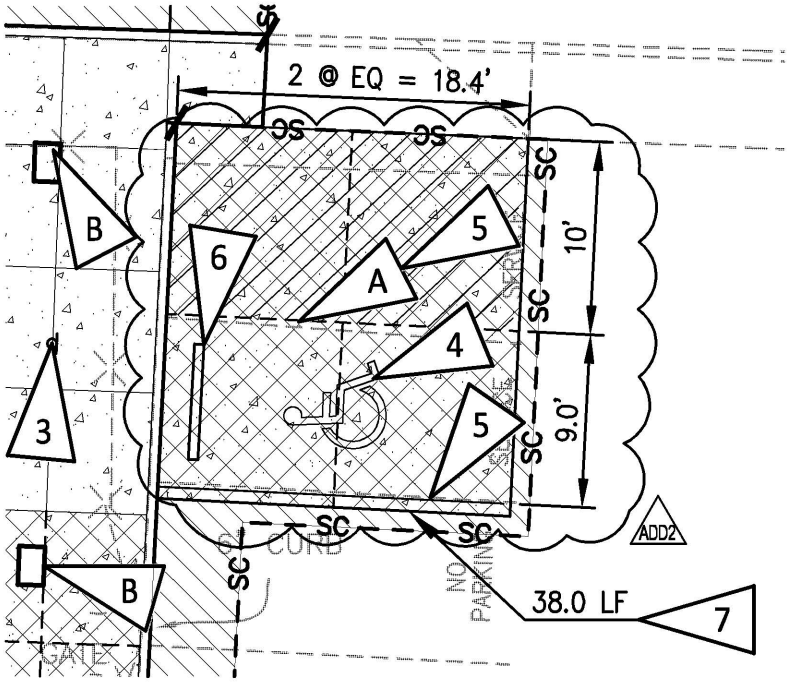
PRIVATE UTILITIES PLAN

OSU GOSS STADIUM EXPANSION

BID & PERMIT SET







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#13,624
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JULY 16, 1987
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EXPIRES 12/31/15

Attachment C3 to
ADDENDUM 2
Dated: 05-29-14

DLR Group
Architecture Planning Interiors

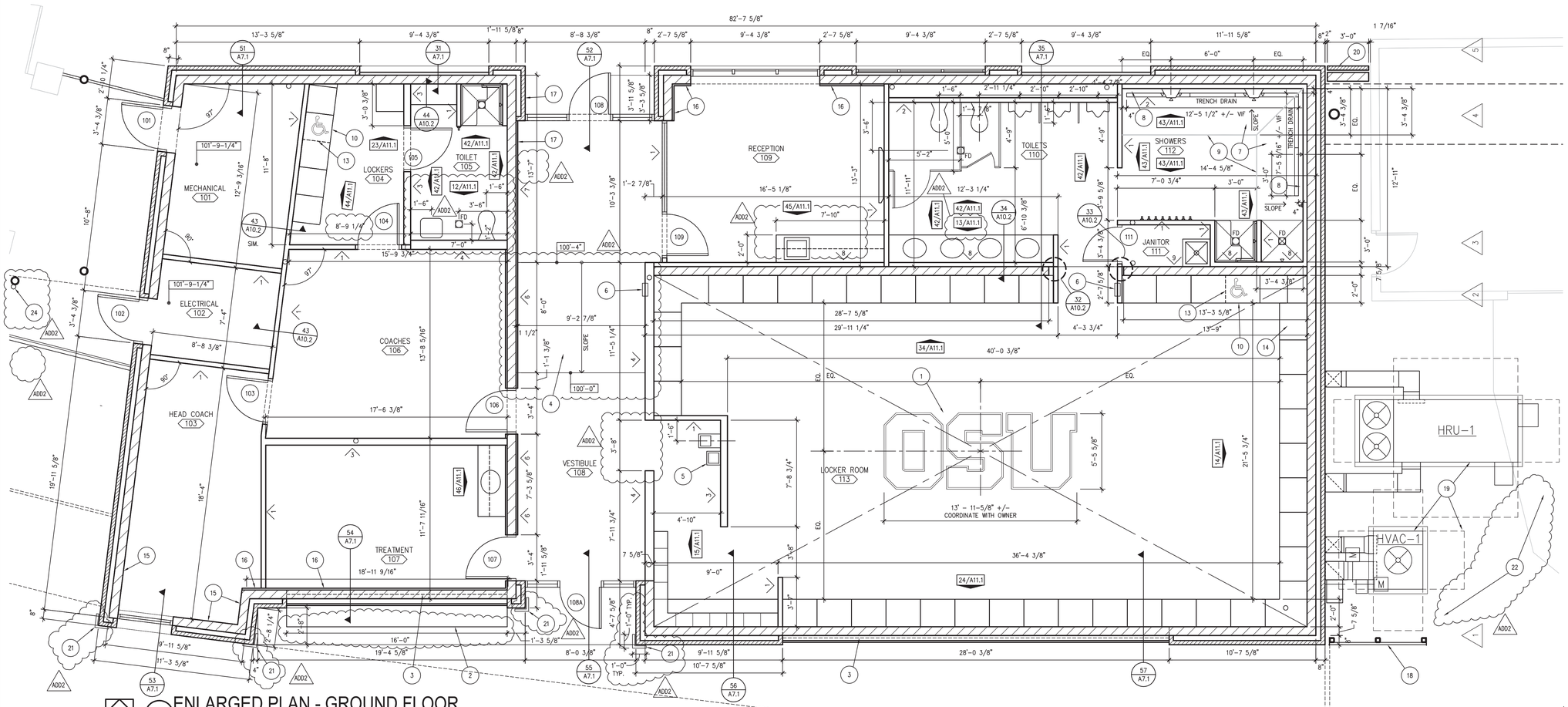
C5.0

74-13115-00
04-29-14

PAVING PLAN

OSU GOSS STADIUM EXPANSION

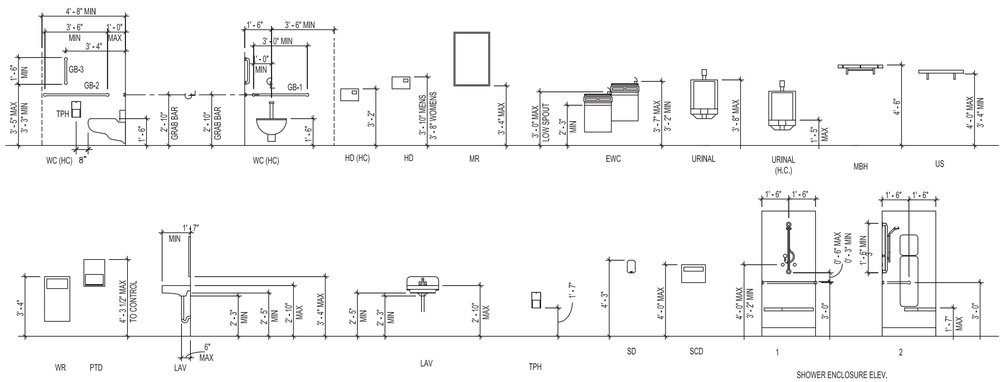
BID & PERMIT SET



ENLARGED PLAN - GROUND FLOOR

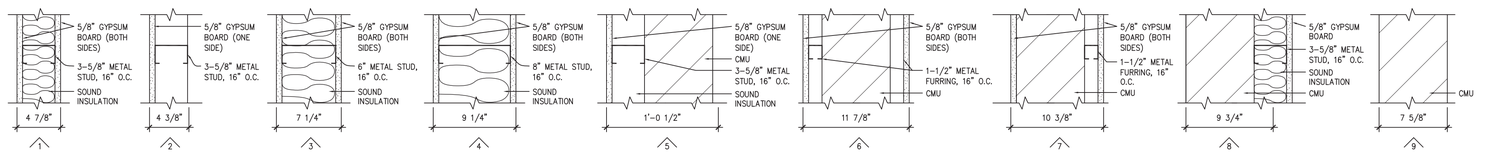
22 / A2.1 — SCALE: 1/4" = 1'-0"

NORTH



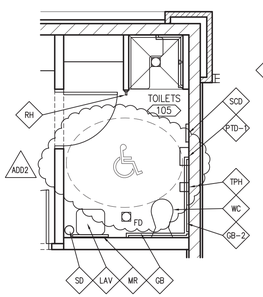
INTERIOR WALL TYPES

41 / A2.1 — SCALE: 1 1/2"=1'-0"



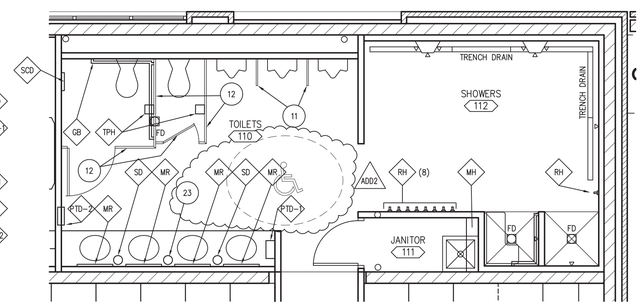
ACCESSORIES PLAN

33 / A2.1 — SCALE: 1/4" = 1'-0" — ROOM 105



ROOMS 110 & 112 - ACCESSORIES / PARTITIONS PLAN

34 / A2.1 — SCALE: 1/4" = 1'-0"



ABBREVIATIONS

EWC	ELECTRIC WATER COOLER
GB	GRAB BAR
HC	ADA ACCESSIBLE HEIGHT
HD	ELECTRIC HAND DRYER
LAV	LAVATORY
MH	MOP / BROOM HOLDER
MR	MIRROR
PTD–1	SURFACE–MOUNTED PAPER TOWEL DISPENSER
PTD–2	RECESSED PAPER TOWEL DISPENSER
RH	ROBE HOOK
SCD	SEAT COVER DISPENSER
SD	LIQUID SOAP DISPENSER
SH	SHOWER
TPH	SURFACE MOUNTED TOILET PAPER DISPENSER

THESE ABBREVIATIONS APPLY TO THE TOILETS' AND ACCESSORIES' PLANS ON THIS SHEET

LEGEND

? IS A SYMBOL THAT INDICATES THE TYPICAL ACCESSORIES. NOT EVERY ITEM IS IDENTIFIED WITH A SYMBOL. SOME ITEMS ARE SHOWN IN TYPICAL APPLICATION. PROVIDE ACCESSORIES FOR ALL LIKE CONDITIONS. THIS NOTE APPLIES TO SHEET A2.1.

FD FLOOR DRAIN. SEE ALSO PLUMBING PLANS

TOILET ROOM NOTES

1. CALLOUTS ON PLANS INDICATE TYP. ITEMS, PROVIDE ALL ITEMS SHOWN FOR A COMPLETE INSTALLATION.
2. PROVIDE INSULATION AT ALL EXPOSED HOT WATER AND DRAIN PIPES PER ADA/ADAAG 4.24.6. & OSSC 1109.10.7.4.
3. SEE DIAGRAM ON THIS SHEET FOR STANDARD TOILET ACCESSORY HEIGHTS.

GENERAL NOTES

A. GENERAL NOTES APPLY TO ALL SHEETS.

B. DIMENSIONS ARE ACTUAL AND ARE TO FACE OF STUDS, FACE OF CONCRETE WALLS, FACE OF CMU WALLS, FACE OF FRAMES, OR CENTERLINE OF COLUMNS, UNLESS NOTED OTHERWISE.

C. FLOOR SPOT ELEVATIONS ARE SHOWN THUS ● 100'–0"

D. ALL INTERIOR CMU WALLS SHALL BE 8" NOMINAL THICKNESS, UNLESS NOTED OTHERWISE.

E. WALLS SHADED ON THE FLOOR PLANS INDICATE GROUND FACE MASONRY UNITS (GFCMU). EXTEND GMCMU TO 4 INCHES MINIMUM ABOVE FINISH CEILINGS AND CONTINUE WITH CMU OF SAME THICKNESS.

F. WALL TYPES SHALL BE DESIGNATED ON FLOOR PLANS THUS ◇ , SEE SHEET A2.1 FOR WALL TYPES. ALL INTERIOR PARTITIONS ARE WALL TYPE "1" UNLESS NOTED OTHERWISE.

G. ALL MASONRY WALLS AND INTERIOR STUD WALLS SHALL EXTEND TO UNDERSIDE OF FLOOR OR ROOF DECK ABOVE UNLESS NOTED OTHERWISE. SEE REFLECTED CEILING PLAN NOTES.

H. PROVISIONS SHALL BE MADE AT ALL FULL HEIGHT NONBEARING WALLS FOR 1–INCH VERTICAL MOVEMENT OF THE BUILDING STRUCTURE WITHOUT TRANSFER OF COMPRESSIVE LOADS TO WALL. FILL IRREGULARITIES BETWEEN TOP OF WALL AND DECK ABOVE WITH FIRE SAFING INSULATION OR FIRE STOPPING MATERIALS. SEE DETAIL 32 ON SHEET A10.1.

J. SEE STRUCTURAL DRAWINGS FOR BRACING OF NONLOAD BEARING MASONRY WALLS.

K. FURNISH AND INSTALL TREATED WOOD BLOCKING OR METAL BACKING PLATE IN METAL STUD PARTITIONS FOR THE PROPER ANCHORAGE OF ALL WALL ATTACHED ITEMS; I.E. TOILET ACCESSORIES, CASEWORK, MILLWORK, WALL–MOUNTED FIXTURES, DOOR STOPS, VIDEO DISPLAY UNITS FURNISHED BY OWNER, ETC.

L. GYPSUM BOARD AND PLASTER SURFACES SHALL BE ISOLATED WITH CONTROL JOINTS WHERE SHOWN ON DRAWINGS AND AS DESCRIBED IN THE SPECIFICATIONS.

P. MASONRY CONTROL JOINTS (CJ) AND CONTROL JOINTS ABOVE (CJA) SHALL BE LOCATED AS SHOWN ON THE FLOOR PLAN AND BUILDING ELEVATIONS, AND WHERE LARGE PLUMBING VENTS OR RISERS OCCUR IN SINGLE WYTHE MASONRY WALLS, AND WHERE MASONRY WALLS BEARING ON THE CONCRETE FLOOR SLAB ABUT MASONRY WALLS BEARING ON CONCRETE FOOTINGS OR AS INDICATED ON DRAWINGS.

Q. SEE DIVISION 10 SECTION "TOILET, BATH AND LAUNDRY ACCESSORIES" FOR ITEMS THE OWNER SHALL FURNISH AND INSTALL.

R. INCLUDE ALL OWNER FURNISHED AND INSTALLED ITEMS AND OWNER FURNISHED AND CONTRACTOR INSTALLED ITEMS IN THE CONSTRUCTION SCHEDULE, AND COORDINATE WITH THE OWNER TO ACCOMMODATE THESE ITEMS.

S. COORDINATE ALL MECHANICAL CHASE SIZES WITH THE MECHANICAL CONTRACTOR.

T. COORDINATE WITH MECHANICAL AND ELECTRICAL CONTRACTORS THE SIZE AND LOCATION OF EQUIPMENT PADS SHOWN ON PLANS.

U. ARCHITECTURAL FINISH FLOOR ELEVATION 100'–0" EQUALS ACTUAL SITE REFERENCE ELEVATION OF FINISH FLOOR 236.000 FEET.

V. EXTEND FURRING CHANNELS AND GYPSUM BOARD UP 4 INCHES ABOVE FINISHED CEILING ON CMU WALLS.

W. SCRIBE GYPSUM BOARD OF WALL AND PARTITIONS TO IRREGULARITIES OF DECK ABOVE. SEAL TIGHTLY AROUND ALL PENETRATIONS.

X. PROVIDE SEISMIC BRACING FOR SUSPENDED CEILINGS OR AS SHOWN ON THE DRAWINGS.

KEY NOTES

ADD2

1. UNIVERSITY LOGO. CENTER IN ROOM & INTEGRATE WITH CARPET. COORDINATE WITH OWNER.
2. TWO (2) 96" STRAIGHT FOUR–UNIT GROUP BENCHES, BACKLESS SEAT, SILVER FINISH, SURFACE MOUNTED – SEE SECTION 109000.
3. GLAZING ABOVE (DASHED). SEE BUILDING ELEVATIONS AND FRAME TYPES (SHEETS A5.1 AND A9.1)
4. SLOPED FLOOR
5. DUAL DRINKING FOUNTAINS WITH CANE DETECTION ADD2
6. FIRE EXTINGUISHING CABINET – SEE DETAIL 31/A10.1. CONFIRM FINAL LOCATION WITH FIRE MARSHAL.
7. DEPRESS CONCRETE SLAB 2" AT SLOPED AREA. SLOPE CERAMIC TILE 1/4": 12"
8. SLOPE DOWN FROM COVE EDGE TO TRENCH DRAIN, 1/4":12"
9. EDGE OF DEPRESSED SLAB
10. ACCESSIBLE LOCKER
11. URINAL SCREEN
12. TOILET PARTITION
13. REMOVABLE PANEL (DASHED)
14. AV CLOSET – COORDINATE WITH OWNER INSTALLATION OF EQUIPMENT
15. 1 LAYER OF GWB ON INTERIOR FACE OF CMU. BLOCK SPACE IN CMU TO ACCOMMODATE ELECTRICAL OUTLETS. SEE ELECTRICAL.
16. GWB OVER 1–1/2" METAL FURRING, INSIDE FACE OF EXTERIOR WALL.
17. ADA HAND SENSOR DOOR OPERATOR – SEE ELECTRICAL.
18. MECHANICAL EQUIPMENT SCREEN – SEE 21/A10.2 FOR DETAILS.
19. MECHANICAL EQUIPMENT
20. MASONRY SCREEN WALL – SEE 31/A10.2 FOR PARAPET AND JOINT DETAILS
21. WALL PADDING, 10'–0" HIGH FROM GRADE, ALIGN TOP WITH TOP OF ADJACENT ALUMINUM STOREFRONT.
22. METAL BOLLARDS (PROVIDE 4), COORDINATE LOCATIONS WITH ARCHITECT AND OWNER
23. 8" ø GROMMET AT SS COUNTER FOR WASTE RECEPTACLE (OFOI)
24. 3" DOWNSPOUT (CONNECT TO FLOOR DRAIN ABOVE)

