

Date: June 11, 2010

RE: City of Duluth Bid #10-4401
(New Passenger Terminal Bid Package 1 – Sitework, Structure and Enclosure)

Addendum No. 1

TO: Prospective Bidders

This Addendum forms a part of the Contract Documents and modifies the original Bidding Documents dated May 17, 2010. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification.

Invitation to Bid:

INV-4 – Paragraph 1- 5th sentence, Paragraph 2- 2nd sentence, Paragraph 3- 2nd and 4th sentence all read 60 days; **ALL shall be changed to read: 90 Days.**

***Also see Kraus-Anderson Addendum No. 1 attached.**

Bid Form:

Use enclosed “Bid Form Packet” included with this “Addendum No. 1” to submit your bids with City of Duluth “Notice to Bidder” sticker via sealed envelope to be received no later than June 17th at 2:00 p.m at the office of the City Purchasing Department – Duluth, MN. Bids received after 2:00 at the City Purchasing Department are null and void. *No facsimiles accepted.*

***Also see Kraus-Anderson Addendum No. 1 attached.**

Specifications:

Table of Contents: Division 07 – Thermal and Moisture Protection 07610 – Sheet Metal Roofing, 11 pages, shall read: 07610 – Sheet Metal Roofing, 12 pages.

Table of Contents: Division 07 – Thermal and Moisture Protection ~~07543 – Thermoplastic Polyolefin (TPO) Roofing~~, 11 pages.

Table of Contents: Division 07 – Thermal and Moisture Protection ~~07531 – Ethylene Propylene-Diene-Monomer (EPDM) Roofing~~, 10 pages shall be.

Table of Contents: Division 03 – Concrete 03300 – Cast-In-Place Concrete, 33 pages, shall read 03300 – Cast-In-Place Concrete, 29 pages.

Volume No. 1 Specification: Section 00100 Instructions to Bidders.

***See Kraus-Anderson Addendum No. 1 attached.**

Volume No. 1 Specification: Section 00305 Bid Form. ***See Kraus-Anderson Addendum No. 1 attached.**

Volume No. 1 Specification: City of Duluth Purchasing Division-General Specifications. No. 15 ALL shall read 90 days.

Volume No. 1 Specification: Section 001014 Work Scope Descriptions. *See Kraus-Anderson Addendum No. 1 attached.

Volume No. 1 Specification: Section 01500 Construction Facilities and Temporary Controls. *See Kraus-Anderson Addendum No. 1 attached

Volume No. 1 Specification: Replace "Work Scope Schedule" included in Bid Form Section with attached "Work Scope Schedule-Addendum No. 1" – revising Line Numbering and Quantities.

Volume No. 1 Specification: Include attached "Notice to Bidders – Suspensions/Debarments page.

Volume No. 1 Specification: General Provisions-Section 30 Award of Contract 30.02 60 days: Shall Read 90 days.

Volume No. 2 Specification: Remove Division 03 – Concrete Section 03300 – Cast in Place Concrete – replace with revised Section 03300 attached.

Volume No. 2 Specification: Remove Division 07 –Section 07413 – Insulated Core Metal Wall Panels – replace with revised Section 07413 attached.

Volume No. 2 Specification: Remove Division 07 –Section 07610 – Sheet Metal Roofing – replace with revised Section 07610 attached.

Volume No. 2 Specification: Remove Division 07 –Section 07620 – Sheet Metal Flashing and Trim – replace with revised Section 07620 attached.

Volume No. 2 Specification: Remove Division 07 –Section 07543 – Thermoplastic Polyolefin (TPO) Roofing in its entirety. REPLACE with Section 07531 Ethylene-Propylene-Diene-Monomer (EPDM) Roofing attached.

Volume No. 2 Specification: Division 08 –Section 08800 – Glazing- Article 1.2, Paragraph C. The curtain wall work specified in this section shall be performed under a single subcontract as specified in Section 08900 GLAZED ALUMINUM CURTAIN WALLS shall read: **C. The curtain wall work specified in this section shall be performed under a single subcontract as specified in Section 08911 Glazed Aluminum Curtain Walls.**

Drawings: *Replace list of drawings below with attached sheets to this Addendum No. 1*

- Volume No. 1 Civil Sheet G1-01: Revised drawing list.
- Volume No. 1 Civil Sheet C001: Revised Summary of Quantities.
- Volume No. 1 Civil Sheet C600: Revised Sheet Layout and Revised Gas Notes.
- Volume No. 1 Civil Sheet C601: Revised Key Map.
- Volume No. 1 Civil Sheet C602: Revised Water Main and Notes.
- Volume No. 1 Civil Sheet C603: Revised Water Main and Notes.
- Volume No. 1 Civil Sheet C604: Revised Water Main and Notes and Page Layout.
- Volume No. 1 Civil Sheet C605: Revised Sheet Layout and Sheet No.
- Volume No. 1 Civil Sheet C606: Revised Water Main, Notes and Sheet No.
- Volume No. 1 Civil Sheet C607: Revised Sheet No. and Layout.
- Volume No. 1 Civil Sheet C608: Revised Water Main Profiles, Notes & Sheet No.
- Volume No. 1 Civil Sheet C609: Revised Sheet No.
- Volume No. 1 Civil Sheet C610: Revised Sheet No.

Drawings: Replace list of drawings below with attached sheets to this Addendum No. 1

Revised Architectural Drawings – Volume 2

Sheet G101 Drawing List - Revised Drawing List.
Sheet A002 Symbols and Accessibility Clearances -Revised labels and notes.
Sheet A003 Partition Types-Revised Partition Types 5 & 7.
Sheet A101 Overall First Floor Plan-Added notes clarifying scope*Revised Stair 193.
Sheet A102 Overall Second Floor Plan-Added notes clarifying scope *Revised Stair 193.
Sheet A103 Overall Third Floor Plan-Added note clarifying scope.
Sheet A104 Overall Roof Plan-Added snow guards*Revised and added cuppers *
Revised antenna mounts.
Sheet A112 Enlarged Second Floor Plan Part A-Added portals at airside curtainwall.
Sheet A113 Enlarged Second Floor Plan Part B-Added portals at airside curtainwall.
Sheet A114 Enlarged Third Floor Plan Part A-Revised chiller screen wall framing to
match Structural.
Sheet A301 Exterior Elevations-Added portals at airside curtainwall.
Sheet A310 Building Sections-Revised "AEISS" references to "Str. Stl."
Sheet A311 Building Sections-Revised "AEISS" references to "Str. Stl."
Sheet A401 Wall Sections-Revised "Exterior Grade Sheathing Board" references to
"Protection Board" *Noted Air Floor System and concrete topping "N.I.C."
Sheet A402 Wall Sections-Revised "Exterior Grade Sheathing Board" references to
"Protection Board"

Revised Architectural Drawings - continued

Sheet A403 Wall Sections-Revised "Precast Concrete" reference to "C.I.P. Concrete"
*Revised exterior block wall detail *Added section through airside curtainwall portals.
Sheet A511 Plan Details-Added scope clarification notes.
Sheet A512 Plan Details-Added airside curtainwall portal details.
Sheet A520 Section Details-Revised "Dens-Deck" references to "Protection Board"
*Revised curtainwall detail at vestibule.
Sheet A521 Section Details-Revised curtainwall detail at PBB portal-*Revised detail
at metal roof/core wall interface-*Revised roof drain detail-*Revised exterior block
wall detail.
Sheet A530 Exterior Systems Vertical Circulation-Revised Stair 193.
Sheet A530A Exterior Systems Vertical Circulation-Revised Stair 193.
Sheet A532 Interior Systems Vertical Circulation-Revised notes and targets.
Sheet A533 Interior Systems Vertical Circulation-Revised notes and targets.
Sheet A702 Door Details-Revised opening dimensions at exterior coiling door
Sheet A710 Exterior Systems Landside Curtainwall-Revised and added curtainwall
wind brace details -*Revised metal roof gutter detail-*Revised cast-in-place
concrete kneewall.
Sheet A711 Exterior Systems Landside Curtainwall-Revised metal roofing details.
Sheet A712 Exterior Systems Airside Curtainwall-Revised coping details-*Revised
curtainwall plan details.
Sheet A713 Exterior Systems Airside Curtainwall-Revised detail references-
*Revised coping/fascia detail.

Revised Architectural Drawings – continued

Sheet A714 Exterior Systems Entry Vestibules-Revised detail references
Sheet A715 Exterior Systems Core Wall-Revised membrane roofing details-
*Revised targets and labels-*Added typical metal panel dimensions.

New Architectural Drawings

Sheet A522 Section Details-*New trench drain details-*New airside curtainwall
portal details
Sheet A530B Exterior Systems Vertical Circulation-New section at Stair 193
Sheet A540 Interior Systems Vertical Circulation-Stair details
Sheet A723 Exterior Systems Canopy-Canopy details clarifying scope and
indicating concrete finish

Revised Structural Drawings

Sheet S002 General Structural Notes-Added note clarifying structural stair
construction
Sheet S108 Canopy Roof Framing Plan Area A-Added dimensional information
Sheet S109 Canopy Roof Framing Plan Area B-Added dimensional information
Sheet S111 Foundation Plan Area B-Revised layout of apron access stair
Sheet S112 Second Level Framing Plan Area A-Revised slab edge conditions near
grid intersection G-1-*Adjusted framing between grid intersections C-6 and C-7 for
future pedestrian bridge
Sheet S113 Second Level Framing Plan Area B-Revised layout of apron access
stair
Sheet S114 Third Level Framing Plan Area A-Clarified numbering of AHU Weight
table
Sheet S115 Third Level Framing Plan Area B-Clarified numbering of AHU Weight
table

Revised Structural Drawings - continued

Sheet S504 Structural Details-Revised detail 3/S504*Added detail 8/S504
Sheet S505 Structural Details-Revised details at apron access stair
Sheet S706 Structural Details-Added details 10/S706 and 11/S706 for future
pedestrian bridge

Electrical Drawings Deleted in their Entirety:

Sheet E110 Enlarged First Floor Electrical Plan Area A
Sheet E110 Enlarged First Floor Electrical Plan Area B
Sheet E403 Panel Schedules
Sheet E404 Panel Schedules
Sheet E405 Panel Schedules
Sheet E406 Panel Schedules
Sheet E407 Panel Schedules

Other:

There will be no "Request for Substitutions" considered until each Bid Division has been awarded.

Attached for reference - Pre-Bid Meeting Notes dated May 25, 2010.

Faxed Questions:

1) Identify the manufacturers of the curtain wall used in the plan details (Section 8911)
(SGI dated 5/24/10)

Answer: *The curtainwall details depict a customized system and are not based on any manufacturers' stock systems*

2) What does CFMF stand for on Drawing A-402? (MAP dated 5/26/10)

Answer: *Cold-formed Metal Framing as indicated in the list of abbreviations on Sheet A001.*

3) Sheet C502, 603, 604, 506: Symbol for site lighting conduit/conductors is shown as a dash-dot-dash. There is no symbol referencing this. Clarify conduit and conductor size and quantity.
(BEC dated 5/27/10)

Answer: *See Volume No. 1 Civil Plan sheets E100 through E106 and E400 for electrical and communication information and details. Civil 600 series sheets show electrical utilities for reference only.*

4) Sheet C603, 604, 605: There are a number of manholes shown for both power and communications. Is there a detail showing size and other requirements? Who provides these manholes? (BEC dated 5/27/10)

Answer: *See Volume No. 1 Civil Plan sheets E100 through E106 and E400 for electrical and communication information and details. Civil 600 series sheets show electrical utilities for reference only.*

5) Sheet C604, 605: There is an underground electrical duct shown south of Grinden Drive. It appears there are two duct banks extending from these manholes and traveling around the perimeter of the roadway. Are there actually two separate duct banks or is this one structure? There also appears to be 4C #6, 1C #4 traveling the same route. Is this separate from the duct bank or installed inside the duct bank? (BEC dated 5/27/10)

Answer: *See Volume No. 1 Civil Plan sheets E100 through E106 and E400 for electrical and communication information and details. Civil 600 series sheets show electrical utilities for reference only.*

6) Sheet C605: there is underground telephone cable at existing manholes on north of plan sheet, extending south to two manholes north of Grinden Drive. It appears these manholes are existing, is this accurate? It also appears the UT cable is routed through existing duct bank, is this duct bank existing? There is 4C #6, 1C #4 shown routed through this as well. Is this routed in duct bank or separate? (BEC dated 5/27/10)

Answer: *See Volume No. 1 Civil Plan sheets E100 through E106 and E400 for electrical and communication information and details. Civil 600 series sheets show electrical utilities for reference only.*

7) Sheet C605: Plans show EUD from existing manholes routed south to south of Grinden Lane. It appears there are two duct banks. Is there two or one? (BEC dated 5/27/10)

Answer: *See Volume No. 1 Civil Plan sheets E100 through E106 and E400 for electrical and communication information and details. Civil 600 series sheets show electrical utilities for reference only.*

8) Is the UT cable supplied and installed by others? If not, please provide specs on cable. (BEC dated 5/27/10)

Answer: *See Volume No. 1 Civil Plan sheets E100 through E106 and E400 for electrical and communication information and details. Civil 600 series sheets show electrical utilities for reference only.*

9) Sheet ET010: There is a typical duct bank detail shown. Is this what we are to supply for the site duct banks that are shown on sheets C600 thru C606? If not, please clarify quantity and size of conduit. (BEC dated 5/27/10)

Answer: *The duct bank detail shown on sheet ET010 is for reference for duct banks shown on ET0-10 only. It is shown to indicate conduit spacing, concrete thickness, duct bank bedding, etc. Actual quantity and sizes of conduit are indicated on the plan on sheet ET010.*

10) Are concrete bases for site lighting and the site lighting itself included in this bid package? If so, please provide fixture schedule and detail of concrete base. (BEC dated 5/27/10)

Answer: *Concrete bases are to be provided under Work Scope 2.10 Bid Item No. 104 and Bid Item No. 105. See Volume No. 1 Civil Plan sheet E400 for details.*

11) Sheet E110: Is conduit for junction boxes and outlets for baggage conveyors to be routed underground? (BEC dated 5/27/10)

Answer: *No.*

12) Sheet E110: The note says to include conduit underground for escalators, conveyors, elevators, etc. What size conduit is required for this equipment? Is there an equipment schedule available for sizing of conduit? (BEC dated 5/27/10)

Answer: *Conduit for escalators, conveyors, elevators, etc. will be routed above ground and specified later. Provide underground conduit as specified on ET0-10. Sheets E110 and E111 are deleted in this Addendum*

13) Please clarify what equipment, receptacles, etc are to be fed underground and included in this bid package. (BEC dated 5/27/10)

Answer: *Underground conduit is shown on ET0-10.*

14) Sheet ET010: It appears all duct bank and underground electrical is to be included with Bid scope 16.10 and the duct bank and underground electrical shown on sheets C600 and C606 is to be included with bid scope 2.10. Is this accurate? (BEC dated 5/27/10)

Answer: *Electrical work shown on ET010 shall be included in Div. 16. Refer to CM's Summary of Scope Modifications contained in this Addendum.*

15) I would like to know if the site utilities are to be installed by open trench method or trenchless (directionally drilled). (GE dated 5/28/10)

Answer: *See Volume No. 1 Civil Plan sheet E105 for directional boring location. All other conduit as per trench detail sheet E400.*

16) Will you consider using 90 mill roofing instead of TPO? (Pre-bid 5/26/10)

Answer: *Yes, please refer to revised specifications in this Addendum.*

17) Is underfloor venting allowed in Minnesota? (Pre-bid 5/26/10)

Answer: *Yes, under floor venting of the sanitary system is allowed by the Minnesota plumbing code when installed correctly. The vent must rise from the line to be vented at an angle of not less than 45 degrees until it is above the flood rim level of the fixture or floor drain being vented.*

18) Who is responsible for providing the temporary heat once the building is enclosed? (Pre-bid 5/26/10)

Answer: *See response in Kraus-Anderson Addendum No. 1.*

19) AL Entrances – 2/714 & Work Scope 8.10 1.02P6. Aluminum entrance work and immediate frames are not in this contract. Please advise who is responsible for temporary wood doors in these areas? (HG dated 6/1/10)

