ADDENDUM NO. 3  
June 7, 2013

Duluth International Airport
New Parking Structure and Exterior Wayfinding Signage
Bid Package 2D
Duluth, MN  55811

TO ALL CONTRACTORS:

The following are clarifications and/or changes to the Plans and Specifications, dated May 15, 2013, to be Bid on June 11, 2013, for the above named Project. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification.

1. A specific Bid Form Packet is required for the Prime Contractor's bid submission on this project. Bidders must contact Kim Lofquist, Kraus-Anderson Construction Company, at 218-722-3775 or kim.lofquist@krausanderson.com to obtain the required Bid Form Packet.

   A. Bid Form Packet documents can be found in Volume 1 of the Project Manual, following is a list of those documents included in the Bid Form Packet: City of Duluth cover page; Bid Form; City of Duluth Purchasing Division General Specifications; AIA Document A310 Bid Bond; Affidavit of Non-Collusion; EEO Affirmative Action Policy Statement & Compliance Certificate; Forms 1 & 2 for Demonstration of Good Faith Efforts, Good Faith Efforts Affidavit and Certificate of Good Faith Efforts.

2. Section 00 41 00 – Bid Form

   A. Bid Form

      1. Bid Form replaced in its entirety.

   B. Official Bid Form Packet

      1. The official Bid Form packet will be issued in PDF format after the last Addendum is issued.
2. Note: Only Work Scope 2.20D is required to include the Reynolds, Smith & Hills, Inc.'s, unit price schedule.

3. **Section 01 32 13 - Schedules**

   A. **Schedules, Part 7. Preliminary Schedule Milestone Dates, A**

   1. Add the following note to Item 2: "The underground plumbing, backfill, and slab-on-grade concrete work will not be able to start until after the precast construction is complete."

   2. Delete Item 4 in its entirety and replace with the following: "Substantial completion is on May 1, 2014."

   3. Delete Item 5 in its entirety and replace with the following: "Final completion is on May 16, 2014."

4. **Section 01 23 00 - Alternates**

   A. **Alternates, Part 3 Schedule of Alternate, Par. 3.1 – L, M, & N**

   1. Add the following sentence to the end of Alternate Descriptions 10A, 10B, and 10C: "With this alternate there are thirty one (31) 4'x10' openings and thirty one (31) 4'x2'-2" (which are located directly above the 4'x10' openings) openings in the precast panels along grid line B."

   B. **Alternates, Part 3 Schedule of Alternate, Par. 3.1**

   1. Add the following Alternate No. 13 to Par. 3.1 as indicated below:

      a. "R. Alternate No. 13: Work Scope 9.20D": "Replace the rigid insulation and vapor barrier behind the metal panels on the underside of the skywalk with spray applied closed cell polyurethane. Include all necessary items (backing, etc.) to install the spray foam. Note: Base bid is to include, rigid insulation and foam at perimeter of insulation to create a continuous vapor barrier. This work will not be completed until the summer of 2014."

5. **Section 01 01 40 Work Scope Descriptions**

   A. **Work Scope Index**

   1. Work Scope 10.20U – Interior & Exterior Wayfinding Signage – Add the following under Specification Sections and Remarks: "10 14 53 Traffic Signage Complete."

   2. Work Scope 26.10D – Electrical Systems – Add the following under Specification Sections and Remarks: "Division 27 Communications Complete."
B. **Work Scope Descriptions**

1. **Work Scope 10.20D – Interior & Exterior Wayfinding Signage:**
   
   a. Add the following under Specification Sections: “10 14 53 Traffic Signage Complete.”

2. **Work Scope 26.10D – Electrical Systems:**
   
   a. Add the following under Specification Sections: “Division 27 Communications Complete.”

6. **General Information**

A. **Drawing Page W100**

1. Add Electrical Notes as follows:
   
   a. “Provide 277V power for sign illumination as follows:
      i. Signs E/01, E/04, E/05, & E/08 may be connected to perimeter roadway lighting circuit FP-9 or FP-10.
      ii. Sign E/13 may be connected to roadway lighting circuit FP-5.”
   
   b. “All wiring shall be in conduit.”
   
   c. “Existing circuit splice shall be done in handholes.”

2. Add note as follows: “The contractor shall retain a certified utility locating service to locate all private (DAA owned) utilities within the project limits. It shall be the contractors’ responsibility to locate all private utilities as necessary to complete the work.”

B. See attached Site Electrical “Record” drawings for reference as it relates to the power requirements for the Exterior Wayfinding Signage.

C. See Appendix A for Responses to Bidder Questions (four pages).

D. Add Reynolds, Smith & Hills, Inc.’s, Addendum No. 3 dated June 7, 2013, in its entirety.

END OF ADDENDUM NO. 3
In accordance with the Invitation to Bid and the proposed Contract Documents prepared by Reynolds, Smith and Hills, Inc., relating to the construction of:

Duluth International Airport
New Parking Structure and Exterior Wayfinding Signage
Bid Package 2D
Duluth, Minnesota

the undersigned, having visited the site of proposed construction and having become thoroughly familiar with local conditions affecting the cost and performance of the Work and with all requirements of the Contract Documents and related Addenda, hereby proposes and agrees to provide all labor, materials, equipment, applicable permits and taxes required to construct and complete the Work in accordance with the Contract Documents and Addenda for the following amounts:

**Base Bids:**

Instructions for Submitting Base Bids:

- Base Bid includes the Parking Structure and Skywalk.
- Provide Skywalk and Exterior Wayfinding Signage breakdown in space provided. These costs are to be included in the base bid and broken out in the space provided.
- Note: Cost breakdowns are for funding purposes only. These will not have an impact on award.
- For bidders wishing to submit bids on more than one Work Scope, space has been provided to submit bids for Multiple Work Scopes on the same Bid Form.
- State Base Bid in both words and figures in spaces provided.
1. Base Bid for Work Scope No. 2.20D Title Civil, Site Work, & Building Earthwork
   Bid Amount: ___________________________ $ ________________
   a. Cost Breakdown No. 1: Skywalk (Part of Unit Price 71)
      Breakdown Amount: ___________________________ $ ________________

2. Base Bid for Work Scope No. 2.90D Title Landscaping
   Bid Amount: ___________________________ $ ________________
   a. Cost Breakdown No. 1: Skywalk
      Breakdown Amount: ___________________________ $ ________________

3. Base Bid for Work Scope No. 3.30D Title Concrete
   Bid Amount: ___________________________ $ ________________
   a. Cost Breakdown No. 1: Skywalk
      Breakdown Amount: ___________________________ $ ________________

4. Base Bid for Work Scope No. 3.40D Title Precast Wall Panel & Floor Plank
   Bid Amount: ___________________________ $ ________________
   a. Cost Breakdown No. 1: Skywalk
      Breakdown Amount: ___________________________ $ ________________

5. Base Bid for Work Scope No. 4.20D Title Unit Masonry
   Bid Amount: ___________________________ $ ________________
   a. Cost Breakdown No. 1: Skywalk
      Breakdown Amount: ___________________________ $ ________________

6. Base Bid for Work Scope No. 5.10D Title Struct. Steel & Misc. Metal Fabrication & Erection
   Bid Amount: ___________________________ $ ________________
   a. Cost Breakdown No. 1: Skywalk
      Breakdown Amount: ___________________________ $ ________________
7. Base Bid for Work Scope No. 7.10D Title Metal Panels & Roofing
   Bid Amount: ________________________________ $ __________________
   a. Cost Breakdown No. 1: Skywalk
      Breakdown Amount: ________________________________ $ __________________

8. Base Bid for Work Scope No. 8.22D Title Overhead Coiling Doors
   Bid Amount: ________________________________ $ __________________
   a. Cost Breakdown No. 1: Skywalk
      Breakdown Amount: ________________________________ $ __________________

    Specialties (Materials Only)
   Bid Amount: ________________________________ $ __________________
   a. Cost Breakdown No. 1: Skywalk
      Breakdown Amount: ________________________________ $ __________________

10. Base Bid for Work Scope No. 8.40D Title Aluminum Framed Automatic Entrances, Storefronts, and Glass
    Bid Amount: ________________________________ $ __________________
    a. Cost Breakdown No. 1: Skywalk
       Breakdown Amount: ________________________________ $ __________________

11. Base Bid for Work Scope No. 9.20D Title Metal Studs & Drywall
    Bid Amount: ________________________________ $ __________________
    a. Cost Breakdown No. 1: Skywalk
       Breakdown Amount: ________________________________ $ __________________

12. Base Bid for Work Scope No. 9.60D Title Terrazzo
    Bid Amount: ________________________________ $ __________________
    a. Cost Breakdown No. 1: Skywalk
       Breakdown Amount: ________________________________ $ __________________
13. Base Bid for Work Scope No. 9.65D Title Flooring  
   Bid Amount: ___________________________ $ ________________  
   a. Cost Breakdown No. 1: Skywalk  
      Breakdown Amount: ___________________________ $ ________________  

14. Base Bid for Work Scope No. 9.90D Title Painting  
   Bid Amount: ___________________________ $ ________________  
   a. Cost Breakdown No. 1: Skywalk  
      Breakdown Amount: ___________________________ $ ________________  

15. Base Bid for Work Scope No. 10.20D Title Interior & Exterior Wayfinding Signage  
   Bid Amount: ___________________________ $ ________________  
   a. Cost Breakdown No. 1: Skywalk  
      Breakdown Amount: ___________________________ $ ________________  
   b. Cost Breakdown No. 2: Exterior Wayfinding Signage  
      Breakdown Amount: ___________________________  

16. Base Bid for Work Scope No. 14.20D Title Elevator  
   Bid Amount: ___________________________ $ ________________  
   a. Cost Breakdown No. 1: Skywalk  
      Breakdown Amount: ___________________________ $ ________________  

17. Base Bid for Work Scope No. 21.10D Title Fire Suppression System  
   Bid Amount: ___________________________ $ ________________  
   a. Cost Breakdown No. 1: Skywalk  
      Breakdown Amount: ___________________________ $ ________________  

18. Base Bid for Work Scope No. 22.10D Title Mechanical Systems  
   Bid Amount: ___________________________ $ ________________  
   a. Cost Breakdown No. 1: Skywalk  
      Breakdown Amount: ___________________________ $ ________________  

DULUTH INTERNATIONAL AIRPORT  
NEW PARKING STRUCTURE AND  
EXTERIOR WAYFINDING SIGNAGE  
BID PACKAGE 2D  
ISSUE FOR BID  
FOR REFERENCE ONLY  
Actual Bid Form MUST be obtained through  
Kraus-Anderson Construction Company
   Bid Amount: ________________________________ $ ________________
   a. Cost Breakdown No. 1: Skywalk
      Breakdown Amount: ________________________________ $ ________________
   b. Cost Breakdown No. 2: Exterior Wayfinding Signage
      Breakdown Amount: ________________________________ $ ________________

Combined Base Bid:

Work Scope Numbers and Titles on which Combined Bid is based:

<table>
<thead>
<tr>
<th>Work Scope No.</th>
<th>Title</th>
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Combined Bid Amount: ________________________________ $ ________________

Alternates:

Refer to Section 01 23 00 for complete description of Alternates.

ADD

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<thead>
<tr>
<th>Alternate No.</th>
<th>to Work Scope</th>
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<tbody>
<tr>
<td>1A</td>
<td>8.40D</td>
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<td>1B</td>
<td>26.10D</td>
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<td>2</td>
<td>3.40D</td>
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<tr>
<td>3A</td>
<td>9.60D</td>
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<td>3B</td>
<td>9.65D</td>
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<td>4</td>
<td>26.10D</td>
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<tr>
<td>5</td>
<td>26.10D</td>
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</table>
Alternate No. 6 to Work Scope 26.10D $___________
Alternate No. 7 to Work Scope 26.10D $___________
Alternate No. 8 to Work Scope 26.10D $___________
Alternate No. 9 to Work Scope 26.10D $___________
Alternate No. 10A to Work Scope 3.40D $___________
Alternate No. 10B to Work Scope 5.10D $___________
Alternate No. 10C to Work Scope 1.10D $___________
Alternate No. 11A to Work Scope 1.10D $___________
Alternate No. 11B to Work Scope 7.10D $___________
Alternate No. 12A to Work Scope 8.10D $___________
Alternate No. 12B to Work Scope 8.10D $___________
Alternate No. 13 to Work Scope 3.20D $___________

Addenda: Receipt of the following Addenda to the Contract Documents and their costs being incorporated into the Bid is acknowledged (provide Addenda numbers below):

Addenda No. Dated Addenda No. Dated
_________ ___________ ___________ ___________

Bid Acceptance: If written notice of the acceptance of this Bid is received by the undersigned within 60 days after date set for opening of this Bid, or at any other time thereafter before Bid is withdrawn, the undersigned agrees to enter into and execute a Contract with the Owner in accordance with this Bid as accepted and in a form acceptable to Owner, and to furnish and deliver to the Construction Manager the Performance Bond, Payment Bond, and proof of insurance coverage, all within 10 days after notice of acceptance of this Bid.
Execution of Proposal: The entity(ies) signing this proposal is fully authorized to sign on behalf of the named firm and to fully bind the named firm to all of the conditions and provisions of the Contract. This proposal shall remain valid and not be withdrawn for 60 calendar days after bid due date.

Submitted this _____________ day of ____________________, 20 ______.
Name of Firm: ________________________________
Street Address: ________________________________
City: ___________________ State: _______ Zip: _______
Phone Number: ___________________ Fax Number: ___________________

Bidder is: (check one)
☐ Individual  ☐ Partnership  ☐ Corporation

If Bidder is a corporation, give legal name of corporation, state where incorporated, and names of president and secretary. If a partnership, give names of all individual co-partners composing the firm. If an individual, give first and last name in full.