ADD2

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Robert J. Esau

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Date: 2014.05.30 10:42:45 -07'00'

BID & PERMIT SET

ENLARGED PLAN - GROUND FLOOR
OSU GOSS STADIUM EXPANSION

A2.1
74-13115-00
04-29-14
ADD2 5/29/14 - ADD-2
ATTACHMENT A1

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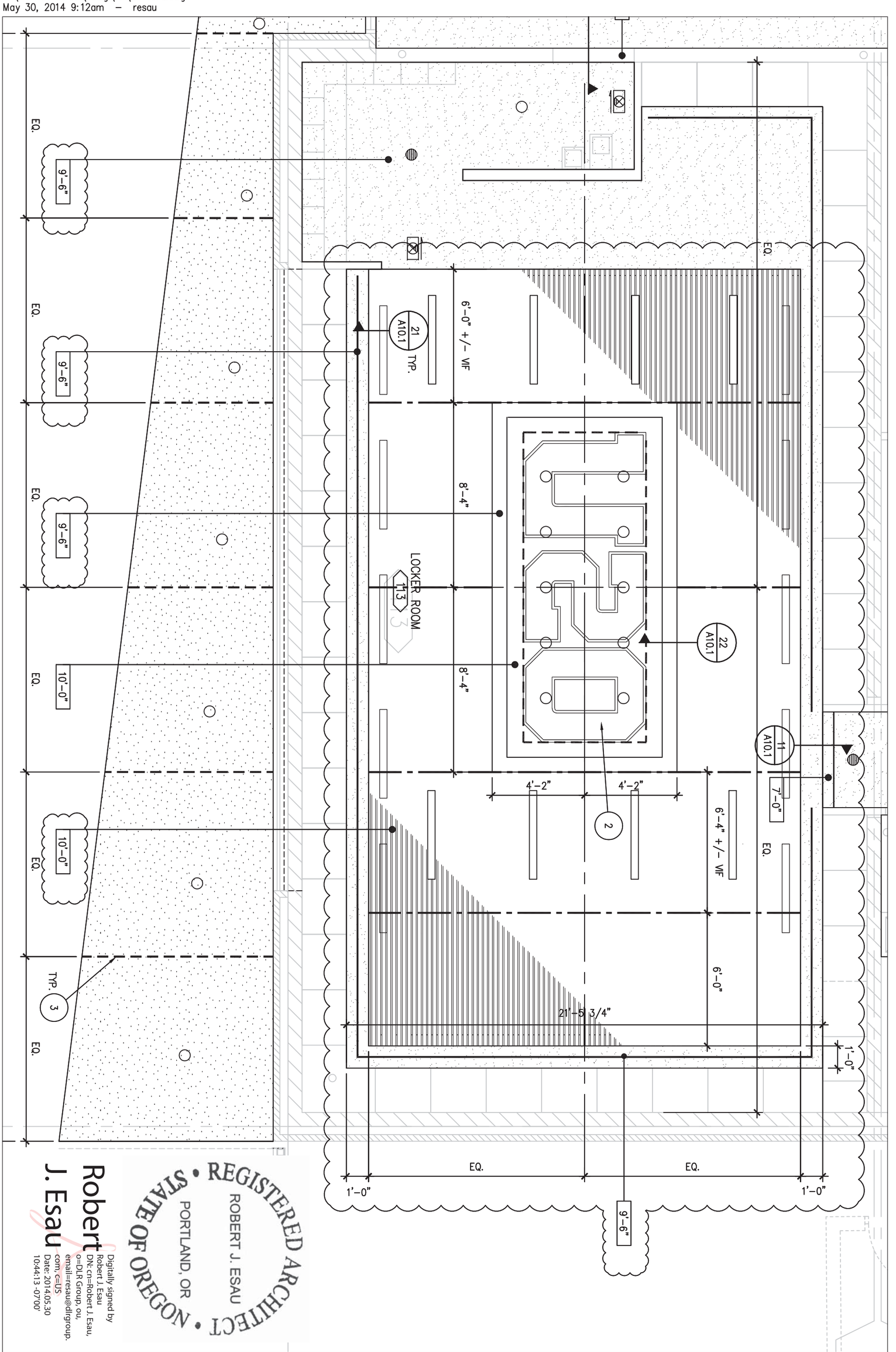

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A3.1
74-13115-00
05-29-14

REFLECTED CEILING PLANS
OSU GOSS STADIUM EXPANSION

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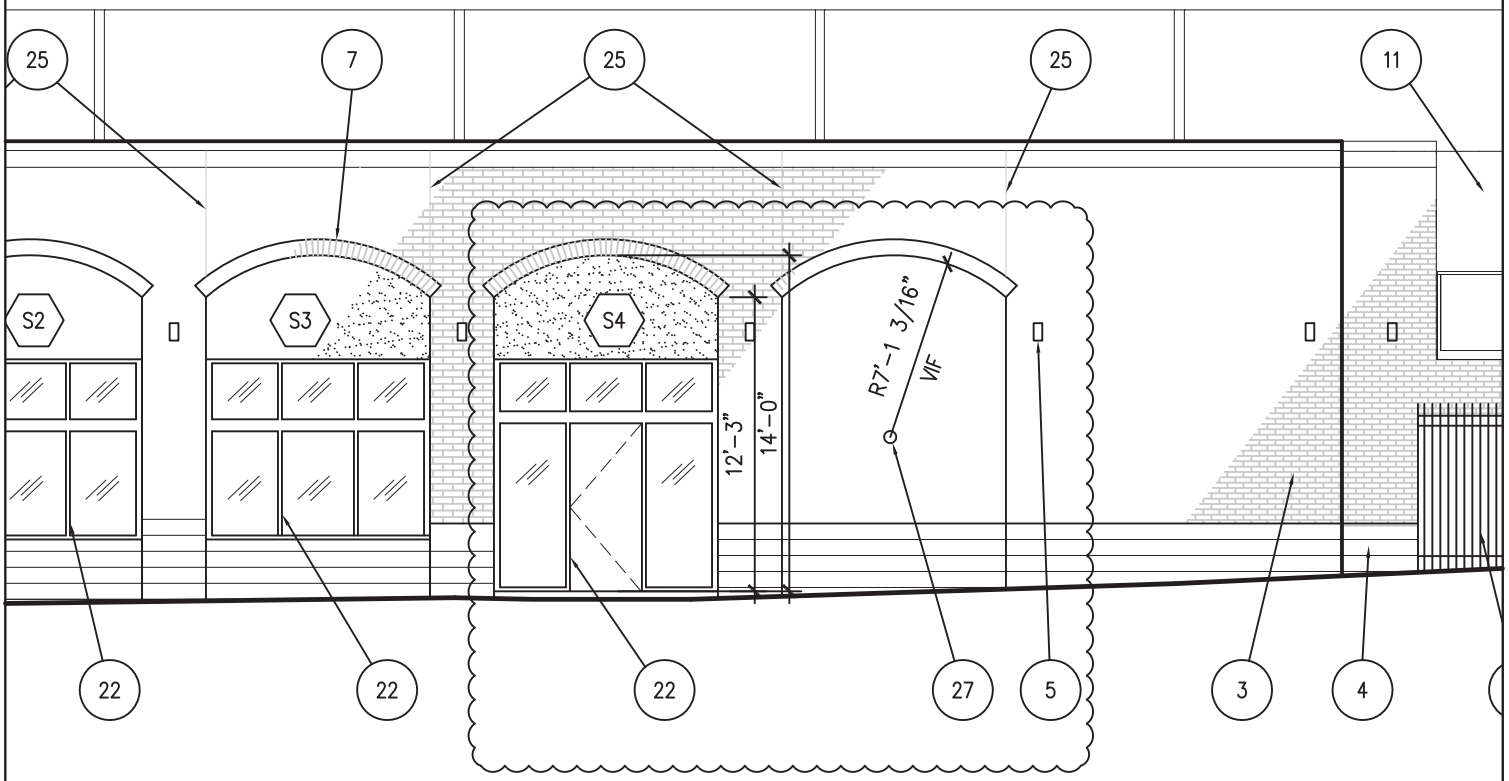

NORTH

Attachment A3 to
ADDENDUM 2
Dated: 05-29-14

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A5.1
74-13115-00
04-29-14

BUILDING ELEVATIONS
OSU GOSS STADIUM EXPANSION

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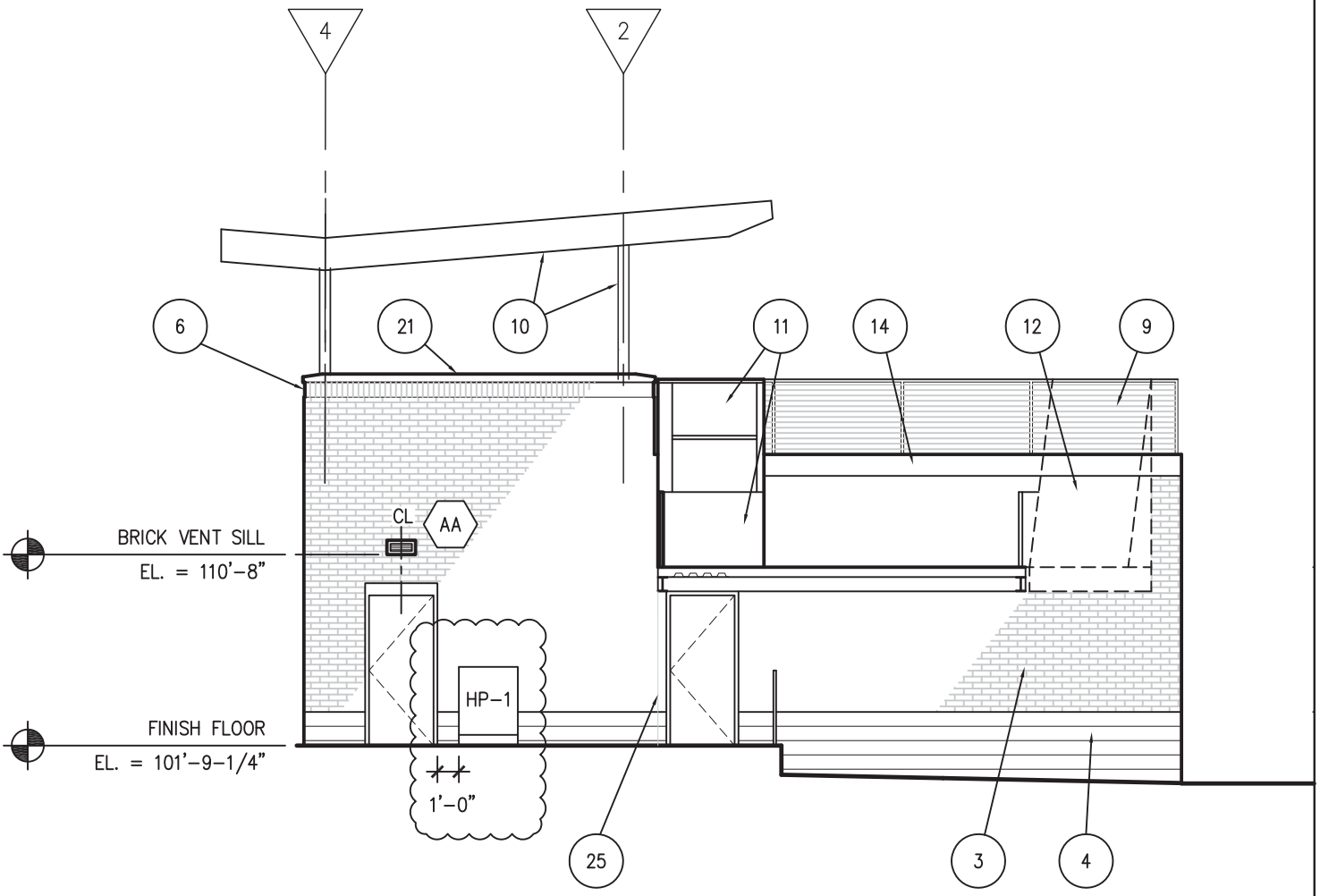

WEST ELEVATION

41
A5.1

SCALE: 1/8" = 1'-0"

Attachment A4 to
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Dated: 05-29-14

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OSU GOSS STADIUM EXPANSION

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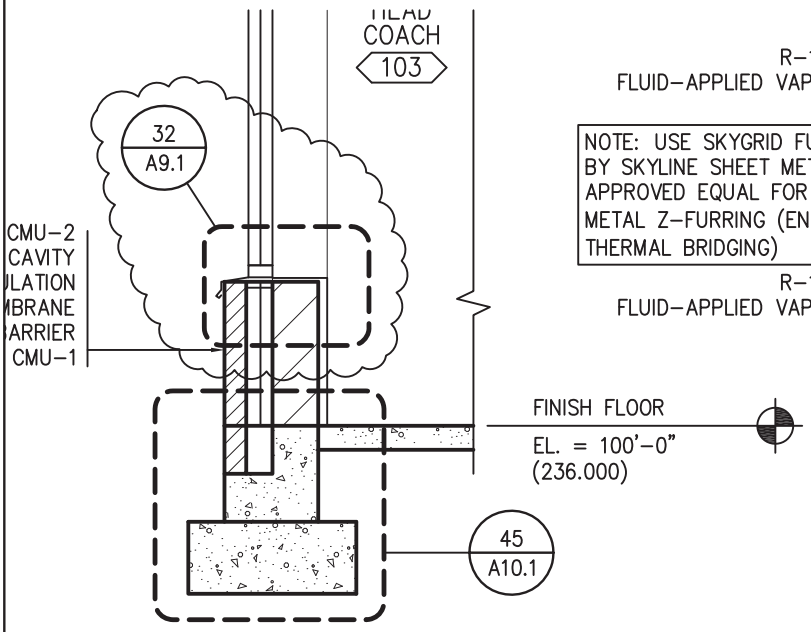
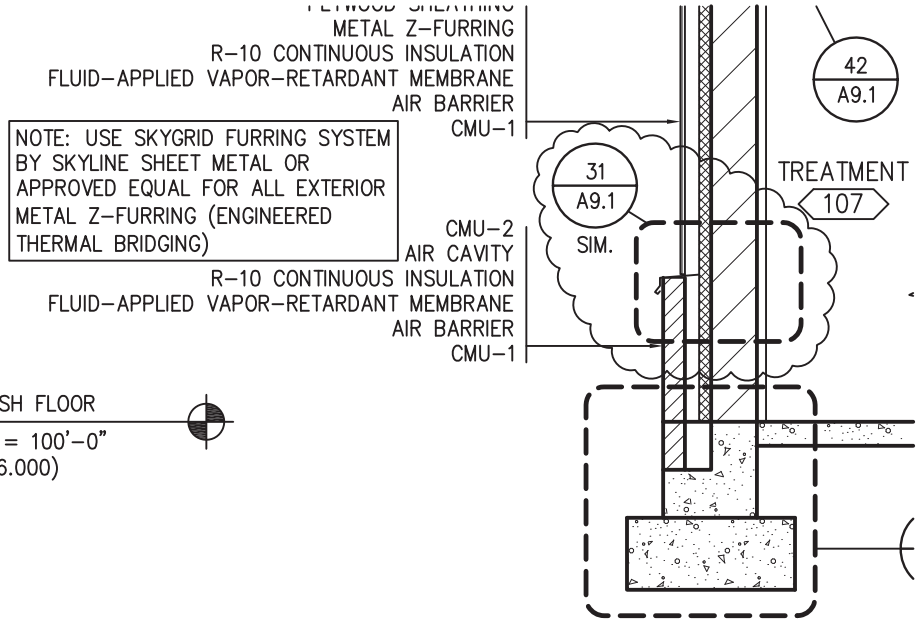


WALL SECTION

53 / A7.1

SCALE: 3/8"=1'–0"



WALL SECTION

54 / A7.1

SCALE: 3/8"=1'–0"

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Attachment A5 to
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A7.1

74-13115-00

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WALL SECTIONS
OSU GOSS STADIUM EXPANSION

