



DULUTH INTERNATIONAL AIRPORT

Closer to everywhere.

**CONTRACT DOCUMENTS
AND
SPECIFICATIONS
FOR
NEW PASSENGER TERMINAL
DULUTH
INTERNATIONAL AIRPORT
60%
CONSTRUCTION DOCUMENT
REVIEW SET**

Volume 1 of 2

February 15, 2010

Prepared By:



850 East Diehl Road, Suite 120
Naperville, Illinois 60563

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

TABLE OF CONTENTS

| <u>DIVISION 01 – GENERAL REQUIREMENTS</u> | | Pages |
|--|--|--------------|
| 01010 | Summary of Work | 1 |
| 01027 | Applications for Payment | 2 |
| 01035 | Modification Procedures | 3 |
| 01040 | Coordination..... | 5 |
| 01050 | Field Engineering | 3 |
| 01200 | Project Meetings | 4 |
| 01210 | Allowances | 3 |
| 01230 | Alternates | 2 |
| 01270 | Unit Prices..... | 2 |
| 01300 | Submittals | 9 |
| 01400 | Quality Requirements | 3 |
| 01421 | Standards and Definitions | 4 |
| 01450 | Structural Tests and Special Inspections..... | 9 |
| 01500 | Construction Facilities and Temporary Controls | 8 |
| 01631 | Products and Substitutions | 5 |
| 01700 | Contract Closeout | 7 |
| 01732 | Selective Demolition | 8 |
| 01740 | Warranties | 3 |
| <u>DIVISION 02 – SITE WORK</u> | | |
| 02221 | Building Demolition | 8 |
| 02230 | Site Clearing | not issued |
| 02300 | Earthwork | not issued |
| 02510 | Water Distribution | not issued |
| 02530 | Sanitary Sewerage..... | not issued |
| 02620 | Subdrainage..... | not issued |
| 02630 | Storm Drainage..... | not issued |
| 02751 | Cement Concrete Paving..... | not issued |
| 02764 | Pavement Joint Sealants | not issued |
| <u>DIVISION 03 – CONCRETE</u> | | |
| 03100 | Concrete Formwork | 5 |
| 03200 | Concrete Reinforcement..... | 6 |
| 03300 | Cast-In-Place Concrete | 26 |
| 03331 | Cast-In-Place Architectural Concrete | not issued |
| <u>DIVISION 04 – MASONRY</u> | | |
| 04810 | Unit Masonry Assemblies | not issued |
| <u>DIVISION 05 – METALS</u> | | |
| 05120 | Structural Steel | 15 |
| 05121 | Architecturally Exposed Structural Steel | 6 |
| 05312 | Steel Roof Deck..... | 6 |
| 05360 | Composite Steel Deck | 5 |
| 05400 | Cold-Formed Metal Framing..... | 9 |
| 05500 | Metal Fabrications..... | 9 |

| | | |
|-------|--|------------|
| 05510 | Metal Stairs | 7 |
| 05530 | Metal Gratings..... | 5 |
| 05720 | Ornamental Handrails and Railings..... | 8 |
| 05811 | Architectural Joint Systems | not issued |

DIVISION 06 – CARPENTRY, WOODS AND PLASTICS

| | | |
|-------|---|------------|
| 06100 | Rough Carpentry..... | 5 |
| 06105 | Miscellaneous Carpentry | not issued |
| 06160 | Sheathing | not issued |
| 06220 | Interior Prefinished Wall Surfacing | 3 |
| 06402 | Interior Architectural Woodwork | 8 |

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

| | | |
|-------|--|------------|
| 07210 | Thermal Insulation | 6 |
| 07260 | Reinforced Underslab Vapor Retarders | not issued |
| 07413 | Insulated Core Metal Wall Panels | 13 |
| 07543 | Thermoplastic Polyolefin (TPO) Roofing | 8 |
| 07610 | Sheet Metal Roofing | 15 |
| 07620 | Flashing and Trim | not issued |
| 07710 | Roof Specialties | not issued |
| 07720 | Roof Accessories | not issued |
| 07841 | Through-Penetration Firestop Systems..... | not issued |
| 07920 | Joint Sealants | not issued |
| 07950 | Expansion Control | not issued |

DIVISION 08 – DOORS AND WINDOWS

| | | |
|-------|---|------------|
| 08110 | Steel Doors and Frames..... | 11 |
| 08163 | Sliding Aluminum-Framed Glass Doors | not issued |
| 08311 | Access Doors and Frames | not issued |
| 08331 | Overhead Coiling Doors | not issued |
| 08334 | Overhead Coiling Grilles..... | not issued |
| 08380 | High Performance Doors | not issued |
| 08710 | Door Hardware..... | not issued |
| 08800 | Glazing | not issued |
| 08830 | Mirrors | not issued |
| 08911 | Glazed Aluminum Curtain Walls..... | not issued |

DIVISION 09 – FINISHES

| | | |
|-------|--|------------|
| 09111 | Non-Structural Steel Framing..... | not issued |
| 09250 | Gypsum Board..... | not issued |
| 09260 | Gypsum Board Assemblies | not issued |
| 09402 | Resinous Matrix Terrazzo Flooring..... | 10 |
| 09511 | Acoustical Panel Ceilings | not issued |
| 09514 | Acoustical Metal Pan Ceilings | 8 |
| 09653 | Resilient Base and Accessories | not issued |
| 09681 | Carpet Tile | not issued |
| 09720 | Wall Coverings..... | not issued |
| 09910 | Painting | not issued |
| 09911 | Exterior Painting..... | not issued |
| 09912 | Interior Painting..... | not issued |
| 09960 | High-Performance Coatings | not issued |

DIVISION 10 – SPECIALTIES

| | | |
|-------|-----------------------------------|------------|
| 10155 | Toilet Compartments | 4 |
| 10200 | Louvers and Vents | not issued |
| 10410 | Directories | not issued |
| 10431 | Signage | not issued |
| 10520 | Fire Protection Specialties | not issued |
| 10606 | Wire Mesh Partitions..... | not issued |
| 10651 | Operable Panel Partitions..... | not issued |
| 10800 | Toilet Accessories..... | not issued |

DIVISION 11 – EQUIPMENT

| | | |
|-------|-------------------------|------------|
| 11132 | Projection Screens..... | not issued |
|-------|-------------------------|------------|

DIVISION 12 – FURNISHINGS

| | | |
|-------|--------------------------------------|------------|
| 12484 | Entrance Floor Mats and Frames | not issued |
| 12491 | Horizontal Louver Blinds | not issued |
| 12494 | Roller Shades | not issued |

DIVISION 13 – SPECIALTY SYSTEMS

| | | |
|-------|--|----|
| 13050 | Fire Protection General Requirements | 21 |
| 13053 | Fire Protection General Materials and Methods..... | 11 |
| 13055 | Fire Protection Motors | 8 |
| 13060 | Fire Protection Hangers and Supports | 9 |
| 13075 | Fire Protection Identification | 5 |
| 13520 | Fire Protection Cabinets | 8 |
| 13915 | Fire Protection Suppression Piping | 18 |
| 13916 | Fire Suppression Sprinklers | 21 |
| 13921 | Electric-Drive, Horizontal Fire Pumps..... | 16 |
| 13970 | Pre-Action Sprinkler System..... | 21 |
| 13975 | Standpipes and Hoses | 16 |

DIVISION 14 – CONVEYING SYSTEMS

| | | |
|-------|---------------------------------|------------|
| 14240 | Hydraulic Elevators | 11 |
| 14310 | Escalators | 8 |
| 14950 | Passenger Boarding Bridges..... | 25 |
| 14952 | Baggage Lifts..... | not issued |

DIVISION 15 – MECHANICAL

| | | |
|-------|---|----|
| 15010 | Basic Mechanical Requirements | 21 |
| 15050 | Basic Mechanical Materials and Methods | 29 |
| 15051 | Basic Plumbing Materials and Methods | 39 |
| 15055 | Motors | 6 |
| 15061 | Plumbing Hangers, Supports, Anchors and Guides | 15 |
| 15072 | Plumbing Vibration Controls | 8 |
| 15075 | Plumbing Identification..... | 6 |
| 15083 | Plumbing Pipe Insulation | 21 |
| 15110 | Plumbing Valves | 19 |
| 15121 | Plumbing Pipe Expansion Fittings and Loops..... | 4 |
| 15122 | Plumbing Meters and Gauges | 9 |
| 15140 | Plumbing Domestic Water Piping..... | 10 |
| 15150 | Plumbing Sanitary, Vent and Storm Drainage Piping | 12 |
| 15240 | Vibration Isolation | 12 |
| 15250 | Mechanical Insulation | 12 |
| 15260 | Acoustical Duct Lining | 3 |

| | | |
|-------|---|------------|
| 15300 | Fire Protection..... | 2 |
| 15410 | Plumbing Fixtures | 20 |
| 15412 | Plumbing Emergency Fixtures..... | 10 |
| 15413 | Plumbing Security Fixtures | 6 |
| 15415 | Drinking Fountains and Water Coolers | not issued |
| 15425 | Plumbing Vibration Controls | 17 |
| 15430 | Plumbing Specialties | 23 |
| 15441 | Plumbing Domestic Water Pumps..... | 5 |
| 15444 | Plumbing Packaged Booster System | 9 |
| 15448 | Natural Gas Piping..... | not issued |
| 15486 | Plumbing Fuel-Fired Water Heaters..... | 8 |
| 15500 | Heating, Ventilation and Air Conditioning Piping..... | 46 |
| 15530 | Refrigerant Piping | 9 |
| 15540 | HVAC Pumps..... | 13 |
| 15545 | Chemical Water Treatment | 20 |
| 15550 | Heat Generation..... | 9 |
| 15591 | Fuel Oil System Piping and Storage Tanks..... | 20 |
| 15681 | Air Cooled Refrigeration Machine..... | 7 |
| 15775 | Plumbing Electric Heat Trace | 9 |
| 15784 | Central Station Air-Handling Units | 9 |
| 15790 | Air Coils..... | 12 |
| 15880 | Metal Ductwork | 18 |
| 15882 | Air Distribution Devices..... | 34 |
| 15886 | Dampers | 12 |
| 15920 | Sound Attenuation | 8 |
| 15940 | Enclosed Controllers..... | 6 |
| 15942 | Variable Frequency Controllers | 11 |
| 15950 | HVAC Instrumentation and Controls | not issued |
| 15951 | Sequence of Operations..... | not issued |
| 15990 | Testing, Balancing and Adjusting | 27 |
| 15991 | Plumbing Testing, Adjusting and Balancing | 7 |
| 15995 | Special Mechanical Systems | 4 |

DIVISION 16 – ELECTRICAL

| | | |
|-------|--|----|
| 16050 | Basic Electrical Materials and Methods..... | 22 |
| 16055 | Overcurrent Protective Device Coordination | 6 |
| 16060 | Grounding and Bonding..... | 9 |
| 16075 | Electrical Identification | 8 |
| 16080 | Electrical Testing | 2 |
| 16119 | Underground Ducts and Utility Structures | 18 |
| 16120 | Conductors and Cables | 12 |
| 16130 | Raceways and Boxes | 16 |
| 16140 | Wiring Devices..... | 7 |
| 16145 | Lighting Control Devices..... | 3 |
| 16190 | Supporting Devices..... | 8 |
| 16231 | Packaged Engine Generators | 24 |
| 16269 | Variable Frequency Controllers | 4 |
| 16289 | Transient Voltage Suppression | 5 |
| 16410 | Enclosed Switches and Circuit Breakers..... | 5 |
| 16415 | Transfer Switches | 8 |
| 16419 | Fused Power Circuit Devices | 4 |
| 16420 | Enclosed Controllers..... | 4 |
| 16422 | Selection of Overcurrent Devices | 9 |

| | | |
|-------|--|----|
| 16424 | Feeders and Branch Circuitry | 6 |
| 16427 | Metering | 2 |
| 16428 | Submetering Systems..... | 5 |
| 16430 | Switchgear | 14 |
| 16441 | Switchboards | 13 |
| 16442 | Panelboards..... | 10 |
| 16461 | Dry Type Transformers..... | 5 |
| 16491 | Fuses | 3 |
| 16496 | Provisions for Elevators | 3 |
| 16511 | Lighting..... | 15 |
| 16670 | Lightning Protection..... | 4 |
| 16719 | Fire Protective Alarm Systems | 40 |
| 16741 | Telecommunication Distribution Systems | 4 |

END OF TABLE OF CONTENTS

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

**SECTION 01010 – SUMMARY
OF WORK**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PROJECT DESCRIPTION

- A. Project Identification:
 - 1. Name of the Project: NEW PASSENGER TERMINAL.
 - 2. Project Location: DULUTH INTERNATIONAL AIRPORT, DULUTH, MINNESOTA
 - 3. Owner: DULUTH AIRPORT AUTHORITY
 - 4. Architect / Engineer: RS&H ILLINOIS, Inc., NAPERVILLE, ILLINOIS
SJA, DULUTH, MINNESOTA
MBJ, DULUTH, MINNESOTA
COSENTINI ASSOC., CHICAGO, ILLINOIS
 - 5. Contract Documents Dated: MAY 1, 2010
- B. The project and the work of the Contract can be described in summary as follows:
 - 1. The project shall include: Construction of New Passenger Terminal, Staged Demolition of Existing Terminal, Site Utility Relocation, Temporary Paving, Passenger Boarding Bridge Relocations, Access Road Modification, Fencing and Traffic Control.
- C. The Work will be constructed under a single prime contract.
- D. There are multiple Allowances and Additive Allowances, see Project Manual and Project Documents for further information.

1.3 CONTRACTOR USE OF PREMISES

- A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
- B. Ownership of Property: Do not perform work, disturb or trespass upon properties not possessed by the Owner.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01010

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

**SECTION 01027 - APPLICATIONS
FOR PAYMENT**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
 - 1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 1 Section 01300 - SUBMITTALS.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - a. Contractor's Construction Schedule.
 - b. Application for Payment forms, including Continuation Sheets.
 - c. List of subcontractors.
 - d. Schedule of allowances.
 - e. Schedule of alternates.
 - f. Schedule of submittals.
 - 2. Submit 3 copies of the Schedule of Values to the Architect for approval at the earliest possible date but no later than 21 days before the date scheduled for submittal of the initial Applications for Payment.
 - 3. Subschedules: Where Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.
- B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of the Architect.
 - c. Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of Work / generic name of the item.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value.
 - h. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Sum in sufficient detail, acceptable to the Architect, to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
4. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.
6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Margins of Cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor's option.
8. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
- B. Payment Application Times: The "date" for each progress payment is as indicated in the Owner-Contractor Agreement or, if none is indicated therein, it is the 25th day of each month. The period of construction work covered by each payment request is the period indicated in the Owner-Contractor agreement or, if none is indicated therein, starting the day following the end of the preceding period. Refer to General Conditions and other Contract Documents for other dates related to payment application times.

- C. Payment-Application Forms: Use AIA Document G702 and Continuation Sheets G703 as the form for Applications for Payment.
- D. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Architect will return incomplete applications without action.
 - 1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- E. Transmittal: Submit five (5) signed and notarized original copies of each Application for Payment to the Architect by a method ensuring receipt within 24 hours. One copy shall be complete, including waivers of lien and similar attachments, when required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect.
- F. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics liens from every entity who may lawfully be entitled to file a mechanics lien arising out of the Contract, including but not limited to subcontractors, sub-subcontractors and suppliers, for the construction period covered by the previous application.
 - 1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit final or full waivers.
 - 3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Waiver Delays: Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period of construction covered by the application.
 - a. Submit final Applications for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - 5. Waiver Forms: Submit waivers of lien on forms and executed in a manner acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following:
 - 1. List of subcontractors.
 - 2. List of principal suppliers and fabricators.
 - 3. Schedule of Values.
 - 4. Contractor's Construction Schedule (preliminary if not final).
 - 5. Schedule of principal products.
 - 6. Schedule of unit prices.
 - 7. Submittal Schedule (preliminary if not final).
 - 8. List of Contractor's staff assignments.
 - 9. List of Contractor's principal consultants.
 - 10. Copies of building permits.
 - 11. Copies of authorizations and licenses from governing authorities for performance of the Work.
 - 12. Certificates of insurance and insurance policies.