________________________________________________________________________
Name (typed or printed): ________________________________
Signature: __________________________________________
Title: ________________________________________________

END OF DOCUMENT
FOR REFERENCE ONLY
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<tr>
<td>1.</td>
<td>WS 7.10D</td>
<td>I have some concern with the sizes of the ACM (aluminum composite material) that are currently detailed for the underside of the skywalk. Due to maximum width of ACM sheet being 62&quot; wide, I would propose the introduction of an additional joint line, as the panels are currently detailed at 80&quot; wide, 72&quot; wide, and 60&quot; wide.</td>
<td>To be addressed in Addendum 3.</td>
</tr>
<tr>
<td>2.</td>
<td>WS 7.10D</td>
<td>Please help I can't find &quot;Division D7 Section Roof Specialties.&quot; It is referred to in Spec D75323 EPDM 1.2 B 3. Is there supposed to be a &quot;Roof Specialties&quot; Spec section?</td>
<td>Spec section does not exist. Will revise spec reference in Addendum 3.</td>
</tr>
<tr>
<td>3.</td>
<td>WS 7.10D</td>
<td>The EPDM Spec calls for insulation adhesive to be used. This adhesive needs 40 degrees minumum for application. With the roofs on the two stair towers being constructed during the winter months, this is not going to work. Please advise of an acceptable mechanical fastener instead of the adhesive.</td>
<td>No, roof will be installed as specified.</td>
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**Life Safety Hardware Consultants**

1. WS 8.30D Section 087100 article 2.1 the project calls for Best cylinders; however, on the actual locksets they have 4 other manufacturers listed and excluded the Best locksets. Just want to know if I can bid the Best lockset to go with the cores? Manufacturer of locks and keyed cylinders must match items provided on the new terminal project. All cylinders must be keyed into the DAA's existing new terminal PRIMUS XP High Security key system. No substitutions allowed.

**Bunting Graphics, Inc.**

1. WS 10.20D Please provide details for the following sign types: S1, S2, and S3. The detail beneath the Sign Schedule on sheet A701 "Example Sign" is the one that applies for those three sign types.

2. WS 10.20D Can we assume you will provide the foundations for the 19 large site directional signs? No, Signage Contractor is responsible for foundations for Signage.

3. WS 10.20D Please advise where we can find the mounting details for the banner and the smaller traffic signs? The banners will hang off of the pre-existing bunting arms on the existing light poles.

**Northern Door & Hardware, Inc.**

1. WS 8.30D Should the locks and cylinders for this project be keyed into the system we just created for the new Terminal? Manufacturer of locks and keyed cylinders must match items provided on the new terminal project. All cylinders must be keyed into the DAA's existing new terminal PRIMUS XP High Security key system. No substitutions allowed.

2. WS 8.30D Where are the corner guards shown on the print? The detail for the corner guards is 3/A520. It is called out on sheet A100 (corner of room #B05) and sheet A101 (corner of rooms #105 and #106).

**Northern Industrial Erectors, Inc.**

1. WS 5.10D Just to clarify, are the following assumptions correct: 
   - The steel for the CMU and Precast connections are by the Steel Contractor.
   - The steel for the Precast Plank and Precast Panels connections are by the Precast Contractor.
   Yes to both assumptions.

2. WS 5.10D Will the stairs be able to be installed before the precast roofs are set? No.

3. WS 5.10D Will the equipment screen be installed before the rubber roof is installed? Base plates will need to be installed first, then the EPDM roof will be installed, and then the equipment screen will be installed.

4. WS 5.10D Per the Work Scope 5.10D Item W, the architectural drawings do not have any detail that matches the existing edge detail. I believe the architect should make a detail and add it to the bid documents. Detail 6/A526 added to Addendum 3.

**Sign Source, Inc.**

1. WS 10.20D It appears that the ID and ADA signage is not specified or on the signage schedule for the parking structure interior signage. Where are the details and information for this signage? No other ADA signage is required except for Area of Refuge sign, which will be added by this addendum.

2. WS 10.20D In the exterior wayfinding signs the Banners W202 of the plans item 13. No counts are specified. And Banners are not called out in Section 10 14 00, 1.2. A page 1.
   Contractor to provide 85 banners in accordance with specification section 101453 Traffic Signage, to be issued with Addendum 3.

3. WS 10.20D Also note that Sunbrella fabric is not available in white. White ink cannot be printed on it. There are Vinyl banner fabrics in white available.
   Banner detail and spec section 101453 Traffic Coatings(to be issued as part of Addendum 3) say "Sunbrella fabric or equal". If Sunbrella fabric not available in specified colors, submit equal product.

4. WS 10.20D This is in reference to pole sizes for wayfinding sign type E.1.1 & E.1.2 elevation also sign type E.2(L) elevation. Lakehead Sign had a local engineer look at the pole sizes on these signs and recommended 14" x 14" poles (instead of 10" x 10") on the double pole mount overhead mounted signs and 14" x 14" or as much as 16" x 16" poles for the flag mounted overhead signs. Will engineering certification be required for these signs? Yes, refer to Work Scope Description and Specifications for engineering requirements.

5. WS 10.20D Are signage contractors required to bid on supports and foundations shown for exterior signage and go through the change order process if our engineered drawings dictate that a larger support or foundation is required? Contractors are required to provide foundations and supports properly sized as required for the exterior wayfinding signage. Refer to Work Scope Description and Specifications for engineering requirements.

6. WS 10.20D Has the "Neon Illuminated FULL" sign been removed from the project? Yes, it has been removed.
### Hunt Electric Corporation

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>WS 26.10D</td>
<td>CCTV Alt # 6 indicates we will be installing CAT6 cable for the cameras. Is low, med., or high performance cable required?</td>
<td>See addendum #3 Specification 27.13.00 &amp; 27.15.00</td>
</tr>
<tr>
<td>2.</td>
<td>WS 26.10D</td>
<td>Plans show Area of Rescue assistance stations. Is there a specific manufacturer required?</td>
<td>See Specification 27.32.01</td>
</tr>
<tr>
<td>3.</td>
<td>WS 26.10D</td>
<td>The plans show communications drops. There is no specifications on this system. What manufacturer is required at the airport?</td>
<td>See addendum #3 Specification 27.11.00, 27.13.00, &amp; 27.15.00</td>
</tr>
<tr>
<td>4.</td>
<td>WS 26.10D</td>
<td>The plans show communication drops as a black triangle. How many data patch panel?</td>
<td>See Legend Sheet E001</td>
</tr>
<tr>
<td>5.</td>
<td>WS 26.10D</td>
<td>Sheet E601 indicates we’ll be providing and installing a 24 strand fiber patch panel. Is there a specific manufacturer required?</td>
<td>None specified. However, Corning was used in the Terminal Bldg</td>
</tr>
<tr>
<td>6.</td>
<td>WS 26.10D</td>
<td>Sheet E601 (detail # 2) Technology riser diagram: What is the distance from MDF to GCCTC? There is no sheet showing where the MDF is. Is there any more information that can be provided?</td>
<td>MDF is room 217 in Terminal Bldg. GCCTC to Skywalk / Terminal column C7 is approximately 350′. See Terminal Bldg 2nd floor plan.</td>
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### Hinrichs Estimating, Inc.

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<tr>
<td>1.</td>
<td>WS 9.60D</td>
<td>I have a couple questions regarding the Terrazzo 096623 on this project. I see there is a Work Scope 9.60D but it is also listed in 9.65D. Flooring as well. I see there are also two separate alternates for this work (3A &amp; 3B) that include the same area. Is a bid form required for terrazzo work? Also, section 096623 1.2.A says section includes flooring and base. I don’t see that any base is shown or called for on the drawings. Is terrazzo base required?</td>
<td>Work Scope 9.60D and 9.65D are completely separate work scopes. A bid form is required for all bidders bidding on a work scope. Only one work scope (9.60D or 9.65D) will be awarded depending on how the bids come out. Alt. 3A is for Work Scope 9.60D only. Alt. 3B is for WS 9.65D only. There is no Terrazzo base required.</td>
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### Rice Lake Construction Group

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<tbody>
<tr>
<td>1.</td>
<td>WS 3.30D</td>
<td>Based on the schedule in bidding documents, the pouring of the curb in the parking structure would happen during winter months. Will there be provisions to heat this area or the precast plank?</td>
<td>All curbing will be poured starting in April 2014. Curbing in DAA Parking will be poured over the winter as this area is going to be heated by the Construction Manager.</td>
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### Benson Electric Company

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<tr>
<td>1.</td>
<td>WS 26.10D</td>
<td>On sheet E601 there is a panel on the riser diagram shown as P1RA. There is no feed shown to this panel and there is also not a panel schedule to indicate the breakers or even the amp rating. What is the amp rating of this panel? What quantity and size should the breakers be for this panel?</td>
<td>See typical lighting control detail on E002</td>
</tr>
<tr>
<td>2.</td>
<td>WS 26.10D</td>
<td>There is a specification for the programmable circuit breaker lighting control. The prints do not indicate which panels and which breakers this section relates to. Which panels are to receive programmable breakers and which breakers in that panel should be programmable?</td>
<td>P1RA lighting control panel can be used in lieu of programmable CBs in panel P1MA.</td>
</tr>
<tr>
<td>3.</td>
<td>WS 26.10D</td>
<td>There are two type H fixtures mounted to the underside of the skywalk. Are these two also to be changed to LED under alternate 4?</td>
<td>No</td>
</tr>
<tr>
<td>4.</td>
<td>WS 26.10D</td>
<td>The riser diagram on sheet E601, keyed note 1 mentions duct bank. The utility transformer appears to be located within 5′ from the parking structure. Typically a duct bank would not be required. Please clarify if the feed from the utility transformer to the service panel is required to be in duct bank. If so, is there a specification for the duct bank?</td>
<td>Addendum #3 revised drawing E010 to show utility feed ductbank and detail. Secondary feed ductbank is not required unless required by the utility, based on actual transformer location.</td>
</tr>
<tr>
<td>5.</td>
<td>WS 26.10D</td>
<td>There is a specification for the lighting protection system. There is not a lightning protection system shown on the drawings. Is a lightning protection system required? If so, is there a drawing depicting what is required?</td>
<td>Lightning protection is required using 50’ air terminal spacing around garage perimeter and along top of skywalk and SW stair tower.</td>
</tr>
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<td>6.</td>
<td>WS 26.10D</td>
<td>Reference sheet E101 near gridline 1 just outside mechanical room 106 near OHD-1. There is an “E” symbol with an arrow and a note that reads “see note 8.” There is no note on the plans, please clarify what note 8 is.</td>
<td>Addendum #3 adds note 8 to drawing E101: Provide OH door controls installation and wiring per manufacturer’s instructions.</td>
</tr>
<tr>
<td>7.</td>
<td>WS 26.10D</td>
<td>Also near this is a symbol EIB shown. This is part of an access control system. There is no access control system specification nor are there any other access control symbols shown. Please clarify if this is a typo or what the intent is. If there is supposed to be an access control system, please provide a specification as well as details of what is required.</td>
<td>Addendum #3 deletes EIB box and DCP circuit P1LA-2 at OH door</td>
</tr>
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<td>8.</td>
<td>WS 26.10D</td>
<td>Alternate 8 references CCTV. There is no CCTV specification. The notes on the prints make reference to the existing cameras system. Please provide a specification for the cameras and the CCTV system.</td>
<td>See E601 revision for Addendum # 2</td>
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<td>9.</td>
<td>WS 26.10D</td>
<td>Drawing E010, note 3 appears to require an underground vehicle detection system and references sheet CE101. CE101 is not under this electrical scope according to the Work Scope Description. Please clarify who provides the vehicle detector loop, what work is required at this location and which Work Scope provides this?</td>
<td>Addendum #3 deletes sensor wiring and Note 3.</td>
</tr>
<tr>
<td>10.</td>
<td>WS 26.10D</td>
<td>There are communication outlets shown on the prints; however, there are no specs for this section other than the security phones. Please provide a specification to detail the type of cabling, outlets, connectivity, racks, etc., that are to be used.</td>
<td>See addendum #3 Specification 27.11.00, 27.13.00, &amp; 27.15.00</td>
</tr>
<tr>
<td>11.</td>
<td>WS 26.10D</td>
<td>Is there a set of electrical drawings for the site lighting that we can reference for the Exterior Wayfinding Signage power tie in?</td>
<td>See site electrical record drawings &quot;for reference&quot; in this addendum.</td>
</tr>
</tbody>
</table>
## DULUTH INTERNATIONAL AIRPORT