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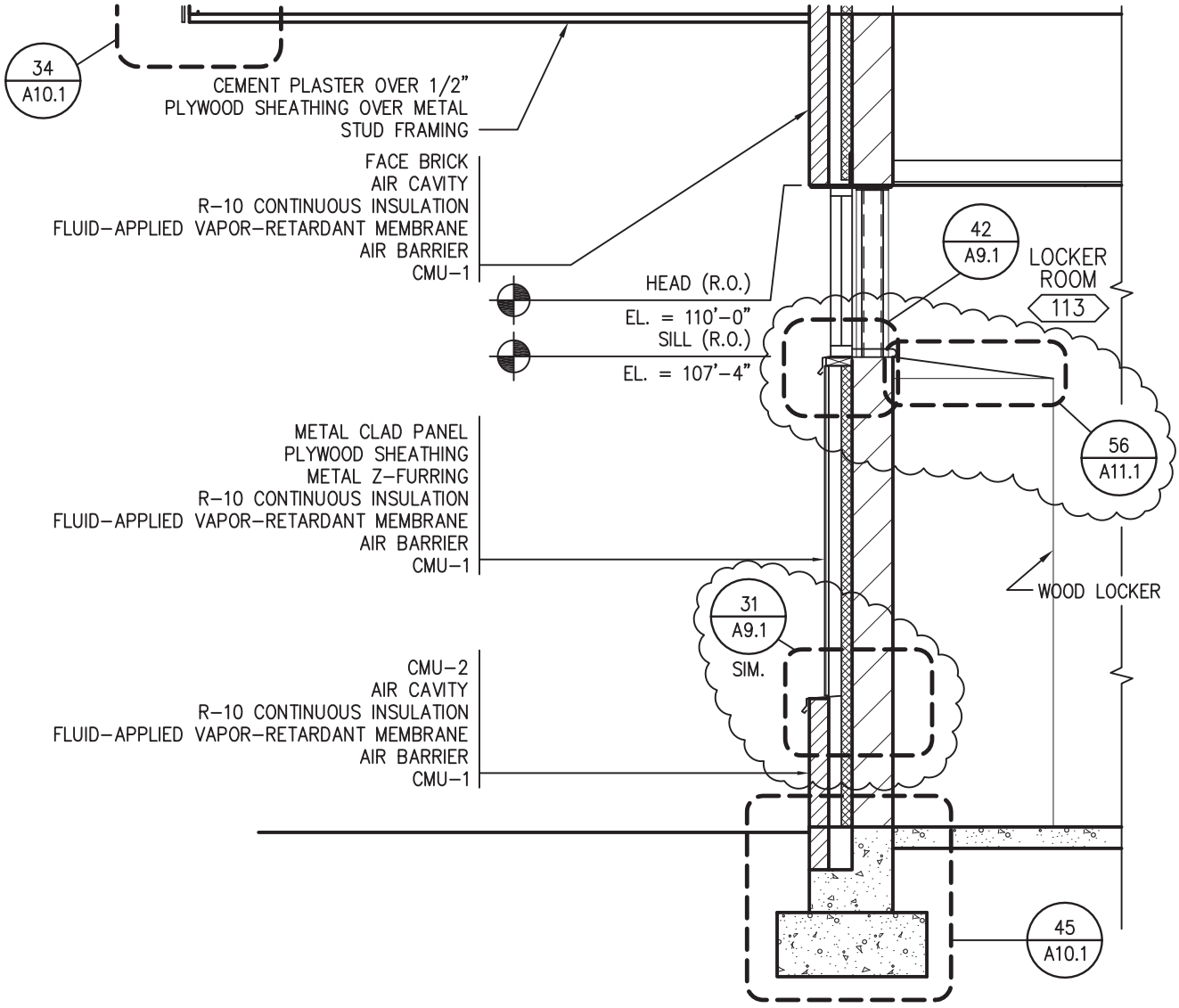

WALL SECTION

57
A7.1

SCALE: 3/8"=1'-0"

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WALL SECTIONS
OSU GOSS STADIUM EXPANSION

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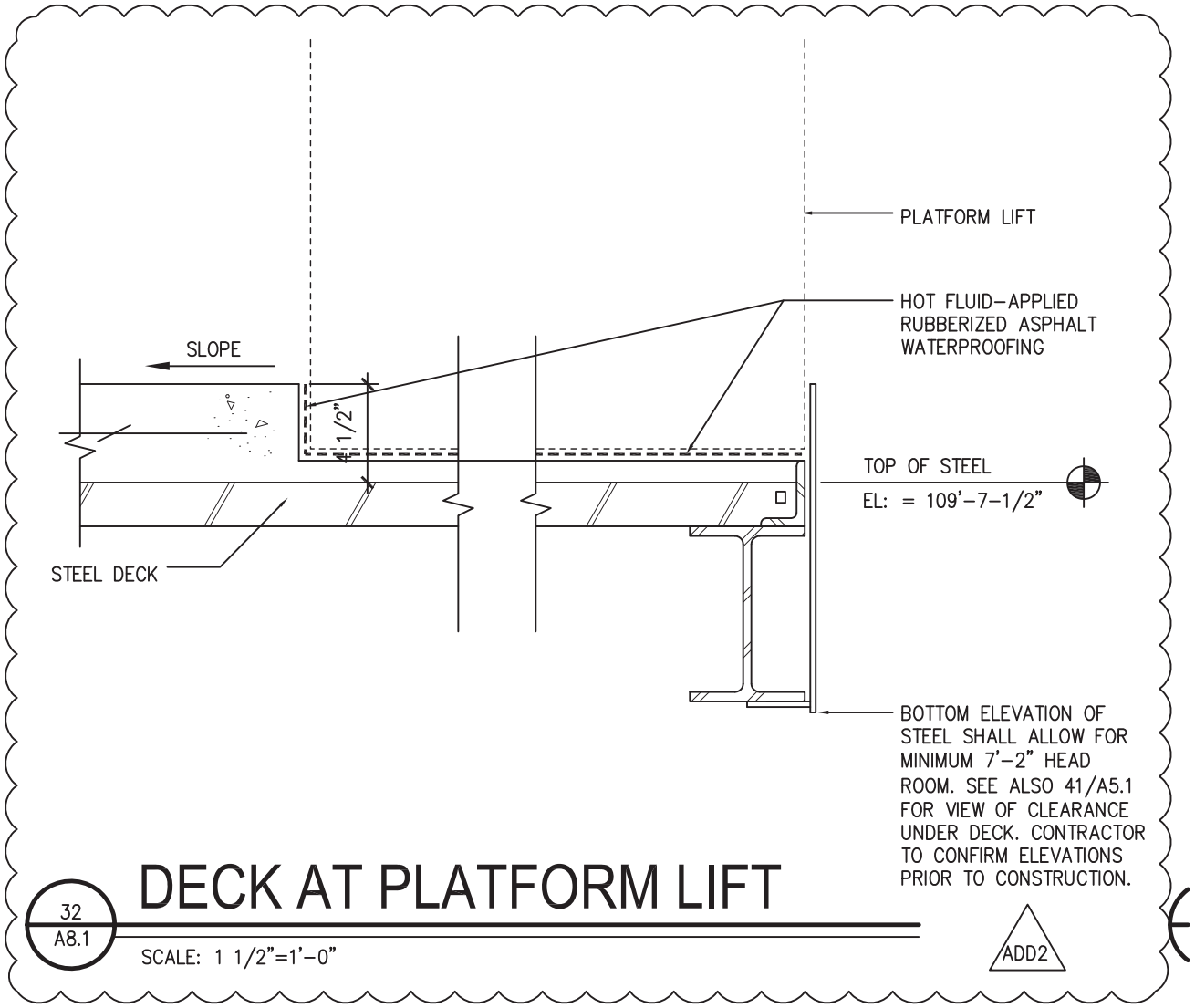

32
A8.1

DECK AT PLATFORM LIFT

SCALE: 1 1/2"=1'–0"

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Dated: 05-29-14

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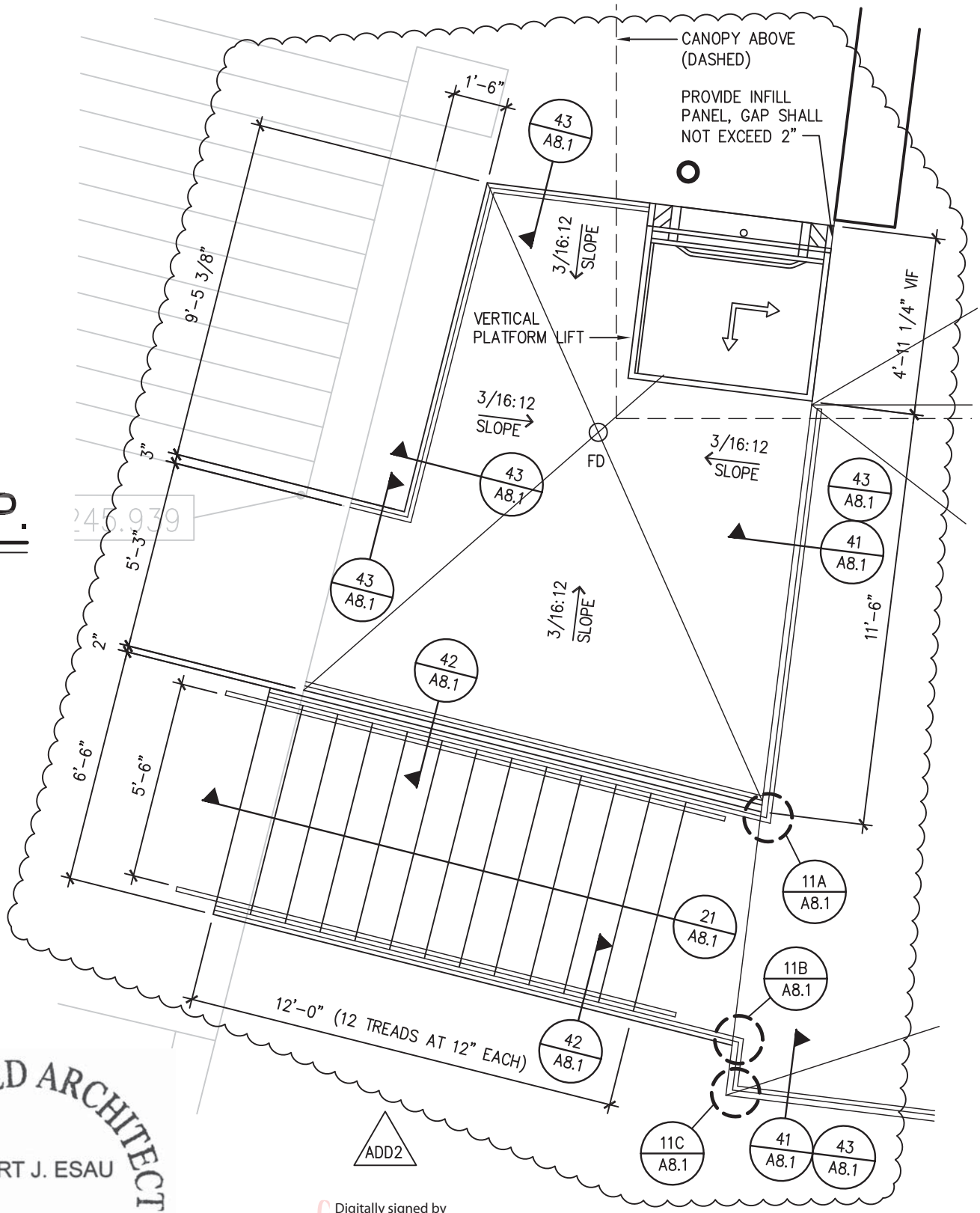
A8.1
74-13115-00
04-29-14

VERTICAL CIRCULATION
OSU GOSS STADIUM EXPANSION

BID & PERMIT SET



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A8.1

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04-29-14

VERTICAL CIRCULATION
OSU GOSS STADIUM EXPANSION

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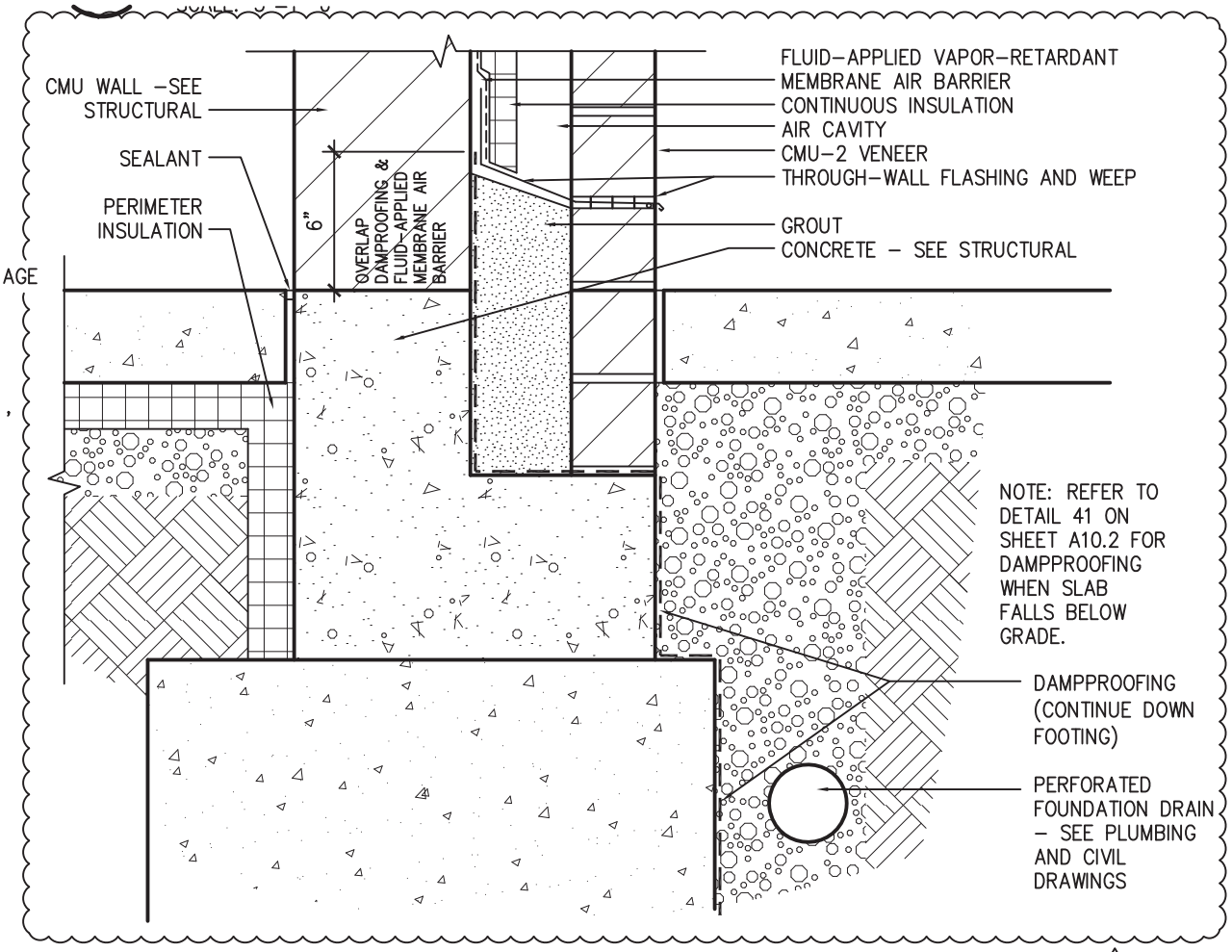

45
A10.1

FOUNDATION DETAIL

ADD2

SCALE: 1 1/2"=1'–0"

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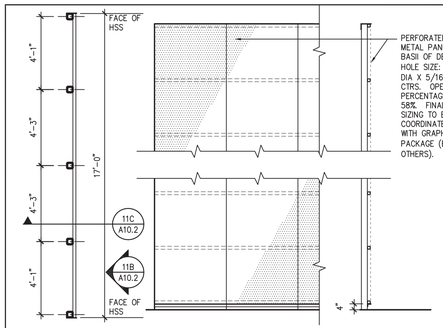
A10.1
74-13115-00
04-29-14

BUILDING DETAILS
OSU GOSS STADIUM EXPANSION

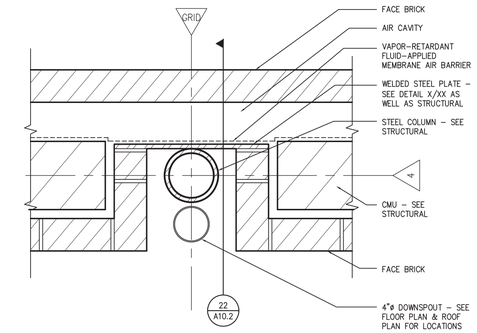
BID & PERMIT SET



A PLAN B PARTIAL ELEVATION C SECTION

11 A10.2 GRAPHICS SCREEN

SCALE: 1/4"=1'-0"



12 A10.2 COLUMN DETAIL

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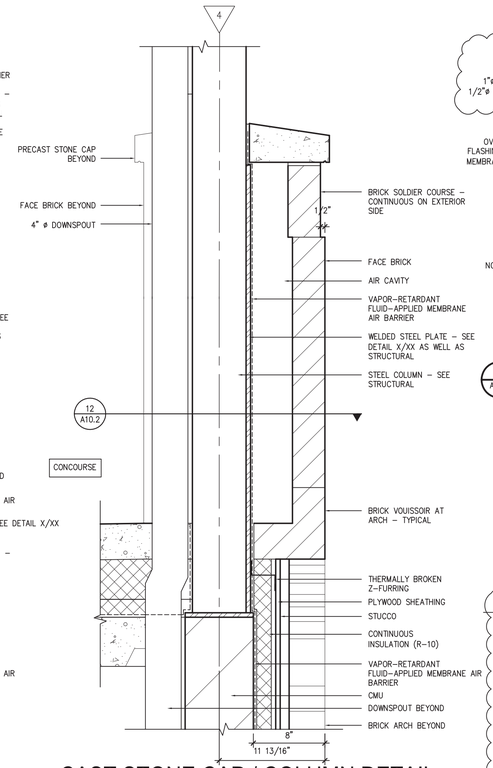
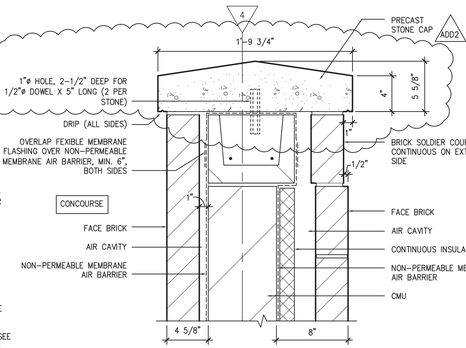