Answer: *Refer to CM's Summary of Scope Modifications contained in this Addendum.*

20) Interior Aluminum Storefront and Glass Handrails TYP A113: Please confirm that all interior glass and aluminum elements are not in contract. (HG dated 6/1/10)

Answer: *Confirmed.*

21) Fin Tube Enclosure – TYP 2/510, 1,5,7/520, 5/521: Please confirm that the fin tube enclosures are not in 8.10 work scope. (HG dated 6/1/10)

Answer: *Confirmed.*

22) Metal Panels – Work Scope 1.02 P2: Scope identifies panels that occur within CW system to be provided under Work Scope 8.10. There does not appear to be any aluminum panel work that occurs within aluminum curtain wall system. All panel work interfaces with the aluminum curtain wall and can be handled as a standalone system. (HG dated 6/1/10)

Answer: *Refer to CM's Summary of Scope Modifications contained in this Addendum.*

23) Work Scope 7.10 Metal Panels. What is the desired size of grid, as illustrated on the elevations? Details show panel scaled at 40" see 11/A715 (Jamar dated 6/3/20)

Answer: *The panels are to be nominally 40" as depicted in the elevations and as indicated in revised Specification in this Addendum.*

24) Work Scope 7.10 Metal Panels. Is the panel 3"? (Jamar dated 6/3/20)

Answer **Yes.**

25) Work Scope 7.10 Metal Panels. Spec references 16" with no reference to R-value. (Jamar dated 6/3/20)

Answer *Please refer to the revised specification contained in this Addendum.*

26) Work Scope 7.10 Metal Panels. Is there any metal panels on the interior of building as A311 may illustrate. (Jamar dated 6/3/20)

Answer *No, the interior panels depicted on A311 will be different materials.*

27) Work Scope 7.10 Metal Panels. Detail 1/712 references pre-finished panel? What type? (Jamar dated 6/3/20)

Answer: *Composite Metal Panel.*

28) Work Scope 7.10 Metal Panels. Detail 2/715 references Corrugated Metal Panel. Is that correct? (Jamar dated 6/3/20)

Answer *No, the detail reference has been corrected in this Addendum.*

29) Metal panel fascia 3/A713 What material? (Jamar dated 6/3/20)

Answer *See revised detail contained in this addendum.*

30) Work Scope 7.10 Metal Panels. Prefinished Metal Panel 1/A713 is this composite? Or insulate core? (Jamar dated 6/3/20)

Answer *Composite.*

31) Work Scope 7.10 Metal Panels. What bid package is responsible for the insulation and cold formed framing behind composite panels reference A711 and similar? (Jamar dated 6/3/20)

Answer *Refer to CM's Summary of Scope Modifications contained in this Addendum.*

32) Work Scope 7.10 Metal Panels. Is prefinished metal panels fascia different from composite panel system – See notes on 8/A711? (Jamar dated 6/3/20)

Answer **No.**

33) Work Scope 7.10 Metal Panels. 6/A712 Metal panel fascia referenced – is this composite 07415 what scope has the insulation? (Jamar dated 6/3/20)

Answer: See response in Kraus-Anderson Addendum No. 1.

34) Metal Roof. .040 Aluminum is spec'd with expansion coefficients aluminum will have performance issues due to the long lengths. (Jamar dated 6/3/20)

Answer **Several manufacturers of the roll-formed metal roofing have confirmed the ability of their products to perform satisfactorily at the indicated lengths provided they are installed in accordance with the manufacturer's recommendations.**

35) Metal Roof. Is 24 gage steel an option? (Jamar dated 6/3/20)

Answer **No.**

36) Metal Roof. Are transverse joint acceptable? (Jamar dated 6/3/20)

Answer **No.**

37) Metal Roof. Can roof have a joint at the high point? (Jamar dated 6/3/20)

Answer **No.**

38) Metal Roof. Identify profile of pan and type seam joinery. (Jamar dated 6/3/20)

Answer **Pans shall be 18" in width with min. 2½" high standing seams. See revised specification in this Addendum.**

39) Metal Roof. No snow guard shown but referenced in spec? (Jamar dated 6/3/20)

Answer **Snow guards are depicted in this Addendum.**

40) Metal Roof. 4/A530 – A530a references metal roof. What is it attached to? What type material? Is it composite? (Jamar dated 6/3/20)

Answer **It is composite metal panel attached to CFMF and CIP concrete.**

41) Metal Roof. Clarify system below metal roof panel drawings differ from specification. See detail 8/A711. (Jamar dated 6/3/20)

Answer *Discrepancies between the drawings and specification are resolved in this Addendum.*

42) Metal Roof. Clarify bid package responsible for materials and installation below metal roof panel. (Jamar dated 6/3/20)

Answer: *Refer to CM's Summary of Scope Modifications contained in this Addendum. *See response in Kraus-Anderson Addendum No. 1.*

43) Sheet Metal Flashing. Is it supposed to be aluminum? What thickness? (Jamar dated 6/3/20)

Answer: *See revised specification in this Addendum.*

44) Sheet Metal Flashing. What is equipment support flashing? (Jamar dated 6/3/20)

Answer: *Flashing required at rooftop equipment.*

45) Is there a door schedule, and if so, where would we find it? (LBC dated 6/2/10)

Answer *No, doors are Not In Contract.*

46) Is there a specification on the insulated Coiling Doors? (LBC dated 6/2/10)

Answer *No, coiling doors are Not In Contract.*

47) Is there a specification of the High Speed O.H. Doors? (LBC dated 6/2/10)

Answer *No, the High Speed O.H. Doors are Not In Contract.*

All else remains the same.

Sincerely,
Reynolds, Smith and Hills, Inc.



John E. Hippchen, PE

END OF ADDENDUM NO. 1

WORK SCOPE 2.10 SCHEDULE - ADDENDUM NO. 1

| BID ITEM | SPEC. NUMBER | ITEM DESCRIPTION | UNIT | ESTIMATED QUANTITY | UNIT COST | TOTAL COST |
|-----------------|---------------------|-----------------------------------------------------------------|-------------|---------------------------|------------------|-------------------|
| 1 | P-100-3.1 | MOBILIZATION | LS | 1 | | |
| 2 | P-102-10.1 | SAFETY AND SECURITY | LS | 1 | | |
| 3 | P-104-5.1 | PROJECT SURVEY AND STAKEOUT | LS | 1 | | |
| 4 | P-105-5.1 | TEMPORARY CONSTRUCTION ITEMS | LS | 1 | | |
| 5 | F-162-5.1 | 14' WIDE x 6' DOUBLE LEAF MANUAL GATE | EACH | 1 | | |
| 6 | F-162-5.2 | 6' CHAIN LINK FENCE W/ 3 STRANDS BARBED WIRE | LF | 25 | | |
| 7 | 2101.501/00010 | CLEARING | ACRE | 2 | | |
| 8 | 2101.502/00010 | CLEARING | TREE | 75 | | |
| 9 | 2101.506/00010 | GRUBBING | ACRE | 2 | | |
| 10 | 2102.501/00010 | PAVEMENT MARKING REMOVAL & SEAL COAT | SF | 115 | | |
| 11 | 2104.501 | REMOVE WATER MAIN AND VALVES | LF | 535 | | |
| 12 | 2104.501/00016 | REMOVE SEWER PIPE (STORM) | LF | 1535 | | |
| 13 | 2104.501/00017 | REMOVE SEWER PIPE (SANITARY) | LF | 275 | | |
| 14 | 2104.501/00035 | REMOVE FENCE | LF | 1050 | | |
| 15 | 2104.501/00040 | REMOVE GUARD RAIL & FOUNDATION | LF | 500 | | |
| 16 | 2104.501/00062 | REMOVE CONCRETE CURB AND GUTTER | LF | 2700 | | |
| 17 | 2104.505/00110 | REMOVE CONCRETE PAVEMENT | SY | 1500 | | |
| 18 | 2104.505/00120 | REMOVE BITUMINOUS PAVEMENT (NOMINAL 4-8") | SY | 28000 | | |
| 19 | 2104.509/00094 | REMOVE FLAGPOLE | EACH | 1 | | |
| 20 | 2104.509/00100 | REMOVE MANHOLES OR CATCH BASINS | EACH | 14 | | |
| 21 | 2104.509/00101 | REMOVE MANHOLE (SANITARY) | EACH | 1 | | |
| 22 | 2104.509/00111 | REMOVE HYDRANT | EACH | 2 | | |
| 23 | 2104.511/00011 | SAWING CONCRETE PAVEMENT (FULL DEPTH) | LF | 140 | | |
| 24 | 2104.513/00011 | SAWING BITUMINOUS PAVEMENT (FULL DEPTH) | LF | 515 | | |
| 25 | 2105.503/00010 | ROCK EXCAVATION | CY | 2000 | | |
| 26 | 2105.505/00010 | MUCK EXCAVATION | CY | 2000 | | |
| 27 | 2105.515/00010 | UNCLASSIFIED EXCAVATION (Civil Only) | CY | 27500 | | |
| 28 | 2105.521/00032 | GRANULAR BORROW MOD 7% (CV) | CY | 11989 | | |
| 29 | 2105.525/00030 | TOPSOIL BORROW (CV) OBTAINED OFFSITE | CY | 905 | | |
| 30 | 2105.604 | GEOTEXTILE FABRIC TYPE V | SY | 21029 | | |
| 31 | 2211.503/00050 | AGGREGATE BASE (CV) CLASS 5 | CY | 7987 | | |
| 32 | 2221.503/00010 | AGGREGATE SHOULDERING (CV) CLASS 1 | CY | 90 | | |
| 33 | 2357.502/00010 | BITUMINOUS MATERIAL FOR TACK COAT | GAL | 1551 | | |
| 34 | 2358.501/00010 | BITUMINOUS MATERIAL FOR PRIME COAT | GAL | 1734 | | |
| 35 | 2360.501/23600 | TYPE (SP12.5) WEARING COURSE MIXTURE (3.F) | TON | 1490 | | |
| 36 | 2360.502/23600 | TYPE (SP12.5) NON WEARING COURSE MIXTURE (3.F) | TON | 1875 | | |
| 37 | 2401.515 | INTEGRALLY COLORED SIDEWALK CONCRETE (MIX #3A32) W/ 6" x 6" WWF | SF | 1925 | | |
| 38 | 2401.521/00030 | STRUCTURE EXCAVATION CLASS R | CY | 250 | | |

| BID ITEM | SPEC. NUMBER | ITEM DESCRIPTION | UNIT | ESTIMATED QUANTITY | UNIT COST | TOTAL COST |
|-----------------|---------------------|-------------------------------------------------------------------------------------|-------------|---------------------------|------------------|-------------------|
| 39 | 2502.541 | 4" PERFORATED (PVC) PIPE UNDERDRAIN SDR35 | LF | 3325 | | |
| 40 | 2503.511 | 12" CORRUGATED HDPE PIPE SEWER | LF | 802 | | |
| 41 | 2503.511 | 15" CORRUGATED HDPE PIPE SEWER | LF | 195 | | |
| 42 | 2503.511 | 18" CORRUGATED HDPE PIPE SEWER | LF | 355 | | |
| 43 | 2503.511 | 24" CORRUGATED HDPE PIPE SEWER | LF | 615 | | |
| 44 | 2503.511 | 30" CORRUGATED HDPE PIPE SEWER | LF | 85 | | |
| 45 | 2503.511 | 42" CORRUGATED HDPE PIPE SEWER | LF | 170 | | |
| 46 | 2503.511/13080 | 8" PVC PIPE SEWER (SANITARY) | LF | 545 | | |
| 47 | 2503.515 | 42" STEEL FLARED END SECTION | EACH | 1 | | |
| 48 | 2503.602 | CONNECT TO EXISTING STORM MANHOLE | EACH | 4 | | |
| 49 | 2503.602/00040 | CONNECT TO EXISTING SANITARY SEWER | EACH | 3 | | |
| 50 | 2503.603/00045 | PLUG, FILL & ABANDON PIPE | LF | 75 | | |
| 51 | 2503.603/01308 | LINING SEWER PIPE 8" | LF | 500 | | |
| 52 | 2504.602/00022 | RELOCATE HYDRANT & VALVE | EACH | 1 | | |
| 53 | 2504.602/00024 | INSTALL HYDRANT & VALVE | EACH | 1 | | |
| 54 | 2504.602/00808 | 8" GATE VALVE & BOX | EACH | 6 | | |
| 55 | 2504.602/00812 | 12" BUTTERFLY VALVE & BOX | EACH | 2 | | |
| 56 | 2504.603 | 4" PVC IRRIGATION CONDUIT SDR 35 | LF | 325 | | |
| 57 | 2504.603/01042 | 4" WATERMAIN DUCTILE IRON CL 52 | LF | 50 | | |
| 58 | 2504.603/01063 | 6" WATERMAIN DUCTILE IRON CL 53 | LF | 360 | | |
| 59 | 2504.603/01083 | 8" WATERMAIN DUCTILE IRON CL 53 | LF | 390 | | |
| 60 | 2504.603/01123 | 12" WATERMAIN DUCTILE IRON CL 53 | LF | 1063 | | |
| 61 | 2505.602/00020 | CONNECT TO EXISTING GAS MAIN | EACH | 1 | | |
| 62 | 2505.603/02020 | 2" HP POLYETHYLENE GAS MAIN | LF | 235 | | |
| 63 | 2506.502 | CONSTRUCT DRAINAGE STRUCTURE TYPE 'G' | EACH | 3 | | |
| 64 | 2506.502 | CONSTRUCT DRAINAGE STRUCTURE TYPE 48-4020 | EACH | 12 | | |
| 65 | 2506.502 | CONSTRUCT DRAINAGE STRUCTURE TYPE 60-4020 | EACH | 7 | | |
| 66 | 2506.502 | CONSTRUCT DRAINAGE STRUCTURE TYPE 72-4020 | EACH | 1 | | |
| 67 | 2506.521 | INSTALL CASTING | EACH | 23 | | |
| 68 | 2506.521 | INSTALL SANITARY CASTING | EACH | 1 | | |
| 69 | 2506.522/00011 | ADJUST FRAME & RING CASTING | EACH | 6 | | |
| 70 | 2506.602/00011 | MANHOLE (SANITARY) | EACH | 1 | | |
| 71 | 2511.501 | RANDOM RIPRAP CLASS IV | CYD | 14 | | |
| 72 | 2531.501/02120 | CONCRETE CURB & GUTTER DESIGN D424 | LF | 355 | | |
| 73 | 2531.501/02320 | CONCRETE CURB & GUTTER DESIGN B624 | LF | 2570 | | |
| 74 | 2531.602/00030 | INTEGRAL COLORED CONCRETE PEDESTRIAN CURB RAMP (TYPE SPECIAL) PEDESTRIAN CROSSWALKS | EACH | 4 | | |
| 75 | 2545.523 | 2 INCH TWO WAY CONCRETE ENCASED DUCT | LF | 270 | | |
| 76 | 2545.523 | 2 INCH FOUR WAY CONCRETE ENCASED DUCT | LF | 270 | | |
| 77 | 2545.523 | DIRECTIONAL BORING 2" SCHEDULE 80 PVC | LF | 460 | | |
| 78 | 2545.523/00053 | 2" NON-METALLIC CONDUIT (PVC) | LF | 9614 | | |
| 79 | 2550.512 | QUAZITE CAT. NO. PG1730BB30 ELECTRICAL HANDHOLE w/ LID OR APPROVED EQUAL | EACH | 11 | | |