### APPENDIX A

**NEW PARKING STRUCTURE AND EXTERIOR WAYFINDING SIGNAGE**

**BID PACKAGE 2D - ADDENDUM NO. 3**

<table>
<thead>
<tr>
<th>Item</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>WS 8.30D</td>
<td>I do not see an Access Control Spec. Is there going to be one?</td>
<td>No Access Control being provided</td>
</tr>
<tr>
<td>2.</td>
<td>WS 8.30D</td>
<td>Are there going to be any Card Readers for the parking ramp?</td>
<td>The detail for the corner guards is 3A520. It is called out on sheet A100 (corner of room #B05) and sheet A101 (corner of rooms #105 and #106)</td>
</tr>
<tr>
<td>3.</td>
<td>WS 8.30D</td>
<td>Do you have a correct Specification for the programmable LED sign on drawing W724 detail 9?</td>
<td>Daktronics model AF-3200-32x96-8A is an obsolete unit</td>
</tr>
<tr>
<td>4.</td>
<td>WS 8.30D</td>
<td>Is there going to be a CCTV Spec, other than the notes on page E601, addenda 2 drawings. Is there going to be one. NVR's should be added for recording and existing fail-over needs.</td>
<td>E601 Addendum #2 specifies cameras. No specification section issued. No NVR required. Garage CCTV will tie into Terminal system.</td>
</tr>
<tr>
<td>5.</td>
<td>WS 8.30D</td>
<td>Are there going to be any Card Headers for the parking ramp?</td>
<td>No</td>
</tr>
<tr>
<td>6.</td>
<td>WS 8.30D</td>
<td>Are there any details of the Access Control and its connections back to the Airport Terminal.</td>
<td>GCTC switches are to be connected to Terminal MDF. Coordinate with Airport IT contractor for Access Control connections</td>
</tr>
<tr>
<td>7.</td>
<td>WS 8.30D</td>
<td>On page E100, Note 7 states to provide a &quot;network connection……to Terminal Bldg FACP.&quot; It does not state specifically what that connection should be. It needs to be 2 strands of Single Mode Fiber, which will communicate both data (alarm / trouble type information) and Voice, so if an announcement is made from the Terminal via Fire System Microphone the Parking Ramp broadcasts that same information.</td>
<td>Addendum #3 adds note 10 to fire alarm notes on drawing E601: Fire alarm system shall operate as network node of the Terminal bldg system.</td>
</tr>
<tr>
<td>8.</td>
<td>WS 26.10D</td>
<td>There are no details of the Access Control and its connections back to the Airport Terminal.</td>
<td>Area of Rescue intercom is to be flush mounted.</td>
</tr>
<tr>
<td>9.</td>
<td>WS 26.10D</td>
<td>My biggest question / comment is that the terminology &quot;Area of Rescue&quot; typically means there is a head-end of some sort with a light / communication means to each remote box for the fire dept to communicate with whoever is in trouble. There is not any &quot;Area of Rescue&quot; head-end shown, nor does the Spec 273201 ask for one. The ETP-100EB does work independently via a phone line and calls that phone # when activated. I am just being certain this is the desired operation.</td>
<td>The units are to be programmed to call a number designated by the airport, to contact the security center in the airport police office.</td>
</tr>
<tr>
<td>10.</td>
<td>WS 26.10D</td>
<td>For the 28 cameras, there will definitely be an NVR added to the system, and possibly a 2nd NVR to meet the failover requirements (again, no CCTV Spec but we do know what is expected). Is there room in the existing rack to add 2 NVR's, or if a rack is needed, is there room in the I.T. room for another rack?</td>
<td>No NVR required. Garage CCTV will tie into Terminal system.</td>
</tr>
</tbody>
</table>

### SimplexGrinnell

1. WS 26.10D: I do not see an Access Control Spec. Is there going to be one? No Access Control being provided.

2. WS 26.10D: Are there going to be any Card Readers for the parking ramp? No.

### Sell Hardware Inc.

1. WS 26.10D: I do not see an Access Control Spec. Is there going to be one? No Access Control being provided.

### SimplexGrinnell

1. WS 26.10D: I do not see an Access Control Spec. Is there going to be one? No Access Control being provided.

### Sell Hardware Inc.

1. WS 26.10D: I do not see a CCTV Spec, other than the notes on page E601, addenda 2 drawings. Is there going to be one. NVR's should be added for recording and existing fail-over needs.

2. WS 26.10D: Are there any details of the Access Control and its connections back to the Airport Terminal. GCTC switches are to be connected to Terminal MDF. Coordinate with Airport IT contractor for Access Control connections.

### Harmon Sign

1. WS 10.20D: Do you have a correct Specification for the programmable LED sign on drawing W724 detail 9? Daktronics model AF-3200-32x96-8A is an obsolete unit.

### Dell Comm Inc.

1. WS 26.10D: I don't see the Specifications for Voice, Data, Sound, PA, and Intrusion. Is one coming soon? See addendum #3 Specification 27.11.00, 27.13.00, & 27.15.00. Intrusion and PA are not required.

2. WS 26.10D: The existing voice and data infrastructure has a 25 year manufacturers warranty; will the ramp be included in this? If a different manufacturer of voice/data connectivity is allowed other than what is currently installed, it won't be covered under the warranty the airport has on the existing system. If the garage system is not covered under the Terminal warranty, it won't be covered under the warranty the airport has on the existing system. It should have its own warranty.

3. WS 26.10D: Will temporary service be needed to bring the ramp live when the skywalk is under construction? Yes, this Work Scope is to provide temporary service.
### DULUTH INTERNATIONAL AIRPORT

### NEW PARKING STRUCTURE AND EXTERIOR WAYFINDING SIGNAGE

### BID PACKAGE 2D - ADDENDUM NO. 3

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<tr>
<td>1.</td>
<td>WS 22.10D</td>
<td>Here is what Minnesota Air would like to get approved: Spec section 238239 ELECTRIC UNIT HEATERS AND BASEBOARD HEATERS– Berko</td>
<td>Substitution requests will not be reviewed until after contract award</td>
</tr>
<tr>
<td>2.</td>
<td>WS 22.10D</td>
<td>Here is what Minnesota Air would like to get approved: Spec section 237339 INDOOR DIRECT FIRED HEATING AND VENTILATING UNIT – Rupp</td>
<td>Substitution requests will not be reviewed until after contract award</td>
</tr>
<tr>
<td>3.</td>
<td>WS 22.10D</td>
<td>Here is what Minnesota Air would like to get approved: Spec section 239000 BUILDING AUTOMATION SYSTEM – Carrier.</td>
<td>Substitution requests will not be reviewed until after contract award</td>
</tr>
</tbody>
</table>

**Hanson Structural Precast, Inc.**

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>WS 3.40D</td>
<td><strong>1.</strong> Crane access—will a crane be allowed at the interior of the ramp for erection or is the crane required to sit on the outside of the footprint? <strong>2.</strong> The screw side finish of the exterior walls call for gray color. Is the colored concrete required to wrap around the sides of the panels or can the panels be poured with half colored concrete and half gray concrete? <strong>3.</strong> Since it is unknown to the bidders how many days the crane will be shut down due to airport restrictions, is there an allowance, or number of hours, or days that should be accounted for in the bid? Per the union agreements I have been told that the crew is still entitled to 2 hours pay plus per diems if the job site is shut down. There is also the cost of the delivery trucks that would not be able to be unloaded. <strong>4.</strong> Is heat and enclosures to be provided by each trade or is the owner enclosing the ramp and supplying heat? <strong>5.</strong> Should the base bid mix design only be grey concrete? <strong>6.</strong> In the 034500-part 2 products, it calls for the base bid to be colored concrete with just the form finish. This is something that is not done with an architectural colored panel. Maybe a thin band or something, but not the entire surface of the panel. You will see any and all form lines, form oil, footprints, etc. Nobody would accept this on the completed ramp and I would be afraid that the design team thinks it is different than what it is and would reject panels. Is this the intent? <strong>7.</strong> If you read the description for the grade A form finish, it is the Spec for standard panels that are going to be painted. If they are going to paint the walls, then they don’t need to be colored concrete. Is the intent that these panels be painted? <strong>8.</strong> The plank connects to the CMU walls as indicated on the drawings.</td>
<td><strong>1.</strong> The plank connects to the CMU walls as indicated on the drawings. <strong>2.</strong> Colored concrete in both the base bid and alternate bid is for the first 3” of the thickness of the panel only. Color is not required to wrap around openings. <strong>3.</strong> This Work Scope is responsible to provide a complete bid. Unforeseen conditions will be handled on a case-by-case basis as they arise. <strong>4.</strong> Review Work Scopes Descriptions “Winter Conditions.” Also note that joint sealants will be installed starting April 2014. Joint sealants in the DAA Parking area will be installed over the winter as this area is going to be heated by the Construction Manager. <strong>5.</strong> No. Base bid mix design should be as specified. <strong>6.</strong> Base bid mix design should be as specified. Finish of base bid panels should be Smooth Form Grade A Finish. Form lines should be minimized as much as possible though whatever means possible. Specification for precast units contains language describing the level of finish expected and any/all finish and cleaning requirements. Precast units that do not meet those requirements given in the specifications will be rejected. <strong>7.</strong> The intent is for the walls to have the finish specified.</td>
</tr>
</tbody>
</table>

**Swanson & Youngdale, Inc.**

<table>
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<tr>
<td>1.</td>
<td>WS 9.90D</td>
<td>Section 071816 Vehicular Traffic Coatings lists only one manufacturer for product selection and requires the manufacturer’s acceptance of subcontractor as an approved applicator. Will an equal product be accepted and who will determine if it is in fact an equal?</td>
<td>See Addendum changes to traffic coating spec.</td>
</tr>
</tbody>
</table>

**St. Germain’s Glass, Inc.**

<table>
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<tbody>
<tr>
<td>1.</td>
<td>WS 8.40D</td>
<td>Hollow metal frame type HMS is called out to be GL-5 (1/4” clear tempered) but also is called out as 90 min fire rated. If it is to be fire rated, the largest size can be 56” x 46 1/2”. Could this be clarified please?</td>
<td>In checking the Door Schedule, door #106 (where this frame is located) is not noted to be a rated door. Not sure where you are getting this question from, but the answer is NO - it is not a rated assembly.</td>
</tr>
<tr>
<td>2.</td>
<td>WS 8.40D</td>
<td>The skywalk storefront needs to have something structural to attach it to at both the head and sill conditions and to support the dead load at the sill. The fastening is typically done in the glass pocket area but can also be done using a strap anchor back into the building.</td>
<td>To be addressed in addendum 3 drawings</td>
</tr>
</tbody>
</table>
Date: June 7, 2013

RE: City of Duluth Bid #13-4401
    New Parking Structure and
    Exterior Wayfinding Signage
    Bid Package 2D

    Addendum No. 3

TO: Prospective Bidders

This Addendum forms a part of the Contract Documents and modifies the original Bidding Documents dated May 15, 2013. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification.

1.0 PROJECT MANUAL

1.1 Bid Form:

1.2 Table of Contents:

Volume 2 of 2 – Part 11 Division 10 – Specialties: Add Section 10 14 53 Traffic Signage to the table of contents

Volume 2 of 2 – Part 11: Add Division 21 – Fire Suppression to the table of contents

Volume 2 of 2 – Part 11 Division 26 – Electrical: Add the following sections to the table of contents:
   27 11 00 Communications Equipment Room Fittings
   27 13 00 Communications Backbone Cabling
   27 15 00 Communications Horizontal Cabling

1.3 Technical Specifications:

Volume 2 – Part 11 Division 1-49 Technical Specifications, Division 7 Thermal and Moisture Protection

Revise Specification Section 071816 Vehicular Traffic Coatings: Section 2.1 to read:
   A. Basis of Design Product: Provide CCW-5123 Deck Coating System as manufactured by Carlisle Coatings and Waterproofing, Incorporated, 900 Hensley Lane, Wylie, Texas 75098, Phone: (800) 527-7092, Fax: (972) 442-0076.

   B. Acceptable alternative products:
      3. Flexodeck Mark 170.2” – Poly-Carb.
      5. “Conipur II” – Sonneborn (BASF).

   C. System shall be manufacturer’s “Medium duty” system in parking stall and driving areas, and “Heavy Duty” in turning lanes.

   D. The traffic coating color shall be gray.

   E. Use VOC compliant traffic coatings not exceeding 400 grams/liter.

   F. Aggregates for Traffic Coating: Provide aggregate with a minimum hardness of 6.5 on Mohr’s Hardness Scale with #16-#30 grit that is approved by traffic coating manufacturer.
1. Approved Products:
   b. “Grade 4” – Flint Rock Products (phone: 918-673-1737).
   c. “#3 Q-ROK” – U.S. Silica (phone: 304-258-2500).
   e. “Granusil 2095” – Unimin.

Volume 2 – Part 11 Division 1-49 Technical Specifications, Division 7 Thermal and Moisture Protection
Revise Specification Section 071816 Vehicular Traffic Coatings: Section 2.2 to read:
“2.2 Basis of Design Product Description”

Volume 2 – Part 11 Division 1-49 Technical Specifications, Division 7 Thermal and Moisture Protection
Revise Specification Section 075323 Ethylene-Propylene Diene-Monomer (EPDM) Roofing: Section 1.2 B to read:

B. Related Sections:
1. Division 06 Section 061000 “Rough Carpentry” for wood nailers, curbs and blocking.
2. Division 07 Section 076200 “Sheet Metal Flashing and Trim” for metal roof penetration flashings, flashings and counterflashings.
3. Division 07 Section 079200 “Joint Sealers” for joint sealants, joint fillers and joint preparation.
4. Division 15 Section “Sanitary, Vent and Storm Drainage Piping” for roof drains.

Volume 2 – Part 11 Division 1-49 Technical Specifications, Division 10 Specialties:
Add: Specification Section 10 14 53 Traffic Signage in its entirety. (9 pages)

Volume 2 – Part 11 Division 1-49 Technical Specifications, Division 21 Fire Suppression:
Add: Specification Section 21 13 16 Dry-Pipe Sprinkler Systems in its entirety. (15 pages)

Volume 2 – Part 11 Division 1-49 Technical Specifications, Division 26 Electrical
Add: Specification Section 27 11 00 Communications Equipment Room Fittings in its entirety. (6 pages)

Volume 2 – Part 11 Division 1-49 Technical Specifications, Division 26 Electrical
Add: Specification Section 27 13 00 Communications Backbone Cabling in its entirety. (22 pages)

Volume 2 – Part 11 Division 1-49 Technical Specifications, Division 26 Electrical
Add: Specification Section 27 11 00 Communications Horizontal Cabling in its entirety. (18 pages)

2.0 DRAWINGS: Replace drawings listed below with sheets included with this Addendum No. 3

Structural Drawings: Replace drawings with sheets included with this addendum No. 3.

S002 – General Structural Notes
S101 – First Level Framing Plan
S102 – Second Level Framing Plan
S104 – Skywalk Floor and Roof Framing Plans
S301 – Truss Elevation and Details
S503 – Structural Foundation Details
S702 – Structural Framing Details

Architectural Drawings: Replace drawings with sheets included with this addendum No. 3.
A104 – Enlarged Skywalk Plans
A302 – Enlarged Skywalk Elevations
A403 – Wall Sections - Skywalk
A514 – Plan Details – Skywalk
A521 – Room Finish Schedule & Miscellaneous Details
A522 – Enlarged Roof Plans & Details
A526 – Section Details – Skywalk
A701 – Door & Window Schedules Types & Details
A710 – Signage Schedule & Details

Electrical Drawings: Replace drawings with sheets included with this addendum No. 3.