CAST STONE CAP / COLUMN DETAIL



14 A10.2 PARAPET DETAIL

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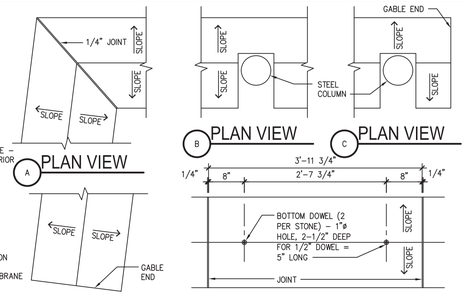
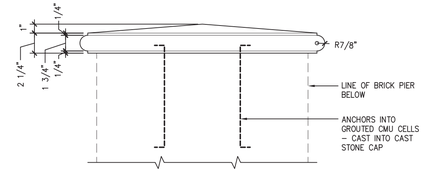


15 A10.2 CAST STONE COPING DETAILS

SCALE: 3/4"=1'-0"

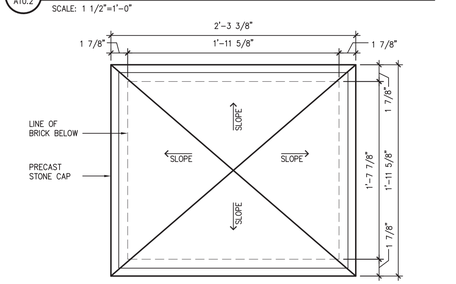


16 A10.2 CAST STONE CAP DETAIL

SCALE: 1 1/2"=1'-0"

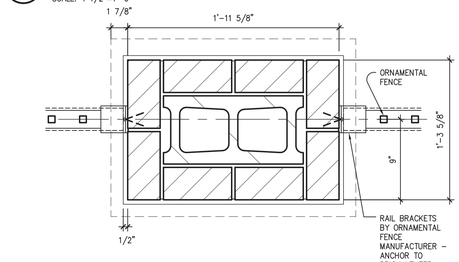
24 A10.2 RS PROFILE DETAIL

SCALE: 3"=1'-0"



25 A10.2 CAST STONE CAP DETAIL

SCALE: 1 1/2"=1'-0"



35 A10.2 PIER DETAIL

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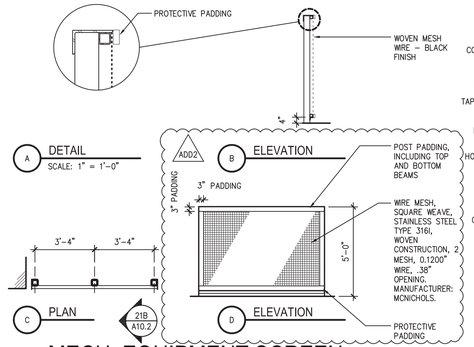
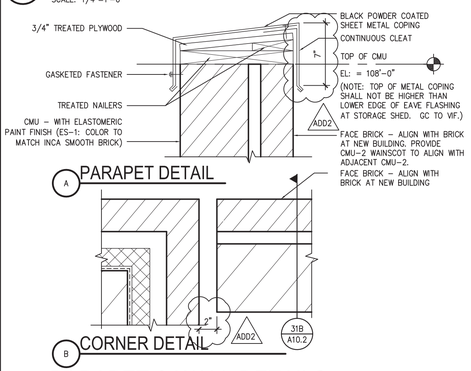


21 A10.2 MECH. EQUIPMENT SCREEN

SCALE: 1/4"=1'-0"



31 A10.2 PARAPET & WALL DETAILS

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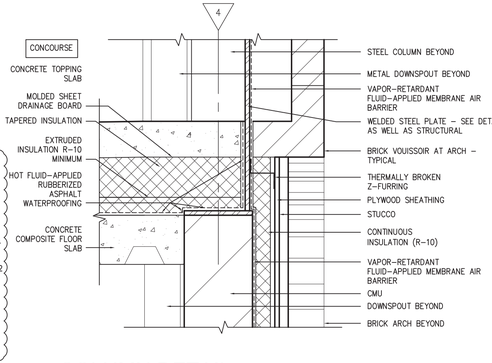
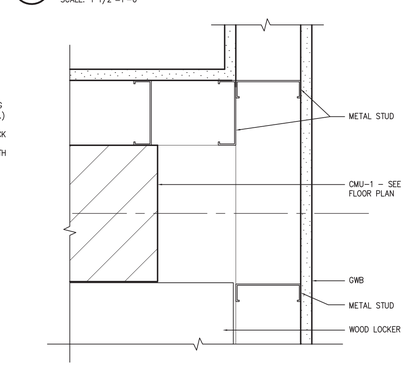


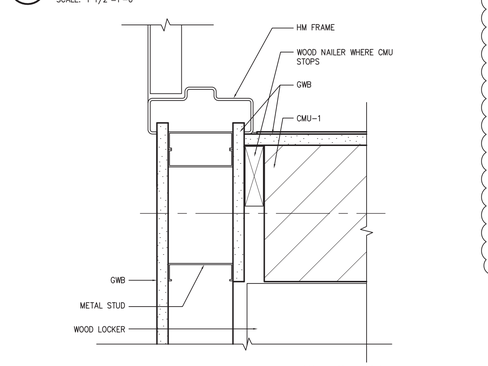
22 A10.2 COLUMN DETAIL

SCALE: 1 1/2"=1'-0"



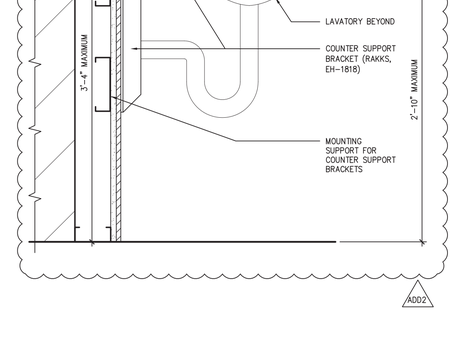
32 A10.2 CMU / STUD DETAIL

SCALE: 3"=1'-0"



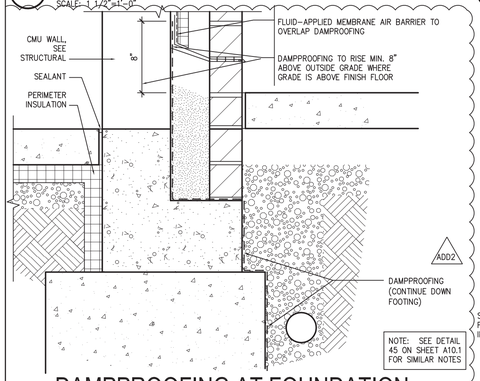
33 A10.2 JAMB DETAIL

SCALE: 3"=1'-0"



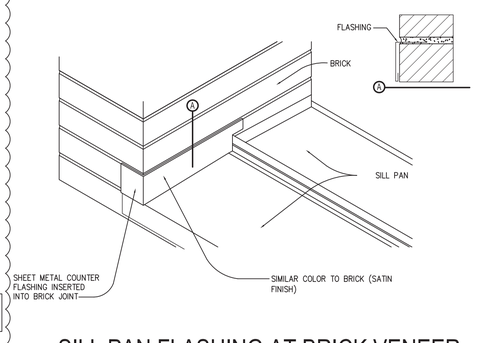
34 A10.2 TOILET SINK SECTION

SCALE: 1 1/2"=1'-0"



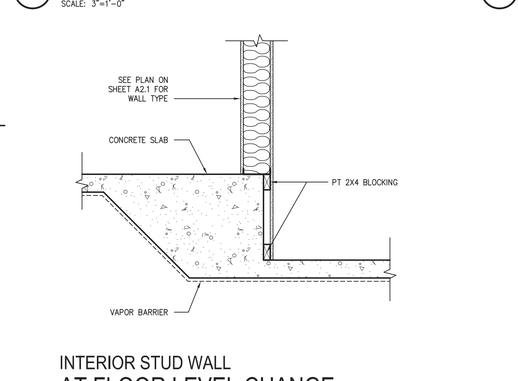
41 A10.2 DAMPPROOFING AT FOUNDATION

SCALE: 1 1/2"=1'-0"



42 A10.2 SILL PAN FLASHING AT BRICK VENEER

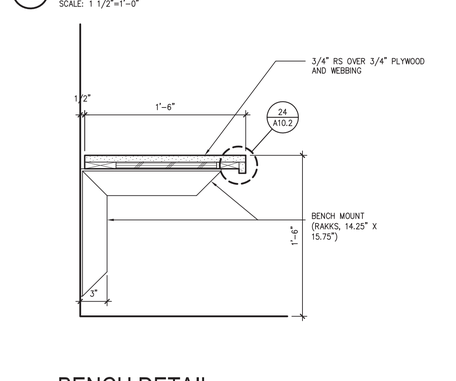
SCALE: 1 1/2"=1'-0"



INTERIOR STUD WALL AT FLOOR LEVEL CHANGE

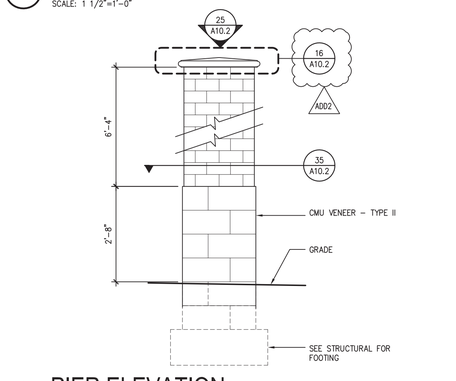
43 A10.2

SCALE: 3/4"=1'-0"



44 A10.2 BENCH DETAIL

SCALE: 1 1/2"=1'-0"



45 A10.2 PIER ELEVATION

SCALE: 1/2"=1'-0"

REGISTERED ARCHITECT
ROBERT J. ESAU
PORTLAND, OR
STATE OF OREGON
Robert J. Esau
Digitally signed by Robert J. Esau
DN: cn=Robert J. Esau, o=DLR Group, ou, email=resaua@dlrgroup.com, c=US
Date: 2014.05.30 10:43:44 -07'00'

BID & PERMIT SET

BUILDING DETAILS
OSU GOSS STADIUM EXPANSION

A10.2

74-13115-00

04-29-14

05/29/14 - ADD-2

ATTACHMENT A10

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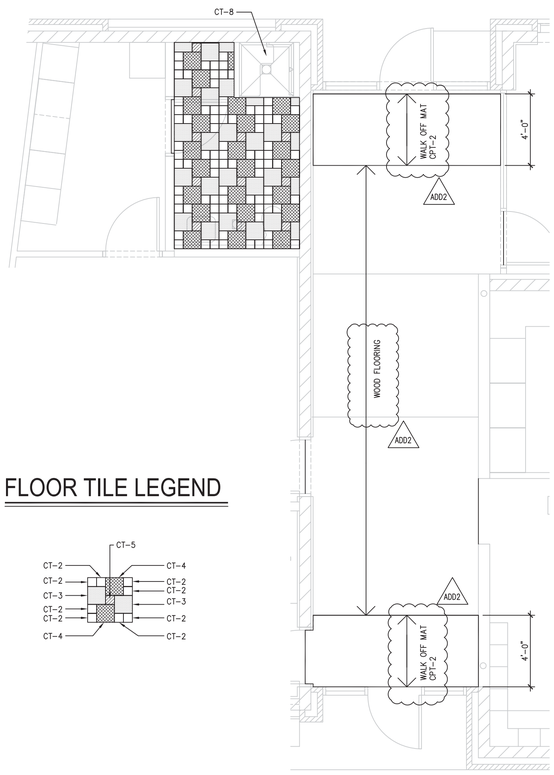
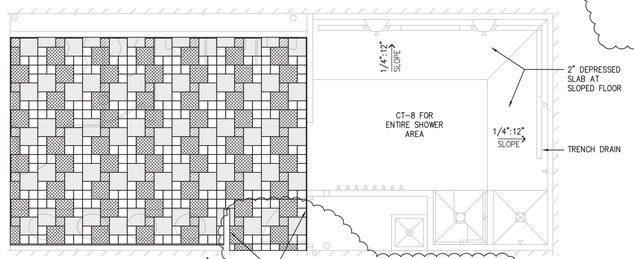
May 30, 2014 10:05am - resau



FLOOR TILE LEGEND

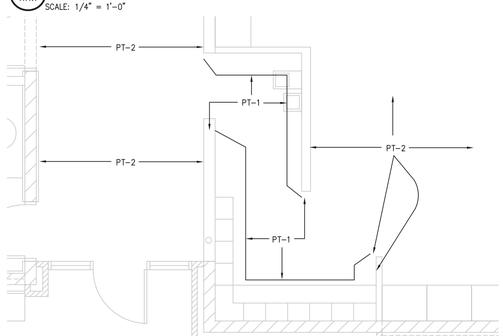
31 A11.1 FLOOR FINISH PLAN - TOILETS,SHOWERS, VESTIBULE

SCALE: 1/4" = 1'-0"



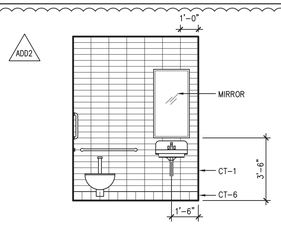
41 A11.1 TILE FINISH PLAN - TOILETS AND SHOWERS

SCALE: 1/4" = 1'-0"



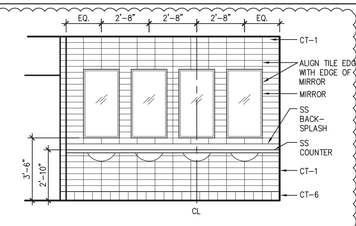
51 A11.1 PAINT AREAS - LOCKER ROOM 113

SCALE: 1/4" = 1'-0"



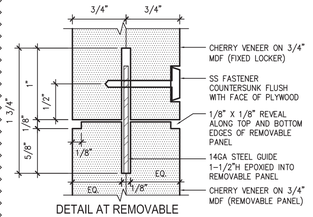
12 A11.1 WALL TILE ELEVATION

SCALE: 1/4" = 1'-0"



13 A11.1 WALL TILE ELEVATION

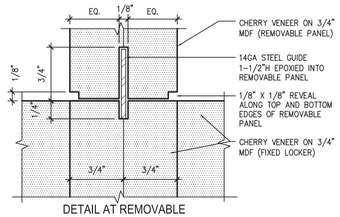
SCALE: 1/4" = 1'-0"



DETAIL AT REMOVABLE

22 A11.1 PANEL TOP

SCALE: 12"=1'-0"



DETAIL AT REMOVABLE

23 A11.1 PANEL BASE

SCALE: 12"=1'-0"

ROOM FINISH SCHEDULE

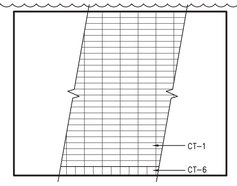
ROOM #	ROOM NAME	FLOOR FINISH	BASE	WALLS N	WALLS E	WALLS S	WALLS W	CEILING MATL	CEILING FINISH	CEILING HEIGHTS	SPECIFIC NOTES
101	MECHANICAL	SCONC.	-	-	-	-	-	EXP. ST.	-	-	
102	ELECTRICAL	SCONC.	-	-	-	-	-	EXP. ST.	-	-	
103	HEAD COACH	CPT-3	RB-1	PT-3	PT-3	PT-3	PT-3	APC	-	10'-4"	
104	LOCKERS	CPT-3	RB-1	PT-3	PT-3	PT-3	PT-3	APC	-	9'-0"	
105	TOILET	CT-2,3,4,5	CT-6	CT-1	CT-1	CT-1	CT-1	GWB	PT-2	9'-2"	
106	COACHES	CPT-3	RB-1	PT-3	PT-3	PT-3	PT-3	APC	-	10'-0"	
107	TREATMENT	CPT-3	RB-1	PT-3	PT-3	PT-3	PT-3	APC	-	10'-4"	
108	VESTIBULE	WD-1, CPT-2	RB-1	PT-2	PT-2	PT-2	PT-2	APC	-	VARIES	2
109	RECEPTION	CPT-3	RB-1	PT-2	PT-2	PT-2	PT-2	APC	-	10'-0"	
110	TOILETS	CT-2,3,4,5	CT-6	CT-1	CT-1	CT-1	CT-1	GWB	PT-2	9'-2"	
111	JANITOR	SCONC.	RB-1	PT-2	PT-2	PT-2	PT-2	EXP. ST.	-	-	
112	SHOWERS	CT-8	CT-7	CT-1	CT-1	CT-1	CT-1	GWB	PT-2	9'-2"	
113	LOCKER ROOM	CPT-1,3	RB-1	PT-1,2	PT-2	PT-1,2	PT-1,2	GWB / WD	PT-2	VARIES	1, 2

FINISH SCHEDULE NOTES:

1. SEE 51.A11.1 FOR PAINT COLOR LOCATIONS IN LOCKER ROOM 113
2. SEE REFLECTED CEILING PLAN FOR CEILING ELEVATIONS

INTERIOR PAINT LEGEND:

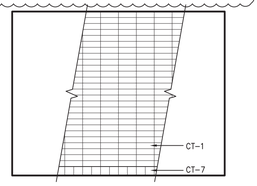
ABBREVIATION	COLOR	MANUFACTURER
PT-1	50 YY – 63/041	ICI
PT-2	SW7005 PURE WHITE	SHERWIN WILLIAMS
PT-3	AC-26 OZARK SHADOWS	BENJAMIN MOORE



TOILET

42 A11.1 TILE ELEVATION - TYP.

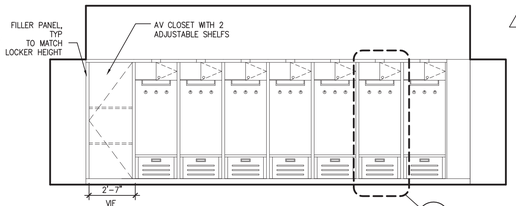
SCALE: 1/4" = 1'-0"



SHOWER

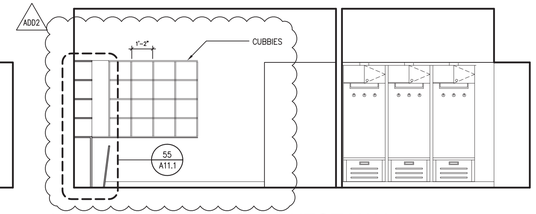
43 A11.1 TILE ELEVATION - TYP.