13. Performance and payment bonds.
 14. Data needed to acquire the Owner's insurance.
 15. Initial settlement survey and damage report, if required.
- H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.
1. This application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
 2. Administrative actions and submittals that shall precede or coincide with this application include:
 - a. Occupancy permits and similar approvals or certifications by governing authorities, assuring Owner=s full access and use of the completed work.
 - b. Warranties (guarantees) and maintenance agreements.
 - c. Test / adjust / balance records.
 - d. Maintenance instructions.
 - e. Meter readings.
 - f. Start-up performance reports.
 - g. Change-over information related to Owner's occupancy, use, operation, and maintenance.
 - h. Final cleaning.
 - i. Application for reduction of retainage and consent of surety.
 - j. Advice on shifting insurance coverages, including proof of extended coverages as required.
 - k. Final progress photographs.
 - l. List of incomplete Work recognized to be completed by the Contractor, as exceptions to Architect's Certificate of Substantial Completion.
- I. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
1. Completion of Project closeout requirements.
 2. Completion of items specified for payment application at time of Substantial Completion (regardless of whether such application was made).
 3. Assurance, satisfactory to Owner, that unsettled claims will be settled and that work not actually completed or accepted will be completed without undue delay.
 4. Transmittal of required Project construction records to the Owner.
 5. Certified property survey.
 6. Proof, satisfactory to Owner, that taxes, fees, and similar obligations of the Contractor have been paid.
 7. Removal of temporary facilities and services.
 8. Removal of surplus materials, rubbish, and similar elements.
 9. Change of door locks and other Contractor access to Owner's property.
 10. Consent of Surety for Final Payment.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01027

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

SECTION 01040 – COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
 - 1. General project coordination procedures.
 - 2. Coordination Drawings.
 - 3. Administrative and supervisory personnel.
 - 4. Cleaning and protection.
- B. Related Sections: Refer to other Division 1 sections for coordination requirements regarding field engineering services, project meetings, Contractor's construction schedule, general installation and contract closeout.

1.3 COORDINATION

- A. Coordinate construction operations included in various sections of these Specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different sections that are dependent upon each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
 - 3. Make provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of schedules.
 - 2. Installation and removal of temporary facilities.
 - 3. Delivery and processing of submittals.

4. Progress meetings.
5. Project closeout activities.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare coordination drawings as careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 1. Show the relationship of components shown on separate Shop Drawings.
 2. Indicate required installation sequences.
 3. Comply with requirements contained in Section 01300 - SUBMITTALS.
 4. Refer to Divisions 15 and 16 for additional requirements.
- B. Staff Names: Within fifteen (15) days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
 1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.
- C. Subcontractor / Supplier Names: Within fifteen (15) days of commencement of construction operations, submit a listing of Contractor's principal subcontractors and suppliers, naming persons and listing their addresses and phone numbers.

1.5 SITE USE PLAN

- A. Within ten (10) working days of Contract award, the Contractor shall develop and submit for Owner's approval a site use plan. This plan shall clearly describe the proposed temporary facilities, staging areas, ramps and major traffic ways, hazardous material storage, provisions for site services, safety and security. Changes to the site plan shall be submitted for review and approval five (5) working days prior to effecting the changes.

1.6 TRADESPERSONS AND WORKMANSHIP STANDARDS

- A. General: Instigate and maintain procedures to ensure that persons performing work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required quality levels for workmanship in completed work. Remove and replace work which does not comply with workmanship standards as specified and as recognized in the construction industry for applications indicated. Remove and replace other work damaged or deteriorated by faulty workmanship or its replacement.
- B. Availability of Tradespersons: At each progress or coordination meeting, review availability of tradespersons and projected needs to accomplish work as scheduled. Require each entity employing personnel to report on events which might affect progress of work. Where possible, consider alternatives and take actions to avoid disputes and delays.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.
- C. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- D. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- E. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.
- F. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- G. Recheck measurements and dimensions, before starting each installation.
- H. Install each component during conditions of temperature, humidity, exposure, forecasted weather and status of project completion that will ensure the best possible results, in coordination with entire work. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.2 CLEANING AND PROTECTION

- A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.
- C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High-speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

3.3 ENVIRONMENTAL PROTECTION

- A. Soil Disposal and / or Borrow: Conduct all soil disposal and / or borrow work in accordance with requirements of local regulatory authorities. Dispose of all excess soil in a legal manner off site.
- B. Solid, Liquid and Gaseous Contaminants: Contractor shall be responsible for the proper disposal of all solid, liquid and gaseous contaminants in accordance with all local codes and regulations, together with the following requirements.
 1. Discharge gaseous contaminants so that they will be sufficiently diluted with fresh air to reduce the toxicity to an acceptable level.
 2. Liquid contaminants may, subject to local utility standards, be diluted with water to a level of quality acceptable in the local sewer system or shall be contained in approved vessels for disposal at approved sites.
- C. Disposal of Refuse: Remove refuse resulting from construction operations from the site. Burning on the site is not permissible.
- D. Hazardous Waste: All hazardous waste generated by the Contractor and the Contractor's subcontractors during the course of construction shall be stored, transported and disposed of in accordance with 40 CFR 260. The Contractor and his subcontractors shall be responsible for all documentation related to hazardous

waste generated as a result of this Contract and that documentation shall be in accordance with 40 CFR 260.

- E. Construction Site Maintenance:
 - 1. Store all supplies and equipment on project site so as to preclude mechanical and climatic damage. Maintain site in a neat and orderly manner.
 - 2. Contractor shall be responsible for maintaining the temporary structures and construction enclosure (fence) in good repair and visually pleasant. Contractor shall further provide adequate security, supplementing the existing fencing as necessary, to prevent the presence of unauthorized persons on the site and to keep gates secured when not in actual use to ensure the integrity of the barrier as well as for property security.
- F. Noise Control: Comply with all applicable state and local laws, ordinances and regulations relative to noise control.

END OF SECTION 01040

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

**SECTION 01200 – PROJECT
MEETINGS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
 - 1. Preconstruction conferences.
 - 2. Preinstallation conferences.
 - 3. Progress meetings.
- B. Contractor=s Construction Schedule requirements are specified in another Division 1 section.
- C. Refer to individual sections for the portions of the project requiring preinstallation conferences.

1.3 PRECONSTRUCTION CONFERENCE

- A. The Owner and / or Architect will schedule a preconstruction conference and organizational meeting prior to the start of construction, but no later than fifteen (15) days after the execution of the Owner-Contractor Agreement. The preconstruction conference will be held at the project site, or an otherwise convenient location. The meeting shall be conducted to review responsibilities and personnel assignments.
- B. Attendees: Authorized representatives of the Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers, and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the work.
- C. Agenda: Discuss items of significance that could affect progress, including the following:
 - 1. Tentative construction schedule.
 - 2. Critical work sequencing.
 - 3. Designation of responsible personnel.
 - 4. Procedures for processing field decisions and Change Orders.
 - 5. Procedures for processing Applications for Payment.
 - 6. Distribution of Contract Documents, if not previously distributed.
 - 7. Submittal of Shop Drawings, Product Data, and Samples.
 - 8. Preparation of record documents.
 - 9. Use of the premises.
 - 10. Parking availability.

11. Office, work, storage areas and temporary facilities.
 12. Equipment deliveries and priorities.
 13. Safety procedures.
 14. First aid.
 15. Security.
 16. Housekeeping.
 17. Working hours.
 18. Coordination with work of concurrent and subsequent contracts under other Contractors.
 19. Other appropriate topics.
- D. Schedule of Values: The Contractor shall provide an outline or draft copy of the Schedule of Values, in accordance with the requirements of Section 01027 - APPLICATIONS FOR PAYMENT, for initial review. The intent of this submittal is to review the Schedule of Values for organization and content with respect to the construction progress and work requirements, such that the review time of the formal submittal may be minimized. No dollar values or other monetary breakdowns are required with this outline. The formal submittal of the Schedule of Values with all monetary breakdowns and other requirements shall be in accordance with Section 01027 - APPLICATIONS FOR PAYMENT.
- E. The Architect shall record the results of the meeting and distribute copies to attendees and other interested parties.

1.4 PREINSTALLATION CONFERENCES

- A. The Contractor shall conduct a preinstallation conference at the Project Site before each construction activity that requires coordination with other construction.
- B. Attendees: The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect at least ten (10) working days in advance of scheduled meeting dates.
- C. Do not schedule conferences until the submittals required by the Contract Documents for work associated with the construction activity requiring the conference have been approved and returned to the Contractor.
- D. Review the progress of other construction activities and preparations for the particular activity under consideration at each preinstallation conference, including requirements for the following:
1. Contract Documents.
 2. Options.
 3. Related Change Orders.
 4. Purchases.
 5. Deliveries.
 6. Shop Drawings, Product Data, and quality-control samples.
 7. Review of mockups.
 8. Possible conflicts.
 9. Compatibility problems.
 10. Time schedules.
 11. Weather limitations.
 12. Manufacturer's recommendations.

13. Warranty requirements.
 14. Compatibility of materials.
 15. Acceptability of substrates.
 16. Temporary facilities.
 17. Space and access limitations.
 18. Governing regulations.
 19. Safety.
 20. Inspecting and testing requirements.
 21. Required performance results.
 22. Recording requirements.
 23. Protection.
- E. The Contractor shall record the results of the meeting and distribute copies to attendees and other interested parties.
- F. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of work and reconvene the conference at the earliest feasible date.

1.5 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project Site at regularly scheduled times on a biweekly interval. Notify the Owner and the Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request and in conjunction with any coordination meetings.
- B. Attendees: In addition to representatives of the Owner and the Architect, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to progress.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.
1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time.
 2. Review the present and future needs of each entity present, including the following:
 - a. Interface requirements.
 - b. Time.
 - c. Sequences.
 - d. Status of submittals.
 - e. Deliveries.
 - f. Off-site fabrication problems.
 - g. Access.
 - h. Site utilization.
 - i. Temporary facilities and services.
 - j. Hours of work.

- k. Hazards and risks.
 - l. Housekeeping.
 - m. Quality and work standards.
 - n. Change Orders.
 - o. Documentation of information for payment requests.
- D. Reporting: Contractor shall record minutes of the meeting and distribute to each party present and to parties who should have been present. Contractor shall revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Contractor shall issue the revised schedule to attendees and others who should have been present no later than three (3) days after the meeting.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01200

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

SECTION 01230 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

ALTERNATES SHALL INCLUDE:**A. Alternate No. 1.**

Add (deduct) the sum of: _____ Dollars (\$_____).

B. Alternate No. 2.

Add (deduct) the sum of: _____ Dollars (\$_____).

C. Alternate No. 3.

Add (deduct) the sum of: _____ Dollars (\$_____).

END OF SECTION 01230

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

SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes administrative and procedural requirements for submittals required for performance of the work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Submittal schedule.
 - 3. Daily construction reports.
 - 4. Construction photographs.
 - 5. Shop Drawings.
 - 6. Product Data.
 - 7. Samples.
 - 8. Quality assurance submittals.
- B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
 - 1. Permits.
 - 2. Applications for Payment.
 - 3. Performance and payment bonds.
 - 4. Insurance certificates.
 - 5. List of subcontractors.
- C. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 1, Section 01027 - APPLICATIONS FOR PAYMENT specifies requirements for submittal of the Schedule of Values.
 - 2. Division 1, Section 01040 - COORDINATION specifies requirements governing preparation and submittal of required Coordination Drawings.
 - 3. Division 1, Section 01200 - PROJECT MEETINGS specifies requirements for submittal and distribution of meeting and conference minutes.
 - 4. Division 1, Section 01400 - QUALITY CONTROL specifies requirements for submittal of inspection and test reports.
 - 5. Division 1, Section 01700 - CONTRACT CLOSEOUT specifies requirements for submittal of Project Record Documents at project closeout.

1.3 QUALITY ASSURANCE

- A. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.4 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related elements of the work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
 3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
 - a. Allow 2 weeks plus time in transit for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Architect will advise the Contractor when a submittal being processed must be delayed for coordination.
 - b. If an intermediate submittal is necessary, process the same as the initial submittal.
 - c. Allow 2 weeks plus time in transit for reprocessing each submittal.
 - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the work to permit processing.
 4. The Architect will review up to 2 submissions (original and one resubmission) of shop drawings and other data submitted by the Contractor. Thereafter, additional reviews will be at the expense of the Contractor. These two referenced submissions shall be the only two whose associated review costs shall be borne by the Owner, regardless of whether a different product is submitted in subsequent submittals and regardless of whether a product is submitted as an equal product or substitution. The Architect will record the time required by him or his consultants in reviewing and approving submission in excess of the original and one 1 resubmission and notify the Contractor of the charges therefore. The Owner shall deduct any such expenses of the Architect from the Contractor's monthly periodic pay requests.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Provide a space approximately 4 by 5 inches on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
 2. Include the following information on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.
 - c. Name and address of the Architect.
 - d. Name and address of the Contractor.
 - e. Name and address of the Subcontractor.
 - f. Name and address of the supplier.

- g. Name of the manufacturer.
 - h. Number and title of appropriate Specification section.
 - i. Drawing number and detail references, as appropriate.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using the standard transmittal form. Submittals received from sources other than the Contractor will be returned without action. A separate transmittal shall be used for each required submittal and the contents shall be itemized separately thereon to allow indication of disposition for each element of the submittal.
- D. Contractor's Action: Each shop drawing sheet and the cover sheet of bound packets of product data shall bear a stamp indicating the Contractor's disposition following his review and checking. The disposition shall be indicated as "approved," "approved as noted," or similar as applicable. The stamp shall include the Contractor's name, the signature of the reviewer and the date checked. The notated sample shall be construed as evidence the Contractor has performed the review, check, verification and coordination as required by the GENERAL CONDITIONS. Shop drawing submittals received without this stamp (executed) will be returned to the Contractor with no action taken.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, Contractor's construction schedule. Submit within thirty (30) days after the date established for "Commencement of the Work."
- 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. At the minimum, use the same breakdown of units of the work as indicated in the "Schedule of Values."
 - 2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As work progresses, place a contrasting mark in each bar to indicate actual completion.
 - 3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
 - 4. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the work.
 - 5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other schedules.
 - 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
- B. Phasing: On the schedule, show how requirements for phased completion to permit work by separate Contractors and partial occupancy by the Owner affect the sequence of work.

- C. Work Stages: Indicate important stages of construction for each major portion of the work, including submittal review, testing, and installation.
- D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the work. Indicate where each element in an area must be sequenced or integrated with other activities.
- E. Cost Correlation: At the head of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of work performed as of the dates used for preparation of payment requests.
 - 1. Refer to Division 1, Section 01027 - APPLICATIONS FOR PAYMENT for cost reporting and payment procedures.
- F. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
 - 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.
- G. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.6 SUBMITTAL SCHEDULE

- A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for establishment of the Contractor's Construction Schedule.
 - 1. The submittal schedule shall include all product data, shop drawings, samples, inspection reports, test reports and similar items as called out in the individual specification sections, to be submitted by the Contractor during the course of the project.
 - 2. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.
 - 3. Prepare the schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:
 - a. Scheduled date for the first submittal.
 - b. Related section number.
 - c. Submittal category.
 - d. Name of the subcontractor.
 - e. Description of the part of the work covered.
 - f. Scheduled date for resubmittal.
 - g. Scheduled date for the Architect's final release or approval.
- B. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.
 - 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.

- C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.7 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Architect at weekly intervals:
 1. List of subcontractors at the site.
 2. Approximate count of personnel at the site.
 3. High and low temperatures, general weather conditions.
 4. Accidents and unusual events.
 5. Meetings and significant decisions.
 6. Stoppages, delays, shortages, and losses.
 7. Meter readings and similar recordings.
 8. Emergency procedures.
 9. Orders and requests of governing authorities.
 10. Change Orders received, implemented.
 11. Services connected, disconnected.
 12. Equipment or system tests and startups.
 13. Partial Completions, occupancies.
 14. Substantial Completions authorized.

1.8 SHOP DRAWINGS

- A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information submitted without being specifically tailored to this Project is not a Shop Drawing.
- B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
 1. Dimensions.
 2. Identification of products and materials included.
 3. Compliance with specified standards.
 4. Notation of coordination requirements.
 5. Notation of dimensions established by field measurement.
 6. Sheet Size: Except for templates, patterns and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
 7. Submittal Quantity and Type: Submit one correctable, translucent, reproducible print and two blueline or blackline prints for the Architect's review. The Architect will return the reproducible print.
 8. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

1.9 PRODUCT DATA

- A. Collect product data into a single submittal for each element of construction or system. Product data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams

and templates, standard wiring diagrams, and performance curves. Where product data must be specially prepared because standard printed data is not suitable for use, submit as "shop drawings."

1. Mark each copy to show applicable choices and options. Where printed product data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with recognized trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
2. Do not submit product data until compliance with requirements of the Contract Documents has been confirmed.
3. Submittals: Submit 6 copies of each required submittal. The Architect will retain 3 and will return the others marked with action taken and corrections or modifications required.
4. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until an applicable copy of product data is in the Installer's possession.
 - b. Do not permit use of unmarked copies of product data in connection with construction.