E010 – Electrical Site Plan

3.0 OTHER:

END OF ADDENDUM NO. 3
NEW PARKING STRUCTURE AND EXTERIOR WAYFINDING SIGNAGE
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA

SECTION 101453 – TRAFFIC SIGNAGE

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. Exterior Wayfinding Roadway Signs.
3. Electrical work and lighting for illuminated signs.
4. Regulatory Signage.
5. Banners.

B. Related Requirements:

1. Section 032000 “Concrete Reinforcement”
2. Section 033000 “Cast-in-Place Concrete”
3. Section 051200 “Structural Steel”
4. Section 101400 “Signage” for parking structure signs.
5. Division 26 - Electrical
6. Division 31 - Earthwork

C. The Drawings show design intent are not intended to cover every detail of materials, parts, construction, mounting or installation. Furnish all required engineering, materials, parts, construction, mounting, and installation necessary to complete the entire work, whether or not said details are shown or specified, at no additional cost to the Project.

D. These contract documents are for design intent compliance and should only be used as a guide to produce the finished size, appearance, and function shown. Nothing contained in these contract documents shall be construed as a design for any engineered element.

E. The Manufacturer shall provide all required structural and electrical engineering drawings. Drawings shall be stamped and signed by the respective structural and electrical engineers currently registered in the State of Minnesota.

F. All applicable national, state and local codes, ordinances and safety standards shall take precedence over these contract documents and it shall be the
responsibility of the Manufacturer or his Subcontractor(s) to make certain that these codes, ordinances and safety standards are in compliance.

1.3 DEFINITIONS
A. Accessible: In accordance with the accessibility standard.

1.4 REFERENCES
B. Federal Aviation Administration Advisory Circular 150/5360-12E “Airport Signing and Graphics”.
D. Minnesota Department of Transportation’s “2011 Standard Signs Summary”

1.5 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings:
   1. Include fabrication and installation details.
   2. Show sign mounting heights and accessories.
   3. Provide location plans for all signs.
   4. Show message list, typestyles, graphic elements, and scaled graphic layouts for each sign at least one/eighth full size.
C. Samples:
   1. Materials:
      a. Aluminum sheet, with specified finishes, 12” x 12”.
      b. Sign face color samples on specified material, 4” x 4”.
      c. Paint sample for finish of sign structures, 4” x 4”.
   2. Wayfinding Signs:
      a. One (1) full-size field sample of Sign Type E.2. When approved, sign may be installed.
b. One (1) full-size field sample of Sign Type E.5. When approved, sign may be installed.

3. Regulatory Signs: One (1) full-size field sample of each of the following sign types:
   a. R1-1
   b. R3-2
   c. R5-1A
   d. R7-C
   e. R7-108
   f. R7-201
   g. R8-3

D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

E. Delegated-Design Submittal:
   1. Include complete structural drawings and supporting calculations signed and sealed by a qualified structural engineer licensed in the State of Minnesota.
   2. Include complete electrical drawings for roadway sign lighting signed and sealed by a qualified professional engineer licensed in the State of Minnesota.

1.6 INFORMATIONAL SUBMITTALS
   A. Qualification Data: Manufacturer and Installer.

1.7 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For signs to include in maintenance manuals.

1.8 COORDINATION
   A. Coordinate sign installations with shop drawings and Manufacturer’s data for other construction components that may affect or may be affected by the work.

1.9 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Minimum 5 years experience performing the Work required by this section on successful in-service Projects similar in size and scope to this Project.
   B. Installer Qualifications: Manufacturer of products or an entity that employs installers and supervisors who are trained and approved by manufacturer.
   C. Sole Suppliers: Sign products of similar types shall be supplied by one manufacturer.
1.10 DELIVERY, STORAGE AND HANDLING.

A. Signs and materials shall be delivered to the Project tagged or labeled bearing Manufacturer's name with material or sign identification number and installation location as shown on the Drawings. Signs and materials shall be stored in strict accordance with the Manufacturer's written directions.

1. Finished surfaces shall be adequately protected during all phases of the Work to prevent damage by scratches, stains, discoloration, or other causes. Damage to any surface during fabrication, handling, shipment, storage, and erection shall be remedied by the Contractor at his own expense.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Deterioration of finishes beyond normal weathering.
   b. Deterioration of embedded graphic image.
   c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer licensed in the State of Minnesota to design sign structures and anchorage for sign types E.1, E.2 and E.3.

B. Loads: Signs shall withstand loads across the total sign area equivalent to 100 miles per hour in any direction:

C. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

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


E. Color, finish, material and process shall match for all work.
2.2 SIGNS

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. Cummings Signs.
   2. Lakehead Sign Co.
   5. Poblocki Sign Company, LLC.
   6. Sign Source
   7. Summit Signs.
   8. Todd Signs.
   9. Western Remac Inc.
   10. White Way Signs.

B. Wayfinding Signs: Provide smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
   1. Solid-Sheet Sign and Back: Aluminum sheet with finish specified in "Surface Finish" Subparagraph below and as indicated.
   2. Graphics: Characters and symbols die cut from 3- to 3.5-mil thick, weather-resistant reflective pressure-sensitive vinyl film with release liner on the back and carrier film on the front for on-site alignment and application. Manufacturer to produce all pressure-sensitive vinyl graphics on digitally controlled cutting equipment.
      a. Edge Condition: Square cut.
      b. Corner Condition in Elevation: Rounded.
   4. Surface Finish:
      a. Baked-Enamel or Powder-Coat Finish protected by a clear coat in colors matching Architect's samples.
   5. Flatness Tolerance: Sign panel shall remain flat under installed conditions as indicated and within a tolerance of plus or minus 1/4 inch measured diagonally from corner to corner.

C. Regulatory Signs: Provide smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
   1. Solid-Sheet Sign and Back: Aluminum sheet, 0.080 inch minimum thickness.
      a. Edge Condition: Square cut.
      b. Corner Condition in Elevation: Rounded.
3. Flatness Tolerance: Sign panel shall remain flat under installed conditions as indicated and within a tolerance of plus or minus 1/4 inch measured diagonally from corner to corner.


2.3 WAYFINDING SIGN AND SIGN SUPPORT MATERIALS

A. Structural Steel Hollow Structural Sections: ASTM A 500, Grade B.

B. Aluminum Sheet and Plate: ASTM B 209 alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Aluminum Extrusions: ASTM B 221 alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

D. Aluminum Pipe: ASTM B 429 alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

E. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.

F. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 REGULATORY SIGN SUPPORT MATERIALS

A. Posts: Galvanized Steel Pipe, ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

B. Bases: For installation on pavement: Cast iron, either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/1 47M

2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer’s standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
   1. Furnish nonferrous-metal or stainless-steel devices unless otherwise indicated.
   2. Exposed Metal-Fastener Components, General:
      a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
b. Fastener Heads: For nonstructural connections, use flathead screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.

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

2.6 FABRICATION

A. General: Provide sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Form assemblies and joints exposed to weather to resist water penetration and retention.

3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.

4. Provide rebates, lugs, and brackets necessary to assemble components. Drill and tap for required fasteners.

B. Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.

C. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated.

2.7 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.
2.8 ALUMINUM FINISHES
   A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.9 BANNERS
   A. Fabric: 100% Acrylic “Sunbrella” fabric, as manufactured and recommended for its intended use by Glen Raven, Inc., Glen Raven, NC, or equal.
      1. Color and Pattern: As selected by Architect from manufacturer’s standard colors and patterns.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine conditions, with Installer present, for compliance with requirements and other conditions affecting performance of signage work.
      1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
   A. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
   B. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
   C. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 ADJUSTING AND CLEANING
   A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
   B. Remove temporary protective coverings and strippable films as signs are installed.
   C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.
END OF SECTION 101453
NEW PARKING STRUCTURE AND EXTERIOR WAYFINDING SIGNAGE
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA

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:
   1. Pathways.
   2. UTP cabling.
   3. Multi-user telecommunications outlet assemblies.
   4. Cable connecting hardware, patch panels, and cross-connects.
   5. Telecommunications outlet/connectors.
   6. Cabling system identification products.
   7. Cable management system.

B. Related Sections:
   1. Division 16 Section 16710 “Premise Distribution System.”
   2. Division 16 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
   3. Division 16 Section "Communication Equipment Room fittings" for voice and data cabling systems.

1.3 DEFINITIONS


B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

G. LAN: Local area network.
H. MUTOA: Multi-user telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.

I. Outlet / Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

J. RCDD: Registered Communications Distribution Designer.

K. UTP: Unshielded twisted pair.

1.4 HORIZONTAL CABELING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
   1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet / connectors be installed for each work area.
   2. Horizontal cabling shall contain no more that one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet / connector.
   3. Bridged taps and splices shall not be installed in the horizontal cabling.
   4. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) in the horizontal cross-connect to the workstation equipment.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

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

B. Shop Drawings:
   1. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
   2. Cabling administration drawings and printouts.
   3. Wiring diagrams to show typical wiring schematics, including the following:
      b. Patch panels.
      c. Patch cords.
4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

5. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
   a. Vertical and horizontal offsets and transitions.
   b. Clearances for access above and to side of cable trays.
   c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
   d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration and faceplates for color selection and evaluation of technical features.

D. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

E. Source quality-control reports.

F. Field quality-control reports.

G. Maintenance Data: For splices and connectors to include in maintenance manuals.

H. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On magnetic media or compact disk, complete with data files.
   3. Device address list.
   4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
   2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician who shall be present at all times when Work of this Section is performed at Project site.

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: 450 or less.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.


1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
   1. Test each pair of UTP cable for open and short circuits.

1.9 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.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner’s telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.11 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two (2) years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two (2) years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
   1. Provide thirty (30) days’ notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.12 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Patch-Panel Units: One of each type.
   2. Connecting Blocks: One of each type.
   3. Device Plates: 10 of each type.
   4. Multi-user Telecommunications Outlet Assemblies: 10 of each type.
PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
   1. Support brackets with cable tie slots for fastening cable ties to brackets.
   2. Lacing bars, spools, J-hooks, and D-rings.
   3. Straps and other devices.

C. Cable Trays: See specification section 16127

D. Conduit and Boxes: Comply with requirements in Division 16 Section "Raceways and Boxes." Flexible metal conduit shall not be used.
   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 in Division 6 Section "Rough Carpentry" for plywood backing panels.

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements of paragraph 1.2 C., Section 16710, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Belden CDT Inc.; Electronics Division.
   2. Berk-Tek; a Nexans company.
   3. CommScope, Inc.
   4. Genesis Cable Products; Honeywell International, Inc.
   5. KRONE Incorporated.
   6. Mohawk; a division of Belden CDT.
   7. Nordex/CDT; a subsidiary of Cable Design Technologies.
   8. Superior Essex Inc.
   9. SYSTIMAX Solutions; a CommScope, Inc. brand.
   10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
   11. Or approved equal.

B. Horizontal Wiring: Provide plenum rated 100 Ohm Unshielded Twisted Pair (UTP) cable with the following physical characteristics:
   1. The diameter of the insulated conductor shall be .048 in. maximum and shall consist of (4) 22 to 24 AWG twisted pairs.
   2. Shall be suitable for the environment in which they are to be installed. For Plenum, shall meet applicable requirements of ANSI/ICEA S-80-576. All four pairs must be insulated with F.E.P. No 2x2 or 3x1 construction will be allowed. Plenum rated cable shall be UL certified to conform to UL 910, CMP and shall be marked as such. Riser rated cable shall be third party
certified to conform to UL 1666, CMR, CMG and IEC 332-1 and shall be marked as such.

3. The color-coding of pairs shall be:
   a. Pair 1  W-BL; BL
   b. Pair 2  W-O; O
   c. Pair 3  W-G; G
   d. Pair 4  W-BR; BR

C. Horizontal Category 6 Wiring: Provide high speed data cabling conforming to ANSI/TIA/EIA 568-B.3 Category 6. All Category 6 cables shall conform to ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard. Applications standards supported should include, but are not limited to, IEEE 802.3, 10BaseT-T, IEEE 802.5, 4 Mbps, 16 Mbps, 100 Base-T and 155 Mbps ATM1, 1000BaseT Gbps Ethernet, potentially 1.2 Gbps ATM and 2.4 Gbps ATM, Multitasked Split Screen Computing, Virtual Holographic Video Conferencing, 3D CAD/CAM Engineering, Internet-Intranet Communications / Commerce, as well as all 77 channels (550 MHz) of analog broad band video.

1. From each jack location there will be one sheath of plenum rated Inside Wiring Cable to the associated distribution frame.
2. The plenum cable shall be composed of 22 to 24 AWG bare solid copper conductors each with an insulation of Teflon. The insulated conductors are tightly twisted into pairs and jacketed with white low smoke PVC. It shall conform to a UL Type CMP listing for plenum and riser applications.
3. Each sheath shall contain four unshielded copper pairs. Each pair shall have a different twist ratio per foot.
4. The cables shall meet or exceed the following standards:
   a. ANSI/TIA/EIA 568-B “Commercial Building Wiring Standard
   b. UL listed
   c. National Electrical Code – Article 800
5. The cables shall meet the following representative electrical and transmission characteristics:

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<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Insertion Loss (cB/100m)</th>
<th>Power Sum NEXT (dB)</th>
<th>Power Sum NEXT (dB)</th>
<th>ELFEXT (dB)</th>
<th>SRL (dB)</th>
<th>Power Sum ELFEXT (dB)</th>
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6. Cable Manufacturer shall be ISO-9001 certified.
7. The cable packaging shall be constructed so as to prevent kinking and other damage to the cable during shipping and handling. All damaged cable will be replaced.