SCALE: 1/4" = 1'-0"



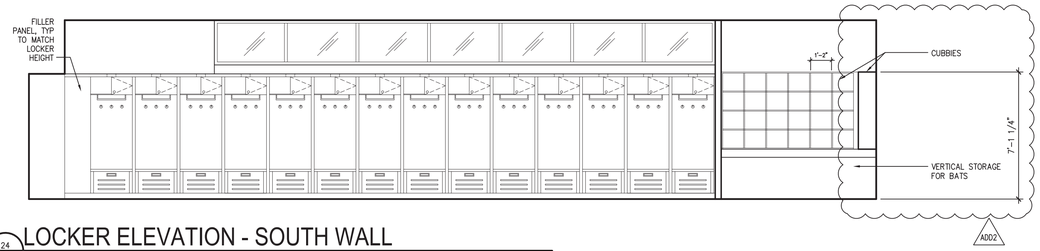
14 A11.1 LOCKER ELEVATION - EAST WALL

SCALE: 1/4" = 1'-0"



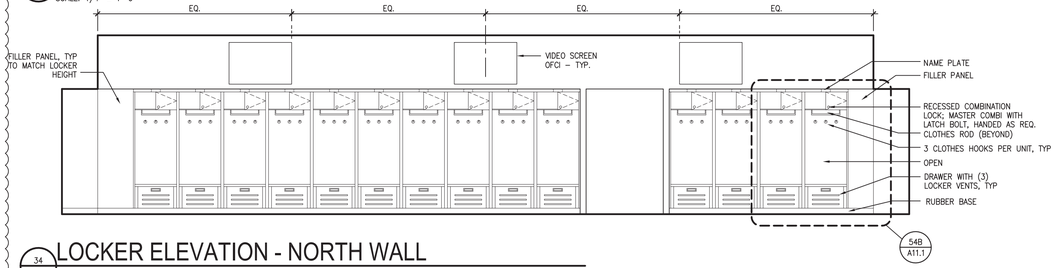
15 A11.1 LOCKER ELEVATION - WEST WALL

SCALE: 1/4" = 1'-0"



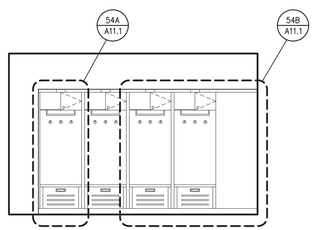
24 A11.1 LOCKER ELEVATION - SOUTH WALL

SCALE: 1/4" = 1'-0"



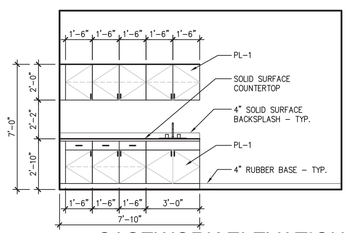
34 A11.1 LOCKER ELEVATION - NORTH WALL

SCALE: 1/4" = 1'-0"



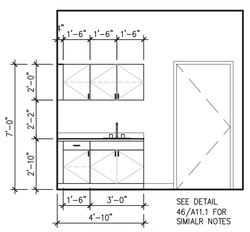
44 A11.1 LOCKER ELEVATION - 104

SCALE: 1/4" = 1'-0"



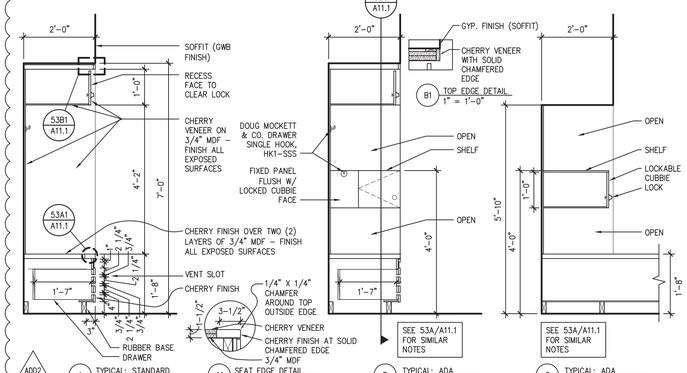
45 A11.1 CASEWORK ELEVATION

SCALE: 1/4" = 1'-0"



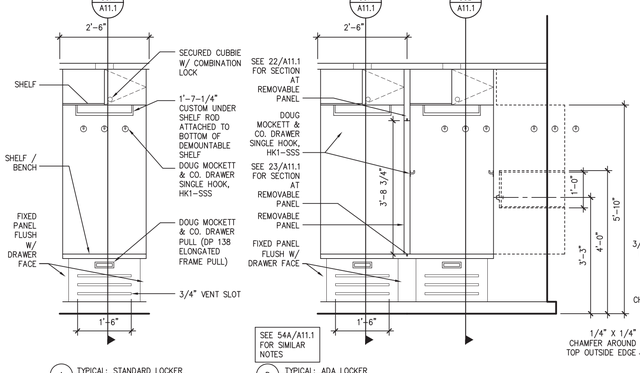
46 A11.1 CASEWORK ELEVATION

SCALE: 1/4" = 1'-0"



53 A11.1 LOCKER SECTIONS - STANDARD & ADA

SCALE: 1/2"=1'-0"



SECTION AT CUBBIES / BAT STORAGE

54 A11.1 LOCKERS: INTERIOR CONFIGURATION

SCALE: 1/2"=1'-0"

55 A11.1 SECTION AT CUBBIES / BAT STORAGE

SCALE: 1/2"=1'-0"

56 A11.1 LOCKER DETAIL

SCALE: 1 1/2"=1'-0"

REGISTERED ARCHITECT • ROBERT J. ESAU • PORTLAND, OR • STATE OF OREGON

Robert J. Esau

Digitally signed by Robert J. Esau
DN: cn=Robert J. Esau, o=DLR Group, ou, email=resau@dlrgroup.com, c=US
Date: 2014.05.30 11:15:39 -07'00'

INTERIOR ELEVATIONS, FINISH PLANS, DETAILS
OSU GOSS STADIUM EXPANSION

BID & PERMIT SET

A11.1

74-13115-00
04-29-14
05/29/14 - ADD-2
ATTACHMENT A11

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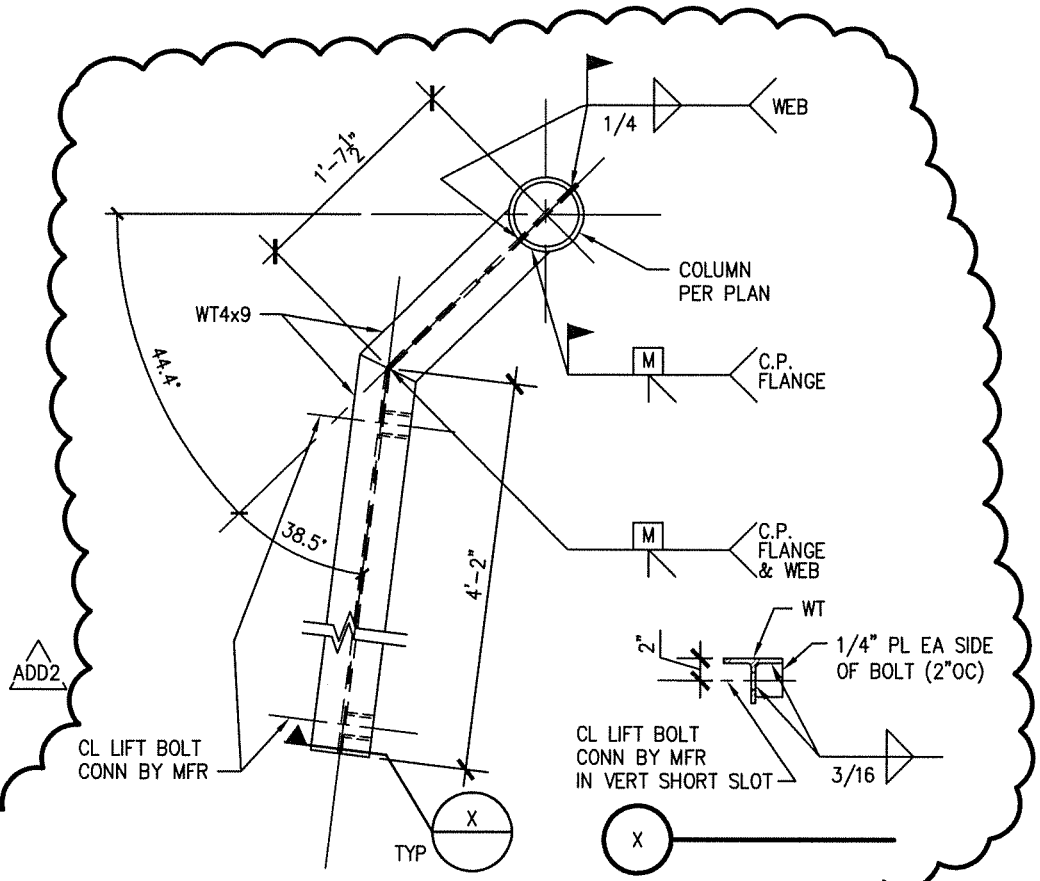

LIFT MAST SUPPORT - PLAN

11
S0.1

SCALE: NO SCALE

STRUCTURAL
REGISTERED PROFESSIONAL
ENGINEER
87395
OREGON
MARCH 15, 2013
MICHAEL WERNER ZIEMANN

Renews 6/30/14

Attachment S1 to
ADDENDUM 2
Dated: 05-29-14

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S0.1
74-13115-00
04-29-14

GENERAL STRUCTURAL NOTES
OSU GOSS STADIUM EXPANSION

BID & PERMIT SET

LEGEND NOTES

⑦ 3 1/2" AIR-ENTRAINED CONCRETE WITH 6X6 W2.9XW2.9 WWF OVER 2" X20 GA METAL DECK (TOTAL SLAB DEPTH=5 1/2"), TYPICAL FLOOR SLAB. TOP OF STEEL ELEVATION = 14'-10 1/2" UNLESS NOTED OTHERWISE.

ADD2

⑧ POUR CONCRETE 1" ABOVE TOP OF DECK FLUTES AT LIFT. PROVIDE 5x3x3/8 ANGLE FRAMING CENTERED BELOW LIFT ANCHORS SIMILAR TO DETAIL 43B/S4.2.

⑨ FRAME EXTERIOR SOFFIT WITH 600S162-33 STUDS AT 24" OC

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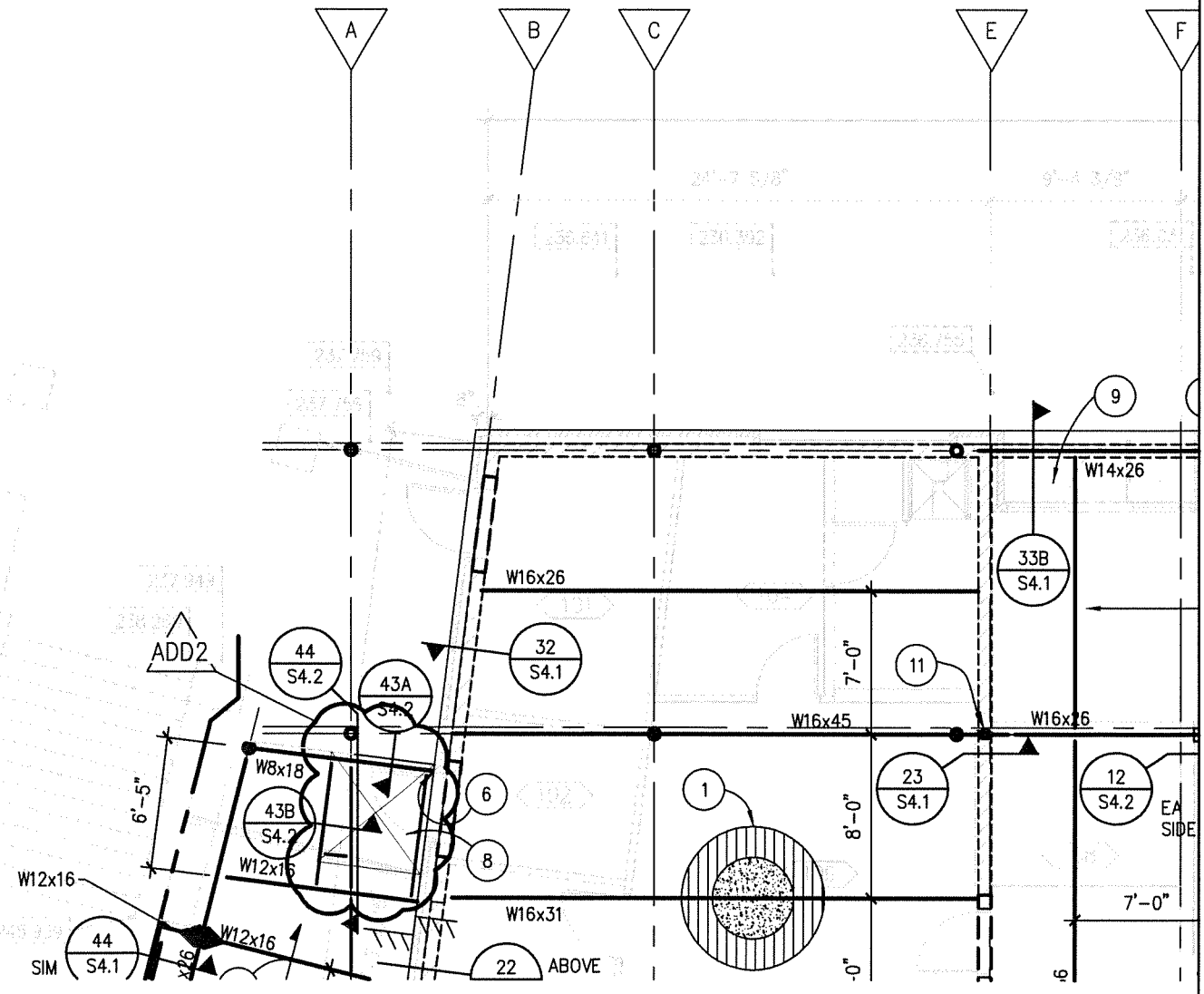
OREGON
MARCH 15, 2013
MICHAEL WERNER ZIEMANN

Renews 6/30/14



PARTIAL CONCOURSE LEVEL FRAMING PLAN

NORTH SCALE: 1/8" = 1'-0"

Attachment S2 to
ADDENDUM 2
Dated: 05-29-14

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S2.1
74-13115-00
04-29-14

CONCOURSE LEVEL FRAMING PLAN
OSU GOSS STADIUM EXPANSION

BID & PERMIT SET

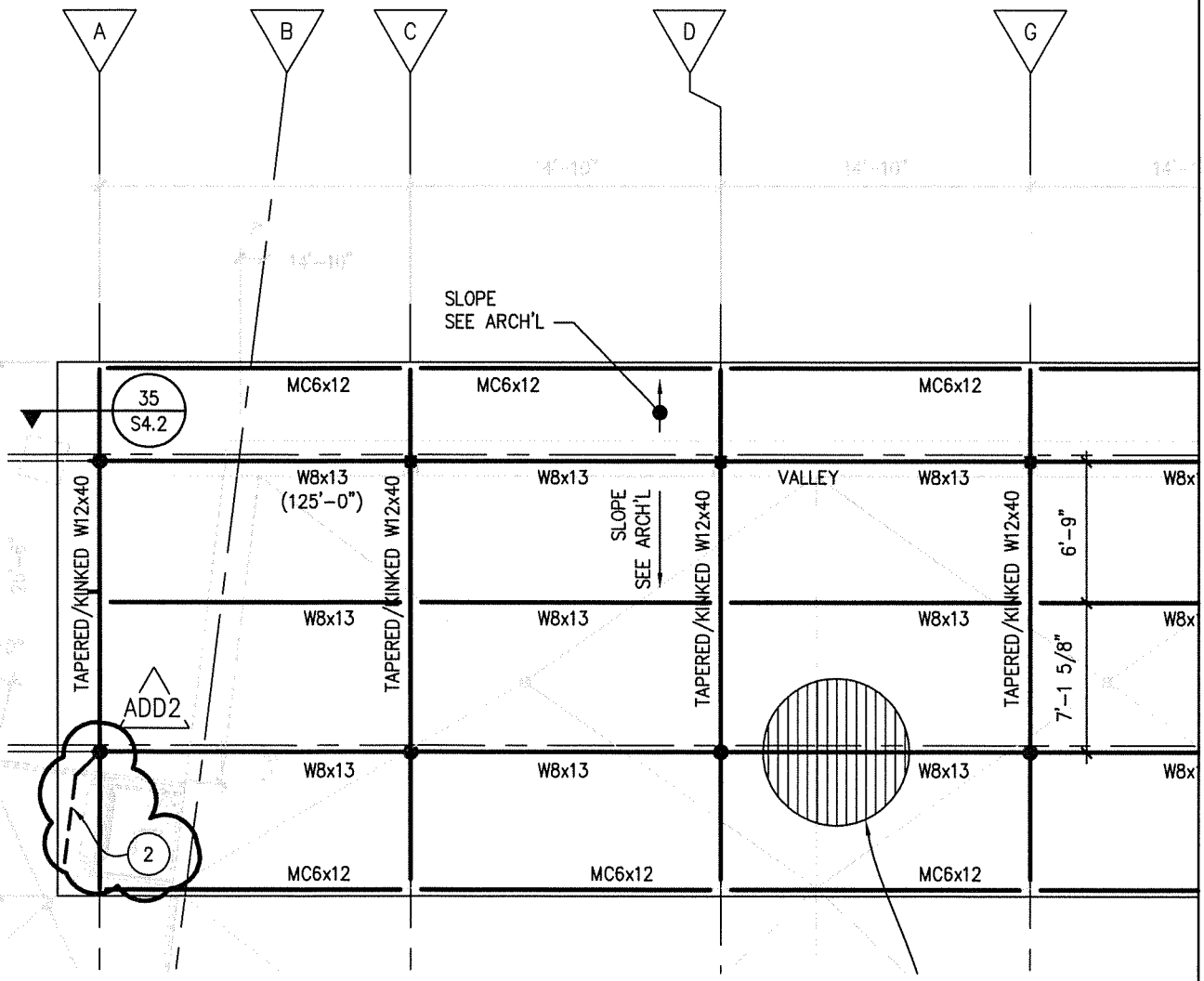
LEGEND NOTES

1. FRAME EXTERIOR SOFFIT WITH 600S162-33 STUDS AT 24" OC
2. LIFT TIEBACK SUPPORT BRACE BELOW. SEE DETAIL 11/S0.1. COORIDINATE ELEVATION WITH LIFT MFR.