1.10 SAMPLES

- A. Submit full-size, fully fabricated samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
 1. Mount, display or package samples in the manner to facilitate review of qualities indicated. Prepare samples to match the Architect's sample. Include the following:
 - a. Specification section number and reference.
 - b. Generic description of the sample.
 - c. Sample source.
 - d. Product name or name of the manufacturer.
 - e. Compliance with recognized standards.
 - f. Availability and delivery time.
 2. Submit samples for review of size, kind, color, pattern, and texture. Submit samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
 - b. Refer to other Specification sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

3. Preliminary Submittals: Where samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
 - a. Preliminary submittals will be reviewed and returned with the Architect's notation indicating selection and other action.
 4. Submittals: Except for samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 3 sets. The Architect will return one set marked with the action taken.
 5. Maintain sets of samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the work. Show distribution on transmittal forms.
1. Field samples specified in individual sections are special types of samples. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the standard by which the work will be judged.
 - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.11 QUALITY ASSURANCE SUBMITTALS

- A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other sections of the Specifications.
- B. Certifications: Where other sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
 1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.
- C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1, Section 01400 - QUALITY CONTROL.

1.12 CONSTRUCTION PHOTOGRAPHS

- A. General: Provide construction progress photographs taken one day each month to coincide with monthly pay request, until Substantial Completion. Take photographs at Substantial Completion as specified.
- B. Photographer Qualifications: A professional commercial photographer acceptable to the Owner.
- C. Format: Color photographic prints in 8-inch by 10-inch size, smooth surface, glossy finish and in a plastic jacket with a left hand binding margin.

1. Provide 3 copies of each monthly set, with negatives, to the Architect, within 5 working days of taking photograph.
 2. Label each photograph, in lower right-hand corner, with the name of the project, date and time of the exposure, description of the view, Contractor's name and other pertinent data.
 3. Consecutively number each exposure from beginning of project through Substantial Completion.
- D. Quantity:
1. Monthly: Until Substantial Completion, take photographs of 4 representative views of the project showing, as much as possible, the work installed during the previous month. Architect reserves the right to determine location of photographs.
 2. At Substantial Completion: Take photographs of the project from 10 locations as selected by the Owner and Architect.

1.13 ARCHITECT'S ACTION

- A. Except for submittals for the record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return in accordance with the Article "Submittal Procedures".
1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
1. Final Unrestricted Release: When submittals are marked "Approved," the work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final acceptance and payment depends on that compliance.
 2. Final-But-Restricted Release: When submittals are marked "Approved as Noted," the work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final acceptance and payment depends on that compliance.
 3. Returned for Resubmittal: When submittals are marked "Not Approved" or "Returned for Correction", do not proceed with work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark. Do not permit submittals so marked to be used at the project site or elsewhere where work is in progress.
 4. Other Action: Where a submittal is for information or record purposes, special processing or other activity, the submittal will be returned marked "Returned Without Action".
- C. Unsolicited Submittals: The Architect will return unsolicited submittals to the sender without action.
- D. Except for verification of finishes, colors and other aesthetic matters left to the Architect's discretion by the Contract Documents, Architect's review of shop drawings is only for the convenience of the Owner in following the work and shall not relieve the Contractor from responsibility for any deviations from the requirements of

the Contract Documents. The Architect's review shall not be construed as a complete check nor shall it relieve the Contractor from responsibility for errors of any sort in shop drawings or schedules or from the necessity of furnishing any work required by the Contract Documents which may have been omitted on the shop drawings. The Architect's review of a separate item shall not indicate review of the complete assembly in which it functions.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01300

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

**SECTION 01400 – QUALITY
REQUIREMENTS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes administrative and procedural requirements for quality-control services.
- B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this section relate to customized fabrication and installation procedures, not production of standard products.
 - 1. Specific quality-control requirements for individual construction activities are specified in the sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
 - 2. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this section.

1.3 RESPONSIBILITIES

- A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and similar quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.
- B. Contractor's Convenience Testing: Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.
- C. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate

noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests were performed on original construction.
- D. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
1. Provide access to the work.
 2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
 3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
 4. Provide facilities for storage and curing of test samples.
 5. Deliver samples to testing laboratories.
 6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 7. Provide security and protection of samples and test equipment at the Project Site.
- E. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual sections shall cooperate with the Architect and the Contractor in performance of its duties and shall provide qualified personnel to perform required inspections and tests.
1. The agency shall notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the work during performance of its services.
 2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the work.
 3. The agency shall not perform any duties of the Contractor.
- F. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.4 SUBMITTALS

- A. The independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Architect and the Contractor.
1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
 2. Report Data: Written reports of each inspection, test, or similar service shall include, but not be limited to, the following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.

- d. Dates and locations of samples and tests or inspections.
- e. Names of individuals making the inspection or test.
- f. Designation of the work and test method.
- g. Identification of product and specification section.
- h. Complete inspection or test data.
- i. Test results and an interpretation of test results.
- j. Ambient conditions at the time of sample taking and testing.
- k. Comments or professional opinion on whether inspected or tested work complies with Contract Document requirements.
- l. Name and signature of laboratory inspector.
- m. Recommendations on retesting.

1.5 QUALITY ASSURANCE

- A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.
 - 1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
- C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 01400

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

**SECTION 01421 – STANDARDS
AND DEFINITIONS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. General: Basic contract definitions are included in the Conditions of the Contract.
- B. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. No limitation on location is intended.
- C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases. However, no such implied meaning will be interpreted to extend the Architect's responsibility into Contractor's area of construction supervision.
- D. "Approved": The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.
- E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
- I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
- J. "Project Site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- K. "Testing Agencies, Laboratories or Service": All terms interchangeably refer to an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.
- L. "Nationally Recognized Testing Laboratories": The term "nationally recognized testing laboratory (NRTL)" shall mean a firm or organization which is recognized by OSHA in accordance with 29 CFR Part 1910.7 to test and approve (i.e., certify, label or list) equipment or materials as being safe for the intended use. Labeling and / or listing of products by NRTL is acceptable wherever a reference to the UL or FMRC label is made in the specifications.
- M. "Label": The label must be provided by a nationally recognized testing laboratory. The Contractor shall provide a statement from the testing laboratory attesting that the laboratory has been approved by OSHA to certify the category of product(s) being submitted for approval.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

- A. **Applicability of Standards:** Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
 - 1. Reference standards (standards referenced directly in the contract documents) take precedence over standards that are not referenced but generally recognized in the industry for applicability to the work.
 - 2. Unreferenced Standards: Except as otherwise limited by the contract documents, standards not referenced but recognized in the construction industry as having direct applicability will be enforced for performance of the work. The decision as to whether an industry code or standard is applicable, or as to which of several standards are applicable, is the sole responsibility of the Architect.
- B. **Publication Dates:** Comply with the standards in effect as of the date of the Contract Documents.
 - 1. Updated Standards: Submit a change order proposal where an applicable industry code or standard has been revised and reissued after the date of the Contract Documents and before the performance of the work affected. The Architect will decide whether to issue a change order to proceed with the updated standard.
- C. **Conflicting Requirements:** Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different but apparently equal to the Architect for a decision before proceeding.
 - 1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.
 - 2. The Architect is the sole interpreter of what constitutes "minimum requirements" in any given situation. Exceeding minimum requirements in one or more aspects of any given specification does not cancel or replace the need to meet minimum requirements of any other aspect of that specification.
- D. **Copies of Standards:** Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.
- E. **Abbreviations and Names:** Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale

Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

1.5 GOVERNING REGULATIONS AND AUTHORITIES

- A. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents. Contact authorities having jurisdiction directly for information and decision having a bearing on the work.

1.6 SUBMITTALS

- A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01421

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

**SECTION 01450 - STRUCTURAL TESTS
AND SPECIAL INSPECTIONS**

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 INTENT AND CONDITIONS

- A. Intent:
 - 1. For compliance with the Minnesota State Building Code, the Owner shall employ and pay for a special inspector (or inspectors) as required by Chapter 17 of the International Building Code.
 - 2. Duties and responsibilities of the special inspector(s) shall be as outlined in Chapter 17 of the International Building Code and as herein specified.
 - 3. Define and coordinate structural tests and special inspection services.
 - 4. Define and coordinate conventional testing and inspection services.
 - 5. Testing and Inspection services are intended to assist in determining probable compliance of the work with requirements specified. These services do not relieve the Contractor of responsibility for compliance with the requirements of the Contract Documents.
- B. Conditions:
 - 1. If inspection of fabricator's work is required, the Owner's representative may require testing and inspection of the work at the plant, before shipment. Owner, Architect and Structural Engineer of Record (SER) reserve the right to reject material not complying with Contract Documents.
 - 2. Perform testing and inspection in accordance with industry standard used as reference for specific material or procedure unless other criteria are specified. In the absence of a referenced standard, accomplish tests in accordance with generally accepted industry standards.
 - 3. Failure to detect defective work or materials shall in no way prevent later rejection if defective work or materials are discovered.

1.3 RELATED REQUIREMENTS

- A. Refer to individual technical specification sections for additional qualifications, inspections, tests, frequency and standards required.

1.4 DEFINITIONS

- A. Testing: Evaluation of systems, primarily requiring physical manipulation and analysis of materials, in accordance with approved standards.
- B. Inspection: Evaluation of systems, primarily requiring observation and judgment.

- C. Structural Tests and Special Inspections: Structural Tests and Special Inspection Services herein include items required by Chapter 17 of the International Building Code as adopted by the current Minnesota State Building Code, and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.
- D. Conventional Testing and Inspections: Conventional Testing and Inspection Services herein describe those items not specially required by Code but may be considered essential to the proper performance of the building systems.
- E. Architect of Record: The prime consultant in charge of overall design and coordination of the Project.
- F. Structural Engineer of Record (SER): The Licensed Engineer in responsible charge of the structural design for the Project.
- G. Licensed Structural Engineer: A professional engineer with education and experience in the design of structures similar to this Project and licensed in Minnesota.
- H. Testing Agency (TA):
 - a. Testing Agency: Approved independent testing agency acceptable to the Owner, Architect, SER and as noted below:
 - b. Authorized to operate in the State of Minnesota and experienced with the requirements and testing methods specified in the Contract Documents.
 - c. Meeting applicable requirements of references stated in paragraph 1.4.
 - d. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards, or to accepted values of natural physical constants.
- I. Special Inspector (SI): A properly qualified individual or firm performing special inspections.
- J. The categories of special inspector are:
 - 1. Special Inspector - Technical I, II and III: Usually an employee of a testing agency:
 - a. Technical I (Sections 31 20 00, 31 62 23, 31 63 29) - Technician shall be under the direct supervision of a licensed civil / geotechnical engineer regularly engaged in this type of work. Work shall be performed in a qualified geotechnical / testing laboratory.
 - b. Technical I (Sections 03 10 00, 03 20 00, 03 30 00)
 - 1) ACI Certified Concrete Field Testing Technician – Grade I.
 - 2) ACI Certified Concrete Strength Testing Technician.
 - 3) ACI Certified Concrete Laboratory Testing Technician – Grade 1.
 - 4) ACI Certified Concrete Construction Inspector-In-Training.
 - 5) Inspector shall be employed by a testing laboratory, experienced in the type of work being performed, and under the direct supervision of a licensed civil / structural engineer.
 - c. Technical I (Section 04 20 00) - Technician shall be under the direct supervision of a licensed civil / structural engineer regularly

- engaged in testing and inspection of this type of work. The licensed engineer shall review and approve all inspection reports.
- d. Technical I (Section 05 12 00) - Non-destructive Testing Technician SNT-TC-1A Level I, and / or AWS Certified Associate Weld Inspector (CAWI).
 - e. Technical I (Section 07 81 00) - Shall be familiar with the interpretation and use of ASTM E 605, and have prior field experience in testing and inspection of spray-applied fireproofing. Shall be supervised by an engineer licensed to practice in the state of Minnesota.
 - f. Technical II (Sections 31 20 00, 31 62 13, 31 62 23, 31 63 29,) - Technician with a minimum of two (2) years experience, or a graduate engineer, and is an employee of a qualified and approved geotechnical / technical laboratory, under the direct supervision of a licensed civil / geotechnical engineer regularly engaged in this type of work.
 - g. Technical II (Sections 03 10 00, 03 20 00, 03 30 00)
 - 1) ACI Certified Concrete Laboratory Testing Technician - Grade II.
 - 2) ACI Certified Laboratory Aggregate Testing Technician.
 - 3) ACI Certified Concrete Construction Inspector.
 - 4) Inspector shall be employed by a testing laboratory, experienced in the type of work being performed, and under the direct supervision of a licensed civil / structural engineer.
 - h. Technical II (Section 04 20 00) - Graduate civil / structural engineer, with experience in this type of work. Supervised by a licensed civil / structural engineer. The licensed engineer shall review and approve all inspection reports.
 - i. Technical II (Section 05 12 00) - Non-destructive Testing Technician ASNT TC-1A Level II, (NDE Technician II), AWS/CAWI, with minimum 3 years' experience, or an AWS/CWI.
 - j. Technical III (Sections 31 20 00, 31 62 23, 31 63 29) - A civil / geotechnical engineer regularly engaged in this type of work with a minimum of 4 years' experience, licensed in the state of Minnesota, and is an employee of a qualified and approved geotechnical / testing laboratory. This licensed engineer shall review and approve all final field reports.
 - k. Technical III (Section 03 30 00) - A civil / structural engineer regularly engaged in this type of work, with a minimum of four (4) years experience and licensed in the state of Minnesota and is an employee of a qualified and approved testing laboratory. The licensed engineer shall review and approve all reports.
 - l. Technical III (Section 05 12 00) - ASNT Level III with a minimum of ten (10) years experience or an AWS/CWI with a minimum of ten (10) years experience.
2. Special Inspector - Structural I and II: Usually an employee of the Structural Engineer of Record.
- a. Structural I (Sections 03 10 00, 03 20 00, 03 30 00, 03 38 16, 04 20 00, 05 12 00, 31 62 23, 31 63 29) - Graduate civil / structural engineer, or other personnel acceptable to the SER, with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed civil / structural engineer.

- b. Structural II (Sections 03 10 00, 03 20 00, 03 30 00, 04 20 00, 05 12 00, 31 62 23, 31 63 29) - Civil / structural engineer regularly engaged in the design of structural systems of this type, licensed in the state of Minnesota. The licensed engineer shall review and approve all inspection reports.
- K. Building Official: The Officer or duly authorized representative charged with the administration and enforcement of the State Building Code.

1.5 REFERENCES

- A. ANSI/ASTM E329 – Standard Specification for Agencies Engaged in the Testing and / or Inspection of Materials Used in Construction.
- B. ASTM E543 – Standard Practice for Agencies Performing Non-destructive Testing.
- C. ASTM C1077 – Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- D. ASTM C1093 – Standard Practice for the Accreditation of Testing Agencies for Unit Masonry.
- E. ANSI/ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and / or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- F. Minnesota State Building Code.
- G. International Building Code.
- H. See technical specification sections for specific references.

1.6 RESPONSIBILITIES / AUTHORITY

- A. Structural Tests and Special Inspections:
 - 1. Special Inspector:
 - a. Attend all pre-installation meetings to review scope of structural tests and special inspections.
 - b. Test and / or inspect the work assigned for conformance with the building department approved plans, specifications, and applicable material and workmanship provisions of the code. Perform testing and inspection in a timely manner to avoid delay of work.
 - c. Bring nonconforming items to the immediate attention of the Contractor for correction, then, if uncorrected after a reasonable period of time, to the attention of the Structural Engineer of Record, the Building Official, and to the Architect.
 - d. Submit test and / or inspection reports to the Building Official, Contractor, the Structural Engineer of Record, and other designated persons in accordance with the Structural Testing and Special Inspection Schedule.

- e. Submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans, specifications and the applicable workmanship provisions of the code.
 - f. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
2. Architect:
- a. Coordinate the flow of reports and related information to expedite resolution of construction issues.
 - b. Attend pertinent pre-installation meetings to review scope of structural testing and special inspection.
 - c. Complete and sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction. Provide a completed copy of the schedule to all signed parties including Building Official.
3. Structural Engineer of Record:
- a. Identify items requiring structural testing and special inspection including special cases.
 - b. Define "type" of special inspector required for "description" of work indicated on the Structural Testing and Special Inspection Schedule.
 - c. Attend pertinent pre-installation meetings to review scope of structural testing and special inspection.
 - d. Complete and sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
 - e. Review reports issued by all special inspectors.
 - f. If engaged as a special inspector, provide structural testing and special inspection services as noted in Article 1.6.A.1.
4. Testing Agency:
- a. When engaged as a special inspector, provide structural testing and special inspection services as noted in Item 1.6.A.1.
 - b. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
 - c. Attend pertinent pre-installation meetings to review scope of structural testing and special inspection.
5. Contractor:
- a. Arrange and attend all pre-installation meetings to review scope of structural testing and special inspection. Include the Building Official, Owner, Architect, SER, Testing Agency and other parties concerned.
 - b. Post or make available the Structural Testing and Special Inspection Schedule within project site office. Provide timely notification to those parties designated on the schedule so they may properly prepare for and schedule their work.
 - c. Provide special inspector access to the approved plans and specifications at the project site.
 - d. Review all reports issued by special inspectors.
 - e. Retain at the project site all reports submitted by the special inspectors for review by the building official upon request.
 - f. Correct in a timely manner, deficiencies identified in inspection and / or testing reports.