D. 25 Pair High Speed Data Tie Cable: Provide high speed data cabling conforming to ANSI/TIA/EIA 568-B Category 5e. All cables shall meet applicable requirements of ANSI/ICEA S-80-576. All Category 5e cables shall conform to ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section. Applications standards supported should include, but are not limited to, IEEE 802.3, 10BaseT-T, IEEE 802.5, 4 Mbps, 16 Mbps and TP-PMD. In addition, these cables shall be capable of supporting evolving high-end applications such as 100 Base-T and 52/155 Mbps ATM.
   1. The cable shall be composed of 22 to 24 AWG bare solid copper conductors with a suitable plastic dielectric material.
   2. Each cable shall contain 25 unshielded copper pairs. Installed in tight sub-units to meet power sum Near End Crosstalk, swept Insertion loss and SRL requirements. The insulated conductors shall be twisted into pairs and stranded into mini-units. The cable shall employ a honeycomb core construction, consisting of multiple three and four pair tightly stranded sub-units. A total of seven unjacketed sub-units will be stranded to comprise the cable core.
   3. The cables shall meet or exceed the following standards:
      a. ANSI/TIA/EIA 568-B “Commercial Building Wiring Standard,” Category 5e Backbone
      b. Cable Section
      c. Certified Category 5e Cable under UL’s LAN Cable Certification Program
      d. UL Listed CMR or CMP as required, UL Verified Cat 5e
      e. National Electrical Code – Article 800
   4. The cables shall meet the TIA/EIA electrical and transmission characteristics.
      a. Outside Diameter .48 inches
      b. Mutual Capacitance 5.6 nF/100m
      c. Impedance Z 100 ± 15% Ohms from 1-100 MHZ
      d. DC Resistance – Max. 9.38 Ohms/100 m
   5. Cable Manufacturer shall be ISO-9001 certified.
   6. The cable packaging shall be constructed so as to prevent kinking and other damage to the cable during shipping and handling. All damaged cable will be replaced.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements of paragraph 1.2 C of Section 16710, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Dynacom Corporation.
   3. Hubbell Premise Wiring.
   4. KRONE Incorporated.
   5. Leviton Voice & Data Division.
   6. Molex Premise Networks; a division of Molex, Inc.
   7. Nordex/CDT; a subsidiary of Cable Design Technologies.
   8. Panduit Corp.
9. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
10. or approved equal.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
   1. Number of Jacks per Field: One for each four-pair UTP cable indicated, plus 20% spares and blank positions adequate to suit specified expansion criteria.

E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

F. Patch Cords: Factory-made, four-pair cables in 72-inch lengths; terminated with eight-position modular plug at each end.
   1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2.5 CONSOLIDATION POINTS

A. Manufacturers: Subject to compliance with requirements of paragraph 12. C of Section 16710, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Chatsworth Products, Inc.
   3. Dynacom Corporation.
   4. Hubbell Premise Wiring.
   5. Molex Premise Networks; a division of Molex, Inc.
   6. Nordex/CDT; a subsidiary of Cable Design Technologies.
   7. Ortronics, Inc.
   8. Panduit Corp.
  10. Or approved equal.

B. Description: Consolidation points shall comply with requirements for cable connecting hardware.
   1. Number of Terminals per Field: One for each conductor in assigned cables.
   2. Number of Connectors per Field:
      a. One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.
   3. Mounting: Recessed in ceiling, wall, desk or furniture as shown on drawings.
   4. NRTL listed as complying with UL 50 and UL 1863.
5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.6 MULTIUSER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

A. Manufacturers: Subject to compliance with requirements of paragraph 12. C of Section 16710, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Chatsworth Products, Inc.
   2. Hubbell Premise Wiring.
   3. Molex Premise Networks; a division of Molex, Inc.
   4. Nordex/CDT; a subsidiary of Cable Design Technologies.
   5. Ortronics, Inc.
   6. Panduit Corp.

B. Modular Category 6 Jacks: The category 6 jack shall meet or exceed the following standards:

C. ANSI/TIA/EIA 568-B “Commercial Building Wiring Standard”.

D. FCC Part 68, Subpart “F”
   1. The Category 6 modular jacks shall meet the following physical requirements:
      2. Connector-insulation displacement connectors accepting 22 and 24 gauge AWG solid conductor wire
      3. Jack wires-square copper alloy wires with 50 micro-inch lubricated gold plating over 100 micro-inch nickel plate
      4. High impact, flame retardant UL-rated 94V-O thermoplastic
   5. The Category 6 modular jacks shall meet the following mechanical requirements:
      a. Plug insertion life – minimum 750 plug insertions
      b. Contact Force – 100 grams minimum using FCC-approved modular plugs
      c. Plug Retention Force -(133N) minimum between modular plug and jack
      d. Temperature Range - -40° to 66°C
   6. The outlet shall be approved to work in all applications up to 250 MHz, including, but are not limited to 1000BaseT Gigabit Ethernet.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Insertion loss</th>
<th>Pair to Pair</th>
<th>FEXT dB</th>
<th>SRL</th>
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<tbody>
<tr>
<td>MHz</td>
<td>dB/100 m</td>
<td>NEXT dB</td>
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<td>100</td>
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<td>18</td>
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</tbody>
</table>
2.7 HIGH SPEED CATEGORY 6 DATA CROSS-CONNECT PATCH PANELS

A. The data patch panels will be co-located on 19-inch racks with the network hubs and the fiber optical interconnection cabinets as designated on the drawings or as required by the owner. The configuration of the patch panels shall be in an arrangement that minimizes patch cord lengths.

B. The modular patch panels shall have eight wires, 8-position modular jacks with 110 terminations on the rear for connection of station cables. The horizontal Category 6 cables to the outlets will be directly connected to 110 insulation displacement hardware associated with each jack on the patch panel. These panels will be designed to operate at 100/250 MHz. Quantities sufficient for all positions of every outlet are required.

C. The patch panel shall be a Category 6 modular jack panel with the following characteristic:
   1. The patch panel will utilize a 110 insulation displacement connector field on the back of the panel to terminate the horizontal cables. The 110 field is to remain continuous to the 8-pin modular jack field in the front of the panel.
   2. The cross-connect patch panel shall meet the following standards:
      ANSI/TIA/EIA 568-B "Commercial Building Wiring Standard FCC Part 68, Subpart F.

D. The Cross-connect patch panel shall meet the following physical requirements:
   1. Wire termination – insulation displacement, gas tight, slotted beam contact
   2. Plug contact force – 100 grams
   3. Plug retention force – 133 Newtons

E. The cross-connect patch panel shall meet the following environmental requirements:
   1. Operating Environment
      Temperature: 32°F to 140°F (0° to 60°C)
      Humidity: 5% to 95% (noncondensing)
   2. Storage Environment
      Temperature -40°F to 150°F (-40° to 66°C)
      Humidity: 5% to 95% (noncondensing)

F. The Category 6 panels shall be approved to work in all applications up to 250 MHz, including, but are not limited to, 1000BaseT Gigabit Ethernet.

G. The Category 6 panels shall meet or exceed the following representative electrical and transmission characteristics:

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<tr>
<th>Frequency</th>
<th>Insertion loss</th>
<th>Pair to Pair</th>
<th>FEXT dB</th>
<th>SRL dB</th>
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H. Category 5e/6 Modular Patch Cords
1. Provide 100% factory assembled and tested Category 6 plug-end cross-connecting patch cables for each modular patch panel jack. Cable shall be sized for the longest cross-connect and installed in accordance with a schedule developed by the installation contractor. The length of the patch cable or cross-connect jumpers shall not exceed 20 feet. Provide color-coded boot assemblies to match owner’s requirements.

2.8 GROUNDING
A. Comply with requirements in Division 16 Section "Grounding and Bonding" for grounding conductors and connectors.
B. Comply with ANSI-J-STD-607-A.

2.9 IDENTIFICATION PRODUCTS
A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers. Use Panduit Ultimate 10 Network Labeling system or equal.
B. Comply with requirements in Division 16 Section "Electrical Identification."

2.10 CABLE MANAGEMENT SYSTEM
A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
   1. iTRACS Corporation.
   2. Telsoft Solutions.
   3. Or approved equal.
C. Description: Computer-based cable management system, with integrated database and graphic capabilities.
D. Document physical characteristics by recording the network, TIA/EIA details, and connections between equipment and cable.

E. Information shall be presented in database view, schematic plans, or technical drawings.
   1. AutoCAD drawing software shall be used as drawing and schematic plans software.

F. System shall interface with the following testing and recording devices:
   1. Direct upload tests from circuit testing instrument into the personal computer.
   2. Direct download circuit labeling into labeling printer.

2.11 SOURCE QUALITY CONTROL

A. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

B. Factory test UTP cables according to TIA/EIA-568-B.2.

C. Cable will be considered defective if it does not pass tests and inspections.

D. 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 and except in accessible ceiling spaces where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. Comply with requirements for raceways and boxes specified in Division 16 Section "Raceways and Boxes."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 16 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 16 Section "Raceways and Boxes" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:
   1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
   2. Install cable trays to route cables if conduits cannot be located in these positions.
   3. Secure conduits to backboard when entering room from overhead.
   4. Extend conduits 3 inches (76 mm) above finished floor.
   5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:
   2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
   3. Install 110-style IDC termination hardware unless otherwise indicated.
   4. MUTOA shall not be used as a cross-connect point.
   5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
      a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
      b. Locate consolidation points for UTP at least 49 feet (15 m) from communications equipment room.
   6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
   7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
   9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
   10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove
and discard cable if damaged during installation and replace it with new cable.

11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

12. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.

13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:
   2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:
   2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:
   1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
   2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
   3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. 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 6 feet (1800 mm) long not less than 12 inches (300 mm) in diameter below each feed point.

G. Group connecting hardware for cables into separate logical fields.

H. Separation from EMI Sources:
   1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
   2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

A. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At
completion, cable and asset management software shall reflect as-built conditions.

B. Comply with requirements in Division 9 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 3 level of administration, including optional identification requirements of this standard.

D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. 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. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

F. Cable and Wire Identification:
1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
   a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
   b. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
1. Cables use flexible vinyl or polyester that flex as cables are bent.
3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   2. Visually confirm Category 6, marking of outlets, cover plates, outlet / connectors, and patch panels.
   3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

C. UTP Performance Tests:
   1. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
      a. Wire map.
      b. Length (physical vs. electrical, and length requirements).
      c. Insertion loss.
      d. Near-end crosstalk (NEXT) loss.
      e. Power sum near-end crosstalk (PSNEXT) loss.
      f. Equal-level far-end crosstalk (ELFEXT).
      g. Power sum equal-level far-end crosstalk (PSELFEXT).
      h. Return loss.
      i. Propagation delay.
      j. Delay skew.
   2. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
      a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
      b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.8 DEMONSTRATION
A. Engage a factory-authorized service representative to train Owner’s maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets. Include training in cabling administration software.

END OF SECTION 27.15.00
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. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Alarm devices.
7. Control panels.
8. Pressure gages.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from sprinklers that are open.

1.5 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

B. Provide working drawings from the contract drawings for sprinkler systems using requirements and design criteria indicated. Provide hydraulic calculations, where necessary. Coordinate location and elevation of sprinklers and piping with all building components, systems and architectural features. All piping shall be located above minimum garage clearances. Where
piping has to be installed below the minimum clearances (e.g. at beams), the areas shall be out of the drive lanes and shall be approved by the architect/engineer.

C. Sprinkler system shall be approved by authorities having jurisdiction. Obtain all required permits and provide required fees.

1.6 SUBMITTALS

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

B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Items penetrating finished ceiling.

D. Qualification Data: For qualified Installer.

E. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction and Boeing Fire Protection Engineering, including hydraulic calculations prior to installation.

F. Welding certificates.

G. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

H. Field quality-control reports.

I. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

   1. NFPA 13, "Installation of Sprinkler Systems."

1.8 PROJECT CONDITIONS

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

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

1.9 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.10 EXTRA MATERIALS

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

   1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.11 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.12 MAINTENANCE MATERIAL SUBMITTALS

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

   1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.
PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in Part 3 and pipe, tube, and fittings shall be limited to those listed below.

2.2 STEEL PIPE AND FITTINGS

A. Standard Weight, Galvanized Steel Pipe: ASTM A 53/A 53M, Schedule 40 steel pipe for welded, grooved, and threaded joints. Pipe ends may be factory or field formed to match joining method.

B. Thinwall, Galvanized Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 steel pipe for sizes over 2” and welded and rolled-groove joints. Pipe ends may be factory or field formed to match joining method.


D. Galvanized, Steel Couplings: ASTM A 865, threaded.

E. Galvanized Fittings in first paragraph below are available in NPS 1/4 to NPS 12.


G. Galvanized Unions in first paragraph below are available in NPS 1/4 to NPS 3 (DN 8 to DN 80), but NFPA limits them to NPS 2 (DN 50) and smaller.

H. Galvanized Malleable- or Ductile-Iron Unions: UL 860.


J. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

K. Galvanized Fittings in first paragraph below are available in NPS 1/2 to NPS 48 (DN 15 to DN 1200).


M. Galvanized or Coated Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anvil International, Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.

2. Pressure Rating: 175 psig minimum.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
   1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:
   1. Valves shall be UL listed and FM approved.

B. Check Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Clow Valve Company; a division of McWane, Inc.
      c. Kennedy Valve; a division of McWane, Inc.
      d. Milwaukee Valve Company.
      e. NIBCO INC.
      f. Tyco Fire & Building Products LP.
      g. Victaulic Company.
      h. Viking Corporation.
   4. Type: Swing check.
   5. Body Material: Cast iron.
   6. End Connections: Flanged or grooved.

C. Indicating-Type Butterfly Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Global Safety Products, Inc.
      b. Kennedy Valve; a division of McWane, Inc.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Tyco Fire & Building Products LP.
f. Victaulic Company.

2. Standard: UL 1091.


4. Valves NPS 2 and Smaller:
   a. Valve Type: Ball or butterfly.
   b. Body Material: Bronze.
   c. End Connections: Threaded.

5. Valves NPS 2-1/2 and Larger:
   a. Valve Type: Butterfly.
   b. Body Material: Cast or ductile iron.
   c. End Connections: Flanged, grooved, or wafer.

6. Valve Operation: Integral electrical, 115-V ac, prewired, two-circuit, supervisory switch and visual indicating device.