| BID ITEM | SPEC. NUMBER | ITEM DESCRIPTION | UNIT | ESTIMATED QUANTITY | UNIT COST | TOTAL COST |
|-----------------|---------------------|--------------------------------------------------------------------------------------------------------------|-------------|---------------------------|---------------------------------------|-------------------|
| 80 | 2550.512 | QUAZITE CAT. NO. PG4872 ELECTRICAL HANDHOLE w/ PG4872HA00 LID OR APPROVED EQUAL | EACH | 2 | | |
| 81 | 2550.532/11040 | POWER CABLE 1 CONDUCTOR NO 4 (EQUIPMENT GROUND) | LF | 3450 | | |
| 82 | 2550.532 | POWER CABLE 1 CONDUCTOR NO 6 | LF | 8980 | | |
| 83 | 2550.532 | POWER CABLE 1 CONDUCTOR NO 8 | LF | 7025 | | |
| 84 | 2550.532 | 1 CONDUCTOR 18 GA SHIELDED CABLE | LF | 1825 | | |
| 85 | 2564.537/00010 | INSTALL SIGN TYPE A, STOP SIGN, R1-1 (COMPLETE W/ POST) | EACH | 1 | | |
| 86 | 2564.537 | INSTALL SIGN TYPE A, ONE WAY SIGN, R6-2R, CR (COMPLETE W/ POST) | EACH | 1 | | |
| 87 | 2573.502 | SILT FENCE TYPE HEAVY DUTY | LF | 250 | | |
| 88 | 2573.530 | STORM DRAIN INLET PROTECTION | EACH | 50 | | |
| 89 | 2573.540 | FILTER LOG TYPE STRAW BIOROLL | LF | 400 | | |
| 90 | 2573.550 | EROSION CONTROL SUPERVISOR | LS | 1 | | |
| 91 | 2573.604 | ROCK CONSTRUCTION ENTRANCE | SY | 1340 | | |
| 92 | 2575.501/00010 | SEEDING | ACRE | 4 | | |
| 93 | 2575.502 | SEED MIXTURE 250 | LBS | 450 | | |
| 94 | 2575.505/00030 | SODDING TYPE LAWN | SY | 2400 | | |
| 95 | 2575.523 | EROSION CONTROL BLANKET CATEGORY 2 | SY | 10800 | | |
| 96 | 2575.532 | FERTILIZER TYPE 1 10-10-10 | LBS | 1600 | | |
| 97 | 2575.560 | HYDRAULIC SOIL STABILIZER, TYPE 6 | LBS | 1675 | | |
| 98 | 2575.572 | RAPID STABILIZATION METHOD 4 | SY | 10800 | | |
| 99 | 2582.501/01010 | PAVEMENT MESSAGE (HANDICAPPED SYMBOL) PAINT | EACH | 29 | | |
| 100 | 2582.502 | BLACK PAVEMENT MARKING | SF | 475 | | |
| 101 | 2582.502/11104 | 4" SOLID LINE WHITE-PAINT | LF | 13550 | | |
| 102 | 2582.502/11304 | 4" DOTTED LINE WHITE-PAINT | LF | 1150 | | |
| 103 | 2582.502/11524 | 24" STOP LINE WHITE - PAINT | LF | 25 | | |
| 104 | SP 38.3 | INSTALL TYPE 'C' LIGHT W/ FOUNDATION | EACH | 10 | | |
| 105 | SP 39.3 | INSTALL TYPE 'A2' LIGHT W/ FOUNDATION | EACH | 3 | | |
| 106 | SP 40.3 | RELOCATE CHECKPOINT ACCESS & CONTROL SYSTEM FOR EAST BASEMENT ACCESS W/ NEW RED BEACON LIGHT & LOOP | EACH | 1 | | |
| 107 | SP 41.3 | PROVIDE & INSTALL CHECKPOINT ACCESS & CONTROL SYSTEM FOR WEST BASEMENT ACCESS W/ NEW RED BEACON LIGHT & LOOP | EACH | 1 | | |
| 108 | SP 42.3 | SALVAGE GATE OPERATOR | EACH | 6 | | |
| 109 | SP 43.3 | SALVAGE TICKET DISPENSER | EACH | 4 | | |
| 110 | SP 44.3 | REMOVE LIGHT & BASE | EACH | 10 | | |
| 111 | SP 45.3 | WALL & SMALL POST MOUNTED LIGHT REMOVAL | EACH | 10 | | |
| 112 | SP 46.3 | SITE POWER ALLOWANCE | AL | 1 | | |
| 113 | SP 47.3 | COMMUNICATIONS ALLOWANCE | AL | 1 | | |
| 114 | SP 48.3 | TRAFFIC CONTROL/SIGNING ALLOWANCE | AL | 1 | | |
| 115 | SP 49.3 | TERMINAL BUILDING WORK | LS | 1 | | |
| 116 | SP 50.3 | PRIVATE UTILITY LOCATING SERVICE | LS | 1 | | |
| | | | | | TOTAL BASE BID WORK SCOPE 2.10 | |

ADD ALTERNATE #1: GENERAL PARKING LOT SURFACING

| BID ITEM | SPEC. NUMBER | ITEM DESCRIPTION | UNIT | ESTIMATED QUANTITY | UNIT COST | TOTAL COST |
|-----------------|---------------------|-------------------------------------------------|-------------|---------------------------|-----------------------------------------|-------------------|
| 117 | P-100-3.1 | MOBILIZATION | LS | 1 | | |
| 118 | P-104-5.1 | PROJECT SURVEY AND STAKEOUT | LS | 1 | | |
| 119 | 2103.501/00010 | BUILDING REMOVAL (CONRAC) | LS | 1 | | |
| 120 | 2104.501/00035 | REMOVE FENCE | LF | 95 | | |
| 121 | 2104.501/00062 | REMOVE CONCRETE CURB AND GUTTER | LF | 210 | | |
| 122 | 2104.505/00110 | REMOVE CONCRETE PAVEMENT | SY | 365 | | |
| 123 | 2104.505/00120 | REMOVE BITUMINOUS PAVEMENT (NOMINAL 4-8") | SY | 4885 | | |
| 124 | 2104.509/00017 | REMOVE UNDERGROUND TANK | LS | 1 | | |
| 125 | 2104.509/00019 | REMOVE GAS PUMP | LS | 1 | | |
| 126 | 2104.513/00011 | SAWING BITUMINOUS PAVEMENT (FULL DEPTH) | LF | 675 | | |
| 127 | 2105.515/00010 | UNCLASSIFIED EXCAVATION | CY | 990 | | |
| 128 | 2105.521/00032 | GRANULAR BORROW MOD 7% (CV) | CY | 440 | | |
| 129 | 2105.604 | GEOTEXTILE FABRIC TYPE V | SY | 800 | | |
| 130 | 2105.607/00250 | HAUL & DISPOSE OF CONTAMINATED MATERIAL | CY | 100 | | |
| 131 | 2211.503/00050 | AGGREGATE BASE (CV) CLASS 5 | CY | 380 | | |
| 132 | 2357.502/00010 | BITUMINOUS MATERIAL FOR TACK COAT | GAL | 490 | | |
| 133 | 2358.501/00010 | BITUMINOUS MATERIAL FOR PRIME COAT | GAL | 725 | | |
| 134 | 2360.501/23600 | TYPE (SP12.5) WEARING COURSE MIXTURE (3,F) | TON | 590 | | |
| 135 | 2360.502/23600 | TYPE (SP12.5) NON WEARING COURSE MIXTURE (3,F) | TON | 590 | | |
| 136 | 2506.521 | INSTALL CASTING | EACH | 1 | | |
| 137 | 2531.501/02320 | CONCRETE CURB & GUTTER DESIGN B624 | LF | 85 | | |
| 138 | 2545.523/00053 | 2" NON-METALLIC CONDUIT (PVC) | LF | 161 | | |
| 139 | 2550.532/11040 | POWER CABLE 1 CONDUCTOR NO 4 (EQUIPMENT GROUND) | LF | 210 | | |
| 140 | 2550.532 | POWER CABLE 1 CONDUCTOR NO 6 | LF | 280 | | |
| 141 | 2550.532 | POWER CABLE 1 CONDUCTOR NO 8 | LF | 440 | | |
| 142 | 2582.502/11104 | 4" SOLID LINE WHITE-PAINT | LF | 4050 | | |
| 143 | SP 39.3 | INSTALL TYPE 'A2' LIGHT W/ FOUNDATION | EACH | 2 | | |
| 144 | SP 50.3 | PRIVATE UTILITY LOCATING SERVICE | LS | 1 | | |
| | | | | | TOTAL ADD ALT. 1 WORK SCOPE 2.10 | |

ADD ALTERNATE #2: PERIMETER FENCE

| BID ITEM | SPEC. NUMBER | ITEM DESCRIPTION | UNIT | ESTIMATED QUANTITY | UNIT COST | TOTAL COST |
|-----------------|---------------------|-----------------------------------------------|-------------|---------------------------|-----------------------------------------|-------------------|
| 145 | 2104.501/00035 | REMOVE FENCE | LF | 1475 | | |
| 146 | F-162-5.3 | 10' CHAIN LINK FENCE W/ 3 STRANDS BARBED WIRE | LF | 1450 | | |
| 147 | F-162-5.4 | 14' WIDE x 10' DOUBLE LEAF MANUAL GATE | EACH | 1 | | |
| 148 | F-162-5.5 | PEDESTRIAN GATE 10' HEIGHT | EACH | 1 | | |
| | | | | | TOTAL ADD ALT. 2 WORK SCOPE 2.10 | |

May 19, 2010

NOTICE TO BIDDERS
SUSPENSIONS/DEBARMENTS

DEPARTMENT OF TRANSPORTATION

NOTICE IS HEREBY GIVEN that the Department of Transportation (Mn/DOT) has ordered that the following vendors be suspended effective December 28, 2009, until final disposition of the June 4, 2010 hearing or hearing appeal:

Riley Bros. Companies Inc. and its affiliates, Morris MN
Riley Bros. Construction Inc. and its affiliates, Morris MN

NOTICE IS HEREBY GIVEN that the Department of Transportation (Mn/DOT) has ordered that the following vendors be suspended for a period of three (3) years, effective February 24, 2010 until February 24, 2013:

Joseph Edward Riley, Morris MN
John Thomas Riley, Morris MN

Minnesota Statutes, Section 161.315, prohibits the Commissioner, counties, towns or home rule or statutory cities from awarding or approving the award of a contract for goods or services to a person who is suspended or debarred; including

- 1) any contract under which a debarred or suspended person will serve as a subcontractor or material supplier,
- 2) any business or affiliate which the debarred or suspended person exercises substantial influence or control, and
- 3) any business or entity which is sold or transferred by a debarred person remains ineligible during the period of the seller's or transfer's debarment.

DEPARTMENT OF ADMINISTRATION

The Department of Administration in accordance with Minnesota Rules 1230.1150 has debarred and disqualified the following persons and businesses from entering into or receiving a State of Minnesota contract.

| NAME | DATE OF DEBARMENT |
|--------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| Joseph Edward Riley East 7 th Street & Highway 59 Bypass Morris, Minnesota 56267 | November 9, 2009 Through November 9, 2012 |
| John Thomas Riley East 7 th Street & Highway 59 Bypass Morris, Minnesota 56267 | November 9, 2009 Through November 9, 2012 |
| Riley Bros. Construction, Inc. East 7 th Street & Highway 59 Bypass Morris, Minnesota 56267 | November 9, 2009 Through November 9, 2012 |
| Riley Bros. Companies Inc. East 7 th Street & Highway 59 Bypass Morris, Minnesota 56267 | November 9, 2009 Through November 9, 2012 |
| Polyphase Electric Company 2515 West Superior Street Duluth, MN 55816-0151 | May 5, 2010 Through May 5, 2012 |
| Frances Harkonen 2515 West Superior Street Duluth, MN 55816-0151 | May 5, 2010 Through May 5, 2012 |

It is **YOUR RESPONSIBILITY** to make sure you do not use a debarred or suspended individual or business as a subcontractor or supplier of materials or services. This suspension and debarment also applies to county, town, home rule and statutory city contracts for goods or services.

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 03300 – CAST-INPLACE
CONCRETE**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, vapor retarder, concrete materials, mixture design, placement procedures, finishes and all related accessories, for the following:
 - 1. Footings.
 - 2. Foundation walls and piers.
 - 3. Slabs-on-grade.
 - 4. Columns.
 - 5. Concrete toppings.
 - 6. Base slabs.
 - 7. Miscellaneous concrete items.
 - 8. Placement of embedded items provided by other trades
- B. Related Requirements:
 - 1. Division 01 Section “Structural Tests and Special Inspections”.
 - 2. Division 03 Section “Concrete Formwork”.
 - 3. Division 03 Section “Concrete Reinforcement”.
 - 4. Division 03 Section “Concrete Topping”.
 - 5. Division 04 Section “Unit Masonry” for wedge type inserts and dovetail slots.
 - 6. Division 05 Sections for items cast into concrete.
 - 7. Division 31 Section “Earth Moving”.

1.3 REFERENCES

- A. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
- B. ACI 214 - Recommended Practice for Evaluation of Strength Test Results of Concrete.
- C. ACI 223 – Standard Practice for the Use of Shrinkage Compensation Concrete.
- D. ACI 301 - Specifications for Structural Concrete for Buildings.
- E. ACI 302 – Guide for Concrete Floor and Slab Construction.
- F. ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete.
- G. ACI 305 - Hot Weather Concreting.

- H. ACI 306 - Cold Weather Concreting.
- I. ACI 308 – Standard Practice for Curing Concrete.
- J. ACI 309 - Guide for Consolidation of Concrete.
- K. ACI 318 - Building Code Requirements for Structural Concrete.
- L. ASTM E 1155 – Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.

1.4 DEFINITIONS

- A. Floor Flatness Number, F_F , measures floor curvature or flatness per ASTM E 1155.
- B. Floor Levelness Number, F_L , measures floor inclination from a horizontal plane per ASTM E 1155.
 - 1. Floor Levelness, (F_L), tolerances only apply to nonsloping slabs-on-grade and suspended slabs shored at time of testing. Floor Levelness tolerances shall not apply to slabs placed on unshored form surfaces, shored surfaces after removal of shores, or pitched slab surfaces per ACI 302.
- C. Overall F_F/F_L numbers represent minimum values acceptable for all combined local floor test sections representing the specified floor finish area per ACI 302.
- D. Local F_F/F_L test areas shall be defined as follows per ACI 302.
 - 1. Areas bounded by construction or control joints for slabs-on-grade.
 - 2. Areas bounded by columns and/or wall lines for elevated structural slabs. No less than one-half bay size.
- E. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Form-release agents
 - 2. Concrete Admixtures.
 - 3. Curing Materials.
 - 4. Joint Fillers.
 - 5. Waterstops.
 - 6. Floor and Slab Treatments.
 - 7. Bonding Agents.
 - 8. Adhesives.
 - 9. Repair Materials
- B. Concrete Mix Designs: Each concrete mix design submittal shall contain the following information:
 - 1. Mix Number (which will correspond to mix ticket on trucks delivered to site).

2. Application for which concrete is designed (i.e. – footings, slabs, etc...)
3. Applicable mix performance criteria including:
 - a. Final Design strength at 28 days.
 - b. Unit Weight.
 - c. Air Content.
 - d. Slump (with water only and after addition of WRA and/or HRWRA).
 - e. For shrinkage compensating concrete, provide results of restrained prism expansion tests, ASTM C878, with mix design.
4. Applicable mix ingredients including quantities, ASTM designations, and sources for:
 - a. Cementitious materials.
 - b. Aggregate source, geological type, size, and shape.
 - 1) Include total gradation for combined coarse and fine aggregates for mixes specified to contain Well Graded Aggregate.
 - 2) Included calculated Coarseness Factor and Workability Factor for mixes specifying limits on these values.
 - c. Water.
 - 1) Indicate amount of mixing water to be withheld for later addition at Project site.
 - d. Water cementitious materials ratio, w/cm.
 - e. Admixtures.
 - f. Fibers, color pigments, and other additions.
5. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Proposed construction joint and saw-cut contraction joint locations for slabs-on-grade.

1.6 INFORMATIONAL SUBMITTALS

A. Submittal Schedule for all action submittal items.

B. Manufacturer's Instructions for each type of product indicated:

1. Curing and Sealing Compounds.
2. Joint Fillers.
3. Waterstops.
4. Floor and Slab Treatments.
5. Bonding Agents.
6. Adhesives.
7. Repair Materials.

C. Preconstruction Material Test Reports:

1. Cementitious Materials.
2. Compressive strength results of trial batches or historical test data, in accordance with ACI 318 Chapter 5, indicating following:
 - a. Specified compressive strength, f'_c .
 - b. Average compressive strength, f'_{cr} .
 - c. Number of consecutive tests.
 - d. Overall standard deviation.
 - e. Overall coefficient of variation.
 - f. Minimum moving average of three consecutive strength tests.
3. Aggregate gradation, specific gravity, and absorption.