- g. Provide safe access to the work requiring inspection and / or testing.
 - h. Provide labor and facilities to provide access to the work and to obtain, handle and deliver samples, to facilitate testing and inspection and for storage and curing of test samples.
 - i. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
 - j. Verification of conformance of work within specified tolerances is solely the responsibility of the Contractor.
6. Fabricator:
- a. Submit a Certificate of Compliance to the Building Official, Special Inspector, and Structural Engineer of Record stating the work was performed in accordance with the Contract Documents.
 - b. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
7. Building Official:
- a. Review all special inspector qualifications.
 - b. Review all fabricators who perform work in their shop, which requires special inspection.
 - c. Accept and sign completed Structural Testing and Special Inspection Schedule.
 - d. Review reports and recommendations submitted by special inspector.
 - e. Review the "final signed reports" submitted by special inspector. These documents must be accepted and approved by the building department prior to issuance of a Certificate of Occupancy.
 - f. Determine work, which, in the Building Officials opinion, involves unusual hazards or conditions.
8. Owner:
- a. Provide and pay cost of structural testing and special inspection services.
 - b. Provide special inspector with Contract Documents and accepted shop drawings.
 - c. Provide special inspectors and testing agencies with full access to the site at all times.
 - d. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
- B. Inspections by Building Official: provide timely notice for inspections performed by the building official, as required by IBC Chapter 17, the State Building Code, and local ordinance.

1.7 INSPECTION NOTICES

- A. Contractor: Provide minimum of 24 hours notice for all items requiring testing or inspection. Do not place items requiring testing and inspection services prior to or during placement until testing and inspection services are available. Do not enclose or obscure items requiring testing and inspection services after placement until testing and inspection services are performed.

1.8 REPORTS

- A. Testing agency and / or special inspectors shall submit a report in accordance with the Structural Testing and Special Inspection Schedule and shall conduct and interpret tests and inspections and state in each report whether; (1) test specimens and observations comply with Contract Documents, and specifically state any deviations, (2) record types and locations of defects found in work, (3) record work required and performed, to correct deficiencies.
- B. Submit reports for structural testing and special inspection, in timely manner to the Contractor, Building Official, SER, and Architect.
 - 1. Submit reports for ongoing work, to provide the information noted below:
 - a. Date issued.
 - b. Project title and number.
 - c. Firm name and address.
 - d. Name and signature of tester or inspector.
 - e. Date and time of sampling.
 - f. Date of test or inspection.
 - g. Identification of product and specification section.
 - h. Location in project, including elevations, grid location and detail.
 - i. Type of test or inspections.
 - j. Results of tests or inspections and interpretation of same.
 - k. Observations regarding compliance with Contract Documents or deviations there from.
 - 2. Submit final signed report stating that, to the best of the special inspector's knowledge, the work requiring testing and / or inspection conformed to the Contract Documents.

1.9 FREQUENCY OF TESTING AND INSPECTION

- A. For detailed requirements see individual technical specification sections, and Part 3 of this section.

1.10 PROTECTION AND REPAIR

- A. Upon completion of testing, sample-taking, or inspection, repair damaged work and restore substrates and finishes to eliminate deficiencies, including deficiencies in the visual qualities of exposed surfaces, as judged solely by the Architect/Engineer of Record. Protect work exposed by or for testing and / or inspection and protect repaired work. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for testing and / or inspection.

1.11 TESTS TO DEMONSTRATE QUALIFICATION

- A. If the Contractor proposes a product material, method, or other system that has not been pre-qualified, the Architect or SER may require applicable tests, to establish a basis for acceptance or rejection. These tests will be paid for by the Contractor.
- B. The Architect or SER reserves the right to require certification or other proof that the system proposed, is in compliance with any tests, criteria or standards called for. The certificate shall be signed by a representative of an independent testing agency.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCOPE OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

- A. Refer to individual specification section articles for Quality Control testing and inspection items.

3.2 STRUCTURAL TESTS AND SPECIAL INSPECTIONS PROGRAM SUMMARY

- A. The parties involved shall complete and sign the Structural Testing and Special Inspection Schedule. The completed schedule is an element of the Contract Documents and after permit issuance, becomes part of the building department approved plans and specifications. The completed schedule shall include the following:
 - 1. Specific listing of items requiring inspection and testing.
 - 2. Associated specification section which defines applicable standards by which to judge conformance with approved plans and specifications in accordance with IBC Chapter 17 as adopted by the State Building Code. The specification section should also include the degree or basis of inspection and testing; i.e., intermittent/will-call or full-time/continuous.
 - 3. Frequency of reporting, i.e., intermittent, weekly, monthly, per floor, etc.
 - 4. Parties responsible for performing inspection and testing work.
 - 5. Required acknowledgments by each designated party.
- B. See attached "Structural Testing and Special Inspection Schedule".

END OF SECTION 01 45 33

STRUCTURAL TESTS AND SPECIAL INSPECTIONS SCHEDULE

Project Name:

Location:

Permit No. : _____(1)

| STRUCTURAL TESTS AND SPECIAL INSPECTIONS | | | | |
|--|--|--------------------|-------------------------|-------------------|
| Specification Reference (2) | Description (3) | Type Inspector (4) | of Report Frequency (5) | Assigned Firm (6) |
| 03 10 00 | Concrete Formwork | Tech II | Periodic | |
| 03 20 00 | Concrete Reinforcement Footings, Foundation Walls, and Columns | Tech II | Periodic | |
| 03 30 00 | Cast-In-Place Concrete Material Sampling & Testing | Tech I | Daily | |
| 03 30 00 | Cast-In-Place Concrete Concrete Mix Verification | Tech I | Daily | |
| 03 30 00 | Cast-In-Place Concrete Concrete Placement | Tech I | Daily | |
| 03 30 00 | Cast-In-Place Concrete Protection & Curing | Tech II | Daily | |
| 03 30 00 | Cast-In-Place Concrete Embedded Items | Tech II | Periodic | |
| 04 20 00 | Unit Masonry Material Testing | Tech II | Periodic | |
| 04 20 00 | Unit Masonry Preparation & Placement | Tech II | Periodic | |
| 04 20 00 | Unit Masonry Reinforcement | Struc I | Periodic | |
| 04 20 00 | Unit Masonry Grouting | Tech II | Daily | |
| 05 12 00 | Structural Steel High Strength Bolting | Tech II | Periodic | |
| 05 12 00 | Structural Steel Welding | Tech I / Tech II | Periodic | |
| 05 12 00 | Structural Steel Headed Shear Studs | Tech I | Periodic | |
| 05 12 00 | Structural Steel Mechanical Fasteners | Tech I | Periodic | |
| 05 12 00 | Structural Steel General Configuration | Struc I | Periodic | |
| 05 31 00 | Steel Roof Deck Welding | Tech II | Periodic | |
| 07 81 00 | Spray-Applied Fire Resistive Materials | Tech I | Periodic | |
| 31 20 00 | Earthwork | Tech II | Daily | |

Notes: This schedule to be filled out and included in the project specification. Information unavailable at that time shall be filled out when applying for a building permit.

(1) Permit No. to be provided by the Building Official.

(2) Reference to specific technical scope section in program.

(3) Use descriptions per IBC Chapter 17, as adopted by State Building Code.

- (4) Special Inspector – Technical, Special Inspector – Structural.
- (5) Weekly, monthly, per test / inspection, per floor, etc.
- (6) Firm contracted to perform services.

ACKNOWLEDGEMENTS

Each appropriate representative shall sign below:

| | | |
|-------------|-------|-------|
| Owner: | Firm: | Date: |
| Contractor: | Firm: | Date: |
| Architect: | Firm: | Date: |
| SER: | Firm: | Date: |
| SI-S: | Firm: | Date: |
| TA: | Firm: | Date: |
| SI-T: | Firm: | Date: |
| TA: | Firm: | Date: |
| SI-T: | Firm: | Date: |
| F: | Firm: | Date: |
| F: | Firm: | Date: |

* The individual names of all prospective special inspectors and the work they intend to observe shall be identified. (Use reverse side of form, if more room is needed).

LEGEND:

SER = Structural Engineer of Record
 SI-S = Special Inspector – Structural
 TA = Testing Agency
 SI-T = Special Inspector – Technical
 F = Fabricator.

Accepted for the Building Department

By _____ Date. _____

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

**SECTION 01500 - CONSTRUCTION
FACILITIES AND TEMPORARY
CONTROLS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes requirements for temporary services and facilities, including temporary utilities, support facilities, security and protection.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution.
 - 2. Temporary electric power and light.
 - 3. Temporary heat.
 - 4. Ventilation.
 - 5. Telephone service.
 - 6. Sanitary facilities, including drinking water.
 - 7. Storm and sanitary sewer.
- C. Temporary construction and support facilities include, but are not limited to, the following:
 - 1. Field offices and storage sheds.
 - 2. Temporary roads and paving.
 - 3. Dewatering facilities and drains.
 - 4. Temporary enclosures.
 - 5. Temporary project identification signs and bulletin boards.
 - 6. Waste disposal services.
 - 7. Rodent and pest control.
 - 8. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, and lights.
 - 3. Sidewalk bridge or enclosure fence for the site.
 - 4. Environmental protection.

1.3 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Building Code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, Fire Department, and Rescue Squad rules.
 - 5. Environmental protection regulations.

- B. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

- A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect. Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders.
- B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
 1. Sterilization: Sterilize temporary water piping prior to use.
 2. When nonpotable water is used, mark each outlet with hazardous warning signs.
- C. Temporary Electric Power Service: For temporary power alignment and cost, contractor shall contact applicable local electrical utility.
 1. Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during

- construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, AC 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.
- D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.
1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Heat: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
- F. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP-gas or fuel-oil heaters with individual space thermostatic control. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.
- G. Temporary Telephones: Provide temporary telephone service throughout the construction period for all personnel engaged in construction activities. Install telephone on a separate line for each temporary office and first-aid station.
1. Separate Telephone Lines: Provide additional telephone lines for the following:
 - a. Where an office has more than 2 occupants, install a telephone for each additional occupant or pair of occupants.
 - b. Provide a dedicated telephone line for a fax machine in the field office.
 - c. Provide a separate line for the Owner's use.
 2. At each telephone, post a list of important telephone numbers.
- H. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.
- I. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
1. Provide separate facilities for male and female personnel.
- J. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a

healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

1. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
- K. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.
1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F.
- L. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
1. Filter out excessive amounts of soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 2. Connect temporary sewers to the municipal system, as directed by sewer department officials.
 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
- M. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Contractor=s Facilities: Provide a field office building and sheds adequate in size and accommodation for all Contractor=s offices, supply and storage.
1. Within the Contractor=s facilities, provide enclosed space adequate for holding project meetings. Furnish with all required tables, chairs and utilities.
 2. The entire facilities, including furniture, will remain the property of the Contractor and shall be removed from the site after completion of the work.
- C. Architect=s Field Office: Per Owner=s directive, Architect shall use third floor of existing terminal building.
- D. Temporary Paving: Construct and maintain temporary roads and paving to adequately support the indicated loading and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Architect.
1. Paving: Comply with Division 2 sections for construction and maintenance of temporary paving.

2. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
 3. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
 4. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
 5. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.
- E. Dewatering Facilities and Drains: Provide drainage and dewatering facilities as required by conditions and applicable requirements. Maintain the site, excavations, and construction free of water.
- F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat or as required by conditions to allow continuation of scheduled construction activities. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 2. Protection and temporary closures shall be provided at all exterior openings in the building including doors, walls and roof to maintain the building weather and dust tight. All protection shall be substantial so that it will not be disturbed by wind and weather normal to the area and season.
 3. Openings in floors shall be protected and closures provided to prevent floor to floor transfer of dust, debris and conditioned air. Conform to fire and safety regulations of the authorities having jurisdiction.
- G. Project Identification and Temporary Signs: Furnish and install and maintain one project identification sign of the size, graphic design, style of lettering and construction as shown on the drawings or included at the end of this section.
1. Finishes and painting materials shall be adequate to resist weathering and fading for the scheduled construction period.
 2. Location: Unless noted otherwise, erect on the site at a lighted location of high public visibility, adjacent to the main entrance to the site, as approved by the Architect.
 3. Informational Signs: Provide informational signs with painted lettering, or standard products. Size of signs and lettering shall be as required by regulatory agencies, or as appropriate to the usage. Colors as required by regulatory agencies, otherwise of uniform colors throughout the project. Erect at appropriate locations to provide the required information and at a height for optimum visibility.
 4. Materials: Structure and framing may be preservative-treated wood or steel, in sound condition and structurally adequate to the work and suitable specified finish. Paint is specified in Division 9.
 5. Maintenance: Maintain signs and supports in a neat, clean condition, and repair damages to structure, framing or sign as required.
 6. Relocate informational signs as required by progress of the work.

- 7. Remove signs, framing, supports and foundations at project completion.
- H. No other signs or advertising of any kind shall be allowed on the job site, except as specifically approved by the Architect.
- I. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when work is being performed.
- J. Rodent and Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures at regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.
- B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
 - 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- E. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.

1. Provide open-mesh, chainlink fencing, minimum 6 feet high and complete with all required bracing, with posts set in a compacted mixture of gravel and earth.
 2. Maintain fence and gates throughout the construction period and remove at the end of the project, unless otherwise indicated by Architect.
 3. Repair any damage caused by installation and removal, and restore area to original or specified condition.
- F. Covered Walkway: Comply with regulations of authorities having jurisdiction as necessary if determined required by applicable codes erect a structurally adequate, protective covered walkway for passage of persons along the adjacent public street. Coordinate with entrance gates, other facilities, and obstructions.
1. Construct covered walkways using scaffold or shoring framing. Provide wood plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage. Extend the back wall beyond the structure to complete the enclosure fence. Paint and maintain in a manner acceptable to the Owner and the Architect.
- G. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- H. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.

2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.
3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
 - a. Replace air filters and clean inside of ductwork and housings.
 - b. Replace significantly worn parts and parts subject to unusual operating conditions.
 - c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 01500

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

**SECTION 01631 – PRODUCTS
AND SUBSTITUTIONS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 1, Section 01421 - REFERENCE STANDARDS AND DEFINITIONS specifies the applicability of industry standards to products specified.
 - 2. Division 1, Section 01300 - SUBMITTALS specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.

1.3 DEFINITIONS

- A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.
 - 1. "Products" are items purchased for incorporation in the work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature that is current as of the date of the Contract Documents.
 - 2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the work.
 - 3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
 - 1. Substitutions requested by bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this section for substitutions.
 - 2. Revisions to the Contract Documents requested by the Owner or Architect.

3. Specified options of products and construction methods included in the Contract Documents.
4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

- A. Materials, products, equipment and systems are specified in the Contract Documents by manufacturer, trade name or distributor to establish a standard of the required criteria, including function, performance, dimension, appearance and quality to be met by any proposed substitution. Unless otherwise specified, application for substitutions will be considered by the Owner and the Architect after execution of the agreement. The burden of proof of merit of proposed substitute is upon the proposer. Substitute items shall not be incorporated in the work without prior written approval of the item by the Architect.
- B. Where an item is specified by one or more manufacturer's model number or specific item identification and "or approved equal" is included, only the item(s) that is specified by manufacturer's model number or specific identification is approved and any other item must be submitted for approval as a substitution.
- C. Where an item is specified by a referenced standard, the item must be submitted for approval same as a substitute.
- D. Submit three (3) copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals.
- E. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and drawing numbers.
- F. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 1. Coordination information, including a list of changes or modifications needed to other parts of the work and to construction performed by the Owner and separate contractors that will be necessary to accommodate the proposed substitution.
 2. A detailed comparison of significant qualities of the proposed substitution with those of the work specified. Significant qualities may include elements such as performance, weight, size, durability, and visual effect.
 3. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 4. Samples, where applicable or requested.
 5. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 6. Cost information, including a proposal of the net change, if any in the Contract Sum.
 7. The Contractor's certification that the proposed substitution conforms to or exceeds requirements in the Contract Documents in every respect and is appropriate for the applications indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

- G. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within two (2) weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a change order. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
 4. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
 - a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.
 5. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.
- B. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.

- d. Speed.
- e. Ratings.