2.5  TRIM AND DRAIN VALVES

A. General Requirements:
   2. Pressure Rating: 175 psig minimum.

2.6  SPECIALTY VALVES

A. General Requirements:
   2. Pressure Rating:
      a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
   3. Body Material: Cast or ductile iron.
   4. Size: Same as connected piping.
   5. End Connections: Flanged or grooved.

B. Automatic (Ball Drip) Drain Valves:
   2. Pressure Rating: 175 psig minimum.
   3. Type: Automatic draining, ball check.
5. End Connections: Threaded.

C. Dry-Pipe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AFAC Inc.
   c. Reliable Automatic Sprinkler Co., Inc.
   d. Tyco Fire & Building Products LP.
   e. Victaulic Company.
   f. Viking Corporation.

2. Standard: UL 260
4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
5. Air-Pressure Maintenance Device:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) AFAC Inc.
      2) Globe Fire Sprinkler Corporation.
      3) Reliable Automatic Sprinkler Co., Inc.
      4) Tyco Fire & Building Products LP.
      5) Victaulic Company.
      6) Viking Corporation.
   c. Type: Automatic device to maintain minimum air pressure in piping.
   d. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure.
6. Air Compressor:
   a. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
      1) Gast Manufacturing Inc.
      2) General Air Products, Inc.
      3) Viking Corporation.
   d. Power: 120-V ac, 60 Hz, single phase.
2.7 FIRE-DEPARTMENT CONNECTIONS

A. Exposed-Type, Fire-Department Connection:
   1. Existing connections may be relocated or provide new valves subject to compliance with
      requirements, provide products by one of the following:
      b. Fire-End & Croker Corporation.
      c. Guardian Fire Equipment, Inc.
      d. Tyco Fire & Building Products LP.
   3. Type: Exposed, projecting, for wall mounting.
   6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department
      sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and
      check devices or clappers.
   7. Caps: Brass, lugged type, with gasket and chain.
   8. Escutcheon Plate: Round, brass, wall type.
   9. Number of Inlets and size: As indicated
   10. Escutcheon Plate Marking: Similar to "AUTO SPKR."
   11. Finish: Rough brass or bronze.

2.8 SPRINKLER SPECIALTY PIPE FITTINGS

A. Sprinkler Inspector's Test Fittings:
      published by FM Global, listing.
   2. Pressure Rating: 175 psig minimum.
   3. Body Material: Cast- or ductile-iron housing with sight glass.
   4. Size: Same as connected piping.
   5. Inlet and Outlet: Threaded.

2.9 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the
   following:
   2. Reliable Automatic Sprinkler Co., Inc.
   3. Tyco Fire & Building Products LP.
   4. Victaulic Company.
   5. Viking Corporation.

B. General Requirements:
      published by FM Global, listing.

C. Automatic Sprinklers with Heat-Responsive Element:
   1. Nonresidential Applications: UL 199.
   2. Characteristics: Discharge Coefficient K as indicated for "Ordinary" temperature classification rating unless otherwise required by application.

D. Sprinkler Finishes:
   1. Chrome plated.
   2. Bronze.
   3. Painted.

E. Special Coatings:
   1. Corrosion-resistant paint.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
   1. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch vertical adjustment.
   2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

G. Sprinkler Guards:
   2. Type: Wire cage with fastening device for attaching to sprinkler.

2.10 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

A. Electrically Operated Alarm Bell:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fire-Lite Alarms; a Honeywell company.
      b. Notifier; a Honeywell company.
      c. Potter Electric Signal Company.
   3. Type: Vibrating, metal alarm bell.

B. Pressure Switches:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. AFAC Inc.
b. Potter Electric Signal Company.
c. System Sensor; a Honeywell company.
d. Tyco Fire & Building Products LP.
e. Viking Corporation.

3. Type: Electrically supervised water-flow switch with retard feature.
5. Design Operation: Rising pressure signals water flow.

C. Valve Supervisory Switches:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Fire-Lite Alarms, Inc.; a Honeywell company.
   b. Kennedy Valve; a division of McWane, Inc.
   c. Potter Electric Signal Company.
   d. System Sensor; a Honeywell company.

3. Type: Electrically supervised.
5. Design: Signals that controlled valve is in other than fully open position.

2.11 PRESSURE GAGES

A. Standard: UL 393.

B. Dial Size: 3-1/2- to 4-1/2-inch diameter.

C. Pressure Gage Range: 0 to 250 psig minimum.

2.12 BACKFLOW PREVENTERS

A. General: ASSE standard backflow preventers, of size indicated for maximum flow rate indicated and maximum pressure loss indicated.
   1. Working Pressure: 150 psig minimum except where indicated otherwise.
   2. Bronze, cast iron, steel, or stainless steel body with flanged ends.
   3. Interior Lining: FDA approved epoxy coating, for backflow preventers having cast iron or steel body.
   4. Interior Components: Corrosion resistant materials.
   5. Strainer on inlet, where strainer is indicated.

B. Double Check Backflow Prevention Assemblies: ASSE 1015, consisting of shutoff valves on inlet and outlet and strainer on inlet. Include test cocks with 2 positive seating check valves for continuous pressure application.
   1. Pressure Loss: 5 psig maximum at the design system flow rate.
PART 3 - EXECUTION

3.1 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to water-distribution piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. See civil for additional information.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.2 PIPING INSTALLATION

A. All dry-pipe system piping (pipe, fittings, hangers, etc.) shall be galvanized.
   1. Exception: factory-painted grooved fittings are permitted in lieu of galvanized fittings.

B. Locations and Arrangements: Drawings indicate general locations, sizes, and arrangement of piping. Install piping as indicated; coordinate with all other trades and building components.
   1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and piped from the most remote area of each sprinkler system.

H. Install sprinkler piping with drains for complete system drainage. Drains serving more than 5 gallons shall discharge to exterior with splash protection.

I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over to outside building.

J. Connect compressed-air supply to dry-pipe sprinkler piping.

K. Connect air compressor to the following piping and wiring:

L. Pressure gages and controls.

M. Electrical power system.
N. Fire-alarm devices, including low-pressure alarm.
O. Install alarm devices in piping systems.
P. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
Q. Install pressure gages on riser or feed main and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
R. Drain dry-pipe sprinkler piping.
S. Pressurize and check dry-pipe sprinkler system piping air compressors.
T. Install sleeves for piping penetrations of walls, ceilings, and floors.
U. Install sleeve seals for piping penetrations of concrete walls and slabs.
V. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION
A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
B. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
D. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
E. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
G. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.

E. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

F. Install air compressor and compressed-air supply piping.

G. Air-Pressure Maintenance Device: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.

H. Install compressed-air supply piping from building's compressed-air piping system.

3.5 SPRINKLER INSTALLATION

A. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
3.6 FIRE-DEPARTMENT CONNECTION INSTALLATION
   A. Install wall-type, fire-department connections.
   B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.7 IDENTIFICATION
   A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
   B. Identify system components, wiring, cabling, and terminals.

3.8 FIELD QUALITY CONTROL
   A. Perform tests and inspections.
   B. Tests and Inspections:
      1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
      2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
      3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
      4. Energize circuits to electrical equipment and devices.
      5. Coordinate with fire-alarm tests. Operate as required.
      6. Verify that equipment hose threads are same as local fire-department equipment.
   C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
   D. Prepare test and inspection reports.

3.9 CLEANING
   A. Clean dirt and debris from sprinklers and escutcheons.
   B. Remove and replace sprinklers with paint other than factory finish.

3.10 DEMONSTRATION
   A. Engage qualified engineer(s) and/or technicians that are qualified and trained in the proper operation and maintenance of their respective equipment to train Owner's maintenance personnel. The training shall include all modes of operation and shall include all phases of localized maintenance and troubleshooting that does not require specialized equipment.
3.11 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized steel pipe.

B. Provide integral test/drain valves.

C. Use piping and fittings as identified in Part 2.

3.12 SPRINKLER SCHEDULE

A. Use sprinkler types as indicated on the drawings.

END OF SECTION 21 13 13
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:
1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Telecommunications service entrance pathways.
5. Grounding.

B. Related Sections:
1. Division 16 Section 16710 “Premise Distribution System.”
2. Division 16 Section 16716 "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
3. Division 16 Section 16717 "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS


B. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

C. LAN: Local area network.

D. RCDD: Registered Communications Distribution Designer.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.

3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.5 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.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.


1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.7 COORDINATION

A. 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.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
   1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
   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.

C. Cable Trays:
   1. Refer to Section 16127 "Cable Trays" for specification information.

D. Conduit and Boxes: Comply with requirements in Division 16 Section "Raceways and Boxes." Flexible metal conduit shall not be used.
   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 specified in Division 6 Section "Rough Carpentry."

B. Provide prefabricated backboard as indicated on the drawings.

2.3 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements of paragraph 1.2 C of Section 16710, provide products by one of the following:
   1. ADC.
   2. Aim Electronics; a brand of Emerson Electric Co.
   3. AMP; a Tyco International Ltd. company.
   4. Cooper B-Line, Inc.
   5. Hubbell Premise Wiring.
   6. KRONE Incorporated.
   7. Leviton Voice & Data Division.
   8. Middle Atlantic Products, Inc.
   9. Nordex/CDT; a subsidiary of Cable Design Technologies.
  10. Ortronics, Inc.
11. Panduit Corp.
12. Siemon Co. (The).

B. General Frame Requirements:
1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310 standard, 19-inch (480-mm) panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, steel or aluminum construction.
1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
2. Baked-polyester powder coat finish.

D. Modular Freestanding Cabinets:
1. Removable and lockable side panels.
2. Hinged and lockable front and rear doors.
3. Adjustable feet for leveling.
4. Screened ventilation openings in the roof and rear door.
5. Cable access provisions in the roof and base.
10. All cabinets keyed alike.

E. Modular Wall Cabinets:
1. Wall mounting.
2. Steel or aluminum construction.
3. Treated to resist corrosion.
4. Lockable front and rear doors.
5. Louvered side panels.
6. Cable access provisions top and bottom.
7. Grounding lug.
10. All cabinets keyed alike.

F. Cable Management for Equipment Frames:
1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 POWER STRIPS

A. Power Strips: Comply with UL 1363.
1. Rack mounting.
2. Six 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
3. LED indicator lights for power and protection status.
4. LED indicator lights for reverse polarity and open outlet ground.
5. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
7. Rocker-type on-off switch, illuminated when in on position.

2.5 GROUNDING

A. Comply with requirements in Division 16 Section "Grounding and Bonding" for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:
   1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
   2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
   3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with ANSI-J-STD-607-A.

2.6 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and housing when so directed by service provider.

   1. Install underground entrance pathway complying with applicable Division 16 Sections.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 FIRESTOPPING

A. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
   1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 16 Section "Electrical Identification."

B. Comply with requirements in Division 9 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 3 level of administration including optional identification requirements of this standard.

D. Labels shall be preprinted or computer-printed type.

END OF SECTION 27.11.00
NEW PARKING STRUCTURE AND EXTERIOR WAYFINDING SIGNAGE
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA

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:
   1. Pathways.
   2. UTP cable.
   3. Optical fiber cabling.
   5. Cable connecting hardware, patch panels, and cross-connects.

B. Related Sections:
   1. Division 16 Section 16710 "Premise Distribution System."
   2. Division 16 Section 16714 “Communication Equipment Room Fittings.”
   3. Division 16 Section 16717 “Communication Horizontal Cabling.”

1.3 DEFINITIONS


B. CCITT

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. LAN: Local area network.

G. RCDD: Registered Communications Distribution Designer.

H. TIPS

I. UTP: Unshielded twisted pair.

1.4 BACKBONE CABELING DESCRIPTION
A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. For coaxial cable, UTP, and Optical Fiber cable include the following installation data for each type used:
      a. Nominal OD.
      b. Minimum bending radius.
      c. Maximum pulling tension.

B. Shop Drawings:
   1. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
   2. Cabling administration drawings and printouts.
   3. Wiring diagrams to show typical wiring schematics including the following:
      b. Patch panels.
      c. Patch cords.
   4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
   5. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
      a. Vertical and horizontal offsets and transitions.
      b. Clearances for access above and to side of cable trays.
      c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
      d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.
F. Maintenance Data: For splices and connectors to include in maintenance manuals.

G. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings Cabling Administration Drawings, and field testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. 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: 450 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.


1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set.
2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

1.9 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.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner’s telecommunications and LAN equipment and service suppliers.

1.11 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two (2) years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two (2) years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
   1. Provide thirty (30) days’ notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.12 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Patch-Panel Units: One of each type.
   2. Connecting Blocks: One of each type.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
   1. Support brackets with cable tie slots for fastening cable ties to brackets.
   2. Lacing bars, spools, J-hooks, and D-rings.
   3. Straps and other devices.

C. Cable Trays:
   1. Refer to section 16127 for cable tray specifications

D. Conduit and Boxes: Comply with requirements in Division 16 Section "Raceways and Boxes." Flexible metal conduit shall not be used.
E. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 6 Section "Rough Carpentry" for plywood backing panels.

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements of paragraph 1.2 C of Section 16710, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Belden CDT Inc.; Electronics Division.
2. Berk-Tek; a Nexans company.
3. CommScope, Inc.
4. Mohawk; a division of Belden CDT.
5. Nordex/CDT; a subsidiary of Cable Design Technologies.
6. Superior Essex Inc.
7. SYSTIMAX Solutions; a CommScope Inc. brand.
8. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
9. or approved equal.

B. Description: 100-ohm, 100-pair or as shown on the drawings, 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-B.1 for performance specifications.
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.
   f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
   g. Multipurpose, Riser Rated: Type MPR complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements of paragraph 1.2 C of Section 16710, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Dynacom Corporation.
3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Nordex/CDT; a subsidiary of Cable Design Technologies.
7. Panduit Corp.
8. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
9. or approved equal

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
1. Number of Jacks per Field: One for each four-pair UTP cable indicated conductor group of indicated cables, plus 20% spares and blank positions adequate to suit specified expansion criteria.