ADD2

STRUCTURAL
REGISTERED PROFESSIONAL ENGINEER
87395
OREGON
MARCH 15, 2013
MICHAEL WERNER ZIEMANN

Renews 6/30/14



PARTIAL CANOPY LEVEL FRAMING PLAN

NORTH

SCALE: 1/8" = 1'-0"

Attachment S3 to
ADDENDUM 2
Dated: 05-29-14

\\PDXDATA1\Projects\74-13115-00*dwg\S1\zz-fr2a.dwg - May 27, 2014 4:25pm - mziemann

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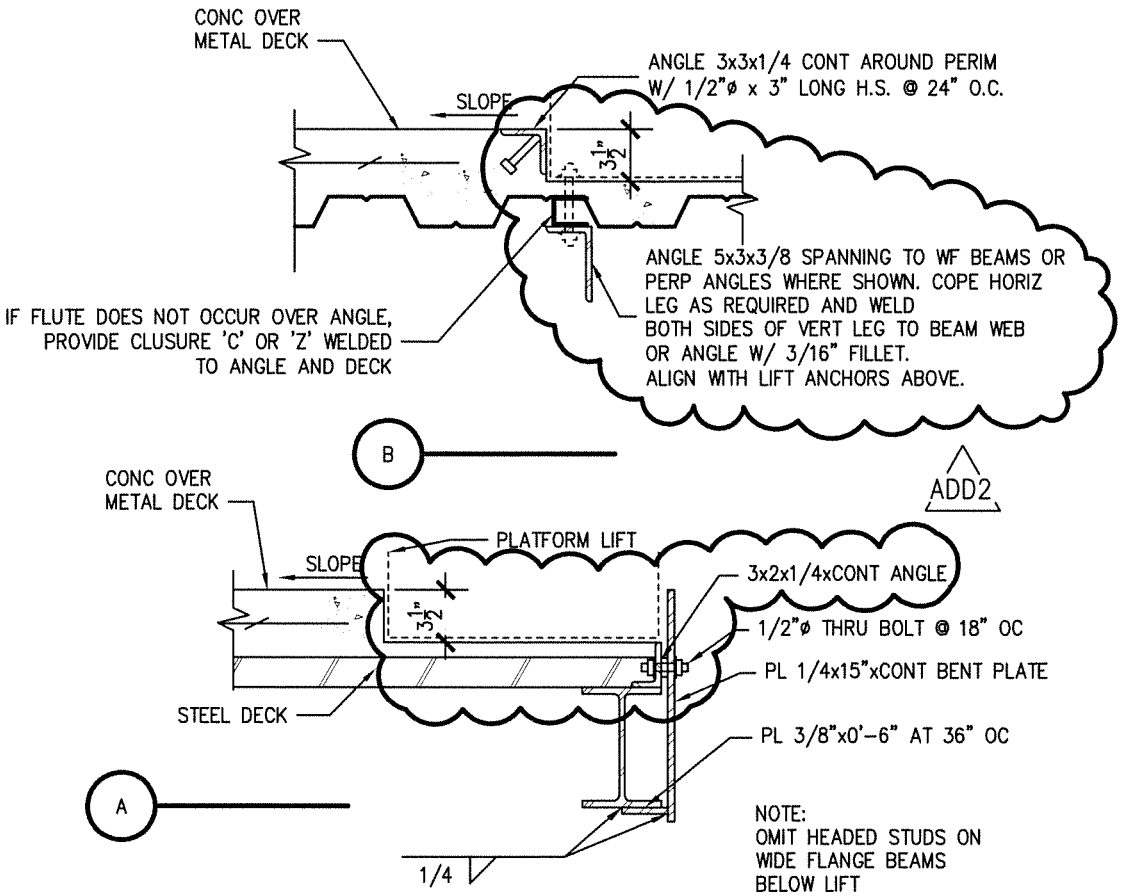
S2.2
74-13115-00
04-29-14

CANOPY LEVEL FRAMING PLAN
OSU GOSS STADIUM EXPANSION

BID & PERMIT SET



COMP DECK AT LIFT

43
S4.2

SCALE: NO SCALE

STRUCTURAL
REGISTERED PROFESSIONAL
ENGINEER
87395
OREGON
MARCH 15, 2013
MICHAEL WERNER ZIEMANN

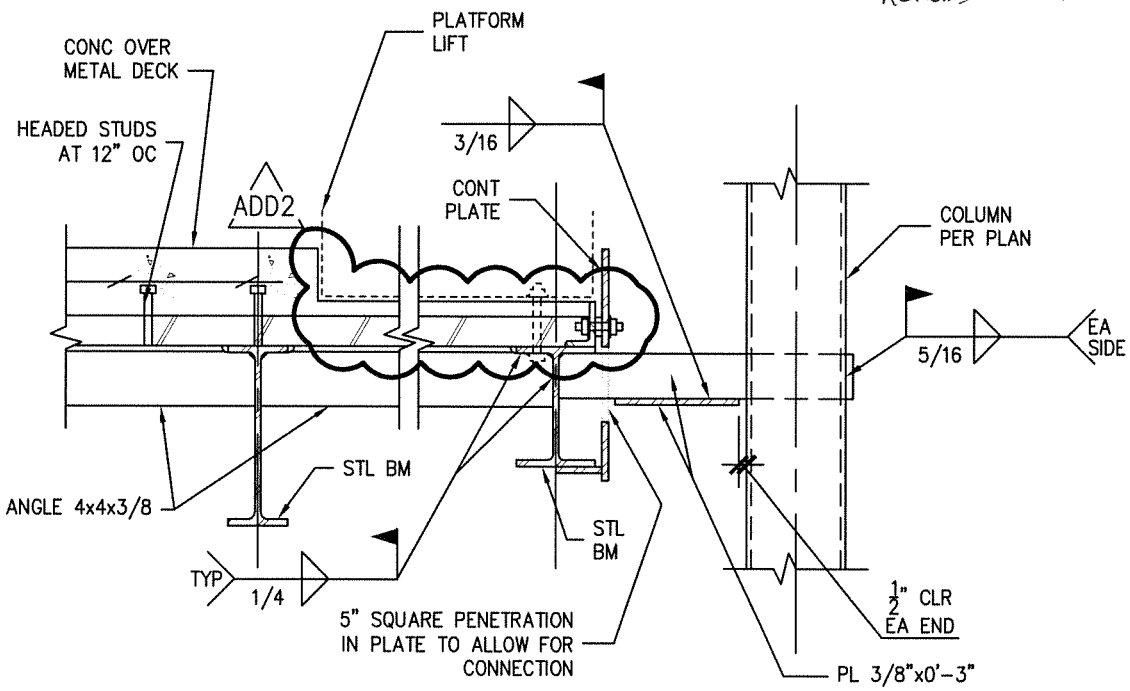
Renews 6/30/14

Attachment S4 to
ADDENDUM 2
Dated: 05-29-14

S4.2
74-13115-00
04-29-14

STRUCTURAL DETAILS
OSU GOSS STADIUM EXPANSION

BID & PERMIT SET



DRAG CONNECTION

44
S4.2

SCALE: NO SCALE

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER
87395
OREGON
MARCH 15, 2013
MICHAEL WERNER ZIEMANN
Renews 6/30/14

Attachment S5 to
ADDENDUM 2
Dated: 05-29-14

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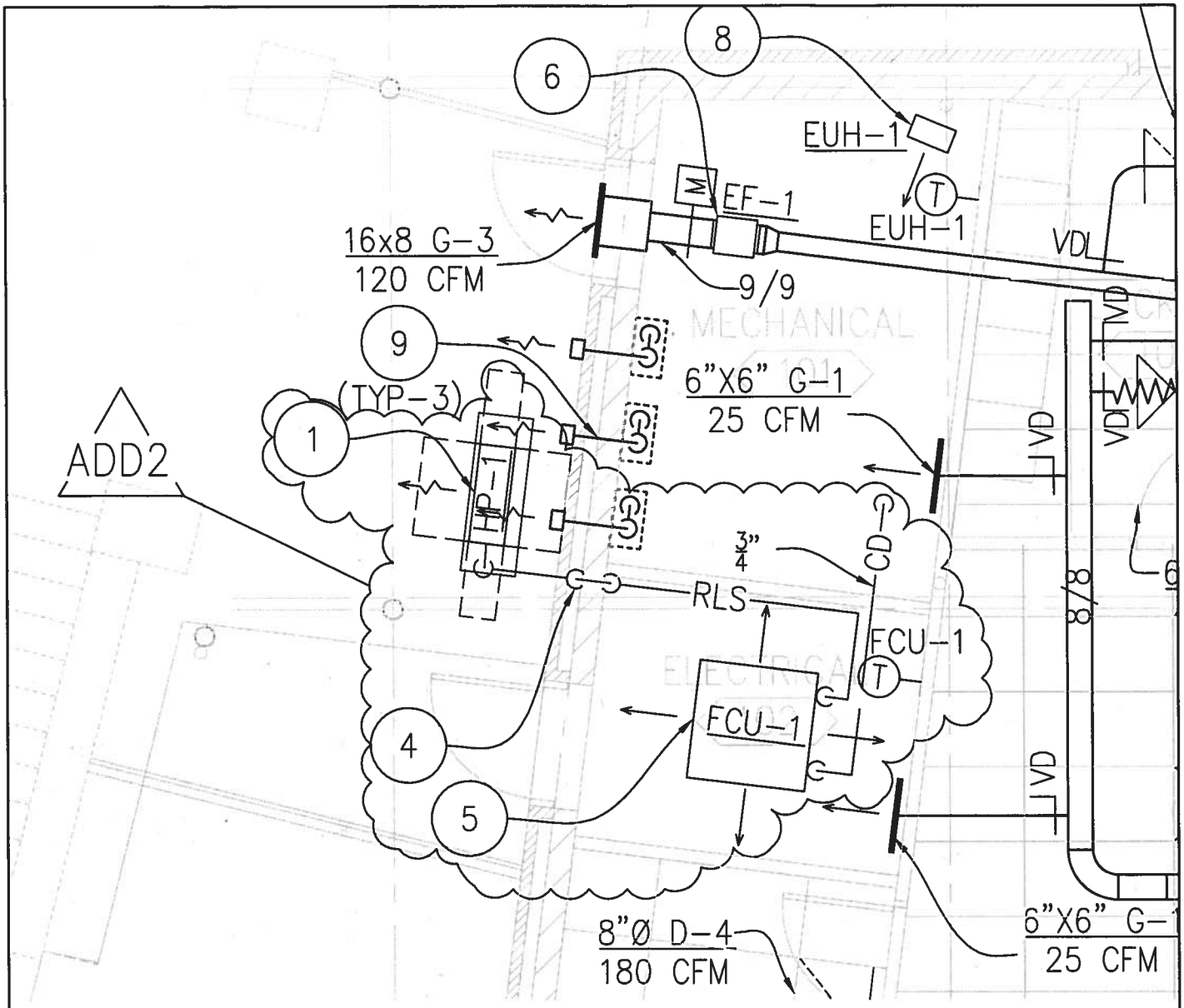
Architecture Planning Interiors

S4.2
74-13115-00
04-29-14

STRUCTURAL DETAILS
OSU GOSS STADIUM EXPANSION

BID & PERMIT SET



REGISTERED PROFESSIONAL ENGINEER
84086PE
OREGON
MARCH 9, 2010
CHRISTOPHER NARRAMORE
5/28/14

EXPIRES: 12/31/2014

NORTH

MECHANICAL PLAN - GROUND LEVEL

SCALE: 1/8" = 1'-0"

Attachment M1 to
ADDENDUM 2
Dated: 05-29-14

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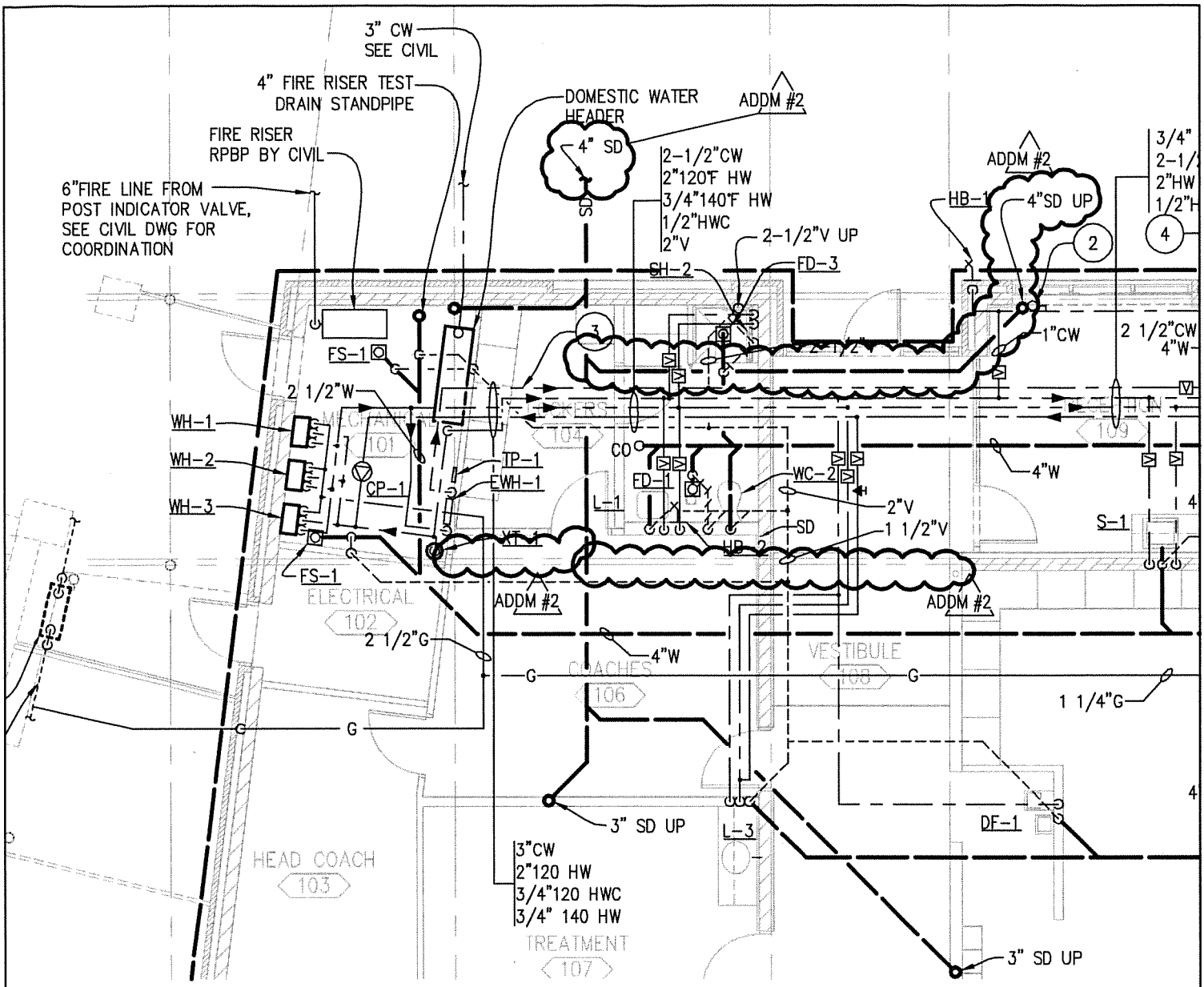
Architecture Planning Interiors

M1.1
74-13115-00
04-29-14

MECHANICAL PLAN - GROUND LEVEL
OSU GOSS STADIUM EXPANSION
BID & PERMIT SET



REGISTERED PROFESSIONAL ENGINEER
84086PE
OREGON
MARCH 9, 2010
CHRISTOPHER NARRAMORE
5/29/14
EXPIRES: 12/31/2014

PLUMBING PLAN - GROUND LEVEL

NORTH

SCALE: 1/8" = 1'-0"