2.2 SUBSTITUTIONS

- A. Conditions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.
 - 1. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the work promptly or coordinate activities properly.
 - 2. The request is directly related to an "or-equal" clause or similar language in the Contract Documents.
 - 3. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting offsetting responsibilities the Owner may be required to bear. The Owner's additional responsibilities may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
 - 4. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 - 5. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
 - 6. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.
 - 7. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.
- B. The Contractor's submittal and the Architect's acceptance of shop drawings, product data, or samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.
- C. Whether or not the Architect and Owner accept a proposed substitution, the Contractor shall reimburse the Owner for the Architect's cost for the Architect and the Architect's consultants for evaluating any proposed substitute including changes required in the Contract Documents for the substitute.
- D. The Architect's decision of approval or disapproval of a proposed substitution shall be final.
- E. All costs that may be incurred associated with a substitution proposed by the Contractor shall be borne by the Contractor. This shall apply to all interfacing components recognized prior to or after approval of the substitution by the Architect.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01631

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

**SECTION 01700 - CONTRACT
CLOSEOUT**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
1. Construction layout.
 2. Field engineering and surveying.
 3. General installation of products.
 4. Coordination of Owner-installed products.
 5. Progress cleaning.
 6. Starting and adjusting.
 7. Protection of installed construction.
 8. Correction of the Work.
- B. Related Sections include the following:
1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
 2. Division 1 Section "Submittal Procedures" for submitting surveys.
 3. Division 1 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
 4. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 SUBMITTALS

- A. Qualification Data: For **[land surveyor] [professional engineer]**.
- B. Certificates: Submit certificate signed by **[land surveyor] [professional engineer]** certifying that location and elevation of improvements comply with requirements.
- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- D. Certified Surveys: Submit **[two] <Insert number>** copies signed by **[land surveyor] [professional engineer]**.
- E. Final Property Survey: Submit **[10] <Insert number>** copies showing the Work performed and record survey data.

1.4 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to [local utility] [Owner] that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. **[Submit requests on CSI Form 13.2A, "Request for Interpretation."]**

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a [land surveyor] [professional engineer] to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 3. Inform installers of lines and levels to which they must comply.
 - 4. Check the location, level and plumb, of every major element as the Work progresses.
 - 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of

surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of **[two] <Insert number>** permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by **[land surveyor] [professional engineer]**, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 4. Maintain minimum headroom clearance of **[8 feet (2.4 m)] <Insert dimension>** in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
 - C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
 - D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
 - E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
 - F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
 - G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 2. Allow for building movement, including thermal expansion and contraction.
 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
 - H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
 - I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction forces.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.
 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify

Owner if changes to schedule are required due to differences in actual construction progress.

2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold materials more than seven (7) days during normal weather or three (3) days if the temperature is expected to rise above 80 deg F (27 deg C).
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01700

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

**SECTION 01732 – SELECTIVE
DEMOLITION**

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) Demolition and removal of selected portions of building or structure.
 - 2) Demolition and removal of selected site elements.
 - 3) Salvage of existing items to be reused or recycled.
- B. Related Requirements:
 - 1) Division 1 Section "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2) Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1) Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

- A. Pre-demolition Conference: Conduct conference at Project site.

- 1) Inspect and discuss condition of construction to be selectively demolished.
- 2) Review structural load limitations of existing structure.
- 3) Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
- 4) Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
- 5) Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for environmental protection, dust control and for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1) Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's and other tenants' on-site operations are uninterrupted.
 - 2) Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3) Coordination for shutoff, capping, and continuation of utility services.
 - 4) Use of elevator and stairs.
 - 5) Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- D. Pre-demolition Photographs or Video: Submit before Work begins.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- F. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1) Before selective demolition, Owner will remove the following items:
 - a) **<Insert items to be removed by Owner>.**
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1) Hazardous materials will be removed by Owner before start of the Work.
 - a) If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1) Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
 - E. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
- 3.2 Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- A. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and / or preconstruction video.
- 3.3 Comply with requirements specified in Division 1 Section "Photographic Documentation."
- A. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
- 3.4 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS
- A. Existing Services / Systems to Remain: Maintain Services / Systems indicated to remain and protect them against damage.
- 3.5 Comply with requirements for existing Services / Systems interruptions specified in Division 1 Section "Summary."
- A. Existing Services / Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
- 3.6 Owner will arrange to shut off indicated Services / Systems when requested by Contractor.
- 1. If Services / Systems are required to be removed, relocated, or abandoned, provide temporary Services / Systems that bypass area of selective demolition and that maintain continuity of Services / Systems to other parts of building.
 - 2. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - 1) Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2) Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3) Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4) Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5) Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - 6) Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

- 7) Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
- C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.7 PREPARATION

- 1. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Comply with requirements for access and protection specified in Division 1 Section "Temporary Facilities and Controls."
- C. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- D. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
- E. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
- F. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
- G. Cover and protect furniture, furnishings, and equipment that have not been removed.
- H. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1 Section "Temporary Facilities and Controls."
- I. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- J. Strengthen or add new supports when required during progress of selective demolition.

3.8 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
- B. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- C. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding,

not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

- D. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
- E. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
- F. Maintain adequate ventilation when using cutting torches.
- G. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
- H. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
- I. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- J. Dispose of demolished items and materials promptly. Comply with requirements in Division 1 Section "Construction Waste Management."
- K. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.
- L. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse.
 - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - 3. Protect items from damage during transport and storage.
 - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- M. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.9 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.
- E. Roofing: Remove existing roofing so that interior of building to remain remains weathertight.

3.10 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Division 1 Section "Construction Waste Management."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.11 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.12 SELECTIVE DEMOLITION SCHEDULE

- A. Existing [Items] [Construction] to Be Removed: <Insert description of items and construction to be removed>.
- B. Existing Items to Be Removed and Salvaged: <Insert description of items to be removed and salvaged>.
- C. Existing Items to Be Removed and Reinstalled: <Insert description of items to be removed and reinstalled>.
- D. Existing Items to Remain: <Insert description of items to remain>.

END OF SECTION 01732

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

SECTION 01740 – WARRANTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section specifies general administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
 - 1. Refer to the General Conditions for terms of the Contractor's period for correction of the work and special warranty of workmanship and materials.
- B. The Contractor will provide a warranty on all project work (including that added by subsequent change order after execution of the construction contract) for a period of one (1) year following the formal declaration of Substantial Completion. This one (1) year warranty will be separate from and in no way affect other standard product / manufacturer or workmanship warranties that extend beyond this one (1) year period for goods and services provided to this project.
- C. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 1, Section 01300 - SUBMITTALS specifies procedures for submitting warranties.
 - 2. Division 1, Section 01700 - CONTRACT CLOSEOUT specifies contract closeout procedures.
 - 3. Divisions 2 through 16 sections for specific requirements for warranties on products and installations specified to be warranted.
 - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- D. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace other work that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
- B. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written

endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

- C. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of the work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- E. Where the Contract Documents require a special warranty, or similar commitment on the work or part of the work, the Owner reserves the right to refuse to accept the work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.4 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the work, or a designated portion of the work, submit written warranties upon request of the Architect.
 - 1. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within fifteen (15) days of completion of that designated portion of the work.
- B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.
 - 1. Refer to Divisions 2 through 16 sections for specific content requirements and particular requirements for submitting special warranties.
- C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- D. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed

- description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES AND BONDS," Project title or name, and name of the Contractor.
 3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01740

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

**SECTION 02221 – BUILDING
DEMOLITION**

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) Demolition and removal of buildings and site improvements.
 - 2) **[Abandoning in-place] [Removing]** below-grade construction.
 - 3) Disconnecting, capping or sealing, and **[abandoning in-place] [removing]** site utilities.
 - 4) Salvaging items for reuse by Owner.
- B. Related Sections:
 - 1) Division 1 Section "Summary" for use of the premises and phasing requirements.
 - 2) Division 1 Section "Selective Demolition" for partial demolition of buildings, structures, and site improvements.
 - 3) Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.
 - 4) Division 2 Section "Piped Utilities - Basic Materials and Methods" for shutting off, disconnecting, removing, and sealing or capping utilities.
 - 5) Division 15 Sections for demolishing or relocating site plumbing and mechanical items.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1) Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified refrigerant recovery technician.
- B. Proposed Protection Measures: Submit informational report, including Drawings, that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.
- C. Schedule of Building Demolition Activities: Indicate the following:
 - 1) Detailed sequence of demolition work, with starting and ending dates for each activity.
 - 2) Temporary interruption of utility services.
 - 3) Shutoff and capping or re-routing of utility services.
- D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- E. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Division 1 "Photographic Documentation." Submit before the Work begins.
- F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
- G. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.
- D. Predemolition Conference: Conduct conference at Project site.
 - 1) Inspect and discuss condition of construction to be demolished.
 - 2) Review structural load limitations of existing structures.
 - 3) Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4) Review and finalize protection requirements.
 - 5) Review procedures for **[noise control] [and] [dust control]**.
 - 6) Review procedures for protection of adjacent buildings.
 - 7) Review items to be salvaged and returned to Owner.

1.7 PROJECT CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
 - 1) Provide not less than seventy-two (72) hours notice of activities that will affect operations of adjacent occupied buildings.
 - 2) Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
 - a) Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Owner assumes no responsibility for buildings and structures to be demolished.
 - 1) Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 2) Before building demolition, Owner will remove the following items:
 - a) **<Insert items to be removed by Owner>.**
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1) Hazardous materials will be removed by Owner before start of the Work.
 - 2) If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. On-site storage or sale of removed items or materials is not permitted.

1.8 COORDINATION

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations. Comply with Division 1 Section "Photographic Documentation."

- D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

3.2 PREPARATION

- A. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.
- B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.
 - 1) Owner will arrange to shut off indicated utilities when requested by Contractor.
 - 2) If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 - 3) Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
- C. Existing Utilities: See Divisions 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.
- D. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 - 1) Strengthen or add new supports when required during progress of demolition.
- E. Salvaged Items: Comply with the following:
 - 1) Clean salvaged items of dirt and demolition debris.
 - 2) Pack or crate items after cleaning. Identify contents of containers.
 - 3) Store items in a secure area until delivery to Owner.
 - 4) Transport items to storage area designated by Owner.
 - 5) Protect items from damage during transport and storage.

3.3 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.
 - 1) Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
 - 2) Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
 - a. Provide at least seventy-two (72) hours notice to occupants of affected buildings if shutdown of service is required during changeover.

- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 1 Section "Temporary Facilities and Controls."
 - 1) Protect adjacent buildings and facilities from damage due to demolition activities.
 - 2) Protect existing site improvements, appurtenances, and landscaping to remain.
 - 3) Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 - 4) Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 5) Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 - 6) Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
 - 7) Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 DEMOLITION, GENERAL

- A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1) Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 - 2) Maintain fire watch during and for at least **<Insert number>** hours after flame cutting operations.
 - 3) Maintain adequate ventilation when using cutting torches.
 - 4) Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.
- C. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1) Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
 - 2) Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- D. Explosives: Use of explosives is not permitted.

3.5 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 1) Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Salvage: Items to be removed and salvaged are indicated on Drawings.
- D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
 - 1) Remove below-grade construction, including basements, foundation walls, and footings, to depths indicated.
- E. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.
 - 1) Piping: Disconnect piping at unions, flanges, valves, or fittings.
 - 2) Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

3.6 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.7 REPAIRS

- A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction. See Division 1 Section "Construction Waste Management" for recycling and disposal of demolition waste.
 - 1) Do not allow demolished materials to accumulate on-site.
 - 2) Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.9 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
 - 1) Clean roadways of debris caused by debris transport.

END OF SECTION 02221

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

**SECTION 03100 -
CONCRETE FORMWORK**

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 formwork for cast-in-place concrete for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Concrete toppings.
 - 5. Building walls.
- B. Related Sections include the following:
 - 1. Division 01 Section "Structural Testing and Special Inspections".
 - 2. Division 03 Section "Concrete Reinforcement".
 - 3. Division 03 Section "Cast-In-Place Concrete".
 - 4. Division 05 Section "Structural Steel" for embedded items.

1.3 REFERENCES

- A. ACI 117 – Specifications for Tolerance for Concrete Construction and Materials
- B. ACI 301 – Specification for Structural Concrete for Buildings.
- C. ACI 318 – Building Code Requirements for Structural Concrete.
- D. ACI 347 – Guide to Formwork for Concrete.
- E. PS1 – Construction and Industrial Plywood.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Formwork Shop Drawings: Prepared by or under the supervision of a Specialty Structural Engineer detailing fabrication, assembly, and support of formwork.
 - 1. Engineering Responsibility: Formwork, bracing, shoring, and reshoring design for construction loads are sole responsibility of Installer's Specialty Structural Engineer.
- C. Samples: For <Insert products>.
- D. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Form materials and form-release agents.

1.5 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Shoring and Reshoring Drawings: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- C. Minutes of Pre-Installation conference.
- D. Sustainable Design Submittals:
 - 1. LEED Credit: Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
 - 2. Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.
 - 3. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
 - a. Include statement indicating costs for each certified wood product.

1.6 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. Specialty Structural Engineer Qualifications: Employ professional Engineer, registered in the State of Minnesota, to perform design of formwork, shoring, and reshoring for construction loads. Sign and seal design Shop Drawings submitted to Owner for review.
- C. Mockups: Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
 - 1. Build panel so size as indicated by Architect in the location indicated or, if not indicated, as directed by Architect.
 - 2. Approved panels may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Preinstallation conference below, which is desirable for major concrete installations, helps minimize misunderstandings and reviews Project conditions that might lead to significant problems. Delete paragraph and subparagraphs if Work of this Section is not extensive or complex enough to justify a preinstallation conference. If retaining, coordinate with Division 01.
- E. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, forms and form removal limitations.

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 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Soil Retainers: Material to be rigid and non-degradable.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

- I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Work shall conform to ACI 117 and ACI 301, except as modified by requirements of these Contract Documents.
- B. Design, erect, shore, brace, and maintain formwork, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated.
- D. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces as indicated by the Architect.
 - 2. [Class B, 1/4 inch] [Class C, 1/2 inch] [Class D, 1 inch] for rough-formed finished surfaces as indicated by the Architect.
- E. Construct forms tight enough to prevent loss of concrete mortar.
- F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.

- J. Form openings, chases, offsets, sinkages, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- K. Fastening Devices for Other Work:
 - 1. Provide for installation of inserts, reglets, hangers, metal ties, anchor bolts and other fastening devices required for attachment of other work.
 - 2. Properly locate fastening devices in cooperation with other trades and secure position before concrete is placed.
 - 3. Where concrete surfaces are veneered with masonry, install masonry anchor slots.
 - a. In concrete forms set vertically 2'-0" on center.
 - b. Install two continuous slots per face at each column face wider than 1'-4".
 - 4. Where masonry abuts concrete surface, install one continuous masonry anchor slot in concrete forms set vertically for each eight inches width of masonry, centered in masonry width.
- L. Install sleeves in concrete piers, columns, beams or joists only upon approval of the Architect.
- M. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- N. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- O. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF VOID FORMS AND SOIL RETAINERS

- A. Placement:
 - 1. Place forms on smooth, level, firm, dry surface.
 - 2. Butt carton forms tightly end to end and side to side, seam side down.
 - 3. Place cover sheets on carton forms and staple.
- B. Moisture Protection:
 - 1. Do not let carton forms become wet.
 - 2. Remove and replace wet cartons.
- C. Place soil retainers at edge of grade beams.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified special inspector and independent testing agency to perform field tests and inspections and prepare test reports. Cooperate with testing agency to facilitate the execution of its duties.
- B. Inspect formwork prior to concrete placement to verify resulting element width, depth and length correspond to those indicated on formwork installation drawings and Contract Documents.
- C. Where special formed surface finish requirements are required, verify forming materials comply with requirements.
- D. Adequacy of formwork, shoring, and reshoring to support vertical and lateral loads during construction is sole responsibility of Contractor.

END OF SECTION 03100

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

**SECTION 03200 -
CONCRETE REINFORCEMENT**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Reinforcing bars for cast-in-place concrete.
 - 2. Smooth bar dowels and diamond dowels and dowel baskets for concrete slab joints.
 - 3. Deformed bar anchors and headed shear connectors.
 - 4. Stud rails.
 - 5. Couplers for reinforcing bars.
 - 6. Welded wire fabric.
 - 7. Ties and supports for reinforcement.
- B. Related Sections:
 - 1. Division 01 Section "Structural Testing and Special Inspections."
 - 2. Division 03 Section "Concrete Formwork."
 - 3. Division 03 Section "Cast-In-Place Concrete."
 - 4. Division 03 Section "Unbonded Post-Tensioned Concrete."

1.3 REFERENCES

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
- B. ACI 301 – Specification for Structural Concrete.
- C. ACI 315 - Standards on Details and Detailing of Concrete Reinforcement.
- D. ACI 318 - Building Code Requirements for Structural Concrete.
- E. AWS D1.4 - Structural Welding Code Reinforcing Steel.
- F. CRSI - Manual of Standard Practice.
- G. CRSI - Placing Reinforcing Bars.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Submit in accordance with ACI 315, "Standards on Details and Detailing of Concrete Reinforcement"
 - 1. Provide necessary plan, elevation and section detail placing drawings that illustrate fabrication, bending, and placement of reinforcement.

2. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Welding certificates – signed by contractor certifying that welders comply with requirements of Article 1.5 – “Quality Assurance.