4. Aggregate potential alkali-silica reactivity (ASR) for concrete in exterior, corrosive, or wet environments in accordance with ASTM C 289.

D. Minutes of Pre-Installation conference.

E. Sustainable Design Submittals:

1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR 4.2 if required: For products having recycled content, documentation indicating weights, costs, and percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating material weights and costs for each product having recycled content.
 - b. Design Mixtures for Credit ID 1.1: For each concrete mixture containing recycled pozzolanic or cementitious materials as a replacement for portland cement and for equivalent concrete mixtures that do not contain portland cement replacements.
2. LEED Credit: Product Data for Credit MR 5.1 and Credit MR 5.2 if required: For products having Regional content (Extracted, and processed or manufactured within 500 miles of site), documentation indicating total weights, costs and percentages by weight of regional content.
 - a. Include statement indicating material weights, and costs for each product having regional content.

F. Construction Test Reports:

1. Concrete tests.
2. Floor tolerance measurement.
3. Industrial floor joint filler inspection.

1.7 CLOSEOUT SUBMITTALS

A. Floor Correction Agreement: Submit written floor slab extended correction period agreement in duplicate within ten days after date of Substantial Completion.

B. Maintenance Contracts:

1. Curing and Sealing Compounds.
2. Floor and Slab Treatments.

C. Operation and Maintenance Data:

1. Curing and Sealing Compounds.
2. Floor and Slab Treatments.

D. Bonds.

E. Warranty Documentation.

F. Record Documentation.

G. Sustainable Design Closeout Documentation.

1.8 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. **Testing Agency Qualifications:** An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- D. **Source Limitations:** Obtain materials from same source throughout Work.
- E. **Mockups:** Construct mockups as directed by the Architect to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. **Exposed Concrete Panel Samples:** Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship for review and acceptance by Architect and Owner.
 - a. Build panel to size and in the location as directed by the Architect.
 - b. Approved mockups may become part of the completed Work and shall remain exposed to view for duration of work as basis for quality of final construction.
 - c. Sample mockups not selected for incorporation shall be demolished and removed from site.
- F. Contractor shall assign a qualified staff member to perform quality control on their own work in the field on a daily basis, for each day work is performed. The Contractor's quality control staff shall review their own work for compliance with contract documents before the Contractor notifies the design team of readiness for required inspections, tests and observations to be provided by the Owner's Representatives.
- G. **Pre-Installation Conference:** Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination" and Division 01 Section "Structural Tests and Special Inspections".
 - 1. Review installer qualifications, methods, scheduling and testing procedures before work is started.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, steel reinforcement installation, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, vapor-retarder installation, anchor rod and anchorage device installation tolerances, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

3. Authorized representatives of concrete supplier, industrial floor supplier and installer, floor finisher, testing and inspection agency, admixture supplier, steel fiber reinforcement supplier, Engineer, Owner and Construction Manager.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.
- B. Joint Filler, Joint Sealers and Curing Materials: Deliver in original factory packaging and unopened containers and protect from damage and contamination.

1.10 SITE CONDITIONS

- A. Provide total building enclosure including weather tight roof and walls before placing interior concrete slabs.
- B. During installation of interior slabs on grade, close openings in exterior walls and roofs enclosing areas.
- C. Provide minimum interior temperature 50 degrees F during installation and curing.
- D. Vent heaters or combustion equipment to outside.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 CONCRETE MATERIALS

- A. Cementitious and Pozzolanic Materials: Use the following materials, of the same type, brand, and source for each required type of concrete and on which selection of concrete proportions was based:
 1. Portland Cement: ASTM C 150, Type 1 or Type I/II.
 2. Fly Ash: ASTM C 618, Class C or F, and as specified herein.
 - a. Available Alkalis, as Na₂O equivalent: 1.5% maximum
 - b. Loss On Ignition (LOI): 1% maximum
 - c. Calcium Oxide Limit (CaO): 20% maximum
 3. Microsilica: ASTM C 1240, amorphous silica.
 4. Replacement Ratio: Portland cement shall be replaced on an equal mass (not weight) basis. Material replacements shall be expressed as a percent, by mass, of the total cementitious materials content, with proportions selected for 28 day compressive strengths equal to those specified. The change in volume resulting

from the substitutions shall be determined and an adjustment in both coarse and fine aggregate proportions shall be determined in order to ensure a unit volume.

- a. Fly Ash replacement shall not exceed 30% for Class C, 20% for Class F, or as specified for a particular mix design.
- b. Microsilica replacement shall not exceed 10%.
- c. Maximum cement replacement of concrete mixes containing pozzolan shall not exceed 40% unless specified otherwise.

B. Normal-Weight Aggregates: ASTM C 33. Do not use aggregates containing soluble salts or other substances which can cause stains on exposed surfaces. Use aggregates from one source of supply corresponding to that on which selection of concrete proportions was based.

1. Coarse Aggregate: Minimum Class Designation:
 - a. Class 3S Typical
 - b. Class 4S Exterior horizontal concrete
 - 1) Maximum absorption 1.7%
 - c. Class 5S Exterior exposed architectural concrete
 - 1) Maximum absorption 1.7%
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. Aggregate Gradation: Conform to ASTM C 33 and as specified herein.
 - a. Well Graded Aggregate: Provide in concrete mixes indicated with the combined coarse and fine aggregates meeting the following criteria:

| Sieve Size | Top Size Aggregate | | |
|------------|---------------------|----------|----------|
| | 1 1/2" | 1" | 3/4" |
| | % Retained on Sieve | | |
| 1 1/2" | 0% - 8% | | |
| 1" | 8% - 18% | 0% - 8% | |
| 3/4" | 8% - 18% | 8% - 22% | 0% - 6% |
| 1/2" | 8% - 18% | 8% - 22% | 6% - 22% |
| 3/8" | 8% - 18% | 8% - 22% | 6% - 22% |
| No. 4 | 8% - 18% | 8% - 22% | 6% - 22% |
| No. 8 | 8% - 18% | 8% - 22% | 6% - 22% |
| No. 16 | 8% - 18% | 8% - 22% | 6% - 22% |
| No. 30 | 8% - 18% | 8% - 22% | 6% - 22% |
| No. 50 | 3% - 12% | 3% - 12% | 3% - 12% |
| No. 100 | 0% - 8% | 0% - 8% | 0% - 8% |
| No. 200 | 0% - 5% | 0% - 5% | 0% - 5% |

- 1) At least 55% by weight shall be retained on or above the #4 sieve.
 - 2) A maximum of two non-adjacent sieves between 1 inch and No. 50 may fall outside the prescribed limits above with a minimum of 5% retained and a maximum of 22% retained on these nonconforming sieves.
4. Aggregates for Exposed Architectural Finish Concrete: Aggregates shall be specially selected for color and size as selected by Architect.

C. Water: ASTM C 94 and potable.

2.3 ADMIXTURES

- A. General: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use admixtures containing calcium chloride or thiocyanates.
- B. Air-Entraining Admixture (AEA): ASTM C 260.
 - 1. Available Products:
 - a. BASF: MB AE 90 or Micro Air.
 - b. Euclid Chemical Company: Air-Mix.
 - c. General Resource Technology: Polychem AE.
 - d. Grace Construction Products: Daravair series or Darex series.
 - e. Protex Industries: Protex AES.
- C. Water-Reducing Admixture (WRA): ASTM C 494, Type A.
 - 1. Available Products:
 - a. BASF: Pozzoloth 210 or Pozzoloth 322 N
 - b. Euclid Chemical Company: Eucon WR-75.
 - c. General Resource Technology: Polychem 1000.
 - d. Grace Construction Products: WRDA.
- D. Mid-Range Water-Reducing Admixture (MRWRA): ASTM C 494, Type A.
 - 1. Available Products:
 - a. BASF: Polyheed 997 or Polyheed FC100.
 - b. Euclid Chemical Company: Eucon A+.
 - c. General Resource Technology: KB-1000.
 - d. Grace Construction Products: Daracem-65.
- E. Polycarboxylate High-Range Water-Reducing Admixture (HRWRA): ASTM C 494, Type F.
 - 1. Available Products:
 - a. BASF: Glenium 3000 NS, 3030 NS, or 3200 HES.
 - b. Euclid Chemical Company: Plastol 5000.
 - c. Grace Construction Products: ADVA.
- F. Whelan Gum or Methylcellulose Viscosity Modifying Admixture (VMA):
 - 1. Available Products:
 - a. BASF: Rheomac VMA 358, 362, or 450.
 - b. Euclid Chemical Company: Viscrol.
- G. Water-Reducing and Retarding Admixture: ASTM C 494, Type B and D.
 - 1. Available Products:
 - a. BASF: Pozzoloth 80 or Pozzoloth 200 N.
 - b. Euclid Chemical Company: Eucon Retarder-75.
 - c. General Resource Technology: Polychem R.
 - d. Grace Construction Products: Daratard 17.
- H. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E.
 - 1. Available Products:
 - a. BASF: Pozzoloth NC 534.

- b. Euclid Chemical Company: Accelguard 80.
- c. General Resource Technology: Polychem Super Set.
- d. Grace Construction Products: Polarset.

I. Integral Water Repellant Admixtures:

- 1. Available Products:
 - a. Grace Construction Products: Darapel
 - b. Xypex Chemical Corporation: Admix C-1000 or C-2000.

J. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures effectively containing chloride ions (more than 0.05 percent) are not permitted.

2.4 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

- 1. Available Products:
 - a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
 - b. Concrete Sealants Inc.; Conseal CS-231.
 - c. Greenstreak; Swellstop.
 - d. Henry Company, Sealants Division; Hydro-Flex.
 - e. JP Specialties, Inc.; Earthshield Type 20.
 - f. Progress Unlimited, Inc.; Superstop.
 - g. TCMiraDRI; Mirastop.

2.5 MISCELLANEOUS EMBEDDED ITEMS

A. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

- 1. Nuts: ASTM A 563 heavy hex carbon steel.
- 2. Plate Washers: ASTM A 36 carbon steel.
- 3. Washers: ASTM F 436 hardened carbon steel.

B. Miscellaneous angles, channels, and plates: ASTM A 36.

C. Reglets: Fabricate reglets of not less than 0.0217-inch- thick (26-ga.), galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

- 1. Available Manufacturers:
 - a. Gateway Building Products.
 - b. Heckman Building Products.
 - c. Hohmann-Bernard.

D. Stair Nosings:

- 1. Available Products:
 - a. Wooster Products: Spectra Type WP4C.

2.6 CURING, CLEANING, AND SEALING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Available Products:
 - a. BASF: Confilm
 - b. Burke by Edoco; BurkeFilm.
 - c. ChemMasters; Spray-Film.
 - d. Conspec; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film.
 - f. Euclid Chemical Company; Eucobar.
 - g. Kaufman Products, Inc.; Vapor Aid.
- B. Water Cure:
1. Waterproof paper.
 2. Reef Industries: Transguard Economy Grade. (ASTM C 171, 20-mils thick, polypropylene sheet with nonperforated white coating.)
 3. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
 4. Dayton Bag and Burlap: Burlene.
 5. Reef Industries: Transguard 4000; 42-mil thick, fiber mat with polyethylene sheet backing.
- C. Water: ASTM C 94 and potable.
- D. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A, minimum 25 percent total solids.
1. Available Products:
 - a. Burke by Edoco; Cureseal 1315.
 - b. ChemMasters; Spray-Cure & Seal Plus.
 - c. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
 - d. Euclid Chemical Company; Super Diamond Clear.
 - e. L&M Construction Chemicals, Inc.; Lumiseal Plus.
 - f. Meadows, W. R., Inc.; CS-309/30.
- E. Concrete Floor Cleaner and Stripper:
1. Available Products:
 - a. Burke by Edoco; Burke Klean.
 - b. Dayton Superior Corporation; Citrus Peel (J-48).
 - c. Euclid Chemical Company; Euco Clean & Strip.
 - d. Kaufman Products, Inc.; K Pro CD.
 - e. L&M Construction Chemicals, Inc.; Citrex.
- F. Penetrating Liquid Densifier and Sealer: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
1. Available Products:
 - a. Burke by Edoco; Titan Hard.
 - b. ChemMasters; Chemisil Plus.
 - c. Curecrete Distribution Inc.; Ashford Formula.
 - d. Dayton Superior Corporation; Day-Chem Sure Hard.

- e. Euclid Chemical Company; Euco Diamond Hard.
- f. Kaufman Products, Inc.; SureHard.
- g. L&M Construction Chemicals, Inc.; Seal Hard.

2.7 JOINT MATERIALS

- A. Equipment Control joint saw:
 - 1. Available Products:
 - a. Soff-Cut International; "Soff-Cut System," early-entry dry-cut saw with Skid Plate.
- B. Expansion Joint Material: ASTM D 1751, asphalt-saturated cellulosic fiber.
 - 1. Available Manufacturers:
 - a. W.R. Meadows.
 - b. BASF.
- C. Joint Backer Rod: Flexible, compressible, closed-cell polyethylene foam, not less than 10 psi compression deflection.
- D. Joint Filler-Industrial Slabs: Two-component, semirigid, 100 percent solids, per ASTM D 2240.
 - 1. Metzger/McGuire, MM80.
 - 2. Metzger/McGuire, SPAL-PRO RSF at freezers.
- E. Interior Joint Sealer: Mameco, Vulkem 45.
- F. Interior Bond Breaker Joint: 30 pound asphalt felt, unperforated.

2.8 RELATED MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- B. Under Slab Vapor Retarder: ASTM E1745, Class A. Permeance of less than 0.01 perms after mandatory conditioning tests per ASTM E 1745 (7.1.1 – 7.1.5). Not less than 15 mils thick.
 - 1. ~~Manufacturers and Products:~~
 - a. ~~Barrier Bac, Inc., VB250 or VB350.~~
 - b. ~~Raven Industries, Vapor Block 10 or 15.~~
 - c. ~~Reef Industries, Inc., Vaporguard.~~
 - d. ~~Stego Industries, Stego Wrap Vapor Barrier 15 mil.~~
 - e. Monaflex
 - f. Flatiron Films
 - 2. Accessories:
 - a. Seam tape: High density polyethylene tape with pressure sensitive adhesive, minimum 4 inches wide.
 - b. Pipe boots: Constructed from vapor barrier membrane and seam tape.

2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXING

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, with exceptions specified herein, and ASTM C 1116 where fibers are used, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- C. Admixtures: Use approved admixtures according to manufacturer's written instructions.
1. Use chemical admixtures in concrete, as required, for placement, workability, durability, and controlled set time.
- D. Air Content: Do not allow air content of hard-troweled finished floors to exceed 3 percent.
- E. Concrete Slump Limits: Measured according to ASTM C 143 at point of placement.
1. 4 inches without water reducing admixtures
 2. 5 inches after addition of WRA or MWRA.
 3. 7 inches after addition of HRWRA.