Attachment P1 to
ADDENDUM 2
Dated: 05-29-14

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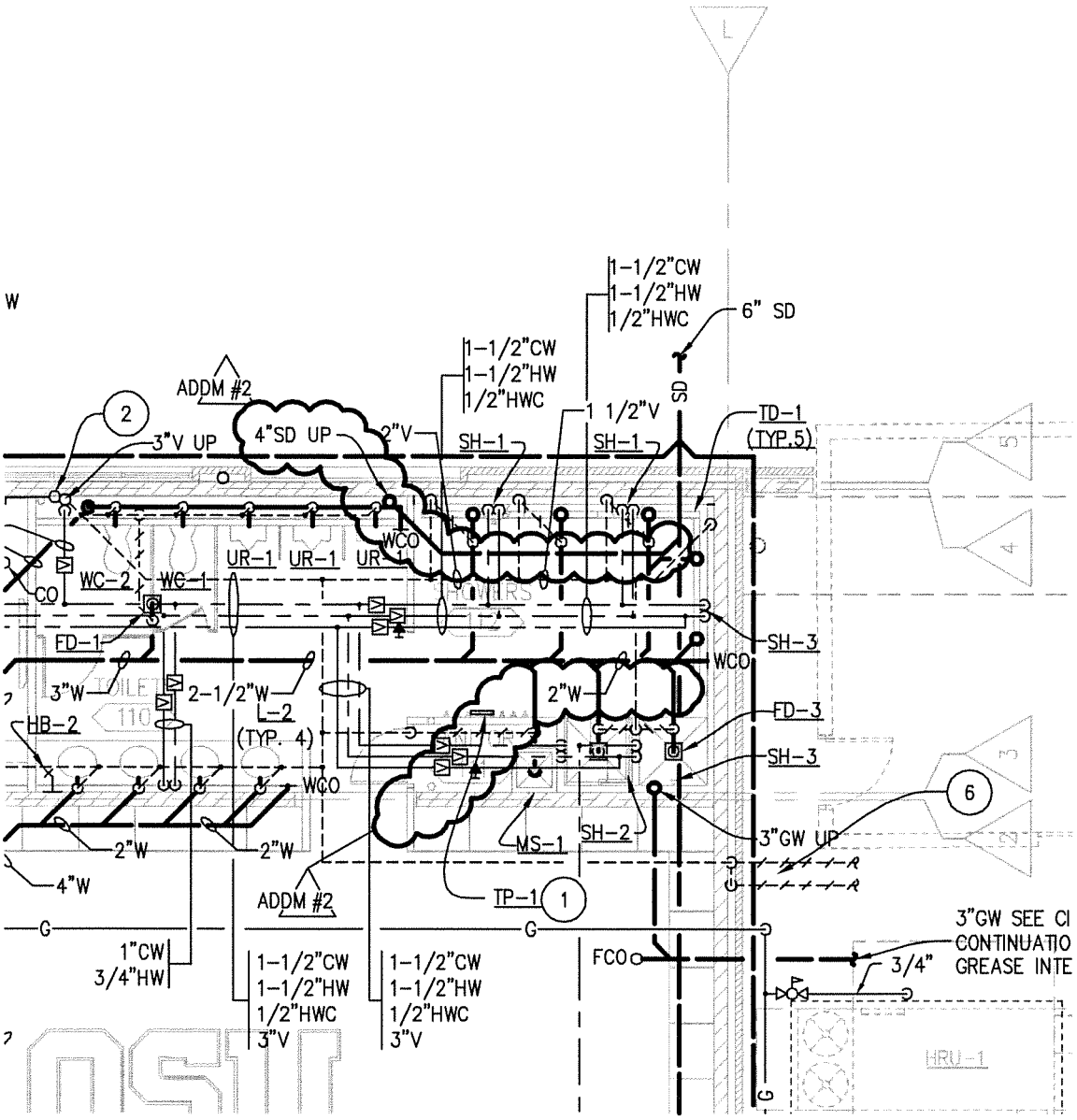
Architecture Planning Interiors

P1.1
74-13115-00
04-29-14

PLUMBING PLAN - GROUND LEVEL
OSU GOSS STADIUM EXPANSION
BID & PERMIT SET



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OREGON
MARCH 9, 2010
CHRISTOPHER NARRAMORE
5/28/14
EXPIRES: 12/31/2014

NORTH

PLUMBING PLAN - GROUND LEVEL

SCALE: 1/8" = 1'-0"

Attachment P2 to
ADDENDUM 2
Dated: 05-29-14

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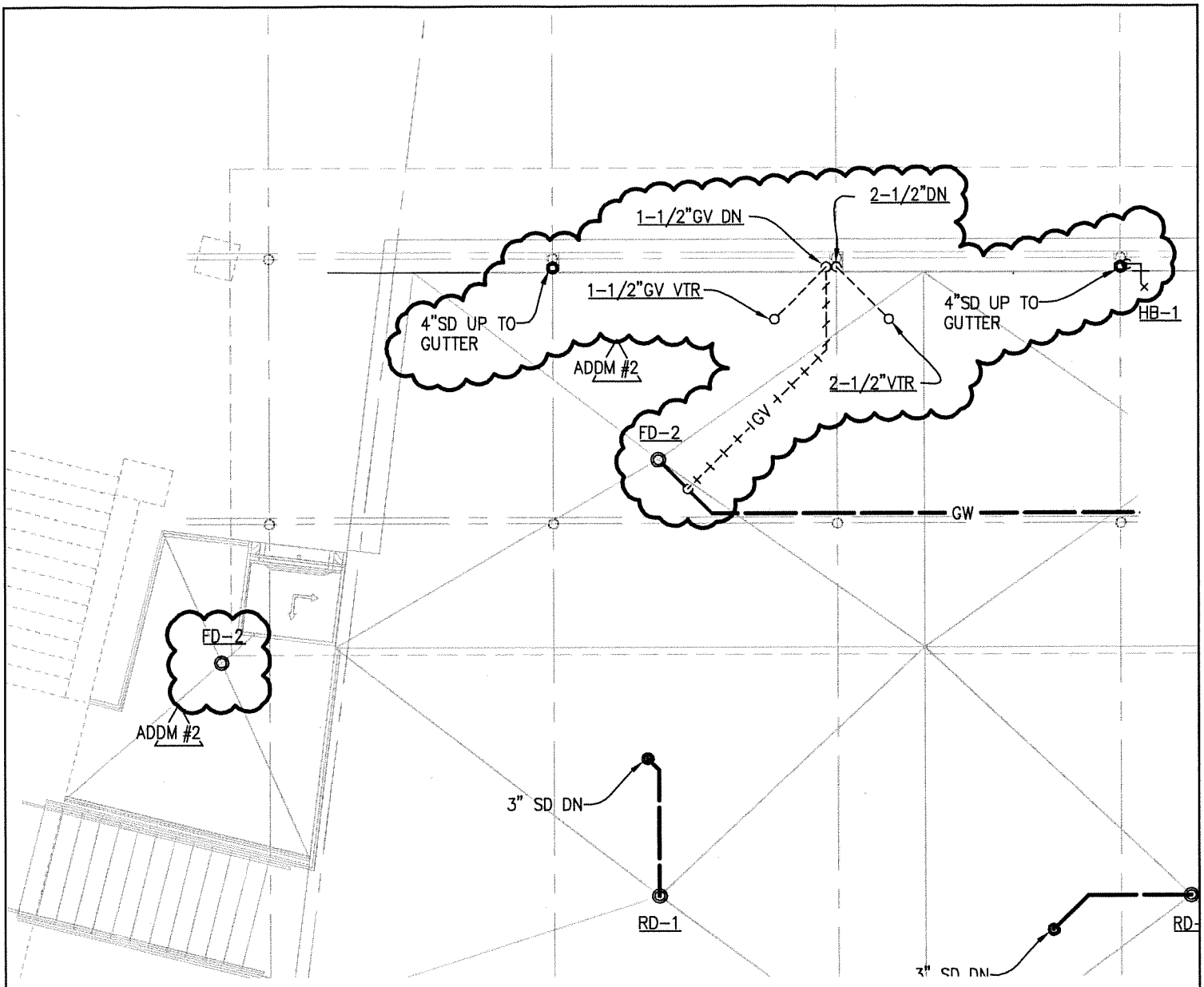
P1.1
74-13115-00
04-29-14

PLUMBING PLAN - GROUND LEVEL
OSU GOSS STADIUM EXPANSION
BID & PERMIT SET



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MARCH 9, 2010
CHRISTOPHER NARRAMORE

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5/30/14

NORTH

PLUMBING PLAN - CONCOURSE LEVEL

SCALE: 1/8" = 1'-0"

Attachment P3 to
ADDENDUM 2
Dated: 05-29-14

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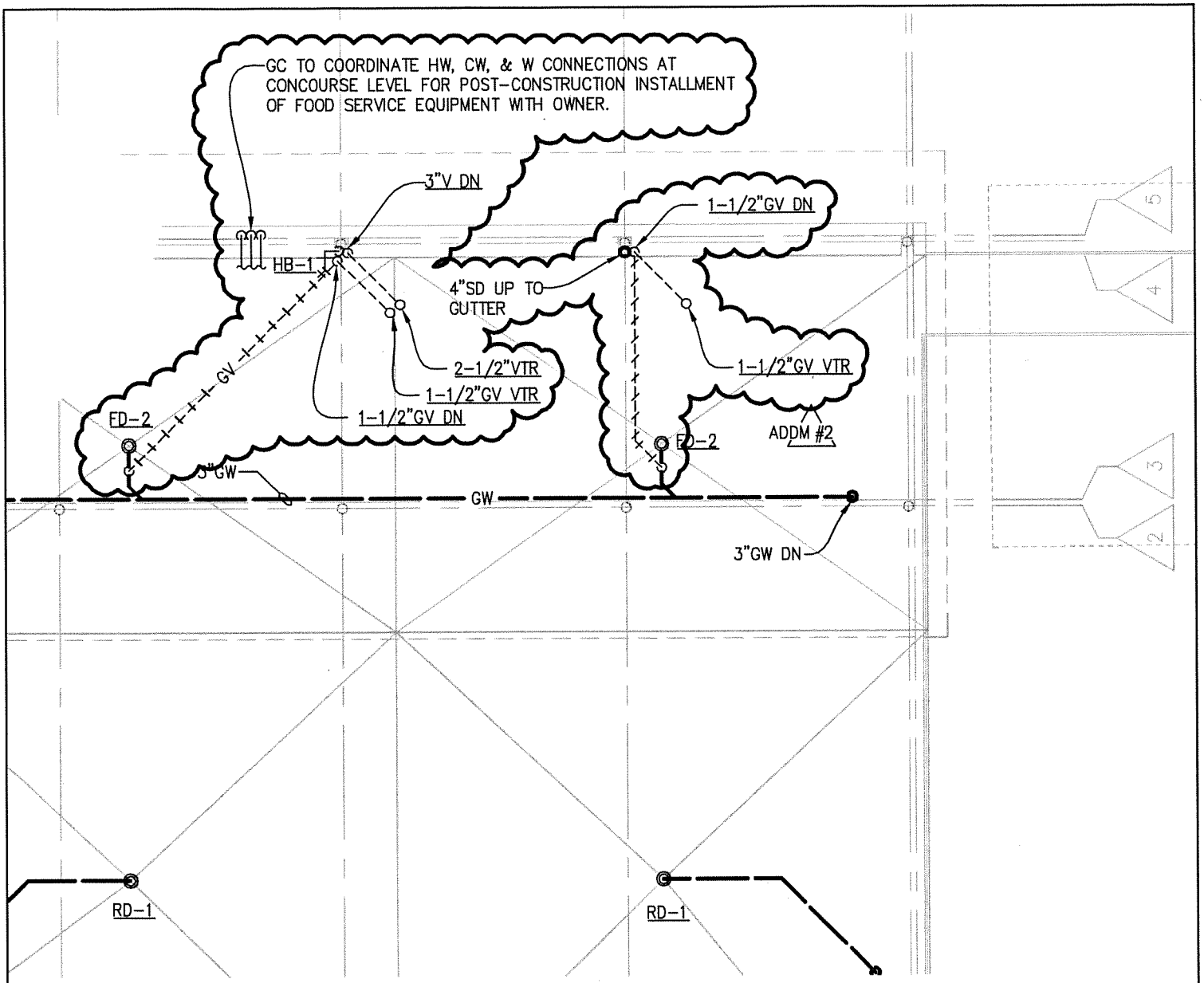
P1.2
74-13115-00
04-29-14

PLUMBING PLAN - CONCOURSE LEVEL
OSU GOSS STADIUM EXPANSION

BID & PERMIT SET



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NORTH

PLUMBING PLAN - CONCOURSE LEVEL

SCALE: 1/8" = 1'-0"

Attachment P4 to
ADDENDUM 2
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PLUMBING PLAN - CONCOURSE LEVEL
OSU GOSS STADIUM EXPANSION
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PLUMBING FIXTURE SCHEDULE

MARK	FIXTURE	LOCAL CONNECTIONS W (IN)	V (IN)	CW (IN)	HW (IN)	BASIS OF DESIGN
DF-1	DRINKING FOUNTAIN	1-1/2"	1-1/2"	1/2"	–	ELKAY EHWM217C
FD-1	FLOOR DRAIN	3"	1-1/2"	–	–	JAY R. SMITH 2005Y
RD-1	ROOF DRAIN	3"	–	–	–	JAY R. SMITH 2320
FD-3	FLOOR DRAIN – SHOWER	2"	2"	–	–	JAY R. SMITH 2005Y
FS-1	FLOOR SINK – MECHANICAL RM	3"	2"	–	–	JAY R. SMITH 3041Y-21
HB-1	HOSE BIBB – EXTERIOR NON-FREEZE	–	–	3/4"	–	JAY R. SMITH – NON FREEZE EXTERIOR WALL HYDRANT 5509QT
HB-2	HOSE BIBB – CW INTERIOR	–	–	3/4"	–	JAY R. SMITH WALL HYDRANT 5518
L-1	LAVATORY – WALL HUNG	2"	1-1/2"	1/2"	1/2"	WALL HUNG, KOHLER K-1722 WITH CHICAGO 116.102.AB.1
L-2	LAVATORY RESTROOM – UNDER MOUNT	2"	1-1/2"	1/2"	1/2"	UNDER MOUNT, KOHLER K-2240 WITH CHICAGO 116.102.AB.1
L-3	LAVATORY LOUNGE/TAPING – UNDER MOUNT	2"	1-1/2"	1/2"	1/2"	UNDER MOUNT, KOHLER K-2240 WITH CHICAGO 895-317ABCP
MS-1	MOP SINK	3"	2"	1/2"	1/2"	KOHLER K-6713-2ER2 WITH HUSKY CHICAGO 897-VBRAS
S-1	RECEPTION SINK	2"	1-1/2"	1/2"	1/2"	ELKAY ELU2816PD WITH CHICAGO 201-AGN8AE35-317AB
SH-1	SHOWER	–	–	1/2"	1/2"	BRADLEY WS-3W-HD-SF-AKV-LBJ-RSD-BH
SH-2	SHOWER ADA	–	–	1/2"	1/2"	BRADLEY WS3W-HD-SF-AKV-LBJ-SR-RSD-BSR-BSR

ADDM #2 (DF-1, FD-1, L-3, S-1, SH-1)

PLUMBING FIXTU

MARK	NOTES	REMARKS
DF-1	5	PROVIDE WITH ELKAY LKAPR2 CANE APRON
FD-1		1/2" CONNECTION TO TP-1
RD-1	–	SLAB EXTENSION, VANDAL PROOF GRATE, BRONZE GRATE
FD-3	6	CHROME PLATED STRAINER, TRAP PRIMER CONNECTION NOT REQURED
FS-1		
HB-1		NON FREEZE WALL HYDRANT WITH ANTI SIPHON, AUTOMATIC DRAINING AND INTEGRAL BACKFLOW PREVENTER
HB-2		BOX TYPE WITH CONCEALED HOSE CONNECTION
L-1	1,4	0.5 GPM AERATOR
L-2	1,4	0.5 GPM AERATOR
L-3	1,4	0.5 GPM AERATOR
MS-1		PROVIDE W/DOME STRAINER, LINT BASKET, BRASS DRAIN,
S-1		
SH-1		2.0 GPM FLOW CONTROL, STANDARD HEIGHT
SH-2		STAINLESS STEEL FOLDING SEAT, ADA GRAB BARS, 2.0 GPM FLOW CONTROL, STANDARD HEIGHT

ADDM #2 (DF-1, FD-1, L-3, S-1, SH-1)

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Attachment P5 to ADDENDUM 2 Dated: 05-29-14

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PLUMBING SCHEDULES
OSU GOSS STADIUM EXPANSION

P5.1
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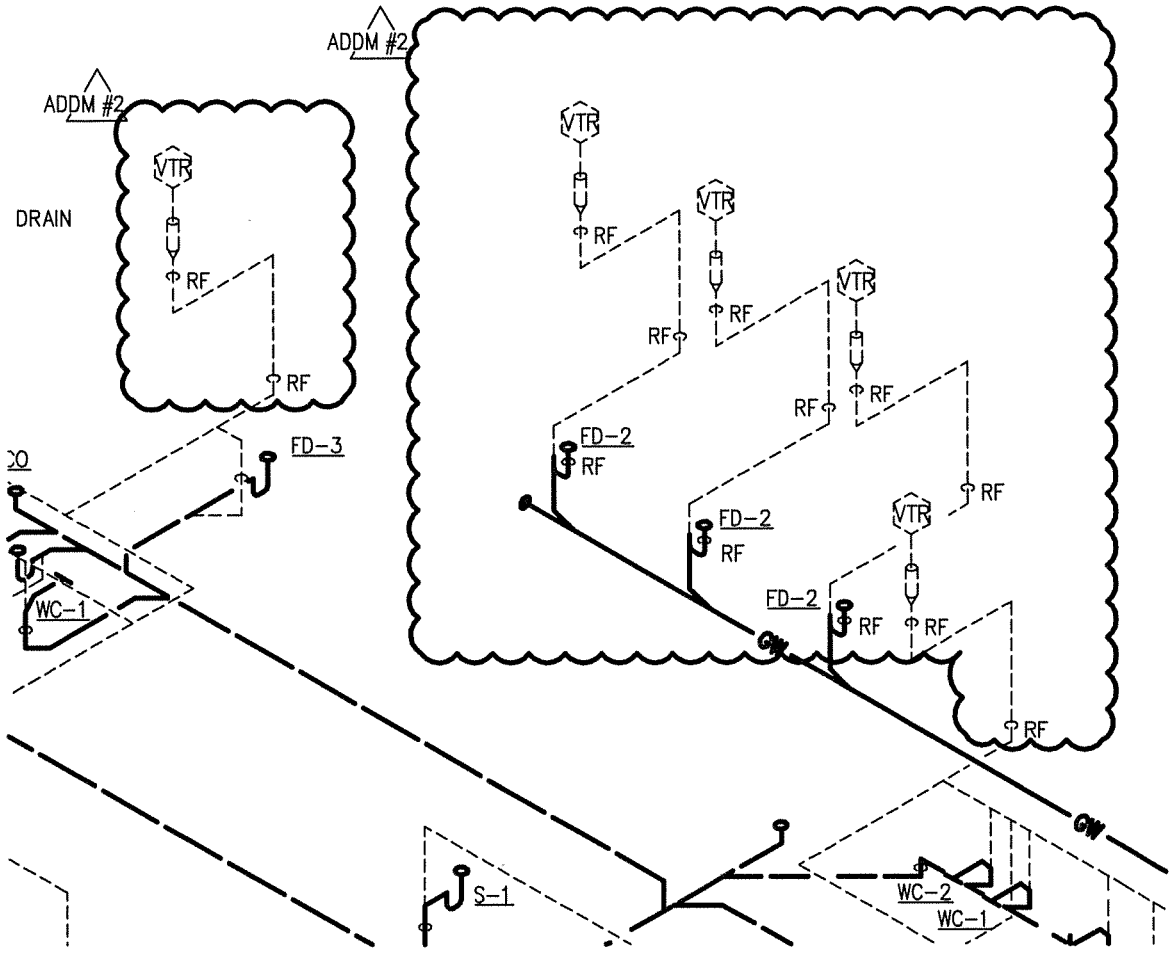