1.5 INFORMATIONAL SUBMITTALS

- A. Minutes of Pre-Installation conference.
- B. Sustainable Design Submittal:
 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR4.2 (if required): For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator utilizing experienced detailers who have successfully completed CRSI’s Reinforcing Bar Detailer Program.
- B. 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.
- C. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- D. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 1. Review special inspection and testing and inspecting agency procedures for field quality control, steel reinforcement installation, and protection during concrete placement.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

1.8 EXTRA MATERIALS

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 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.
- C. Deformed Bar Anchors (DBA): Standard fluxed ASTM A496 deformed bars prepared for stud welding.
 1. Available Manufacturers:
 - a. Erico Fastening.
 - b. Nelson Stud Welding.
- D. Headed Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
 1. Available Manufacturers:
 - a. Erico Fastening.
 - b. Nelson Stud Welding.
- E. Epoxy-Coated Reinforcing Bars: ASTM A 615, Grade 60, deformed bars, ASTM A 775, epoxy coated.
- F. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60, deformed bars, assembled with clips.
- G. Plain-Steel Wire: ASTM A 82, galvanized.
- H. Deformed-Steel Wire: ASTM A 496.
- I. Epoxy-Coated Wire: ASTM A 884, Class A, Type 1 coated, as-drawn, plain or deformed-steel wire, with less than 2 percent damaged coating in each 12-inch wire length.
- J. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- K. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.3 JOINT DOWELS

- A. Dowel Caps: Plastic material of size recommended for rod diameter.
- B. Smooth Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burr. Provide dowel ends that are sawn with round ends, not sheared with crimped ends.
- C. Smooth Dowel Support Baskets:
 1. Available Manufactures:
 - a. American Highway Technology.
- D. Smooth Dowel Coating: Grease or bituminous coating.

- E. Diamond Plate Dowels: Saw cut from ASTM A 36 hot rolled plate.
 - 1. Available Products:
 - a. Diamond Dowel™ by PNA, Inc.
- F. Smooth Plate Dowels and Baskets:
 - 1. Approved Manufacturers:
 - a. PNA, Inc.
- G. Epoxy-Coated Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, ASTM A 775 epoxy coated.

2.4 REINFORCEMENT ACCESSORIES

- A. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.
 - 1. Available Products:
 - a. 3M Scotchkote 213PC or liquid, two-part, epoxy repair coating or approved equal.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, or plastic according to CRSI's "Manual of Standard Practice," and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - 3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
- C. Rebar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Chairs are to be stable and resist tipping.
 - 1. Dayton Richmond: Aztec E-Z Chair – PEZ and Tower Chair PTC.
 - 2. General Technologies, Inc.: Composite Chairs and Composite Slab-Beam Bolsters.
- D. Supports for slabs-on-grade with steel reinforcement: Use supports with sand plates or horizontal runners.
 - 1. Dayton Richmond: Aztec E-Z Chair – PEZ with E-Z Chair Sand Plate PSP.
 - 2. General Technologies, Inc.: Composite Chairs on Sand Plates.
- E. Compression Couplers: Use only where explicitly referenced on Drawings.
 - 1. Speed sleeve by Erico.
 - 2. G-Loc by Gateway Erectors.
- F. Tension Couplers: Use only where explicitly referenced on Drawings.
 - 1. Lenton Couplers by Erico.
 - 2. MRC 150 by Dayton Superior.
 - 3. No-Slip Coupler by Fox-Howlet.

2.5 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice" and accepted shop drawings.
- B. Do not re-bend or straighten steel reinforcement except where specifically accepted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" and accepted shop drawings for placing reinforcement. Adjust reinforcing to avoid sleeves, blockouts and other voids in concrete.
- B. Underfloor Vapor Retarders: When chairing reinforcement on top of underfloor vapor retarders, use only supports with integral sand plates.
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal cuts or punctures in vapor retarder before placing concrete.
- C. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- D. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- E. Provide bar supports in sufficient number and heavy enough to carry steel they support. Place no bar more than 2 inches beyond last leg of continuous bar support. Do not use bar supports to support runways for concrete buggies, or similar loads.
 - 1. Maximum support bar spacing shall not exceed 48 inches.
 - 2. Maximum bolster spacing shall not exceed 36 inches for #4 support bar or 48 inches for #5 support bar.
- F. Bar supports on ground may be concrete block for slab depth of 7 inches or less and if positioned in staggered pattern. Provide bar chairs with sand feet where slab thickness exceeds 7 inches.
- G. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- H. Steel reinforcement partially embedded in concrete shall not be field bent, except as indicated or permitted by Structural Engineer.
- I. For walls reinforced on both faces, provide spreader bars and chairs to surfaces of forms on each side at spacings not to exceed 8 feet in either direction. For walls with single layer of reinforcing, provide chairs each side at spacings not to exceed 8 feet in either direction.

- J. Install epoxy coated reinforcing bars using either epoxy or plastic coated tie wires. Place epoxy coated steel on epoxy coated bar supports. Patch cut ends and areas of damage.
- K. Install welded wire reinforcement in longest practicable lengths. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- L. Center smooth dowel bars on joints, position dowels at center of slab depth and align perpendicular to face of joints both vertically and horizontally. Within 30 minutes before placement of adjacent concrete along doweled joints, apply dowel coating on free ends of dowels.
- M. Install diamond plate dowels in concrete slab-on-grade joints where shown. Install diamond plate dowels per manufacturer's written instructions.

3.2 PROTECTION AND REPAIR

- A. Install additional bar supports at locations where reinforcement position is not maintained due to collapsed chairs or construction activity from time of original placement.
- B. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.
- C. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.3 FIELD QUALITY CONTROL

- A. Assign individual to monitor reinforcement position during concrete placement and reposition bars that are displaced due to construction activity.
- B. Testing and Inspecting: Owner will engage a qualified special inspector and material testing agency to perform field quality control inspections and testing in accordance with Division 01 Section "Structural Tests and Inspections" and as specified herein.
- C. Submit reports of inspections and material testing as soon as practical after they are made.
- D. Inspect reinforcement in all cast-in-place concrete footings, foundation frost walls, basement walls, retaining walls, and columns, slabs on grade, and topping slabs.
- E. Verify reinforcing bar grade.
- F. Verify reinforcing bars are free of dirt, excessive rust and damage.
- G. Verify reinforcing bars are adequately tied, chaired and supported to prevent displacement during concrete placement.

- H. Verify proper clear distances between bars and to surfaces of concrete.
- I. Verify reinforcing bar size and placement.
- J. Verify bar laps for proper length and stagger and bar bends for minimum diameter, slope and length.
- K. Verify mechanical splices are placed in accordance with Contract Documents and reviewed shop drawings.
- L. Verify epoxy coating is present at locations noted on the Contract Documents; include tie wires, chairs, bolsters, etc. Verify coating damage is repaired in accordance with the Contract Documents.
- M. Verify installation of anchor rods, embedded plates and angles are placed in accordance with the Contract Documents.
- N. Correct work that does not comply with specified requirements prior to scheduling concrete placement.
- O. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION 03200

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

**SECTION 03300 -
CAST-IN-PLACE 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.
 - 3. 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 Pozzolan 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. Ground Granulated Blast-Furnace Slag (GGBFS): ASTM C 989, Grade 100 or 120.
 4. Microsilica: ASTM C 1240, amorphous silica.

5. 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.
- Fly Ash replacement shall not exceed 30% for Class C, 20% for Class F, or as specified for a particular mix design.
 - GGBFS replacement shall not exceed 30% unless specified otherwise.
 - Microsilica replacement shall not exceed 10%.
 - Maximum cement replacement of concrete mixes containing pozzolan, and / or GGBFS combinations shall not exceed 50% 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.

- Coarse Aggregate: Minimum Class Designation:
 - Class 3S Typical
 - Class 4S Exterior horizontal concrete
 - Maximum absorption 1.7%
 - Class 5S Exterior exposed architectural concrete
 - Maximum absorption 1.7%
- Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- Aggregate Gradation: Conform to ASTM C 33 and as specified herein.
 - 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% | 0% - 6% |
| 3/4" | 8% - 18% | 8% - 22% | 6% - 22% |
| 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% |

- At least 55% by weight shall be retained on or above the #4 sieve.
- 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: Pozzolith 210 or Pozzolith 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: Pozzolith 80 or Pozzolith 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: Pozzolith NC 534.
 - b. Euclid Chemical Company: Accelguard 80.
 - c. General Resource Technology: Polychem Super Set.
 - d. Grace Construction Products: Polarset.

- I. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494, Type C.
 1. Available Products:
 - a. BASF: Rheocrete CNI.
 - b. Boral Material Technologies, Inc.: Boral BCN.
 - c. Euclid Chemical Company: Eucon CIA.
 - d. Grace Construction Products: DCI.

- J. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
 1. Available Products:
 - a. BASF: Rheocrete 222+.
 - b. Axim Concrete Technologies: Catexol 1000CI.
 - c. Boral Material Technologies, Inc.: Boral BCN2.
 - d. Cortec Corporation: MCI 2000 or 2005NS.
 - e. Grace Construction Products: DCI-S.

- K. Integral Water Repellant Admixtures:
 1. Available Products:
 - a. Grace Construction Products: Darapel
 - b. Xypex Chemical Corporation: Admix C-1000 or C-2000.

- L. 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. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick (22-ga.), with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
1. Available Products:
 - a. Gateway Building Products: Beehive Slot.
 - b. Heckman Building Products: No. 100.
- E. Stair Nosing:
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, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Available Products:
 - a. Burke by Edoco; Aqua Resin Cure.
 - b. ChemMasters; Safe-Cure Clear.

- c. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
 - d. Euclid Chemical Company; Kurez DR VOX.
 - e. L&M Construction Chemicals, Inc.; L&M Cure R.
 - f. Meadows, W. R., Inc.; 1100 Clear.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating certified by curing compound manufacturer to not interfere with bonding of floor covering.
 - 1. Available Products:
 - a. BASF; Kure-N-Seal
 - b. Burke by Edoco; Spartan Cote WB II 20 Percent.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Dayton Superior Corporation; Safe Cure and Seal (J-19).
 - e. Euclid Chemical Company; Diamond Clear VOX.
 - f. L&M Construction Chemicals, Inc.; Dress & Seal WB.
 - g. Meadows, W. R., Inc.; Vocomp-20.
- F. 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.
- G. Clear, Non-yellowing, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A, minimum 25 percent total solids.
 - 1. Available Products:
 - a. BASF; Kure 1315
 - b. Burke by Edoco; Cureseal 1315 WB.
 - c. ChemMasters; Polyseal WB.
 - d. Euclid Chemical Company; Super Diamond Clear VOX.
 - e. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
 - f. Meadows, W. R., Inc.; Vocomp-30.
- H. 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.
- I. 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.
 - 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.
 - 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.
- F. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

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 | 50%-100% |
| Supplementary Cementitious Materials | 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 | 60%-100% |
| Supplementary Cementitious Materials | 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 | 70%-100% |
| Fly Ash, Class C or F | 20% - 30% |
| GGBFS | 10% - 20% |
| Maximum Top Size Aggregate | 1-1/2 inch |
| Aggregate Gradation | Well Graded |
| Coarseness Factor | 52 - 70 |
| Workability Factor | 32 - 40 |
| Multifilament Synthetic Fibers | 1.5 lbs/yd ³ |
| Air Content (at point of placement) | 5.5% ($\pm 1.5\%$) |

| | |
|---|--|
| for slabs exposed to freezing and thawing | |
|---|--|

- 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 GGBFS | 60% maximum 20% - 30% 10% - 20% |
| 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 | 5 lbs/yd ³ |

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

| Item | Requirements |
|--|---------------------------------------|
| Compressive Strength at 28 days (min), f'_c | 4000 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 GGBFS | 60% maximum 20% - 30% 10% - 20% |
| Minimum Top Size Aggregate | 1/2 inch |
| Aggregate Gradation | Well Graded |
| Multifilament Synthetic Fibers | 1.5 lbs/yd ³ |

- 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 | 3500 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 PREPARATION

- A. Verify actual locations of existing structure, new work previously placed and other construction to which the new work must fit by accurate field measurements before submittal of related shop drawings or fabrication; show recorded measurements on shop drawings submitted for review. Coordinate fabrication schedule with construction progress to avoid delay of Work. Where work will be connected to existing masonry or concrete, contractor shall engage a testing agency to pre-locate hidden embeds and reinforcing steel prior to submittal of shop drawings. Provide templates and dimensions to fabricator for accurate alignment with existing conditions. Show field conditions impacting the work on the shop drawings, prior to submittal.

3.3 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.
 4. Install dovetail anchor slots in concrete structures as indicated.

3.4 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.
 - b. Short: long side ratio not less than 2:3.
 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.

3.5 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.

3.6 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.

3.7 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 twelve (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.

3.8 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.

3.9 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 are 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.

3.10 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 unleveled, 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. Restraighten, 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: Float Finish.
 - 1. Follow General Finishing Requirements for initial procedures.
- L. CONC FIN-2: Light Trowel Finish.
 - 1. Follow General Finishing Requirements for initial procedures.
 - 2. Restraighten 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.
- M. CONC FIN-3: Medium Trowel Finish.
 - 1. Follow General Finishing Requirements for initial procedures.
 - 2. Restraighten 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.

- N. CONC FIN-4: Hard Trowel Finish.
1. Follow General Finishing Requirements for initial procedures.
 2. Restraighten 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 three or more passes using power trowel. Hand trowel areas inaccessible by power trowel.
- O. CONC FIN-5: 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.
- P. CONC FIN-6: Scratch Finish.
1. Follow General Finishing Requirements for initial procedures.
 2. While still plastic, scarify slab surface to 1/8-inch amplitude with transverse scored texture by drawing broom, stiff brush, or rake across surface.
- Q. CONC FIN-8: 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.
- R. CONC FIN-9: Exposed Aggregate Finish.
1. Aggregate to be exposed to be colorful and uniform size: 1/4 inches to 1/2 inch in size.
 - a. Flat or sliver-shaped particles are not allowed.
 - b. Exposed Aggregate shall not be reactive with cement when tested in accordance with ASTM standard test methods.
 2. Follow General Finishing Requirements, steps 1 through 3, for initial procedures.
 3. As soon as concrete will support weight of workmen on kneeboards, surface shall be hand floated using magnesium float or darby until aggregate is entirely embedded and mortar completely surrounds and slightly covers it, leaving no holes in surface.
 4. After floating surface set retarder may be sprayed or brushed over surface, following manufacturer's recommendations.

5. Exposing operations by using stiff fiber brush and hosing of surface with water shall commence as soon as work can be done without dislodging aggregate.
 6. Kneeboards shall be used to move about on surface and they shall be gently brought into contact and not slid or twisted on surface.
- S. CONC FIN-10: 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.
- T. CONC FIN-11: Industrial Concrete Slabs with Monolithic Mineral Floor Finish.
1. Apply monolithic mineral floor finish to areas indicated on the Drawings.
 2. Installation:
 - a. Apply monolithic floor finish at rate of 1-1/2 pounds per square foot unless approved otherwise by Architect.
 - b. Use mechanical finishing machine to trowel slab surface and follow with additional trowelings to secure smooth hard dense burnished finish.
 - c. For at least ten days after finishing slab, permit only pedestrian traffic.
 3. Wet Produce Areas: After concrete has completed curing cycle, lightly bead blast concrete slab surface in aisles to attain slip resistive surface.
- U. CONC FIN-12: Industrial Concrete Slabs with Two-Stage Floor Finish.
1. Apply monolithic mineral floor finish to areas indicated on the Drawings.
 2. Installation:
 - a. Hold base slab 5/8 to 3/4 inch below finish floor so top of topping is same elevation as rest of floor slab.
 - b. Finish base slab by troweling to smooth, dense finish in areas where concrete panels are to be cast and wire brooming in other areas to expose coarse aggregate and remove cement laitance.
 - c. Keep surface clean and oil free until topping is placed.
 - d. At time of installation of topping, scarify or provide bonding agent to surface of base slab.
 - e. Finish topping by troweling to smooth, dense burnished finish.
 - f. Joints:
 - 1) Saw construction and control joints full depth of topping.
 - 2) Saw joints directly over base joints.