E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

F. Patch Cords: Factory-made, 4-pair cables in 72-inch lengths; terminated with 8-position modular plug at each end.
1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2.5 OPTICAL FIBER CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Sumitomo Air blown fiber system as shown on the drawings.
2. Superior Essex.
3. Allen Tel.
4. Owens Corning.
5. or approved equal.

B. Air Blown Fiber Installation (ABF)
1. Furnish all labor, materials, tools and equipment to provide air blown fiber through compact cable infrastructure tubes. The air blown fiber equipment manufacture shall have at least 5 years of successful manufacturing of products with characteristics and capacities required by this section. All work shall comply with all applicable codes and standards.
2. Provide rack and key lockable wall-mounted enclosures to terminate optical fibers from the air blown fiber bundles. The enclosures shall support and organize the fibers for termination. All accessories shall include, but are not limited to, breakout cables, tube couplings, plugs,
caps and organizers. All couplings and caps shall be pressure rated to 200 psi.

3. Install the system and all materials in accordance with manufacturer instructions.

4. Provide all cable blowing heads and all equipment necessary for blowing the fiber in the tubes including any air or nitrogen gas required.

5. All optical fibers shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical and environmental requirements of this specification. All fibers in the fiber bundles must be usable.

6. The fiber coating and buffer shall be removable with commercially available stripping tools without damaging the fiber.

7. All fibers in the bundles shall meet industry standards on attenuation, bandwidth and dispersion specifications outlined below. Attenuation specification shall be a maximum attenuation for each fiber over the entire operating temperature range of the cable.

C. Multimode Fiber 62.5/125 micron:

1. The multimode fiber utilized in the cable specified herein shall meet TIA/EIA standards. The 62.5/125 micron grade-index multimode optical fiber shall be plenum or non-plenum rated as required and shall meet the following optical characteristics:

   850 nm:
   - maximum attenuation: 3.5 dB/km
   - typical attenuation: 3.0 dB/km
   - minimum LED bandwidth: 200 MHz•km
   - minimum Gigabit distance: 500 m

   1300 nm:
   - maximum attenuation: 1.0 dB/km
   - typical attenuation: 1.0 dB/km
   - minimum LED bandwidth: 600 MHz•km
   - minimum Gigabit distance: 1000 m

2. The multimode fiber utilized in the cable specified herein shall conform to the following specifications:

   Fiber Core: 62.5/125 micron
   Cladding Diameter: 62.5 ± 3 µm
   Fiber Identification: Individually color-coded per TIA/EIA standards
   Operating Temperature -22°F to 158°F

D. Multimode Fiber 50/125 micron

1. The multimode fiber utilized in the cable specified herein shall meet TIA/EIA standards. The 50/125 micron grade-index multimode optical fiber shall be plenum or non-plenum rated as required and shall meet the following optical characteristics:

   850 nm:
   - maximum attenuation: 3.0 dB/km
   - minimum bandwidth: 500 MHz•km

   1300 nm:
   - maximum attenuation: 1.0 dB/km
   - minimum bandwidth: 500 MHz•km

2. The multimode fiber utilized in the cable specified herein shall conform to the following specifications:

   Fiber Core: 50/125 micron
   Cladding Diameter: 50 ± 3 µm
Fiber Identification: Individually color-coded per TIA/EIA standards
Operating Temperature: -40°F to 158°F

E. Singlemode Fiber:
1. The singlemode fiber utilized in the cable specified herein shall meet TIA/EIA standards. The 8.3 micron singlemode optical fiber shall be plenum or non-plenum rated as required and shall meet the following optical characteristics:
   - 1310 nm: maximum attenuation 0.40 dB/km
   - 1550 nm: maximum attenuation 0.30 dB/km

F. Outdoor Fiber Tubes
1. The multi-tube shall have a polyethylene outer jacket with a dry tape waterblocked cable core and meet TIA/EIA standards. The operating temperature range shall be -40°F to 158°F. The minimum bending radius shall be 20 cable diameters during installation and 10 cable diameters after installation.

G. Indoor Plenum Rated Fiber Tubes
1. The plenum rated multi-tube shall have a low smoke, flame resistant outer jacket and meet TIA/EIA standards. The operating temperature range shall be 32°F to 122°F. The minimum bending radius shall be 20 cable diameters during installation and 10 cable diameters after installation. UL 910 OFNP Rated.

H. Tube Distribution Equipment
1. Provide rack and key lockable wall-mounted enclosures to terminate optical fibers from the air blown fiber bundles. The enclosures shall support and organize the fibers for termination. Include all accessories including but are not limited to breakout cables, tube couplings, plugs, caps and organizers. All couplings and caps shall be pressure rated to 200 psi.

2.6 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements of paragraph 1.2 C of Section 16710, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. ADC.
   3. Berk-Tek; a Nexans company.
   4. Corning Cable Systems.
   5. Dynacom Corporation.
   6. Hubbell Premise Wiring.
   7. Molex Premise Networks; a division of Molex, Inc.
   8. Nordex/CDT; a subsidiary of Cable Design Technologies.
   9. Optical Connectivity Solutions Division; Emerson Network Power.
   10. Siemon Co. (The).
B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

C. Patch Cords: Factory-made, dual-fiber cables in 72-inch lengths.

D. Cable Connecting Hardware:
   2. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.75 dB.
   3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

E. Fiber SC Termination
   1. The fiber building cable shall be terminated at the Fiber Interconnect cabinets, work area outlets and the communication equipment. The connector shall allow many reconnections with consistent repeatable performance.

F. Multimode
   1. The only approved method of termination is the T568 SC multimode connector, manufacturer approved for the cable supplied. The connector shall be an approved component and meet the following requirements:
      - Mean Loss: 0.3 dB
      - Standard Deviation: 0.2 dB
      - Fiber OD: 125 micron
      - Cable OD: 3.0 mm
      - Loss Repeat: <0.3 dB, 200 insertions
      - Axial Load: 30 lbs.
      - Temperature Stability: <0.3 dB Max. change
      - Connector Tip material: Ceramic
      - Connector Cap material: Poly Sulfone
   2. The connector shall be installed on the fiber utilizing an approved tool kit. This kit contains all tools and instructions to mount the connector quickly and easily, utilizing the Manufacturer’s installation procedures.

G. Single-mode
   1. The only approved method of termination is the T568 SC single-mode connector, manufacturer approved for the cable supplied. The connector shall be an approved component and meet the following requirements:
      - Mean Loss: 0.2 dB
      - Standard Deviation: 0.1 dB
      - Fiber OD: 125 micron
      - Cable OD: 3.0 mm
      - Loss Repeat: <0.2 dB, 200 insertions
      - Axial Load: 30 lbs.
      - Temperature Stability: <0.3 dB Max. change
      - Connector Tip material: Zirconia Ceramic
      - Connector Cap material: Poly Sulfone
2. The connector shall be installed on the fiber utilizing an approved tool kit. This kit contains all tools and instructions to mount the connector quickly and easily, utilizing the Manufacturer’s installation procedures.

2.7 FIBER JUMPER CABLES

A. Provide dual fiber FDDI grade fiber optic patch jumper assemblies for each fiber interconnect cabinet connector. Fiber cable shall be sized for the longest connection and installed in accordance with a schedule developed by the installation contractor. Fiber connectors shall match the fiber connector specifications. The patch cord fiber shall match the optical characteristics and specifications for the fiber cable specified and shall be covered by Aramid yarn and a jacket of flame-retardant PVC. The fiber patch cord shall meet the following specifications:

- Minimum bend radius: 1.00 inch (2.54 cm)
- Operating temperature: -4°F to 158°F (-20°C to 70°C)
- Mated connector loss: 0.4 dB
- Minimum bandwidth: 200MHz•km at 850nm, 500MHz•km at 1300nm
- Maximum attenuation: 3.4 dB/km @ 850 nm, 1.0 dB/km @ 1300nm
- ISO 9001 Certified Manufacturer

B. Multimode Fiber Patch Cord Specifications

- Mated Connector Loss: \( \mu = 0.3 \text{dB}, \sigma = 0.2 \text{dB} \)
- Operating temperature: -4°F to 158°F (-20°C to 70°C)
- Cable Retention: 50 lb. (220 N) minimum
- Connection Repeatability: 0.20 dB maximum changer per 100 reconnects

C. Single-mode Fiber Patch Cord Specifications

- Return Loss: -50 dB maximum
- Mated connector loss: \( \mu = 0.35 \text{dB}, \sigma = 0.2 \text{dB} \)
- Cable Retention: 50 lb. (220 N) minimum
- Connection Repeatability: 0.20 dB maximum changer per 200 reconnects

2.8 OPTICAL FIBER TELECOMMUNICATION OUTLETS

A. Provide fiber optical outlets with connectors as designated on the drawings or as required by the owner in single gang, dual gang, fiber optic and office furniture configurations. Provide recessed angled jacks to protect mating cables. Its modular design shall allow the adoption of interchangeable units for standard or customized voice, video, and data applications. The outlets shall include a decorative cover and all associated mounting hardware, modules, couplings, adapters and connectors. Submit color selection during submittal process, color to be determined after submittal. Covers shall come with recessed label space for circuit identifications.

B. All outlets shall be identified with clear permanent typewritten labels matching the numbering plan indicated on the drawings. Each module shall be labeled as to its current function using color-coded icons. All labeling must be permanent. All
labeling shall be a minimum 12-point in size. All labeling systems shall be submitted to the owner’s representative for approval prior to fabrication. Labeling shall last as long as the system is in use.

C. Provide a surface mounted enclosure that attaches directly over the standard electrical box provided.

D. Provide a means of securing the fiber cables while maintaining a minimum bend radius of 30 mm. This fiber ring shall store a minimum of 1 meter of two-count fiber.

2.9 OPTICAL FIBER CABLE INTERCONNECT CABINET

A. All fiber cables will be terminated at the telecommunication room sites in fiber interconnect cabinets. These cabinets will be wall or rack mounted, as designated on the drawings, or as required by the Owner. Rack mounted interconnect cabinets shall be placed at the top of the rack and located to minimize jumper distance to electronic equipment. Provide quantities and configurations as shown on the drawings. The fiber interconnect cabinet shall be a certified component and will directly terminate the fiber building cable.

B. Assure that the connectors for each cabling segment are installed in the correct orientation to ensure proper polarity of an optical fiber system from the main cross-connect to the telecommunications outlet/connector.

2.10 OPTICAL FIBER CABLE SPLICES & CLOSURES

A. Fiber Splicing: All fiber cable splicing shall be performed using the fusion splicing method unless the client specifically requires the mechanical method.

1. Fusion – The fiber splicer shall be fully automatic, calibrated and operate under the various jobsite environmental conditions (e.g. temperature, humidity, altitude, etc.) for all types of fiber cable being deployed.
   a. The mean splice loss for identical dispersion-unshifted single-mode fibers shall be equal to 0.05 dB at 1310 nm and 1550 nm wavelengths in accordance with CCITT G.652.
   b. The microprocessor controlled automatic positioning system shall control the fiber alignment, cleaning, gap-setting correlation of fiber positioning and fusing.
   c. The fusion splicer shall measure and document the splice losses of each splice. These measurements shall be saved and submitted to the TIPS Project Manager.
   d. Heat shrink protection shall be provided for each splice.

2. Mechanical – The fiber splice module shall meet the following specifications:
   a. Accept 250 and 900 micron fibers.
   b. Reenterable, rearrangeable and reusable.
   c. Require no polishing.
   d. Require no adhesives.
   e. No loose parts.
   f. Mean splice loss 0.15 dB.
   g. Blind splice loss < 0.5 dB.
   h. One part index matching gel.
i. Stable from -40°C to 75°C.

B. Splice Closures: The fiber splice canister closure shall seal, bond, anchor and protect fiber optic cable splices. The splice closure shall be re-enterable with a maximum of six (6) cable entries in a butt-end configuration. The cap shall be capable of accepting additional cables without disturbing existing splices. The splice closure shall be designed for application required i.e., aerial, underground and direct buried. It shall use corrosion free construction designed for splicing fibers. The unit shall include slack storage and the splice trays required or the specific project installation.

2.11 COAXIAL 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. Alpha Wire Company.
   2. Belden CDT Inc.; Electronics Division.
   3. Coleman Cable, Inc.
   4. CommScope, Inc.
   5. or approved equal.

B. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-11/U: NFPA 70, Type CATV.
   1. No. 14 AWG, solid, copper-covered steel conductor.
   2. Gas-injected, foam-PE insulation.
   3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
   4. Jacketed with sunlight-resistant, black PVC or PE.
   5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 C.

D. RG-6/U: NFPA 70, Type CATV or CMP
   1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-foam fluorinated ethylene propylene insulation.
   2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
   3. Copolymer jacket.
   4. Suitable for indoor installations.

E. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles.

2.12 COAXIAL CABLE HARDWARE
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. Aim Electronics; a brand of Emerson Electric Co.
   2. Leviton Voice & Data Division.
   3. Siemon Co. (The).

B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.13 GROUNDING
A. Comply with requirements in Division 16 Section "Grounding and Bonding" for grounding conductors and connectors.

B. Communication bonding and grounding shall be in accordance with the NEC, NFPA, NESC and ANSI/TIA/EIA Standard 607. Horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices. Horizontal equipment includes cross-connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment.

C. #6 AWG stranded copper wire cable shall be extended between new ground bars located at each intermediate cross-connect and the building main service ground point. This ground conductor shall be utilized for equipment, termination, equipment rack and computer equipment grounding.

D. When the Telecommunications Rooms contains an electrical panel, provide a telecommunications ground utilizing a #6 AWG or larger bonding conductor that provides direct bonding between telecommunications rooms ground bar and connected to the telecommunications room electrical panel Alternating Current Equipment Ground buss ACEG.

E. All outside plant installation metallic cable elements shall be grounded at the building entry points and at each splice location.

2.14 TELECOMMUNICATIONS BACKBOARD
A. Provide ¾ inch, 8-foot high, void-free, A/C grade plywood as designated on the drawings or as required by the owner. Paint the backboard with one prime coat and one finish coat of fire retardant pearl gray latex paint. Securely fasten the backboard to the wall to support the weight of the attached cable, termination and equipment.