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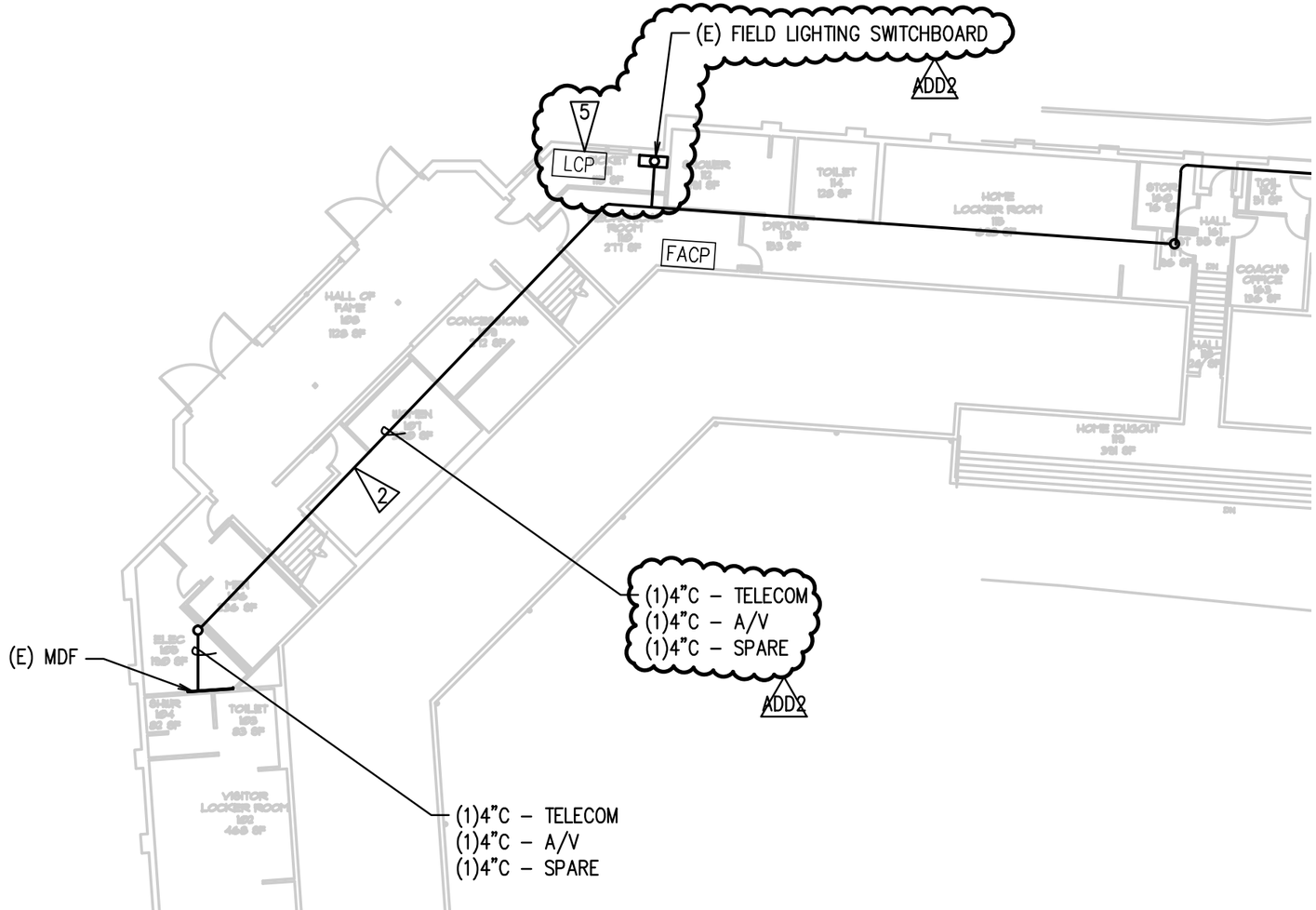
SANITARY WASTE AND VENT RISER DIAGRAM

2
P4.2

SCALE: NO SCALE

NOTE: SEE PLANS FOR SIZES.

Attachment P6 to
ADDENDUM 2
Dated: 05-29-14



1 / E1.0 ELECTRICAL SITE PLAN

SCALE: AS INDICATED

0 10 20 40 60

1 inch plotted — Feet

If measurement is other than 1 inch then the plot is reduced.

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OSU GOSS STADIUM EXPANSION

E1.0

74-13315-00

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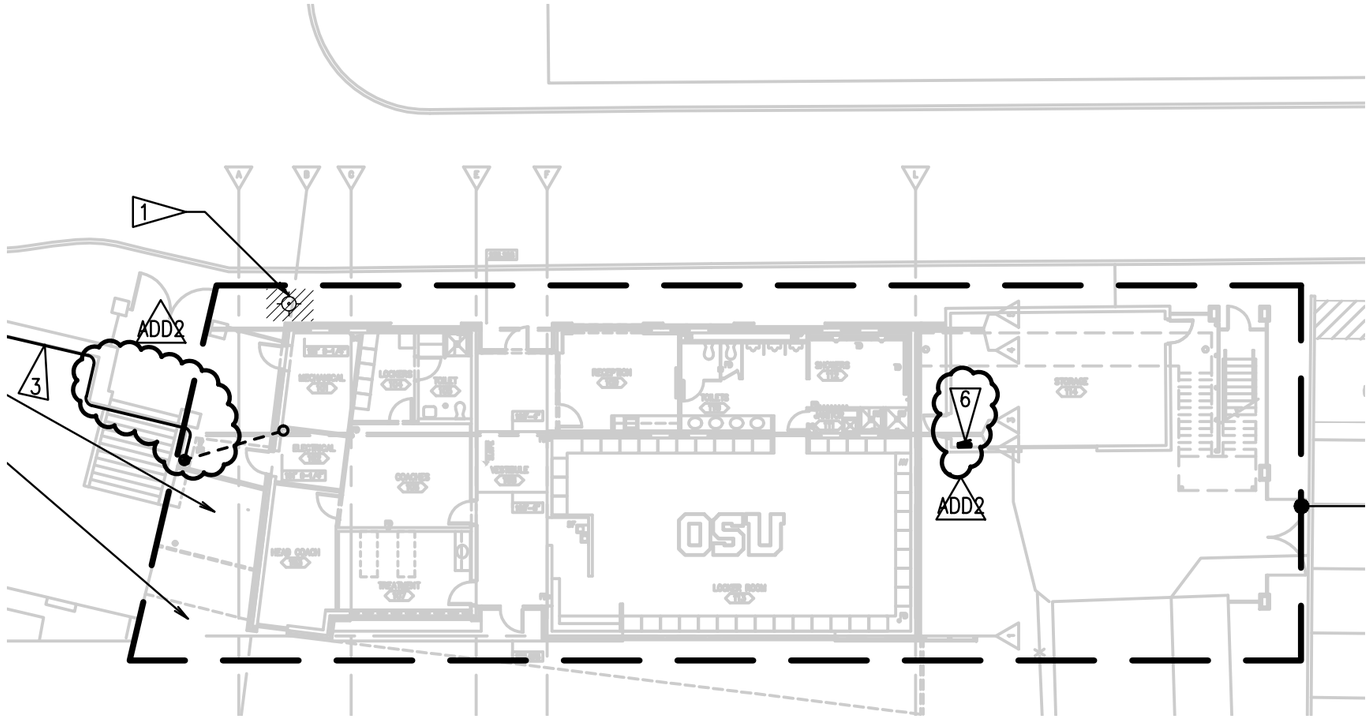

FLAG NOTES:

6 (E) STORAGE ROOM PANEL TO BE FED FROM PANEL A3. REMOVE EXISTING CONDUCTORS BACK TO SOURCE. REMOVE CONDUITS BACK TO EDGE OF EXISTING STADIUM STRUCTURE.
ADD2

1 / E1.0 ELECTRICAL SITE PLAN

SCALE: AS INDICATED

0 10 20 40 60

1 inch plotted — Feet

If measurement is other than 1 inch then the plot is reduced.

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Attachment E2 to ADDENDUM 2 Dated: 05-29-14

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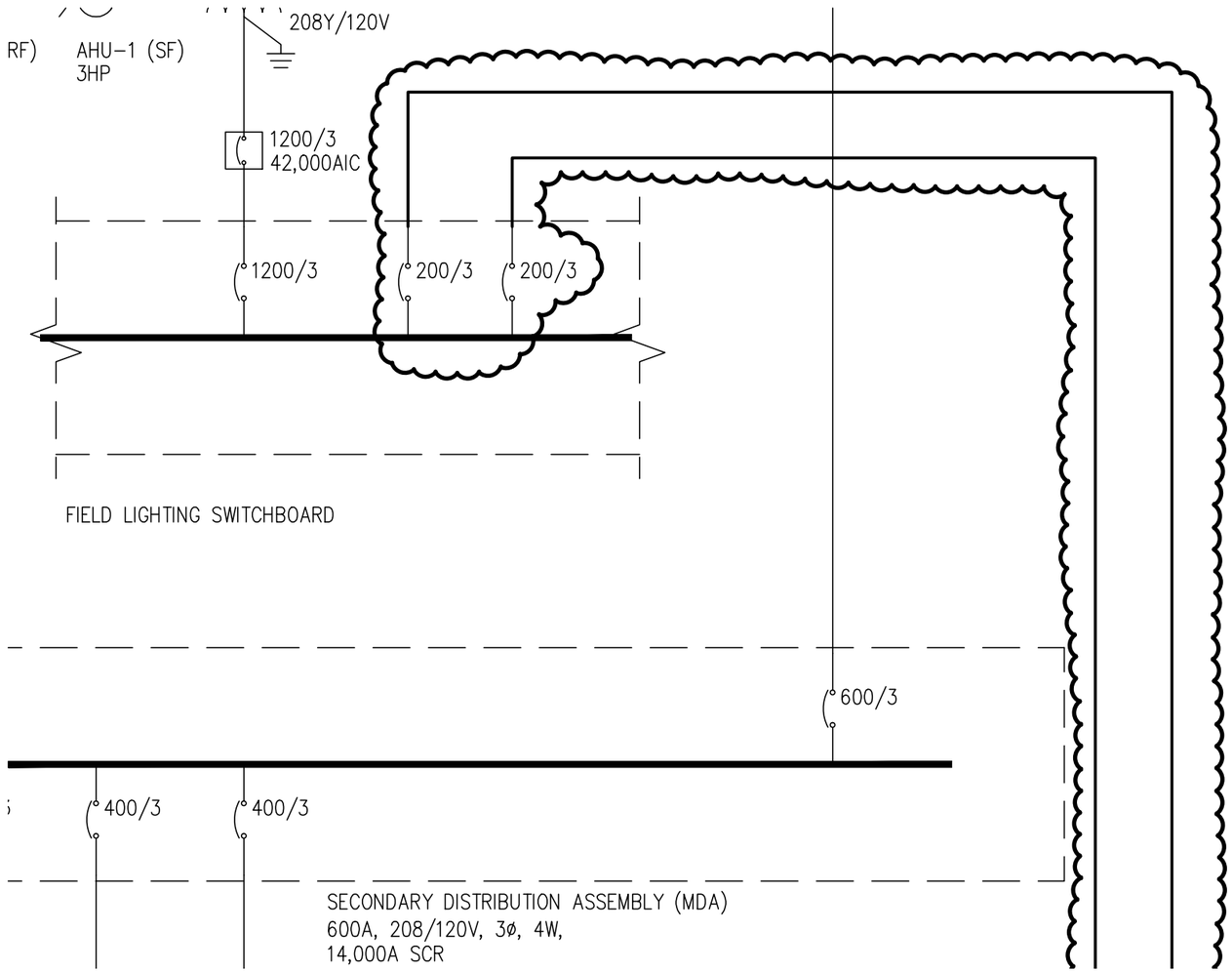

1 / E5.0 PARTIAL ELECTRICAL ONE-LINE DIAGRAM
SCALE: NONE

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ADDENDUM 2
Dated: 05-29-14

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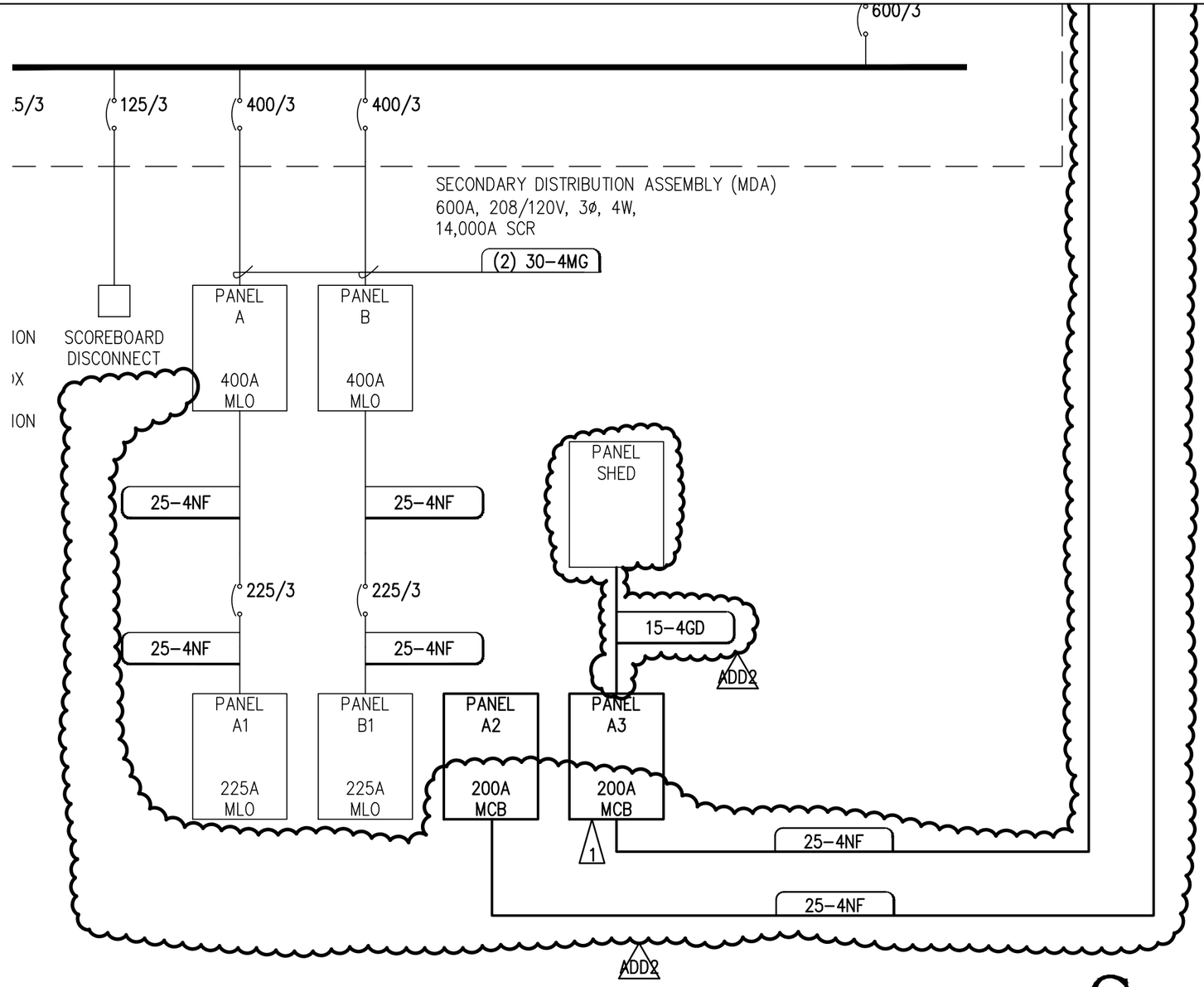

1 / E5.0 PARTIAL ELECTRICAL ONE-LINE DIAGRAM
SCALE: NONE

FLAG NOTES:

1. PROVIDE 100A/3P BREAKER IN PANEL A3 TO BACKFEED EXISTING PANEL IN SHED. REFER TO ADDENDUM DRAWING E2 FOR FURTHER INFORMATION.

ADD2

Attachment E4 to
ADDENDUM 2
Dated: 05-29-14

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E5.0
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