- g. For at least ten days after finishing slab, permit only pedestrian traffic.
- 3. Field Quality Control:
 - a. Qualified representative of supplier will be present during entire installation of topping, directing its mix, testing, placement, finishing and curing.
 - b. Conform to slab installation tolerances and provide floors free from defects of dusting, cracks, tendency toward spalling, pitting or curling as described in industrial floor correction period requirements.
 - c. Propose remedial procedures in writing to Architect within ten days after notification of deficiency.
 - d. Do not proceed without approval of Architect and Owner.
- V. Coordinate final slab texture requirements with Division 9 flooring installer for proper adhesion of final flooring materials.
- W. Summary Slab Finish Schedule:

| SLAB USE | SLAB FINISH | OVER ALL F _F /F _L | LOCAL F _F /F _L |
|---|--|---|---|
| Fluid-applied or sheet waterproofing; built-up or membrane; sand-bed terrazzo | CONC FIN-1 Float Finish | F _F 18/F _L 15 | F _F 15/F _L 10 |
| Carpet; raised access floor; or base slabs below acoustic concrete topping slabs | CONC FIN-2 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-3 Medium Trowel Finish | F _F 30/F _L 25 | F _F 24/F _L 15 |
| Exposed to view with light foot traffic or to receive Penetrating Liquid Densifier and Sealer | CONC FIN-4 Hard 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-5 Trowel and Fine Broom Finish | F _F 18/F _L 15 | F _F 15/F _L 10 |
| Below bonded concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material | CONC FIN-6 Scratch Finish | F _F 18/F _L 15 | F _F 15/F _L 10 |
| Parking ramps; exterior concrete pavement (Ramp > 7%) | CONC FIN-8 Broom Finish (Rake Finish) | F _F 18/F _L 15 | F _F 15/F _L 10 |
| Where shown on Drawings | CONC FIN-9 Exposed Aggregate 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-10 Slip-Resistive Aggregate Finish | F _F 25/F _L 20 | F _F 17/F _L 15 |
| Monolithic Mineral Floor Finish | CONC FIN-11 Shake On | F _F 30/F _L 25 | F _F 24/F _L 15 |

| SLAB USE | SLAB FINISH | OVER ALL F _F /F _L | LOCAL F _F /F _L |
|---|---------------------------------|--|---|
| | Burnished Finish | F _F 100/ F _L 75 (Super flat) | |
| Two-Stage Floor Finish | CONC FIN-12 Burnished Finish | F _F 30/F _L 25 | F _F 24/F _L 15 |
| Base Slab for support of low temperature insulation | CONC FIN-1 Float Finish | Surface deviation +0" and -1/2" without ridges or bull float marks | |

X. 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.

3.11 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 1. Apply to formed concrete surfaces unless indicated otherwise.
- B. 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.
- C. 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.
- D. CONC FIN-22: Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
1. Apply to Smooth-Formed Finish as-cast concrete where indicated.
- E. CONC FIN-23: Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
1. Apply to Smooth-Formed Finish as-cast concrete where indicated.
- F. 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.

3.12 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.

3.13 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.

3.14 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 [seven] [14] [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

3.15 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 (1) 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.

3.16 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 twenty-four (24) hours.

3.17 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 fourteen (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 seventy-two (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.

3.18 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 [24][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 seventy-two (72) hours after finishing operations are complete.
 3. Report deficient areas to Architect to determine repair procedures appropriate for final required finish.

3.19 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 forty-eight (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 dos 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 05120 -
STRUCTURAL STEEL**

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:
 - 1. Structural steel framing members and all related accessories such as structural embeds, connections, bolts, welds, fasteners, threaded rods, headed studs, including fabrication, erection and all related work and accessories.
 - 2. Connections and other performance specified items, including related design by contractor's specialty structural engineer.
 - 3. Temporary bracing and shoring, including related design by contractor's specialty structural engineer.
 - 4. Architecturally exposed structural steel.
 - 5. Shop applied finishes and coatings, including preparation, primers, special paint systems or galvanizing on steel exposed to exterior or aggressive environments, and bitumastic coating on steel below grade in soil.
 - 6. Grouting for base plates, seats and bearing areas.
- B. Related Sections include the following:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 03 Section "Concrete" for items attached to formwork, anchors and embeds to be cast in concrete.
 - 3. Division 04 Section "Unit Masonry" for items attached to masonry, anchors and embeds to be set in masonry.
 - 4. Division 05 Section "Steel Decking" for field installation of shear connectors.
 - 5. Division 05 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
 - 6. Division 09 painting Sections and Division 09 Section "High-Performance Coatings" for surface preparation and priming requirements.
 - 7. Division 13 Section "Metal Building Systems" for requirements related to structural steel.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads, and as indicated on the structural contract documents.

- B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear and moment connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD (service) or LRFD loads as indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Load and Resistance Factor Design," Volume 2, Part 9 or AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4, as indicated in the contract documents.
 - 2. Engineering Responsibility: Fabricator's responsibilities include engaging a specialty structural engineer to prepare structural analysis data and submit calculations for structural-steel connections.
- B. Construction: Type FR, fully restrained.
- C. Construction: Type 2 simple framing.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittal:
 - 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR 4.2 (if required): For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
- C. Shop Drawings and related submittals: Show complete information for fabrication and erection of structural-steel components.
 - 1. Submit shop drawings under provisions of Division 1 Section "Submittal Procedures". Phase submittals to match sequence of actual construction to avoid delay of work. Field verify all existing conditions impacting this work and add relevant field information to shop drawings, prior to submittal of shop drawings.
 - 2. Indicate profiles, sizes, spacing, and locations of structural members, connections, attachments, fasteners, cambers, loads, welds, and headed studs. Cut erection details where details are cut on structural plans and add erection details as needed. Provide erection plans, erection details and member detail sheets. If partial area submittals are made, submit all related sheets and cloud related plan areas. Reference specific structural plans and details from which information is drawn or submittals will be rejected.
 - 3. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths and weld capacities. Indicate shop and field welds and sequence of erection.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

5. Provide setting drawings, templates and directions for the installation of the anchor rods and other anchoring devices, including embedments.
6. Welders Certificates: Submit under provisions of Division 1 Section "Submittal Procedures". Welder's Certificates, certifying welders employed on the Work obtained appropriate AWS qualification within the previous 12 months.
7. Calculations: Contractor shall engage a specialty structural engineer to perform final design calculations and submit same, for all connections not fully designed and detailed on the drawings by the Structural Engineer of Record (SER). Design for the criteria indicated here-in and as shown on the drawings. Submit signed calculations same day as steel framing shop drawings to which they relate, to ensure compatibility between specialty engineers calculations and shop drawing detailers drawings.

1.6 QUALITY ASSURANCE

- A. Installer (erector) Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Cbd or Sbd. Fabricator shall be experienced in preparation of shop drawings using integrated three-dimensional modeling software parametrically linking all major structural piece marks and overall building framing model.
- C. Specialty Structural Engineer Qualifications: Employ professional Engineer, registered in the State of Minnesota, to perform design of connections to meet structural performance requirements. Sign and seal design Shop Drawings submitted to Owner for review.
- D. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- E. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- F. Comply with applicable provisions of the following specifications and documents:
 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
 3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" or "Load and Resistance Factor Design Specification for Structural Steel Buildings."
 4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
 5. AISC's "Specification for Allowable Stress Design of Single-Angle Members" or "Specification for Load and Resistance Factor Design of Single-Angle Members."
 6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- G. Mockups: Build mockups of architecturally exposed structural steel to set quality standards for fabrication and installation.

1. Prior to construction, verify size, quantity and configuration of markups with Architect and verify whether mockups must be separately fabricated and delivered to specified locations, or if they can be a part of the original design integrated in the completed work.
 2. Coordinate finish painting requirements with Division 9 painting Sections.
 3. Approved mockups may become part of the completed Work if integrated mockups are approved by the Architect, and are undamaged at time of Substantial Completion.
- H. 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 or others, of readiness for required inspections, tests and observations to be provided by the Owner's Representatives.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 FIELD MEASUREMENTS

- A. Verify actual locations of existing structure, new work previously placed and other construction to which the new work must fit by accurate field measurements before submittal of related shop drawings or fabrication. Show recorded measurements on shop drawings submitted for review. Coordinate fabrication schedule with construction progress to avoid delay of Work. Where work will be connected to existing masonry or concrete, contractor shall engage a testing agency to pre-locate hidden embeds and reinforcing steel prior to submittal of shop drawings. Provide templates and dimensions to fabricator for accurate alignment with existing conditions. Show field conditions impacting the work on the shop drawings, prior to submittal.

1.9 COORDINATION

- A. Deliver anchor rods and other anchorage devices to be embedded in concrete or masonry construction to site in time for installation without impact on schedule. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992, Grade 50.

- B. Channels, Angles, Plate and Bar: ASTM A 36.
- C. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- D. Steel Pipe: ASTM A 53, Type E or S, Grade B, Finish.
 - 1. Weight Class: As indicated on the documents.
 - 2. Finish: Black, except where indicated to be galvanized.
- E. Welding Electrodes: E70XX, comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 or ASTM A 490, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.
 - a. Finish: Plain.
- B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
- C. Shear Connectors or Headed Concrete Anchors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B. The ferules shall be specifically designed for the weld-through technique.
- D. Unheaded Anchor Rods: ASTM F 1554, Grade 36 or as indicated on Drawings.
 - 1. Configuration: Straight with nut and washer, unless specifically indicated to be hooked on the drawings.
 - 2. Nuts: ASTM A 563 heavy hex carbon steel.
 - 3. Plate Washers: ASTM A 36 carbon steel.
 - 4. Washers: ASTM F 436 hardened carbon steel.
 - 5. Finish: Plain
- E. Headed Anchor Rods: ASTM F 1554, Grade 36 unless otherwise indicated.
 - 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.
 - 4. Finish: Plain.
- F. Threaded Rods: ASTM A 36.
 - 1. Nuts: ASTM A 563 heavy hex carbon steel.
 - 2. Washers: [ASTM F 436 hardened] [ASTM A 36] carbon steel.
 - 3. Finish: Plain.
- G. Deformed Bar Anchors (DBA):
 - 1. Manufactures:
 - a. Nelson Stud Welding, Inc.
 - 2. ASTM A496, uniform diameter with minimum tensile strength of 80ksi.

- H. Expansion Bolts:
 - 1. Manufacturers:
 - a. Liebig International, Ultraplus
 - b. Hilti, Kwik-Bolts II
 - c. ITW Ramset/Redhead, Trubolt
 - d. Wej-it Expansion Products, Inc. Wej-it Bolts
 - 2. If embedment length is not indicated on the drawings, provide embedment length recommended by the manufacturer to develop full strength of bolt.
- I. Adhesive Anchors into Hollow Masonry:
 - 1. Manufacturers:
 - a. Hilti, HIT HY 150
 - 2. Rods: Standard rods per ASTM A36.
 - 3. If embedment length is not indicated on the Drawings, provide embedment length recommended by manufacturer to develop full strength of bolt.
- J. Clevises and Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.

2.3 PRIMER

- A. Primer:
 - 1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.
 - 2. Color: Fabricator's standard. [Light gray] or [White].
- B. Galvanizing Repair Paint: ASTM A 780.
- C. Bituminous Protection Coating: Carboline, Bitumastic 50

2.4 GROUT

- A. Nonmetallic, High Strength, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time. $F'c=4000$ psi minimum at twenty-four (24) hours.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" or "Load and Resistance Factor Design Specification for Structural Steel Buildings" as indicated on the documents.
 - 1. Camber structural-steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
 - 3. Mark and match-mark materials for field assembly.
 - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel

Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.

1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
 2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- D. Fabricate heavy shapes and connections (ASTM A6-Group 4 and 5 Rolled shapes) in accordance with AISC Manual of Steel Construction, Part 5, Paragraph A.3.C and related requirements for finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning" or SSPC-SP 2, "Hand Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened or as indicated on Drawings.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials.
 - 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Painting: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
 - 1. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.
 - 2. Fill vent holes and grind smooth after galvanizing.

2.9 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports in accordance with the quality control program indicated for Field Quality Control, unless the fabricator maintains AISC Certification.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of new and existing support surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements. Verify dimensions that affect the new work including gridlines, column and beam centerlines, face of wall, etc.
- B. Remove and replace existing finishes, utilities and other obstructions that may impede proper access for verification of conditions and installation of new work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" or "Load and Resistance Factor Design Specification for Structural Steel Buildings", as indicated on the drawings.
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 2. Weld plate washers to top of base plate.
 3. Snug-tighten or Pretension anchor rods, as indicated on the drawings, after supported members have been positioned and plumbed. Do not

- remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
- 4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated on the drawings.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection unless approved by structural engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions. The top flanges of the beams receiving stud shear connectors shall be free of any substances that might interfere with the welding operations. During welding the steel decking panels shall be free of detrimental substances and rest tightly upon the top flange of the beam.
- J. No trades may field cut or alter structural members without specific approval of the Structural Engineer. Submit dimensioned plan and detail sketch of proposed modification under cover of a "Request for Information" (RFI) or cloud proposed changes on shop drawings.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened or as indicated on Drawings.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" or "Load and Resistance Factor Design Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds. Contractor shall remove all weld slag using pick and brush to expose bright steel for self-verification of workmanship by the contractor and for Quality Assurance access by testing agency. This shall be done on a daily basis as welding proceeds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.
- C. Tension Control Devices:
1. Install using electric power wrench as recommended by bolt manufacturer.
 2. Tighten until splined end of bolt is sheared off.
- D. Shear Connectors:
1. Do not weld when the temperature is below 0 degrees F.
 2. Remove standing water in deck ribs so that water is not trapped between beams and deck during welding.
 3. Ensure that surfaces of steel beams to which studs are to be welded are dry and free of paint, dirt and debris and that deck bottom is in firm contact with beam.
 4. Install studs after steel framing and metal decking are in place.
 5. Use automatic welding equipment powered to weld studs satisfactorily under site conditions.
 6. Prior to starting each day's operations, weld at least two shear studs to determine proper generator control unit and stud welder settings.
 7. Test that studs are capable of being bent 45 degrees from vertical without weld failure.
 8. Weld additional trial shear studs at request of ITL.
 9. Minimum projection of stud above top of deck: 1-1/2 inches.

3.5 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 1, Section "Structural Tests and Special Inspections", and IBC Chapter 17 as adopted by the current Minnesota State Building Code, and the CASE/Mn Guideline for Special Structural Inspection and Testing, and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.
- B. Special Inspection and Testing Criteria
1. General

- a. If special inspection of fabricators work is required in the shop, testing agent may test and inspect structural steel at plant before shipment. Owner and SER reserve right to reject material not complying with Contract Documents at any time before final acceptance.
- 2. Definitions
 - a. Refer to Division 1, Section "Structural Tests and Special Inspections" for standard requirements.
 - b. A.S.N.T.: The American Society for Non-destructive Testing
 - c. N.D.E.: Non-destructive Evaluation
 - d. A.W.S./C.A.W.I.: American Welding Society / Certified Associate Weld Inspector
 - e. A.W.S./C.W.I.: American Welding Society / Certified Weld Inspector
 - f. Special Inspector – Technical: Shall be employed by a testing agency and shall be supervised by an A.W.S./C.W.I. with a minimum of ten (10) years experience, or an A.S.N.T. Level III with a minimum of ten (10) years experience. These individuals shall satisfy the following requirements:
 - 1) Technical I: Non-destructive Testing Technician A.S.N.T.-TC-1A Level I, and/or A.W.S. Certified Associate Weld Inspector (C.A.W.I.)
 - 2) Technical II: Nondestructive Testing Technician A.S.N.T.-TC-1A Level II (NDE Technician II), A.W.S./C.A.W.I. with minimum 3 years experience, or an A.W.S./C.W.I
 - 3) Technical III: A.S.N.T. Level III with a minimum of 10 years experience or an A.W.S./C.W.I with a minimum of 10 years experience.
 - g. Special Inspector – Structural
 - 1) Structural I: Graduate civil/structural engineer, or other personnel acceptable to the SER, with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed civil/structural engineer.
 - 2) Structural II: Civil/structural engineer regularly engaged in the design of structural systems of this type, licensed in the state in which the project is located. The licensed engineer shall review and approve all inspection reports.
 - 3) Special Inspector – Structural may be an employee of the SER.
- 3. Special Testing and Inspection Requirements
 - a. High Strength Bolting (Field Installed)
 - 1) General (Technical II)
 - a) Visually inspect mating surfaces and bolt type for all slip-critical bolted connections for general conformance with the contract documents prior to bolting.
 - b) Determine the requirements for bolts, nuts, washers, paint and installation/tightening standards are met.
 - c) Observe calibration procedures when such procedures are required in the contract documents and verify that selected procedure is used to tighten bolts.