2.15 ELEVATOR CONDUIT & CABLE
A. Provide a one-inch conduit from the telecommunication room to each elevator control room. The conduit shall originate in the vicinity of the 110 termination blocks and terminate in a 4 square telecommunication outlet box, with a voice jack, located as requested by the elevator contractor. Provide one Category 5e cable from the outlet box to the voice demarcation point.

2.16 FIRE ALARM CONDUIT & CABLE
A. Provide a one-inch conduit from the telecommunication room located closest to the fire alarm panel. The conduit shall originate in the vicinity of the 110 termination blocks and terminate in a 4 square telecommunication outlet box, with two voice jacks, located as requested by the fire alarm contractor. Provide two Category 5e cables from the outlet box to the voice demarcation point.

2.17 T1 TRANSMISSION

A. Provide outlets and circuit wiring for video teleconferencing over T1 transmission lines. The T1 service cable shall be run from the T1 outlet jack to the T1 demarcation outlets as required by the project. Each T1 demarcation outlet shall include a RJ48X miniature, non-keyed, 8-position 8-wire jack for each T1 outlet. Each T1 outlet shall include two ANSI/TIA/EIA-568-B 8-position Category 5e modular voice (telephone) jacks connected to a four pair UTP Category 6 cable and one RJ48X miniature. This T1 jack shall be non-keyed, 8-position 8-wire jack with shorting bars on pins 1 & 4 and 2 & 5, 110 type terminations shall be connected to a four pair UTP Category 5e cable.

2.18 TELECOMMUNICATIONS BONDING BACKBONE

A. Provide a Telecommunications Bonding Backbone, as required, utilizing a #6 AWG or larger bonding conductor that provides direct bonding between equipment rooms and Telecommunications Rooms. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure), and is independent of equipment or cable. The permanent infrastructure for telecommunications grounding and bonding is independent of telecommunications cabling. The co-routed bonding conductor shall be installed as follows:

B. All cables entering a building must conform to the bonding and grounding requirements in the NEC.

C. Provide copper bonding conductors installed through every major telecommunications backbone pathway and directly terminated on a grounding busbar in each telecommunication equipment location. The grounding busbar shall be directly bonded to building structural steel and other permanent metallic systems. Each pathway bonding conductor must be terminated on the busbar. The busbar shall be visibly labeled and physically secured.

D. Route the #6 AWG copper conductor along each backbone cable route. Ensure a minimal separation between the conductor and the cables along the entire distance.

E. Bond each end at the nearest approved ground in the area that the associated cables terminate or are spliced/cross-connected onto other cables. Such bonding shall be done with a grounding busbar.

F. The main busbar shall be directly bonded to the electrical service grounding electrode system. The telecommunications grounding system shall be directly attached to the closet point in the building’s electrical service grounding system.
G. Telecommunication installers shall use the grounding busbars as the local approved ground. Backbone cabling shall be bonded at each sheath opening. All metallic cable trays shall be grounded.

H. Provide telecommunications bonding connections in accessible locations. Make all bonding connections with listed bolts, crimp pressure connectors, clamps, or lugs. Multiple grounding busbars placed in the building shall be directly bonded with a #6 AWG copper conductor.

I. Bonding conductors shall be routed with a minimum number of bends. The bends placed in the conductor shall be swiping.

2.19 PUBLIC AREA TELEPHONES

A. Provide a one-inch conduit from the telecommunication room located closest to each public area telephone location. The conduit shall originate in the vicinity of the 110 termination blocks and terminate in a 4 square telecommunication outlet box, with a voice jack, for each telephone. The telephone outlet box shall be located at a height that will permit the installation of both normal and ADA handicapped mounts without exposure of the telephone outlets for either location. Provide one Category5e cable from each outlet box to the voice demarcation point.

2.20 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers. Use Panduit Ultimate ID Network Labeling System or equal.

2.21 SOURCE QUALITY CONTROL

A. Factory test cables on reels according to TIA/EIA-568-B.1.

B. Factory test UTP cables according to TIA/EIA-568-B.2.

C. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.
3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks. Conceal raceway and cables except in unfinished spaces.
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. Comply with requirements for raceways and boxes specified in Division 16 Section "Raceways and Boxes."

B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA-VE-2 and TIA/EIA-569-A.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 16 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 16 Section "Raceways" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:
   1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
   2. Install cable trays to route cables if conduits cannot be located in these positions.
   3. Secure conduits to backboard when entering room from overhead.
   4. Extend conduits 3 inches (76 mm) above finished floor.
   5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

H. Air Blown Optical Fiber Cable: Install the system and all materials in accordance with manufacturer's instructions.
   1. Do not install the fiber until fiber tube cable system is complete
   2. Do not exceed manufacturer's maximum bending radius on tubes and fiber bundles.
   3. All spare strands shall be installed into spare splice trays, unless otherwise indicated on drawings.
3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:
   2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
   3. Install 110-style IDC termination hardware unless otherwise indicated.
   4. Terminate all conductors; no cable shall contain unterminated elements.
      Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
   5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
   7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer’s limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
   8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
   9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  10. In the communications equipment room, install a 10-foot (3-m) long service loop on each end of cable.
  11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:
   2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:
   2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:
   1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
   2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
   3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
F. Outdoor Coaxial Cable Installation:
   1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
   2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).

G. Group connecting hardware for cables into separate logical fields.

H. Separation from EMI Sources:
   1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
   2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
   3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
   4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
   5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
   6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.5 FIRESTOPPING

A. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

B. Comply with TIA/EIA-569-A; Annex A, "Firestopping."
C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."
   1. Administration Class: 3.
   2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Division 9 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 3 level of administration including optional identification requirements of this standard.

D. Comply with requirements in Division 16 Section "Communications Horizontal Cabling" for cable and asset management software.

E. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

G. Cable and Wire Identification:
1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).

4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
   a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
   b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:

I. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Testing Requirements
   1. Testing shall be performed after all components have been labeled and prior to system cutover. Test results shall meet or exceed manufacturer documentation data. All test equipment shall utilize the latest firmware and software recommended by the manufacturer. All test equipment shall be calibrated, tested and certified within one year of the commencement of the project testing. Otherwise, follow the manufacturer recommendations.
   2. Telecommunications Bonding Backbone (TBB) Testing shall verify the integrity of all bonding connections and compliance to the NEC.
   3. 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-B (B.1, B.2, and B.3). All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but are not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% usable conductors in all cables installed. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the manufacturer’s requirements and BICSI Standards. If any of these are in conflict, the contractor shall bring any discrepancies to the attention...
of the project team for clarification and resolution. Verify proper grounding at service entrance and at all surge suppression devices.

C. Tests and Inspections:
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Optical Fiber Cable Tests:
   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Link End-to-End Attenuation Tests:
      1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
      2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
   c. OTDR (Optical Time-Domain Reflectometer).
      1) Fiber testing shall be performed on all fibers in the completed end to end system.
      2) Testing shall consist of a bidirectional end to end OTDR trace performed per TIA/EIA 455-61. The system loss measurements shall be provided at 850 and 1300 nanometers for multimode fibers and 1310 and 1550 for single mode fibers. The OTDR shall be used only to determine the length and the attenuation of that cable. A power meter shall be used to determine the overall link attenuation, including connectors.
      3) Any link not meeting the requirements of the standard shall be brought into compliance by the Contractor, at no charge to the Owner.
      4) Provide both hard copy and PDF copy on CD-ROM to the A/E for approval.

D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in
BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

F. End-to-end cabling will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.9 SYSTEM ACCEPTANCE

A. Upon completion of the aforementioned tests and before system acceptance, sample system operations shall also be performed with contractor provided test equipment and documentation to verify that the system is operational and ready for acceptance. Testing shall be performed on a sample basis (10% of installed outlets) on various portions of the network as determined by the A/E. The test shall be performed by the contractor, and witnessed by the A/E or owner's representative.

END OF SECTION 27.13.00
<table>
<thead>
<tr>
<th>Level</th>
<th>Door Type</th>
<th>Width</th>
<th>Height</th>
<th>Material</th>
<th>Finish</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Lower Level</td>
<td>Single Leaf</td>
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<td>84&quot;</td>
<td>Steel</td>
<td>Primed</td>
<td>Fire rated</td>
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<tr>
<td>Lower Level</td>
<td>Double Leaf</td>
<td>168&quot;</td>
<td>84&quot;</td>
<td>Wood</td>
<td>Primed</td>
<td>Sound rated</td>
</tr>
</tbody>
</table>

**Diagram Notes:**
- All doors are to be fire rated.
- Double doors require additional framing.
- Door finishes are to be specified by the architect.

**Details:**
- Door handles and hardware are to conform to ADA standards.
- Door jams and sills are to be made of non-combustible material.

**Construction:**
- Doors are to be prepped for paint before installation.
- Door frames are to be pre-finished and delivered to site.

**Architectural Details:**
- Door and window schedules are detailed in Table 1.
- Full-scale details are provided for reference.

**Issued for Bid:**
- Document is intended for bidding purposes.
- All specifications are subject to change.

**Reference:**
- For more details, refer to the project's complete set of drawings.
These notes specify the requirements for the design represented in these documents. The construction and materials shall comply with the specifications and requirements detailed herein. The responsibility for the design and execution of the work shall rest with the contractor and their respective subcontractors. All work shall be performed in compliance with applicable codes, standards, and regulations.

**Structural Fasteners:**
- Precast manufacturer is to design, provide calculations, and furnish steel headers for openings as necessary or as shown on construction documents.
- Refer to Architectural drawings.

**Concrete Base Material:**
- Concrete is to be placed in lift sections to allow for Tamping and compacting to the new work, to the best of our knowledge. Report all discrepancies to the Architect for resolution prior to performing related new work.

**Engineering:**
- All structural work shall be performed using a professional engineer who is registered in the state where the project occurs.
- The special inspectors shall be provided and shall only use approved shop drawings. Special inspection reports are to be submitted immediately to the SER, Architect, and Contractor daily when inspections are performed.

**Concrete:**
- Cast-in-place concrete shall be placed with attention to the vibration and curing of the concrete. Color finishes shall be specified in the contract documents.
- Due to the variation in shrinkage and expansion of different cements and admixtures, the use of color may result in unsatisfactory color matching. A color stability report is required from the manufacturer.

**Steel Roof Deck:**
- Provide reinforcement or frames for deck openings as indicated on the drawings.
- Anchors in concrete or concrete masonry when exposed to earth, weather, or corrosive environment shall be manufactured from AISI 304/316 Stainless Steel.

**Structural Steel:**
- Steel roof deck shall be detailed, fabricated and erected in compliance with AISC Specification for the design, fabrication, erection of structural steel for building, and Code of Practice for the use of Steel in Buildings.

**Reinforced Concrete:**
- Provide reinforcement or frames for deck openings as indicated on the drawings.
- Anchors in concrete or concrete masonry when exposed to earth, weather, or corrosive environment shall be manufactured from AISI 304/316 Stainless Steel.

**Precast Concrete:**
- Provide reinforcement or frames for deck openings as indicated on the drawings.
- Anchors in concrete or concrete masonry when exposed to earth, weather, or corrosive environment shall be manufactured from AISI 304/316 Stainless Steel.

**General Notes:**
- Contractors shall comply with the requirements of the applicable codes and standards. The contractor shall comply with the requirements of the International Building Code (IBC). The contractor shall be responsible for the overall quality and workmanship of the final product.
- Contractors shall provide a complete set of shop drawings and submittal documents.
- Contractors shall ensure that all materials and workmanship comply with the specifications and requirements.

**Preparation for Elevating Machinery:**
- For underground utilities adjacent to foundations and through foundations reference drawings for detail showing step footings and piers. Foundation drawings for detail showing step footings and piers.

**Control and Construction Joints:**
- Refer to the drawings for the typical slab on grade construction and saw cut control joint detail. Control and construction joints must be continuous and not offset.

**Stair Tread Concentrated Load:** 300 lbs

**Mechanical Room Hanging Loads:** 40 psf

**Evaluation Criteria:**
- All components using the concrete beam or column shall be designed in accordance with the AIC Manual for the design of Reinforced Concrete Structures.

**Appendix:**
- Refer to Appendix A for additional information.
VERIFY OPENING SIZES AND LOCATIONS WITH MECHANICAL CONTRACTOR PRIOR TO FABRICATION.

PROVIDE DECK ATTACHMENTS AT SPACING SHOWN UNLESS NOTED OTHERWISE ON DRAWINGS.

AT STEEL BEAM 5" (E) BENT PL W/ PAUL A. JOHNSON HEADED STUD INSTALLED THROUGH THE DECK MAY BE SUBSTITUTED FOR PUDDLE WELD.

1/2" DIA SCREW ANCHOR W/ 2" EXP/CONTRACTION BAR 3/8 x 3 x 0'-6" LONG W/ 2 - 1/2" DIA x 4" PUDDLE WELDS AT EACH LOW FLUTE IS CONTINUOUS ACROSS ADJACENT SPAN.

L5 x 5 x 5/16 COMPOSITE SLAB ON METAL DECK 2 - SPAN MINIMUM 2'-12" MINIMUM

1/2" DIA SCREW ANCHOR W/ 2" EXP/CONTRACTION 1/4 3-12 BAR 3/8 x 3 x 0'-6" LONG W/ 2 - 1/2" DIA x 4" PUDDLE WELDS AT EACH LOW FLUTE IS CONTINUOUS ACROSS ADJACENT SPAN.

NOTE: SEE TYPICAL DETAIL AT BEARING SUPPORT LOCATIONS IF NOT AT JOIST PANEL POINTS.

L4 x 3 x 5/16 x CONT (LLH) - SEE 7/S702 OSF (E) GLAZING - SEE ARCH DWGS TYPICAL 3" ROOF DECK OPENING DETAIL (≤ 4'-6")

L4 x 4 x 1/4 x CONT LEDGER ANGLE FOR BID