4. A tolerance of up to one inch above indicated maximum will be allowed for one batch in any five consecutive batches tested.
5. If the maximum water-cement ratio is not exceeded, concrete arriving at the jobsite within 60 minutes of the initial batching that has a slump less than the maximum allowed may have water added when accepted by the project inspector.
6. Water reducing admixtures will not be incorporated in combination with shrinkage compensating concrete unless approved by the Engineer.
7. Water reducing admixtures may be added to increase the slump when water can not be added and additional slump is necessary for workability when accepted by the project inspector.
8. Water shall not be added to the mix after any supplemental water reducing admixtures have been dosed into the mixer.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:

| Item | Requirements |
|--------------------------------------------------------------------------------------------------------|--------------------|
| Compressive Strength at 56 days (min), f'_c | 4000 psi |
| Maximum Cementitious Content | 520 lb/cy |
| Maximum water/cementitious materials ratio, w/cm | 0.50 |
| Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials | 50%-100% 0%-50% |
| Top Size Aggregate | 1-1/2 inch |

- B. Foundation Walls and Piers: Proportion normal-weight concrete mixture as follows:

| Item | Requirements |
|--------------------------------------------------------------------------------------------------------|--------------------|
| Compressive Strength at 28 days (min), f'_c | 4000 psi |
| Maximum Cementitious Content | 520 lb/cy |
| Maximum water/cementitious materials ratio, w/cm | 0.45 |
| Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials | 60%-100% 0%-40% |
| Top Size Aggregate | 1-1/2 inch |
| Air Content (at point of placement) at un-insulated exterior foundation walls | 5.5% (\pm 1.5%) |

- C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

| Item | Requirements |
|--------------------------------------------------|-------------------------|
| Compressive Strength at 28 days (min), f'_c | 4000 psi |
| Maximum Cementitious Content | 520 lbs/yd ³ |
| Maximum water/cementitious materials ratio, w/cm | 0.44 |

| | |
|-----------------------------------------------------------------------------------------|-----------------------|
| Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F | 70%-100% 20% - 30% |
| Maximum Top Size Aggregate | 1-1/2 inch |
| Aggregate Gradation | Well Graded |
| Coarseness Factor | 52 - 70 |
| Workability Factor | 32 - 40 |
| Air Content (at point of placement) for slabs exposed to freezing and thawing | 5.5% (\pm 1.5%) |

- D. Suspended Slabs-On-Metal Deck: Proportion normal-weight concrete mixture as follows:

| Item | Requirements |
|-----------------------------------------------------------------------------------------|---------------------------------------------------------|
| Compressive Strength at 28 days (min), f'_c | 4000 psi |
| Equilibrium Unit Weight | 150 lbs/ft ³ (\pm 3 lbs/ft ³) |
| Cementitious Materials Content | 520 lbs/yd ³ |
| Maximum water/cementitious materials ratio, w/cm | 0.44 |
| Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F | 60% maximum 20% - 30% |
| Top Size Aggregate | 1.5 inch |
| Coarseness Factor | 52-70 |
| Workability Factor | 32-40 |
| Aggregate Gradation | Well Graded |
| Air Content (at point of placement) | 3% maximum |
| Strux 90/40 Synthetic Fiber Reinforcement | As indicated on drawings |

- E. Concrete Topping Slabs: Proportion normal-weight concrete mixture as follows:

| Item | Requirements |
|-----------------------------------------------------------------------------------------|--------------------------|
| Compressive Strength at 28 days (min), f'_c | 3000 psi |
| Maximum Cementitious Content | 564 lbs/yd ³ |
| Maximum water/cementitious materials ratio, w/cm | 0.42 |
| Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F | 60% maximum 20% - 30% |
| Minimum Top Size Aggregate | 1/2 inch |
| Aggregate Gradation | Well Graded |

- F. Miscellaneous Concrete Items: Concrete stair pan fill, curbs, housekeeping pads, etc. Proportion normal-weight concrete mixture as follows:

| Item | Requirements |
|-----------------------------------------------|--------------|
| Compressive Strength at 28 days (min), f'_c | 3000 psi |

| | |
|--------------------------------------------------------------------------------------------------------|----------------------------|
| Maximum water/cementitious materials ratio, w/cm | 0.45 |
| Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials | 60% maximum 40% minimum |
| Minimum Top Size Aggregate | 1/2 inch |

PART 3 - EXECUTION

3.1 GENERAL

- A. Work shall conform to ACI 117 and ACI 301, except as modified by requirements of these Contract Documents.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 3. Install wedge inserts for masonry shelf angle supports and sleeves for pipe and conduit.

3.3 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect and Engineer.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
 2. Form joints with keyways and/or dowels as detailed. Embed keys at least 1-1/2 inches into concrete.
 3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows where not specifically shown on Drawings:
1. Exterior Slabs:

- a. Spacing shall not exceed 24 times slab thickness; 10 feet on center, maximum.
 - b. Short: long side ratio shall not be less than 3:4.
 - 2. Interior Slabs:
 - a. As indicated on drawings.
 - 3. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 4. Sawed Joints: Form contraction joints with early-entry dry-cut power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
 - a. Install cuts 0 to 2 hours after final finishing and prior to final set.
 - b. Install joint protector at saw-cut intersections prior to cross cut.
 - 5. Provide cleanly cut, straight joints in toppings over joints in base slab.
 - 6. Do not saw cut slabs on metal deck.
 - D. Isolation Joints in Slabs-on-Grade: After removing formwork, install expansion joint material at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend expansion joint material full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - 2. Terminate full-width expansion joint material not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 - 3. Install expansion joint material in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- 3.4 WATERSTOPS
- A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.
- 3.5 INSTALLING UNDER SLAB VAPOR RETARDER
- A. Install according to membrane manufacturer's current published instructions and ASTM E1643.
 - B. Install over level granular base and under reinforcing and slabs on grade.
 - C. Lap over footings and seal to foundation walls.
 - D. Overlap membrane joints minimum 6 inches and seal continuously with seam tape.
 - E. Seal penetrations and pipes with pipe boot fashioned from membrane and sealed with seam tape.

- F. Repair damaged membrane with patches of membrane overlapping damage minimum 6 inches and sealing completely with seam tape.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding water-reducing admixtures to mixture.
- C. Clean forms, reinforcing and accessories and lubricate forms prior to placing concrete.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
 - 4. Do not insert vibrators to bottom of slabs-on-grade with underfloor vapor retarders to avoid damaging this membrane.
 - 5. Do not allow concrete to drop freely more than 4 feet.
 - 6. Use approved chutes equipped with suitable hoppers for placing where required.
 - 7. Place at rate that concrete is always plastic and flows readily into every space.
 - 8. Place beams, girders and haunches monolithically with floor system.
 - 9. Wait until concrete in columns and walls is no longer plastic before casting beams, girders or slabs supported by them.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Before concrete slabs on grade are placed, verify that granular base is level and compacted.
 - 2. Sprinkle base to eliminate suction of water from concrete.
 - 3. Allow no freestanding water.
 - 4. Place interior slabs only after permanent walls and roof enclose slab area.
 - 5. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 6. Maintain reinforcement in position on chairs during concrete placement.
 - 7. Do not insert vibrators to bottom of slabs-on-grade with underfloor vapor retarders to avoid damaging this membrane.
 - 8. Screed slab surfaces with a straightedge and strike off to correct elevations.

9. Slope surfaces uniformly to drains where required.
10. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Concrete Finish Topping:

1. Prior to placing topping, remove laitance and loose particles of sand and dirt.
2. Remove oil and grease spots by washing with 10 percent solution of muriatic acid or strong washing soda.
3. After cleaning, hose down with pressure hose and keep base slab wet for at least 12 hours.

G. Do not use concrete that has partially hardened or been contaminated by foreign materials, nor concrete that has been retempered or remixed after initial set.

H. Before depositing new concrete on or against concrete that has set at construction joints, clean, wet and apply bonding agent to existing surfaces. Tighten forms prior to resuming pouring.

I. Exercise care to prevent splashing of forms or reinforcing with concrete above level of concrete being placed.

J. Clean reinforcement projecting above or out of concrete immediately after completion of particular unit of pour.

K. Do not place concrete under adverse weather conditions unless adequate protection is provided. Refer to ACI 301, for weather restrictions and placing temperatures.

3.7 COLD WEATHER CONCRETING

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
4. Ensure minimum temperatures are maintained for the duration of the curing period in accordance with ACI 306.1.
5. Concrete shall be allowed to dry for at least 12 hours before removing temperature protection for water cured or moisture retention cured concrete.

3.8 HOT WEATHER CONCRETING

A. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. When high temperature, measured on jobsite at concrete placement area, is expected to rise above 90 deg F, maintain concrete temperature below 90 deg F

at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. When temperature of steel reinforcement, embeds, subgrade, or forms, is greater than 120 degrees F, fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
3. Protect concrete from wind and direct sunlight to avoid rapid drying.
4. Apply evaporation retarder to unformed concrete surfaces if the air temperature exceeds 80 degrees F, the wind speed exceeds 10 mph, or the relative humidity is less than 40%. Apply according to manufacturer's written instructions immediately after placing and screeding.
5. Apply moisture retaining covers or wet cure in accordance with concrete curing and protection methods as specified.

3.9 FINISHING FLOORS AND SLABS

- A. Finish bare concrete floors (adjacent to floors with other surfacing) so concrete surface is level with other finishes, unless otherwise noted.
- B. At areas to receive floor covering, grind smooth joints between slabs on grade and structural slabs and between existing and new surfaces to eliminate unevenness and to provide smooth, level surface across joints.
- C. Wetting the concrete surface during finishing operations is prohibited.
- D. Power floating with troweling machines equipped with normal trowel blades is prohibited.
- E. Use caution when finishing lightweight concrete slabs to maintain trowel blades at shallow angle as possible during final finishing operations.
 1. Do not provide a tight steel trowel finish to lightweight concrete slabs.
- F. Protect finished surfaces from damage. Keep free of abrasive materials.
- G. In areas where water will be present (interior and exterior) place and finish slabs so areas will drain and water will not stand in puddles. Conform to slopes shown. At structural slabs, verify elevations of drains to insure drains will be at low points. Where elevations and slopes are not indicated, generally slope floors 1/8 inch per foot uniformly to drains, unless otherwise directed by Architect.
- H. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-foot-long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4-inch.
- I. Apply slab finish to Floor Profile Number tolerances listed unless specifically noted otherwise on Drawings, according to ASTM E 1155 "Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers" for randomly trafficked floor surfaces.
 1. Refer to ACI 302, Chapter 8 and Table 8.15.3, for recommended typical procedures to attain specified Floor Profile Numbers.

- J. General Finishing Requirements: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces as appropriate to attain slab finish specified.
1. Utilize wet-screed guides, dry-screed guides, and/or edge forms for initial strikeoff set with optical or laser instruments as appropriate to attain specified Floor Profile Number. Check elevation after initial strikeoff and repeat as necessary.
 2. Smooth and restraighen surface using 8 to 10 foot wide bull float, darby, or modified highway straightedge.
 - a. Apply in two directions at 45 degree angle to strip for Overall Floor Flatness, F_F 30 or greater.
 3. Wait until bleed water sheen has disappeared and concrete can sustain finishing operations employed without digging in or disrupting the levelness of the surface.
 4. Float surface with one or more passes using a power float (float shoe blades or pans) or by hand floating if area is small or inaccessible to power driven floats. Restraighen, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
- K. CONC FIN-1: Light Trowel Finish.
1. Follow General Finishing Requirements for initial procedures.
 2. Restraighen surface if required following paste-generating float passes using 10-foot wide highway straightedge.
 3. Consolidate concrete surface, uniform in texture and appearance, with one to two passes using power trowel. Hand trowel areas inaccessible by power trowel.
- L. CONC FIN-2: Medium Trowel Finish.
1. Follow General Finishing Requirements for initial procedures.
 2. Restraighen surface if required following paste-generating float passes using 10-foot wide highway straightedge. Apply in two directions at 45 degree angle to strip. Use supplementary material to fill low spots.
 3. Consolidate concrete surface, uniform in texture and appearance, with two to three passes using power trowel. Hand trowel areas inaccessible by power trowel.
- M. CONC FIN-3: Trowel and Fine Broom Finish.
1. Follow General Finishing Requirements for initial procedures.
 2. Consolidate concrete surface, with one pass using a power trowel.
 3. Slightly scarify surface with soft bristled broom while concrete is still plastic.
- N. CONC FIN-4: Broom Finish.
1. Surfaces of concrete mixes with silica fume and/or calcium nitrite must be kept moist (not wet) during finishing operations to promote proper texturing. Pressure foggers with a reach capable of covering the entire surface can aid finishing operations.
 2. Follow General Finishing Requirements, steps 1 through 3, for initial procedures.
 3. Scarify surface with a transverse scored texture using a medium bristled broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
 4. Finish Tolerance: Surface shall not vary by more than $\pm 1/2$ inch anywhere from elevation noted on Drawings.

5. Finish all concrete slabs to proper elevations to insure that all surface moisture will drain freely, and that no puddles exist. Contractor must bear cost of any corrections to provide positive drainage and repairing poorly finished surface areas.
- O. CONC FIN-5: Slip-Resistive Aggregate Finish.
1. Apply at rates recommended by the manufacturer, but not less than 25 pounds per 100 square feet.
 2. Verify all procedures noted below are in compliance with manufacturer's written instructions. Notify Architect of any discrepancies requiring resolution.
 3. Follow General Finishing Requirements, steps 1 through 3, for initial procedures.
 4. Break the surface using a power trowel with float shoes or attached pan.
 5. Evenly distribute approximately two-thirds of the specified amount of non-slip aggregate with mechanical spreader.
 6. After applied material has absorbed moisture, float surface using hand wooden floats. Take care not to tear through into the underlying concrete.
 7. Apply remaining one-third of dry-shake hardener. Tamp aggregate flush with surface, but do not force below surface. Float surface in a like manner.
 8. If needed, trowel until the desired surface finish is achieved.
 9. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.
- P. Coordinate final slab texture requirements with Division 9 flooring installer for proper adhesion of final flooring materials.
- Q. Summary Slab Finish Schedule:

| SLAB USE | SLAB FINISH | OVERALL F _F /F _L | LOCAL F _F /F _L |
|----------------------------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------|--------------------------------------|
| Carpet; raised access floor; or base slabs below acoustic concrete topping slabs | CONC FIN-1 Light Trowel Finish | F _F 25/F _L 20 | F _F 17/F _L 15 |
| Thin set resilient flooring; paint; or other thin film-finish coating system | CONC FIN-2 Medium Trowel Finish | F _F 30/F _L 25 | F _F 24/F _L 15 |
| Thin set ceramic or quarry tile; stone flooring; epoxy terrazzo | CONC FIN-3 Trowel and Fine Broom Finish | F _F 18/F _L 15 | F _F 15/F _L 10 |
| Parking ramps; exterior concrete pavement (Ramp > 7%) | CONC FIN-4 Broom Finish (Rake Finish) | F _F 18/F _L 15 | F _F 15/F _L 10 |
| Egress stair exposed concrete treads and landings; where shown on Drawings | CONC FIN-5 Slip-Resistive Aggregate Finish | F _F 25/F _L 20 | F _F 17/F _L 15 |

R. Measurement of Floor Tolerance:

1. Frequency: For industrial slabs, conduct floor tolerance measurements for each day's slab placement.
 - a. Report deficient areas to Architect to determine repair procedures appropriate for final required finish.
 - b. Make appropriate adjustments to construction procedures prior to next slab placement when previous slab placement is deficient.
2. Frequency: Conduct floor tolerance or measurements within 72 hours of final finishing operations and prior to removal of forms on elevated slabs for each slab placement.
3. Frequency: Conduct floor tolerance or measurements only if slab appears to be out of tolerance.
4. Floor slab tolerances provided for localized areas shall apply to sections maximum one bay in length and minimum one-half bay.
5. Conduct measurement of floor tolerance for F_F100/F_L75 areas by floor consultant utilizing Face Floor Profileograph, or other system approved by Architect.
6. Conduct measurement of floor tolerance for other slab areas utilizing Dip Stick Floor Profiler.

3.10 FINISHING FORMED SURFACES

- A. CONC FIN-20: Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- B. CONC FIN-21: Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 1. Apply to Smooth-Formed Finish as-cast concrete where indicated.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces. Before final troweling of exposed treads and landings, apply dampened non-slip shake at a minimum rate of ¼ pound over square foot of surface.

3.12 CONCRETE PROTECTING AND CURING

- A. General: Concrete shall be maintained above 50-degrees F and in a moist condition for at least the first seven days after placement. Provide curing and protection immediately after placement in accordance with ACI 301 using materials as specified herein.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if the air temperature exceeds 80 degrees F, the wind speed exceeds 10 mph, or the relative humidity is less than 40% before and during finishing operations as measured at the Project site. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Wet Curing: Keep surfaces continuously wet for not less than three days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - d. Protect surface from rapid loss of moisture upon termination of wet curing by covering with moisture-retaining covers for the remainder of the curing period.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. After curing period has elapsed, completely remove curing compound without damaging concrete surfaces using concrete floor cleaner and stripper recommended by curing compound manufacturer.
 4. Curing and Sealing Compound: Apply uniformly to floors and slabs in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
- F. Wet cure or use moisture-retaining covers on all concrete surfaces for first 24 hours, minimum.
1. Continue curing in this manner for as long as Hot Weather Concreting conditions persist.
 2. Industrial slabs shall be water cured for entire curing period.
- G. Curing Compounds or Curing and Sealing Compounds shall not be used on concrete surfaces to receive adhered coverings or Penetrating Liquid Densifier and Sealer without prior manufacturer certification that it will not interfere with bonding of floor covering and warranties of flooring installer are validated.
- H. Moisture Condition of Slabs – Following placement of concrete and climatization of building, check to see that any specified tests for moisture emission have been made and a written report submitted prior to floor covering or coating installation.
- 3.13 PENETRATING LIQUID DENSIFIER AND SEALER
- A. Penetrating Liquid Densifier and Sealer: Prepare, apply, and finish Penetrating Liquid Densifier and Sealer according to manufacturer's written instructions at concrete floors to remain exposed to view.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than 28 days old unless treatment also functions as a curing aid.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Protect finish surface during remainder of construction. Repair immediately any staining of finish concrete surfaces by methods recommended by manufacturer.
- C. Dry buff finish floor surfaces per manufacturer's written instructions to achieve final gloss appearance of liquid densifier and sealer just prior to substantial completion after majority of heavy construction and wet work activities have been completed

3.14 JOINT FILLING

- A. Arrange for on-site supervision by manufacturer's personnel.
- B. Coordinate with Owner that adequate protection or spatial separation is provided to ensure there is not contamination of Owner's stored product during joint filling.
- C. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has cured for 30 to 90 days and space has assumed its normal operating temperature. Do not fill joints until construction traffic has permanently ceased.
- D. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry. Clean inside wall of joints to bare concrete.
- E. Mix filler thoroughly with power equipment according to manufacturer's published instructions.
- F. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.
- G. Protect joint completely from traffic for 8 hours and from vehicular traffic for 24 hours.
- H. Touch Up:
 - 1. Within one year after Substantial Completion, touch up joints with additional material and correct for normal joint movement according to manufacturer's published directions.
 - 2. Coordinate schedule for joint touch up with Owner.
 - 3. Touch up joints during Owner's non-working hours as required by Owner.
 - 4. Coordinate with Owner and Architect to ensure there is no contamination of Owner's stored product.

3.15 JOINT SEALING

- A. When concrete has cured 30 to 90 days, and space has assumed its normal operating temperature, rake out loose debris and clean joint with compressed air.
- B. Install backer rod and sealant according to manufacturer's published recommendations.
- C. Protect joint completely from traffic for 24 hours.

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval and in accordance with ACI 301. Repair methods for defects affecting the concrete's structural performance shall be closely coordinated between Contractor and Engineer.

- B. Patching Mortar: Submit proposed patching materials for Architect's review and approval.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
 - F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

- A. The Owner will engage a qualified testing and inspection agency to provide special inspection and testing services and prepare reports in accordance with Division 01 Section "Structural Tests and Special Inspections", and with IBC 2006 Chapter 17 as adopted by the 2007 MSBC, and the CASE/Mn Guideline for Special Structural Inspection and Testing, and other items which in the professional judgement of the Structural Engineer of Record, are critical to the integrity of the building structure.
- B. Contractor will cooperate with and assist testing agency in obtaining representative concrete samples as concrete is placed for determining slump and air entrainment and casting test cylinders.
 1. Provide suitable space on site for storage for field condition test cylinders.
 2. If testing agency is not available, cast compression test cylinders as concrete is placed, determine and record slump of concrete, determine and record air content of concrete and submit cylinders and information to the testing agency.
- C. Inspections:
 1. Verification of use of required design mixture.
 2. Concrete placement, including conveying and depositing.
 3. Curing procedures and maintenance of curing temperature.
 4. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests (Technical 1): Testing of composite samples of fresh concrete obtained according to ASTM C 172 - Practice for Sampling Freshly Mixed Concrete, ASTM C 31 - Practice for Making and Curing Concrete Test Specimens in the Field, and ASTM C 39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens. Evaluation and acceptance of concrete shall be in accordance with ACI 318 and according to the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture where less than 50 yd³ is placed, plus one additional set for each additional 100 yd³ or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of discharge for each composite sample.
 - a. Perform additional tests when concrete consistency appears to change.
 - b. For industrial slabs, slump each truck until slump stabilization is reached then decrease slump frequency to one test per 25 cubic yards.
 3. Air Content: When air content is specified, perform test in accordance with ASTM C 231, pressure method, for normal-weight concrete and ASTM C 173, volumetric method, for structural lightweight concrete.
 - a. Where placement is by pump, air content shall be measured at location of placement.
 - b. For concrete exposed to freezing and thawing, concrete from each truck shall be tested and concrete not meeting specified percentages shall not be placed.
 - c. For interior concrete not exposed to freezing and thawing, such as lightweight concrete on metal decking, perform one test for each set of test cylinders.
 - d. Concrete used in performing air content test shall not be used in fabricating test specimens
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Unit Weight: ASTM C 567, equilibrium unit weight of structural lightweight concrete; one test for each composite sample.
 6. Compression Test Specimens: ASTM C 31.
 - a. Cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 - b. Cast and field cure one cylinder specimen for each composite sample.
 - 1) Store field-cured cylinders as near as possible to location of concrete represented by sample and give cylinder, insofar as practicable, same protection and curing as adjacent concrete.
 - c. If additional specimens are required to verify early strength of concrete, contractor must pay for additional testing.
 7. Compressive-Strength Tests: ASTM C 39.
 - a. Test one cylinder specimen at 7 days for information, and remaining two cylinder specimens at 28 days for acceptance, plus one cylinder to be held until 90 days in the event that the 28 day compressive strengths are not met.
 - b. Deliver field-cured specimens to laboratory at 28 days and test to verify adequacy of curing and protection in field.
 - c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing when requested by the Owner's Representative(Technical 1):
1. Measurements shall be made prior to removal of forms and shores at elevated structural slabs.
 2. The Contractor shall be notified immediately after the measurements of any section are complete and a written report of the results shall be submitted within 72 hours after finishing operations are complete.
 3. Report deficient areas to Architect to determine repair procedures appropriate for final required finish.

3.18 EVALUATION OF TEST RESULTS

- A. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- B. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- C. Test results shall be reported in writing to Architect, concrete supplier, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete at the expense of the Contractor when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- G. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- H. Fill core holes with concrete specified for location.

END OF SECTION 03300

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 07413 – INSULATED CORE
METAL WALL PANELS**

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. Foamed-insulation-core metal wall ~~panels~~panel assemblies.
- B. Related Sections:
1. Division 1 Section "Sustainable Design Requirements" for related LEED general requirements.
 2. Division 5 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal wall panels.
 3. Division 7 Section "Composite Wall Panels" for metal-faced composite wall panels.
 4. Division 7 Section "Roof Specialties" for sheet metal copings.
 5. Division 7 Section "Joint Sealants" for field-applied joint sealants.

1.3 DEFINITIONS

- A. Metal Wall Panel Assembly: Insulated-core metal wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference:
1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Water Penetration under Static Pressure: No uncontrolled water penetration when tested according to ASTM E 331 at the following test-pressure difference:
1. Test-Pressure Difference: 15.0 lbf/sq. ft.
 2. Water Leakage: ~~Uncontrolled~~No uncontrolled water infiltrating the system or appearing on systems normally exposed interior surfaces from

sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

- E. Water Penetration under Dynamic Pressure: No uncontrolled water penetration when tested according to AAMA 501.1 at the following test-pressure difference:
1. Test-Pressure Difference: 15.0 lbf/sq. ft.
 2. Water Leakage: ~~Uncontrolled~~ No uncontrolled water infiltrating the system or appearing on systems normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
- F. Structural Performance: Metal wall panel assemblies shall withstand the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 72:
1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure of 20 lbf/sq. ft., acting inward or outward.
 - a.b. Loads as indicated for project location per SEI/ASCE 7.
 2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/175 of the span.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, material surfaces.
- H. Thermal Performance: Provide insulated metal wall panel assemblies with U-values less than or equal to 0.064 when tested according to ASTM C 518.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop-, and field-assembled work. Indicate adjacent materials and points of supporting structure that must coordinate with insulated metal wall panel installation.
1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Anchorage systems.
 - a.b. Trim and extrusions as required for complete installation.

- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
1. Metal Wall Panels: 12 inches long by actual panel width. Include fasteners, battens, closures, and other metal wall panel accessories.
 2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
 3. Accessories: 12-inch-long Samples for each type of accessory.
- D. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Exterior elevations, drawn to scale, and coordinating penetrations and wall-mounted items. Show the following:
1. Wall panels and attachments.
 2. Girts and Stud framing.
 3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
 4. Penetrations of wall by pipes and utilities.

- B. Qualification Data:
1. For Manufacturer.
 - 5.2. For Installer.

B-C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product, provide data indicating compliance with the performance requirements specified in this section.

C-D. Field quality-control reports.

D-E. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For insulated-core metal wall panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of metal wall panel systems with minimum 10 years experience in manufacture of similar products in successful use in similar applications.

A-B. Installer Qualifications: An employer of workers trained and approved by manufacturer with a minimum of 5 years experience with successfully completed projects of similar size and scope.

B-C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

~~C~~.D. Source Limitations: Obtain each type of metal wall panel and panel accessories from single source from a single manufacturer.

~~D~~.E. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
2. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
3. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
4. Potential Heat: Acceptable level when tested according to NFPA 259.
5. Surface-Burning Characteristics: Provide wall panels with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.

~~E~~.F. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal wall panel assembly during and after installation.
8. Review wall panel observation and repair procedures after metal wall panel installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal wall panels for period of metal wall panel installation.

1.10 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

1.11 COORDINATION

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts, studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 2. Warranty Period: Five (5) years from date of Substantial Completion.
 3. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 4. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

- A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
 2. Surface: Smooth, flat finish.
 3. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.
- B. Panel Sealants:
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.

2.2 INSULATION FOR PANEL CORES

- A. Polyisocyanurate Insulation: Closed cell, modified polyisocyanurate foam using a non-CFC blowing agent, foamed-in-place type, with maximum flame-spread index of 25 and smoke-developed index of 450.
1. Closed-Cell Content: 90 percent when tested according to ASTM D 2856.

2.3 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch nominal thickness.
- C. Zee Clips: 0.064-inch nominal thickness.
- D. Base or Sill Angles / Channels: 0.064-inch nominal thickness.
- E. Hat-Shaped, Rigid Furring Channels:
1. Nominal Thickness: As required to meet performance requirements.
 2. Depth: As indicated.

- F. Cold-Rolled Furring Channels: Minimum 1/2-inch-wide flange.
1. Nominal Thickness: As required to meet performance requirements
 2. Depth: As indicated.
 3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with 0.040-inch nominal thickness.
 4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- G. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.4 MISCELLANEOUS MATERIALS

- A. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.5 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels. Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
1. Products: Subject to compliance with requirements,
 - a. CENTRIA Architectural Systems.
 - b. Coldmatic Building Systems.
 - c. Galvamet Inc.
 - d. Insulated Panel Systems, Div. of NCI Building Systems.
 - e. Metecno-Aluma Shield, Metecno Panel Systems, Inc.
 - f. Metl-Span.
 - g. Steelox Systems, L.L.C.
 2. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - a. Material: Zinc-coated (galvanized) steel sheet, Minimum 0.030-inch ~~0.024-inch or 0.036-inch~~ nominal thickness, ~~as indicated.~~
 - b. Exterior Facing Finish: 3-coat metallic fluoropolymer.
 - 1) Color: Match Architect's samples.
 - c. Interior Facing Finish: Manufacturer's standard siliconized polyester.
 - d. Exterior Surface: Smooth, flat.
 3. Panel Coverage: 46_40 inches nominal.
 - 3.4. Panel Profile: Segmented Faced Panels formed with intermediate formed joints as indicated on drawings.
 - 4.5. Panel Thickness: 4_3 inches nominal.
 - 5.6. Thermal-Resistance Value (R-Value): 22

2.6 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units,

clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from 0.018-inch-minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.7 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.
- E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.3 METAL WALL PANEL INSTALLATION, GENERAL

- A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install

panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Commence metal wall panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Flash and seal metal wall panels with weather closures at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
4. Install screw fasteners in predrilled holes.
5. Locate and space fastenings in uniform vertical and horizontal alignment.
6. Install flashing and trim as metal wall panel work proceeds.
7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
8. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
9. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
10. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:

1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
2. ~~Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.~~
3. ~~Copper Wall Panels: Use copper, stainless-steel, or hardware-bronze fasteners.~~
4. ~~Stainless-Steel Wall Panels: Use stainless-steel fasteners.~~

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.4 INSULATED-CORE METAL WALL PANEL INSTALLATION

- A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated-core metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
1. Fasten insulated-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
 2. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
 4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
 6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
- B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.
1. Install clips to supports with self-tapping fasteners.
- C. Laminated-Insulation-Core Metal Wall Panels:
1. Wrapped-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging wrapped panel edges. Install clips to supports with self-tapping fasteners. Seal joints with manufacturer's standard gaskets.

3.5 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with

no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Water-Spray Test: After completing the installation of 75-foot-by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
- D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- E. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07413

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 07531 – ETHYLENE-PROPYLENE-
DIENE-MONOMER (EPDM) ROOFING**

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. Adhered EPDM membrane roofing system.
 2. Vapor retarder.
 3. Roof insulation.
- B. Related Sections:
1. Division 06 Section "Rough Carpentry" for wood nailers, curbs and blocking.
 2. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings and counterflashings.
 3. Division 07 Section "Roof Specialties" for proprietary manufactured roof specialties.
 4. Division 07 Section "Joint Sealants" for joint sealants, joint fillers and joint preparation.
 5. Division 15 Section "Sanitary, Vent and Storm Drainage Piping" for roof drains.

1.3 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions and terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrications, installation or other defects in construction. Membrane roofing and base flashings shall remain watertight.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer bases on testing and field experience.

- C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
- D. Thermal Performance: Provide roofing system with U-value less than or equal to 0.043; R-23.0 continuous insulation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives and sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
- C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
 - 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- D. Samples for Verification: For the following products:
 - 1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
 - 2. Roof insulation.
 - 3. Metal termination bars.
 - 4. Battens.
 - 5. Six insulation fasteners of each type, length, and finish.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and manufacturer.
- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of compliance with performance requirements.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
- D. Field quality-control reports.

E. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualification: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized or licensed by membrane roofing system manufacturer to install manufacturer's products and that is eligible to receive manufacturer's special warranty. Minimum five (5) years in business.
- C. Source Limitations: Obtain all components including, but not limited to, roof insulation and fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
- D. Exterior Fire-Test Exposure: ASTM 3 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- F. Preinstallation Roofing Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 3. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 5. Review structural loading limitations of roof deck during and after roofing.
 6. Review base flashing, special roofing details, roof drainage, roof penetrations, equipment curbs and condition of other construction that will affect roofing system.
 7. Review governing regulations and requirements for insurance and certifications, if applicable.
 8. Review temporary protection requirements for roofing system during and after installation.
 9. Review roof observation and repair procedures after roofing installation.

ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

Bid Package 1 – Addendum 1

07531 - 3

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected locations within the temperature range required by roofing system manufacturer. Protection stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling and others sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.10 PROJECT CONDITIONS

- A. Weather Limitations: proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard or customized form, with monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, substrate boards, roofing accessories, and other components of membrane roofing system.
 - 2. Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EPDM MEMBRANE ROOFING

- A. EPDM: ASTM D 4637, Type II, scrim or fabric internally reinforced, uniform, flexible EPDM sheet.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products Company.
 - c. GenFlex Roofing Systems.

ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

Bid Package 1 – Addendum 1

07531 - 4

- d. Johns Manville.
- e. Versico Incorporated.
- 2. Thickness: 90 mils, nominal.
- 3. Exposed Face Color: Black.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials (including Cover Board) as recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - f. Other Adhesives: 250 g/L.
 - g. Single-Ply Roof Membrane Sealants: 450 g/L.
 - h. Nonmembrane Roof Sealants: 300 g/L.
 - i. Sealant Primers for Nonporous Substrates: 250 g/L.
 - j. Sealant Primers for Porous Substrates: 775 g/L.
- B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.
- C. Bonding Adhesive: Manufacturer's standard, water based.
- D. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch-wide minimum, butyl splice tape with release film.
- E. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- G. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provision in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch thick.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Georgia-Pacific Corporation; DensDeck.
 - b. Temple-Inland Inc.; GreenGlass
 - c. United States Gypsum Co.; Securock.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.4 VAPOR RETARDER

- A. Reinforced-Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb / 1000 sq. ft. (12 kg/100 sq. m), with maximum permeance rating of 0.0507 perm (2.9 ng/Pa x s x sq. m).
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Raven Industries, Inc.; DURA-SKRIM 6WW.
 - b. Reef Industries, Inc.; Griffolyn T-6.
 - 2. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
 - 3. Adhesive: Manufacturer's standard lap adhesive.

2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that product FM Approvals-approved roof insulation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.
- D. Provide pre-formed saddles, crickets, tapered edge strips and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

2.7 PIPE BOOTS

- A. Provide pipe boots for single and multiple pipe penetrations. Size and configuration to be appropriate for each specific penetration location. Material to be compatible with roofing systems and to include stainless steel compression ring for each pipe.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Commercial Products Group; PortalsPlus C-412.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plan flatness and fastening of steel roof deck complies with requirements of Division 95 Section "Steel Decking."
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer is passed.
 - 5. Verify that concrete substrate is visible dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projection.

- B. Prevent materials from entering or clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

3.4 VAPOR-RETARDER INSTALLATION

- A. Laminate Sheet: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum 2 inches and 6 inches respectively.
 - 1. Apply adhesive at rate recommended by vapor-retarder manufacturer. Continuously seal side and end laps with adhesive.
- B. Completely seal vapor retarder at terminations, obstruction, and penetrations to prevent air movement into membrane roofing system.

3.4 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints to previous layer a minimum of 6 inches (150 mm) in each direction.
 - 1. Where installing composite and non-composite insulation in two or more layers, install non-composite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- E. Trim surface of insulation where necessary at roof drains so complete surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding ¼ inch (6 mm) with insulation.

1. Cut and fit insulation within ¼ inch (6 mm) of nailers, projections and penetrations.
- G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
1. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
- B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacture. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
- E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations and perimeter of roofing.
- F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- C. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
- D. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
- G. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

3.6 BASE FLASHING INSTALLATION

- A. Install sheet flashing and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured and uncured sheet flashing.

- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashing and mechanically anchor to substrate through termination bars.

3.7 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
- C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or addition work with specified requirements.

3.8 PROTECTION AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to the Architect and the Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacture or affected construction.

END OF SECTION 07531

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 07610 – SHEET METAL
ROOFING**

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) Standing-seam metal roofing, on-site, roll formed.
- B. Related Sections:
- 1) Division 7 Section "Thermal Insulation" for roof insulation and sheet vapor retarders separate from self-adhering underlayments.
 - 2) Division 7 Section "Composite Metal Panels" for factory-formed metal soffit panels.
 - 3) Division 7 Section "Sheet Metal Flashing and Trim" for gutters, fasciae, copings, and flashings that are not part of sheet metal roofing.
 - 4) Division 7 Section "Roof Accessories" for manufactured roof accessories.
 - 5) Division 7 Section "Joint Sealants" for field-applied sealants adjoining sheet metal roofing.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Sheet metal roofing system including, but not limited to, metal roof panels, cleats, clips, anchors and fasteners, sheet metal flashing integral with sheet metal roofing, fascia panels, trim, underlayment, and accessories shall comply with requirements indicated without failure due to defective manufacture, fabrication, installation, or other defects in construction. Sheet metal roofing shall remain watertight.
- B. Thermal Movements: Provide sheet metal roofing that allows for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- 1) Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.
- ~~C. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.~~

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- ~~B. LEED Submittals:~~

- ~~1) Product Test Reports for Credit SS 7.2: For roof panels, documentation indicating that panels comply with Solar Reflectance Index requirement.~~

C.B. Shop Drawings: Show fabrication and installation layouts of sheet metal roofing, including plans, elevations, expansion joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

- 1) Details for forming sheet metal roofing, including seams and dimensions.
- 2) Details for joining and securing sheet metal roofing, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
- 3) Details of termination points and assemblies, including fixed points.
- 4) Details of expansion joints, including showing direction of expansion and contraction.
- 5) Details of roof penetrations.
- 6) Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings.
- 7) Details of special conditions.
- 8) Details of connections to adjoining work.
- 9) Detail the following accessory items, at a scale of not less than 3 inches per 12 inches:
 - a) Flashing and trim.
 - b) Gutters and downspouts as they relate to adjacent sheet metal roofing.
 - c) Roof curbs.
 - d) Snow guards.

D.C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

- 1) Sheet Metal Roofing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners and other attachments.
- 2) Trim and Metal Closures: 12 inches long and in required profile. Include fasteners and other exposed accessories.
- 3) Snow Guards: Full-size Sample.
- 4) Other Accessories: One samples for each type of other accessory identified as to use..

1.5 INFORMATIONAL SUBMITTALS

A. Portable Roll-Forming Equipment Certificate: Issued by UL for equipment manufacturer's portable roll-forming equipment capable of producing panels that comply with UL requirements. Show expiration date no earlier than two months after scheduled completion of sheet metal roofing.

- 1) Submit certificates indicating recertification of equipment whose certification has expired during the construction period.

B. Qualification Data: For qualified Installer authorized by metal roof manufacturer..

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

- 1) ASTM E1592 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Sytems by Uniform Static Air pressure Difference.
- 2) ASTM E1646 Standard Test Method for Water Penetration of Exterior Metal Roof Pane Systems by Uniform Static Air pressure Difference.
- 3) ASTM E1680 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.

~~4)~~ UL 580 Tests for Uplift Resistance of Roof Assemblies

~~C-D.~~ Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing sheet metals and accessories to include in maintenance manuals.

1.7 QUALITY ASSURANCE

~~A.~~ Roll-Formed Sheet Metal Roofing Fabricator—Manufacturer Qualifications: Fabricator authorized by portable roll-forming equipment manufacturer to fabricate and install sheet metal roofing units required for this ProjectManufacturer of Sheet Metal Roofing system with a minimum of 10 years experience on projects of similar size and scope, and who maintains current UL certification of its portable roll-forming equipment. Manufacturer shall maintain responsibility for quality control.

~~A-B.~~ Roll-Formed Sheet Metal Roofing Installer Qualifications: Installer authorized by sheet metal roofing manufacturer to install sheet metal roofing units required for this Project with a minimum of 5 years experience on projects of a similar size and scope.

~~B-C.~~ UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing roofing panels for sheet metal roofing assemblies that comply with UL 580 for Class 90 wind-uplift resistance. Maintain UL certification of portable roll-forming equipment for duration of sheet metal roofing work.

~~C-D.~~ Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

~~D-E.~~ Preinstallation Conference: Conduct conference at Project site.

- 1) Meet with Owner, Architect, Owner's insurer if applicable, sheet metal roofing Installer, portable roll-forming equipment and sheet metal roofing manufacturer's representative for sheet metal roofing and installers whose work interfaces with or affects sheet metal roofing including installers of roof accessories and roof-mounted equipment.
- 2) Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- 3) Review methods and procedures related to sheet metal roofing installation, including ~~portable roll-forming equipment~~ manufacturer's written instructions.
- 4) Examine conditions of substrate for compliance with requirements, including flatness and attachment to structural members.
- 5) Review structural loading limitations of roof deck during and after roofing installation.
- 6) Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal roofing.
- 7) Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.

- 8) Review temporary protection requirements for sheet metal roofing during and after roofing installation.
- 9) Review roof observation and repair procedures after sheet metal roofing installation.
- 10) Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal roofing materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal roofing installation.

1.9 COORDINATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in other Sections.
- B. Coordinate sheet metal roofing with rain drainage work, flashing, trim, and construction of parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: ~~Warranty form at the end of this Section in which Installer agrees to repair or replace components of sheet metal roofing that fail in materials or workmanship within specified warranty period.~~
 - 1) Failures include, but are not limited to, the following:
 - a) Structural failures, including but not limited to rupturing, cracking, or puncturing.
 - b) Wrinkling or buckling.
 - c) Loose parts.
 - d) Failure to remain weathertight, including uncontrolled water leakage.
 - e) Deterioration of metals, metal finishes, and other materials beyond normal weathering, including non-uniformity of color or finish.
 - f) Galvanic action between sheet metal roofing and dissimilar materials.
 - 2) Warranty shall be functional up to design wind speed for this project.
 - 2)3) Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ROOFING SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

- 1) Thickness: 0.040 inch unless otherwise indicated.
 - 2) As-Milled Finish: Mill finish.
 - 3) Surface: Smooth, flat.
- C. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
- 1) Thermal Stability: ASTM D 1970; stable after testing at 240 deg F .
 - 2) Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
 - 3) Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
 - a) Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
 - b) Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c) Henry Company; Blueskin PE200 HT.
 - d) Metal-Fab Manufacturing, LLC; MetShield.
 - e) Owens Corning; WeatherLock Metal High-Temperature Underlayment.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by ~~fabricator~~manufacturer for sheet metal roofing.
- B. Snap-On Seams: Provide snap-on seams integrated with panel-edge profile as recommended by ~~portable roll-forming equipment~~sheet metal roofing manufacturer to produce sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article.
- C. Fasteners: ~~Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other s~~Suitable fasteners as recommended by metal roof manufacturer designed to withstand design loads.
- 1) General:
 - a) Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
 - b) Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - c) Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2) Fastener/Clips for Aluminum Sheet: Aluminum or Series 300 stainless steel. Provide clips as recommended by metal roof manufacturer to freely accommodate thermal movements for panel lengths indicated.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

- E. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant as recommended by ~~portable roll-forming equipment~~ sheet metal roofing manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G-H. Galvanized Steel Zee Section Purlins: 16 ga., 33 KSI min., with height and top flange width as recommended by metal roof manufacturer for roof system.

2.3 ACCESSORIES

- A. Sheet Metal Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, clips, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items. Match material and finish of sheet metal roofing unless otherwise indicated.
- 1) Provide accessories as recommended by ~~portable roll-forming equipment~~ sheet metal roofing manufacturer to produce sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article.
 - 2) Cleats: For mechanically seaming into joints and formed from the following materials:
 - a) Aluminum Roofing: 0.025-inch-thick stainless steel.
 - 3) Clips: Minimum 0.0625-inch-thick, stainless-steel panel clips designed to withstand negative-load requirements.
 - 4) Backing Plates: Plates at roofing splices, fabricated from material recommended by SMACNA.
 - 5) Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible-closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 - 6) Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum 0.018 inch thick.

2.4 SNOW GUARDS

- A. Snow Guards, General: Prefabricated, noncorrosive units designed to be installed without penetrating sheet metal roofing; complete with predrilled holes, clamps, or hooks for anchoring.
- B. Surface-Mounted, Metal, Stop-Type Snow Guards: Cast-aluminum stops designed for attachment to panel surface of sheet metal roofing using construction adhesive, silicone or polyurethane sealant, or adhesive tape.

2.5 FABRICATION

- A. General: Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (panel width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate sheet metal roofing and accessories at the shop to greatest extent possible.
- 1) Standing-Seam Roofing: Form standing-seam panels with a nominal 16" width and a minimum finished seam height of 4-1/2 2-1/2 inches.
 - 2) General: Fabricate roll-formed sheet metal roofing panels with UL-certified, portable roll-forming equipment capable of producing roofing panels for sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article. Fabricate roll-formed sheet metal according to ~~equipment~~ manufacturer's written instructions and to comply with details shown.
 - a) Panels shall be mechanically seamed.
 - a)b) Individual panels shall be removable for replacement/repair without disturbing other panels.
- B. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks; true to line and levels indicated; and with exposed edges folded back to form hems.
- 1) Lay out sheet metal roofing so transverse seams, if required, are made in direction of flow with higher panels overlapping lower panels.
 - 2) Offset transverse seams from each other 12 inches minimum.
 - 3) Fold and cleat eaves and transverse seams in the shop.
 - 4) Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements shown on Drawings and as required for leakproof construction.
- D. Expansion Provisions: Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- E. Sealant Joints: Where movable, nonexpansion-type joints are indicated or required to produce weathertight seams, form metal to provide for proper installation of elastomeric sealant in compliance with SMACNA standards.
- F. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by ~~fabricator~~manufacturer of sheet metal roofing or manufacturers of the metals in contact.
- G. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to

design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

- 1) Form exposed sheet metal accessories without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
- 2) Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
- 3) Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

H. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1) Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking, that tops of fasteners are flush with surface, and that installation is within flatness tolerances required for finished roofing installation.
 - 2) Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for drainage, flashings, and penetrations through sheet metal roofing.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- ~~A. Polyethylene Sheet: Install polyethylene sheet on roof sheathing under sheet metal roofing. Use adhesive for anchorage to minimize use of mechanical fasteners under sheet metal roofing. Apply at locations indicated on Drawings, in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches (50 mm).~~
- ~~B. Felt Underlayment: Install felt underlayment on roof sheathing under sheet metal roofing. Use adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal roofing. Apply at locations indicated, in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

 - ~~1) Apply from eave to ridge.~~
 - ~~2) Apply on roof not covered by self-adhering sheet underlayment. Lap edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.~~~~

- ~~C.A.~~ Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under sheet metal roofing. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply over entire roof, in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within fourteen (14) days.
- ~~D.B.~~ Install flashings to cover underlayment to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
- ~~E.C.~~ Apply slip sheet per manufacturer's recommendations before installing sheet metal roofing.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by ~~fabricator~~manufacturer for sheet metal roofing.
- 1) Field cutting of sheet metal roofing by torch is not permitted.
 - 2) Flash and seal sheet metal roofing with closure strips at eaves, rakes, and perimeter of all openings. Fasten with self-tapping screws.
 - 3) Locate and space fastenings where required in uniform vertical and horizontal alignment. Pre-drill panels for fasteners.
 - 4) Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition. Install backing plates at roofing splices.
 - 5) Install sealant tape where indicated.
 - 6) Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.
 - 7) Do not use graphite pencils to mark metal surfaces.
 - 7)8) Use full length panels where possible.
- B. Thermal Movement. Rigidly fasten metal roof panels to structure at only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction.
- 1) Point of Fixity: Fasten each panel along a single line of fixing in accordance with recommendations of metal roof manufacturer.
 - 2) Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.
- C. Fasteners: Use fasteners of sizes not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- D. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by SMACNA.
- 1) Coat back side of uncoated aluminum and stainless-steel sheet metal roofing with bituminous coating where roofing will contact wood, ferrous metal, or cementitious construction.

- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Fasciae: Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal sheet metal roofing with closure strips where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.4 ON-SITE, ROLL-FORMED SHEET METAL ROOFING INSTALLATION

- A. General: Install on-site, roll-formed sheet metal roofing fabricated from UL-certified equipment to comply with ~~equipment~~ sheet metal roofing manufacturer's written instructions for UL wind-uplift resistance class indicated. Provide sheet metal roofing of full length from eave to ridge unless otherwise restricted by on-site or shipping limitations.
- B. Standing-Seam Sheet Metal Roofing: Fasten sheet metal roofing to supports with concealed clips at each standing-seam joint at location, at spacing, and with fasteners recommended by sheet metal roofing ~~manufacturer of portable roll-forming equipment~~.
 - 1) Install clips to ~~substrate~~ galvanized steel zee-section purlins with self-tapping fasteners. Purlins shall be spaced as required to meet structural load requirements of roof system not to exceed 60" O.C.
 - 2) Install pressure plates ~~at locations indicated in equipment~~ in accordance with manufacturer's written installation instructions.
 - 3) ~~Before~~ Where panels are joined, apply continuous bead of sealant to top of flange of lower panel.
 - 4) Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so cleat, sheet metal roofing, and field-applied sealant are completely engaged.
- C. Seal joints as shown and as required for watertight construction. For roofing with 3:12 slopes or less, use cleats at transverse seams.
 - 1) Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 - 2) Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.5 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1) Install components required for a complete sheet metal roofing assembly including trim, copings, seam covers, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items.

- 2) Install accessories integral to sheet metal roofing that are specified in Division 7 Section "Sheet Metal Flashing and Trim" to comply with that Section's requirements.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- 1) Install flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 - 2) Install continuous strip of self-adhering underlayment at edge of continuous flashing overlapping self-adhering underlayment, where "continuous seal strip" is indicated in SMACNA's "Architectural Sheet Metal Manual," and where indicated on Drawings.
 - 3) Install exposed flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - 4) Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, and filled with butyl sealant concealed within joints.
- C. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet sheet metal roofing.
- D. Stop-Type Snow Guards: Attach snow guards to sheet metal roofing with adhesive or adhesive tape, as recommended by manufacturer. Do not use fasteners that will penetrate sheet metal roofing.
- 1) Provide snow guards at locations indicated on Drawings.

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal roofing is installed unless otherwise indicated in manufacturer's written installation

instructions. On completion of sheet metal roofing installation, clean finished surfaces as recommended by sheet metal roofing manufacturer. Maintain sheet metal roofing in a clean condition during construction.

- E. Replace sheet metal roofing components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07610

**NEW PASSENGER TERMINAL
DULUTH INTERNATIONAL AIRPORT
DULUTH, MINNESOTA**

**SECTION 07620
SHEET METAL FLASHING
AND TRIM**

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. This Section includes the following sheet metal flashing and trim:
1. Formed roof drainage sheet metal fabrications.
 2. Formed low-slope roof sheet metal fabrications.
 - ~~3. Formed steep-slope roof sheet metal fabrications.~~
 3. Formed wall sheet metal fabrications.
- B. Related Sections include the following:
1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 2. Division 7 Section "~~Thermoplastic Polyolefin (TPO)~~EPDM Roofing" for installing sheet metal flashing and trim integral with roofing membrane.
 3. ~~Division 7 Section "Composite Wall Panels" for sheet metal flashing and trim integral with composite metal wall panels.~~
 - 3.4. Division 7 Section "Insulated Core Metal Wall Panels" for sheet metal flashing and trim integral with insulated metal wall panels.
 - ~~4.5.~~ Division 7 Section "Sheet Metal Roofing" for custom-formed sheet metal flashing and trim integral with sheet metal roofing.
 - ~~5.6.~~ Division 7 Section "Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
 - ~~6.7.~~ Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Fabricate and install flashing capable of resisting the wind forces according to requirements of the International Building Code for 120 mph wind.

- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 2. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
1. Identification of material, thickness, weight, and finish for each item and location in Project.
 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 4. Details of termination points and assemblies, including fixed points.
 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
 6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 7. Details of special conditions.
 8. Details of connections to adjoining work.
 9. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified fabricator.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- B. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
 - 2. Review methods and procedures related to sheet metal flashing and trim.
 - 3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 - 4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
 - 5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

1.9 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
1. Mill Finish: One-side bright. Use at concealed locations.
 2. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil.
 3. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - 1) Color: As selected by Architect from manufacturer's full range.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.
1. Finish: 2D (dull, cold rolled)
 - 4.2. Surface: Smooth, flat

2.2 UNDERLAYMENT MATERIALS

- A. Composite Sheet: 40-mil thick, self-adhering, polymer modified bitumen bonded to polyethylene sheet complying with ASTM D 1970.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
- C. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
- D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal thicknesses, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
1. Stainless Steel: 0.019 inch thick.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections.
1. Joint Style: Butt, with 12-inch-wide, concealed backup plate.
 2. Fabricate with scuppers as indicated, of dimensions required with 4-inch-wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
 3. Fabricate from the following materials:
 - a. Aluminum: 0.090 inch thick.
- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, seal, and solder or weld watertight.
1. Joint Style: Butt, with 12-inch-wide, concealed backup plate.
 2. Fabricate from the following materials:
 - a. Aluminum: 0.090 inch thick.

2.52.7 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.0187 inch thick.

2.62.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - 1. Coat side of uncoated aluminum, stainless-steel, and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.

SHEET METAL FLASHING AND TRIM

Bid Package 1 – Addendum 1

07620 - 7

3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and butyl sealant.
 - E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 1. Aluminum: Use aluminum or stainless-steel fasteners.
 2. Stainless Steel: Use stainless-steel fasteners.
 - H. Seal joints with butyl sealant as required for watertight construction.
 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 24-inch centers.
 2. Anchor interior leg of coping with screw fasteners and washers at 24-inch centers.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for butyl sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
 2. Seal with butyl sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.4 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with butyl sealant to equipment support member.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07620

KRAUS-ANDERSON CONSTRUCTION COMPANY

ADDENDUM NO. 1

June 11, 2010

Duluth International Airport
New Passenger Terminal
Bid Package 1
Duluth, MN 55811

TO ALL CONTRACTORS:

The following are clarifications and/or changes to the Plans and Specifications, dated May 17, 2010, to be Bid on June 17, 2010, 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.

PLEASE NOTE: A specific Bid Form Packet is required for the Prime Contractor's bid submission on this project. Bidders must contact Chris Barta, Kraus-Anderson Construction Company, at 218-722-3775 or chris.barta@krausanderson.com to obtain the required Bid Form Packet.

1. Invitation to Bid
 - A. Page 4, Replace all references of "60 days" to "90 days".

2. Section 00100 Instructions to Bidders
 - A. Item 14. Replace "sixty 60 days" with "ninety (90) days".

3. Section 00305 Bid Form
 - A. Replace existing Bid Form and with Bid Form incorporated by this Addendum.

4. Section 01014 Work Scope Descriptions

A. Work Scope 2.10 - Civil and Site Electrical

1. Under 1.01, Part A., Item 1., change Bid Items 1 - 146 must...to Bid Items 1 - 148 must conform to:
2. Under 1.02, Part EE. **Terminal Building Work:** Replace "...item #113" with "item #115".
3. Under 1.02, ADD Item FF. **Site Electrical:** Include all work on plan sheets E100 thru E106, and E 400 within VOL 1 plan set. Plan sheet ET010 in VOL 2 plan set is part of Work Scope 16.10.
4. Under 1.03, Part B. **Field Engineering:** Replace Item 1 with:
 1. Civil work outside of the building footprint must review and include all scope required within the Special provisions. The Construction Manager (KA) is not responsible for surveying/staking needs in these areas.
 - 1a. Surveying and staking for work within the building footprint: The CM will provide the standard surveying for the building, including staking all of the gridlines and offsets. (One initial set and one set of offsets. This Work Scope will be required to take the offsets and carry them into the excavations and top of walls, etc as required. The CM may double check random elevations and locations at no cost to this Work Scope.

B. Work Scope 3.10 - Structural Concrete

1. Under 1.02, Part E. **Winter conditions:** Delete the words "heat equipment, fuel".
 - A. Add item 1. Snow removal - if required, will be the responsibility of this work scope.
 - B. Add item 2. Any winter conditions costs to complete your work.
 - C. Add item 3. Frost removal for the on grade pour, if required will be the responsibility of the CM.
2. Under 1.02, Part S. Replace with: Air floor ducting and concrete toppings on 2nd and 3rd floors in a future Bid Package.
3. Under 1.03, Part A. **Field Engineering:** Item 1: Replace Item 1 with: Surveying and staking for work within the building footprint: The CM will provide the standard surveying for the building, including staking all of the gridlines and offsets. (One initial set, one set of offsets and a benchmark per floor). This Work Scope will be required to take the offsets and carry them into the excavations and top of walls, etc as required. The CM may double check random elevations and locations at no cost to this Work Scope. This Work Scope is responsible for all remaining layout.
4. The entire building concrete slab on grade work, including vapor barrier and horizontal rigid insulation is within this work scope.

C. Work Scope 4.10 - Masonry

1. Under 1.02., Part O, Add Item 8: Include all rigid insulation, vapor barrier and flashings concealed by your work.

D. Work Scope 5.10 - Structural/Miscellaneous Steel

1. Under 1.02, Part E. **Winter conditions:** Delete the words "heat equipment, fuel".
 - A. Add item 1. Snow and frost removal - if required, will be the responsibility of this work scope.
 - B. Add item 2. Any winter conditions costs to complete your work.
2. Under 1.03, Part A. **Field Engineering:** Replace Item 1 with: The CM will provide the standard surveying for the building, including staking all of the gridlines and offsets. (One initial set, one set of offsets, and a benchmark per floor). This Work Scope will be required to take the offsets and transfer as required. The CM may double check random elevations and locations at no cost to this Work Scope. This Work Scope is responsible for all remaining layout

E. Work Scope 5.11 - Metal Framing

1. Under 1.02, Part E. **Winter conditions:** Delete the words "heat equipment, fuel".
 - A. Add Item 1. Snow and frost removal - if required, will be the responsibility of this work scope.
 - B. Add Item 2. Any winter conditions costs to complete your work.
2. Under 1.02., Part R., Add: This includes all insulation and vapor barrier concealed by work which cannot be accessed after this Bid Package work is complete. Scope of this also includes areas above grade where this work scope may not have framing.

F. Work Scope 7.10 - Metal Panels

1. Under 1.01, Part A, Item 1. Add: 07415 Composite Wall Panels Complete.
2. Under 1.02, Part E. **Winter Conditions:** Delete the words "heat equipment, fuel".
 - A. Add Item 1. Snow and frost removal - if required, will be the responsibility of this work scope.
 - B. Add Item 2. Any winter conditions costs to complete your work.
3. Under 1.02, Part P., **Rough Carpentry:** Delete in its entirety.
4. Under 1.02, Part Q., Item 2. Delete a: Provided Delegated Design requirements as per specifications.
5. Under 1.02, Part Q., Delete Items 4, 5, 6 and 9.
6. Under 1.04, Part A. **Field Water Testing:** Change the \$2,500 allowance to a \$5,000 allowance.

7. Under 1.06, Part B. **Requirements for "Delegated Design - Third Park Engineering:** Delete in its entirety.

G. Work Scope 7.11 - TPO Roof

1. Change Work Scope 7.11 - TPO Roof to Work Scope 7.11 - EPDM Roof.
2. Under 1.01, Part A, Delete Section 07543 Thermoplastic Polyolefin (TPO) Roofing and replace with Section 07531 Ethylene-Propylene-Diene-Monomer (EPDM) Roofing Complete.
3. Change any reference to TPO Roof, TPO Roofing System to EPDM Roof, EPDM Roofing System.
4. Under 1.02, Part E. **Winter conditions:** Delete the words "heat equipment, fuel".
 - A. Add item 1: Snow and frost removal - if required, will be the responsibility of this work scope.
 - B. Add item 2: Any winter conditions costs to complete your work.
5. Under 1.02, Part O. Change Thermoplastic Membrane Roofing (TPO, PVC): Provide thermoplastic membrane roofing systems in accordance with Section 07543, ...to: "EPDM Roofing (EPDM, PVC): Provide EPDM membrane roofing systems in accordance with Section 07531,...".
6. Under 1.02, Part O. Delete Item 5. entirely.
7. Under 1.03., Part D, Item 5: Add: This includes all insulation and vapor barrier concealed by your work which cannot be accessed after this Bid Package work is complete.

H. Work Scope 8.10 - Curtain Wall

1. Under 1.02, Part E. **Winter conditions:** Delete the words "heat equipment, fuel".
 - A. Add Item 1: Snow removal - if required, will be the responsibility of this work scope.
2. Under 1.02, Part O., Item 2., Replace entirely with: All temporary doors are to be provided and installed by the CM.
 - A. Items 3 thru 5 - Delete in their entirety.
3. Under 1.02, Part P., Items 2 thru 4 - Delete in their entirety.
4. Under 1.02, Part P., Item 6., Replace entirely with: Permanent Aluminum doors, immediate frames, and hardware to be part of a future Bid Package.
5. Under 1.04, Part A., Change the \$2,500 allowance to a \$5,000 allowance.

I. Work Scope 15.10 - Mechanical (Below Grade)

1. Under 1.02, Part E - WINTER CONDITIONS: Delete the words "heat equipment, fuel".
 - A. Add item 1: Snow and frost removal within the building slab on grade area will be the responsibility of the CM.
2. Under 1.02, Part U: Replace with: Air floor ducting and concrete toppings on 2nd and 3rd floors in a future Bid Package.

J. Work Scope 16.10 Electrical (Below Grade)

1. Under 1.02, Part E - WINTER CONDITIONS: Delete the words "heat equipment, fuel".
 - A. Add item 1: Snow and frost removal within the building slab on grade area will be the responsibility of the CM.

5. Section 01500 - Construction Facilities and Temporary Controls

- 1) Temporary heaters and fuel for heating the enclosed building will be provided by the CM. Any other misc. temp. heat equipment, fuel and associated costs are by the corresponding Work Scope.
- 2) Temporary electric service: The CM will contract the work to bring in one - 100 amp temporary power panel per level centrally located. This power will be available prior to 12/31/10 on each floor if the concrete over metal is in place.

6. General Information

- A. Add RS&H's Addendum No. 1 dated June 11, 2010, in its entirety.

END OF KRAUS-ANDERSON CONSTRUCTION COMPANY
ADDENDUM NO. 1

(Bidder may copy this form on his own letterhead)
SUBMIT IN DUPLICATE

BID FORM

BID TO: Duluth Airport Authority;
By the City Purchasing Agent
Room 100 City Hall
Duluth, MN 55802

BID FROM: _____

In accordance with the Invitation to Bid and the proposed Contract Documents prepared by Reynolds, Smith and Hill, relating to the construction of:

Duluth International Airport
New Passenger Terminal
Bid Package 1
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:

- 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.
- *Work Scope 2.10 bidders: You will need to carry forward your totals from the Work Scope 2.10 Schedule to Page 2 of the Bid Form under "Base Bid for Work Scope No. 2.10".*

00305 - BID FORM

- Bidders submitting bids for more than one Work Scope are invited to submit a combined bid for work included under all Work Scopes for which Bidder is submitting a bid.

1. Base Bid for Work Scope No. 2.10 Title Civil and Site Electrical
Bid Amount: _____ \$ _____
Add Alternate No. 1 \$ _____
Add Alternate No. 2: \$ _____
Total Bid Amount: \$ _____
2. Base Bid for Work Scope No. 3.10 Title Structural Concrete
Bid Amount: _____ \$ _____
3. Base Bid for Work Scope No. 4.10 Title Masonry
Bid Amount: _____ \$ _____
4. Base Bid for Work Scope No. 5.10 Title Structural/Miscellaneous Steel
Bid Amount: _____ \$ _____
5. Base Bid for Work Scope No. 5.11 Title Metal Framing
Bid Amount: _____ \$ _____
6. Base Bid for Work Scope No. 7.10 Title Metal Panels
Bid Amount: _____ \$ _____
7. Base Bid for Work Scope No. 7.11 Title EPDM Roof
Bid Amount: _____ \$ _____
8. Base Bid for Work Scope No. 8.10 Title Curtain Wall
Bid Amount: _____ \$ _____
9. Base Bid for Work Scope No. 15.10 Title Mechanical (Below Grade)
Bid Amount: _____ \$ _____
10. Base Bid for Work Scope No. 16.10 Title Electrical (Below Grade)
Bid Amount: _____ \$ _____

Combined Base Bid:

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

Work Scope No. _____ Title: _____

Combined Bid Amount: _____ \$ _____

Unit Prices:

Refer to Section 01270 for complete description of Unit Prices.

| | ADD | DEDUCT |
|---------------------------------------------------|------------------|------------------|
| Unit Price No. <u>1</u> to Work Scope <u>3.10</u> | \$ _____ / _____ | \$ _____ / _____ |
| Unit Price No. <u>2</u> to Work Scope <u>3.10</u> | \$ _____ / _____ | \$ _____ / _____ |
| Unit Price No. <u>3</u> to Work Scope <u>5.10</u> | \$ _____ / _____ | \$ _____ / _____ |
| Unit Price No. _____ to Work Scope _____ | \$ _____ / _____ | \$ _____ / _____ |
| Unit Price No. _____ to Work Scope _____ | \$ _____ / _____ | \$ _____ / _____ |

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

| <u>Addenda No.</u> | <u>Dated</u> | <u>Addenda No.</u> | <u>Dated</u> |
|--------------------|--------------|--------------------|--------------|
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |

Bid Acceptance: If written notice of the acceptance of this Bid is received by the undersigned within 90 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, Labor and Material 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 90 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