- 2) Slip Critical Bolts and Tension Bolts (Technical II)
 - a) Test bolt tightening in 10% of all bolts. Test a minimum of two bolts in each connection. Verify that all plies of connected elements have been brought into contact, at 100% of connection. Verify all tips are removed from "twist-off" bolts.
- 3) Bearing Bolts (Technical II)
 - a) Visually inspect to conform all plies of connected elements have been brought into contact, at 100% of connections. (Applies only to bolts designed for values not requiring exclusion of threads from failure plane, all other bolts require testing as for tension bolts.)
- 4) Standard
 - a) Test High Strength bolted connections per R.C.S.C. Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
- b. High Strength Bolting (Shop Installed) (Technical II)
 - 1) For shop fabricated work, perform tests required for field installation, except that bolt testing may be reduced or deleted, if fabrication shop satisfies AISC Quality Certification Program – Category I, or more stringent criteria, or is approved by SER.
- c. Welding (General): The Special Inspector shall perform the following (Technical II):
 - 1) Prior to start of fabrication, determine if fabrication shop meets the criteria for exempting shop welds from inspection and confirm in writing to SER.
 - 2) Verify qualifications of all welders as AWS certified.
 - 3) Verify proposed welding procedures and materials.
 - 4) Verify adequate preparation of faying surfaces.
 - 5) Verify preheat and interpass temperature of steel, proper technique and sequence of welding, and cleaning and number of passes are provided as required.
- d. Welding (Field)
 - 1) Fillet Welds (Technical II)
 - a) Visually inspect 100% of all fillet welds for size, length and quality per AWS D1.1.
 - 2) Partial Penetration Welds (Technical II)
 - a) Test 100% of all partial penetration welds exceeding 5/16 inch, using Ultrasonic Tester per AWS D1.1. Test 25% of all partial penetration welds less than 5/16 inch, using Magnetic Particle Testing per ASTM E109, performed on root pass on finished weld.
 - 3) Full Penetration Welds (Technical II)
 - a) Test 100% of all full penetration welds exceeding 5/16 inch, using Ultrasonic Tester per AWS D1.1. Test 25% of all full penetration welds less than 5/16 inch, using Magnetic Particle Testing per ASTM E109, performed on root pass on finished weld.
 - 4) Stud Shear Connector Welds (Technical I)
 - a) Visually inspect 100% of installed studs for full 360 degree flash. Test all questionable studs, not

- showing full 360 degree flash by bending studs 15 degrees from vertical, away from weld discontinuity, per AWS D1.1. All ceramic welding ferrules shall be removed by contractor. Randomly test all other studs by bending to 15 degrees from vertical as noted:
- b) Studs welded through deck: 15%
 - c) Studs welded to bare steel: 5%
 - d) Alternatively, sound 100% of installed studs, for full penetration weld, using an 8 lb. Maul. Test questionable studs as noted above. Welding ferrules need not be removed.
- 5) Deck Welds and Fasteners (Technical I)
- a) Visually inspect size, location, length and burn through for 100% of puddle welds on metal deck designed as a structural element, per AWS D1.3.
 - b) Visually inspect sidelap fasteners to meet spacing and size specified.
- 6) Welding of Reinforcing Bars (Technical II)
- a) Be continuously present during welding and visually inspect 100% of all reinforcing bar welds as the welding is performed, per AWS D1.4. Verify proper joint preparation is provided and proper electrodes are used and properly store and dried.
- e. Welding (Shop)
- 1) Perform inspections as for field welding except weld testing may be reduced or deleted, if fabrication shop satisfies AISC Quality Certification Program – Category I, or more stringent criteria, or is approved by SER.
- f. Mechanical Fasteners (Misc.)
- 1) Fasteners (Technical I)
 - a) Visually inspect specified size, spacing, embedment, and location of expansion bolts and adhesive bonded bolts in connections shown on the structural drawings.
- g. Structural Configuration
- 1) Submittals (Structural I)
 - a) Verify mill test reports and other submitted documentation for compliance with contract documents.
 - 2) Materials (Technical I)
 - a) Verify materials delivered to site comply with contract documents and approved shop drawings. Materials include bolts, electrodes, mechanical fasteners and deck gauge.
 - 3) Detail Compatibility (Structural I) On a periodic basis:
 - a) Review project documents affecting integrity of the structure, including contract documents and pertinent submittals (approved shop drawings)
 - b) Visit site, at intervals appropriate to the stage of construction, to perform review of the structure and visually confirm general compliance with the project documents.

- c) Inspect the following to verify member orientation, configuration, type and size comply with details indicated on the contract documents and approved shop drawings:
 - d) Bracing and stiffening members.
 - e) Proper applications of joint details at connections for structural members.
 - f) Other work critical to the integrity of the building structure.
- 4. Conventional Testing and Inspection Requirements
 - a. High Strength Bolting
 - 1) Bolt Material Test (Technical II)
 - a) Test a minimum of two bolts of each ASTM class specified, for bolt hardness and tensile properties.
 - 2) Fabrication and Erection Tolerances (Owner's Construction Manager)
 - a) Verify in-place structure satisfies specified tolerances

3.6 REPAIRS AND PROTECTION

- A. If tests or inspections indicate Work does not meet specified requirements, remove work, replace and retest at no cost to Owner.
- B. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- C. C.Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION 051200

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

**SECTION 05121 - ARCHITECTURALLY
EXPOSED STRUCTURAL STEEL**

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 architecturally exposed structural-steel framing.
 - 1) Requirements in Division 5 Section "Structural Steel" also apply to AESS framing.
- B. Related Sections:
 - 1) Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2) Division 5 Section "Structural Steel" for additional requirements applicable to AESS.
 - 3) Division 5 Section "Metal Fabrications" for other metal items not defined as structural steel.
 - 4) Division 5 Section "Metal Stairs."
 - 5) Division 9 Section "High-Performance Coatings" for surface preparation and priming requirements.

1.3 DEFINITIONS

- A. Architecturally Exposed Structural Steel: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication of AESS components.
 - 1) Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2) Include embedment drawings.
 - 3) Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
 - 4) Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections. Indicate orientation of bolt heads.
 - 5) Indicate exposed surfaces and edges and surface preparation being used.
 - 6) Indicate special tolerances and erection requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified fabricator.

1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.
 - 1) Build mockup of typical portion of AESS as shown on Drawings.
 - 2) Coordinate finish painting requirements with Division 9 painting Sections.
 - 3) Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Use special care in handling to prevent twisting, warping, nicking, and other damage. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1) Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

1.9 COORDINATION

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

PART 2 - PRODUCTS

2.1 BOLTS, CONNECTORS, AND ANCHORS

- A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1) Finish: Mechanically deposited zinc coating.
- B. Corrosion-Resisting (Weathering Steel), Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 3, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

2.2 PRIMER

- A. Primer: Comply with Division 9 painting Sections and Division 9 Section "High-Performance Coatings."
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: ASTM A 780.

2.3 FABRICATION

- A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.
- B. In addition to special care used to handle and fabricate AESS, comply with the following:
 - 1) Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
 - 2) Grind sheared, punched, and flame-cut edges of AESS to remove burrs and provide smooth surfaces and edges.
 - 3) Fabricate AESS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
 - 4) Fabricate AESS with exposed surfaces free of seams to maximum extent possible.
 - 5) Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
 - 6) Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
 - 7) Fabricate AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
 - 8) Fabricate AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.
 - 9) Seal-weld open ends of hollow structural sections with 3/8-inch (9.5-mm) closure plates for AESS.
- C. Curved Members: Fabricate indicated members to curved shape by rolling to final shape in fabrication shop.
 - 1) Distortion of webs, stems, outstanding flanges, and legs of angles shall not be visible from a distance of 20 feet (6 m) under any lighting conditions.
 - 2) Tolerances for walls of hollow steel sections after rolling shall be approximately 1/2 inch (13 mm).
- D. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch (3.2 mm) with a tolerance of 1/32 inch (0.8 mm) for AESS.
- E. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
 - 1) Cut, drill, or punch holes perpendicular to steel surfaces

- 2) Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
- 3) Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.4 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1) Provide continuous welds of uniform size and profile where AESS is welded.
 - 2) Make butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus 0 inch (plus 1.5 mm, minus 0 mm) for AESS. Do not grind unless required for clearances or for fitting other components, or unless directed to correct unacceptable work.
 - 3) Remove backing bars or runoff tabs; back-gouge and grind steel smooth for AESS.
 - 4) At locations where welding on the far side of an exposed connection of AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
 - 5) Make fillet welds for AESS of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to correct unacceptable work.

2.5 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1) Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 - 2) Surfaces to be field welded.
 - 3) Surfaces to be high-strength bolted with slip-critical connections.
 - 4) Surfaces to receive sprayed fire-resistive materials.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1) SSPC-SP 2, "Hand Tool Cleaning."
 - 2) SSPC-SP 3, "Power Tool Cleaning."
 - 3) SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1) Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Examine AECS for twists, kinks, warping, gouges, and other imperfections before erecting.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep AECS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1) If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.
 - 2) Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set AECS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
- B. Weld Connections: Comply with requirements in "Weld Connections" Paragraph in "Shop Connections" Article.
 - 1) Remove backing bars or runoff tabs; back-gouge and grind steel smooth for AECS.
 - 2) Remove erection bolts in AECS, fill holes, and grind smooth.
 - 3) Fill weld access holes in AECS and grind smooth.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect AECS as specified in Division 5 Section "Structural

Steel." The testing agency will not be responsible for enforcing requirements relating to aesthetic effect.

- B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.6 REPAIRS AND PROTECTION

- A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION 05121

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

**SECTION 05312 -
STEEL ROOF DECK**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Roof deck.
 - 2. Cellular roof deck.
- B. Related Requirements:
 - 1. Division 01 Section "Structural Testing and Special Inspections".
 - 2. Division 05 Section "Structural Steel".
 - 3. Division 07 Sections for thermal and moisture protection, and applied fireproofing.
 - 4. Division 09 Sections for painting and coating of exposed deck.

1.3 SUBMITTALS FOR REVIEW

- A. Product Data: For each type of deck, accessory, and product indicated.
 - 1. Include name of deck manufacturer as well as type, depth, gauge and finish of deck.
- B. Shop Drawings:
 - 1. Show layout and types of deck panels, anchorage details, attachment patterns, field welding requirements, side lap fastenings, pans, cut deck openings, special jointing, accessories, and attachments to other construction required for complete installation of decking.
 - 2. Describe types and locations of acoustical materials and closures.
 - 3. Include deck manufacturer's ICBO Approval Number.
- C. Certificates:
 - 1. Product Certificates: For each type of steel deck, signed by product manufacturer.
 - 2. Welding certificates signed by contractor certifying that welders comply with requirements of Article 1.4 – "Quality Assurance."
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Powder-actuated mechanical fasteners.
 - a. Substitute for deck welds at contractor's option. Product data and test reports shall demonstrate fasteners have equal or greater capacity than welds indicated and are suitable for attachment to base material.

2. Acoustical roof deck.

- E. FMG Listings for description of roofing products evaluated to meet minimum requirements for Factory Mutual Research Approval recognition.
- F. Sustainable Design Submittals:
 - 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR4.2 (if required): For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.

1.4 CLOSEOUT SUBMITTALS

- A. Sustainable Design Closeout Documentation.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Fabricate panels to comply with dimensional parameters as defined in "Design Manual for Composite Decks, Form Decks, and Roof Decks" in SDI Publication No. 31. Section properties shall be based in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members.
- B. Installer Qualifications: An experienced installer who has completed steel deck 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.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1 and D1.3 Structural Welding Codes.
- D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 for testing indicated.
- E. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.
- C. Keep construction loads and stored materials, including other decking, off steel deck until it is permanently fastened and inspected.

- D. Do not overload deck beyond 75% rated capacity with stored materials or equipment.

1.7 COORDINATION

- A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation specified in Division 07 Sections for thermal and moisture protection to ensure protection of insulation strips against damage from effects of weather and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Canam Steel Corp.
 2. Epic Metals Corporation.
 3. Nucor Corp.; Vulcraft Division.
 4. United Steel Deck, Inc.
 5. Verco Manufacturing Co.
 6. Wheeling Corrugating Company.

2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 1. Prime-Painted Steel Sheet: ASTM A 1008, Grade 40 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 2. Galvanized Steel Sheet: ASTM A 653, Grade 40 zinc coating.
 3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Grade 40, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's Standard.
 4. Deck Profile: As indicated on Drawings.
 5. Profile Depth: As indicated on Drawings.
 6. Design Uncoated-Steel Thickness: As indicated on Drawings.
 7. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated on Drawings.
 8. Span Condition: Three span minimum.
 9. Side Laps: As indicated on drawings.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, austempered, powder-actuated or pneumatically driven carbon-steel fasteners with knurled shank.

- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 40,000 psi, of same thickness, material and finish as deck; of profile indicated or required for application.
- F. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick (14-ga), of same material and finish as deck. For drains, cut holes in the field.
- G. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- H. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

- I. Mechanical fasteners may be used in lieu of welding to fasten deck at contractor's option. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated on Drawings.
 - 3. Cover weld burn holes with metallic tape.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated on Drawings, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. If deck is 0.0474 inches thick (18-ga) or more, fastenings may be welded with a minimum of 1-1/2-inch- long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 8 inches apart with at least one weld at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 PROTECTION AND REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.
- D. No hangers, fasteners or loads shall be hung from the underside of the deck unless specifically indicated thus on the structural drawings. Such items as mechanical/electrical equipment, utility lines, architectural bulkheads, ceilings, signage, etc, shall have their own sub-framing designed, supplied and installed by their related trade, as required span to adjacent beams, joists or walls for any support needed.

3.5 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with Division 01 Section "Structural Testing and Special Inspections".
- B. Inspections:
 - 1. Visually inspect size, location, length and burn-through for 100% of puddle welds on metal deck, per AWS D1.3, Section 6. (Technical I).
 - 2. Visually inspect size, location, and seating for 100% of powder-actuated or pneumatically driven fasteners on metal deck, per AWS D1.3, Section 6. (Technical I).
 - 3. Report inspection results promptly and in writing to Contractor and Architect.
- C. Inspection Procedure:
 - 1. After five to ten squares of roof deck have been erected, arrange for inspection agency to visually inspect fastening system for size, quality and spacing at interior supporting members, perimeter supports and side laps.
 - 2. Demonstrate corrective procedures for deficiencies found by inspection agency to satisfaction of the Architect and inspection agency before erection of roof deck is resumed.
 - 3. Use approved fastening system, including corrective procedures, as standard for comparison for remaining deck fastening.
 - 4. When erection of roof deck is completed, but before placing roofing materials, arrange for inspection agency to make inspection of complete deck installation and submit written report to Architect.
- D. Deck panels shall be clean, dry, and in firm contact with substrate prior to welding.
- E. Remove and replace work that does not comply with specified requirements.
- F. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION 05312

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

**SECTION 05360 – COMPOSITE
STEEL DECK**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Composite steel deck.
 - 2. Related accessories.
- B. Related Requirements:
 - 1. Section 01 45 33 – Structural Testing and Special Inspections.
 - 2. Section 03 30 00 – Cast-In-Place Concrete
 - 3. Section 05 12 00 – Structural Steel Framing.
 - 4. Division 07 Sections for thermal and moisture protection, and applied fireproofing.
 - 5. Division 09 Sections for painting and coating of exposed deck.

1.3 REFERENCES

- A. AISI – North American Specification for the Design of Cold-Formed Steel Structural Members.
- B. AWS D1.1 – Structural Welding Code - Steel.
- C. AWS D1.3
- D. Steel Deck Institute Design Manual

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
 - 1. Include name of deck manufacturer as well as type, depth, and gauge of deck.
- B. Shop Drawings:
 - 1. Show layout and types of deck panels, anchorage details, attachment patterns, field welding requirements, side lap fastenings, pans, cut deck openings, special jointing, accessories, and attachments to other construction required for complete installation of decking.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Powder-actuated mechanical fasteners.
 - a. Substitute for deck welds at contractor's option. Product data and test reports shall demonstrate fasteners have equal or greater capacity than welds indicated and are suitable for attachment to base material.

1.5 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Product Certificates: For each type of steel deck, signed by product manufacturer certifying that products furnished comply with the requirements.
- C. Welding certificates.
- D. Research / Evaluation Reports: For steel deck.
- E. Sustainable Design Submittals:
 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR4.2 as required: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
- F. Include statement indicating costs for each product having recycled content.

1.6 CLOSEOUT SUBMITTALS

- A. Sustainable Design Closeout Documentation.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer offering deck products to be incorporated into the Work must be a member of Steel Deck Institute.
- B. Installer Qualifications: An experienced installer who has completed steel deck 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.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1 and D1.3 Structural Welding Codes.
- D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- E. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.9 COORDINATION

- A. Provide decking to receive spray-applied fire-resistive materials (SFRM) free of amounts of lubricant or other contaminants which would significantly impair adhesion of sprayed materials.

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. A
 available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. A
 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 COMPOSITE STEEL DECK

- A. Available Products:
 - 1. Epic Metals Corporation: ECP366.
 - 2. Nucor Corp.; Vulcraft Division: Type VLI.
 - 3. United Steel Deck, Inc.: LOK-FLOOR.
 - 4. Verco Manufacturing Co.: FORMLOK
 - 5. Wheeling Corrugating Company: Super-Bond.
- B. Fabricate panels, with integrally embossed or raised pattern ribs, and interlocking side laps to comply with dimensional parameters as defined in "Design Manual for Composite Decks, Form Decks, and Roof Decks" in SDI Publication No. 30. Section properties shall be based in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members.
- C. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40 zinc coating.
- D. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.
- E. Section Properties: Deck profile, depth, design uncoated steel thickness, and finish shall be as indicated on Drawings.

- F. Span Condition: Three span minimum.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 40,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 40,000 psi, of same material and finish as deck, and of thickness and profile indicated.
- F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- G. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- H. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- I. Galvanizing Repair Paint: [ASTM A 780] [SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight].
- J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: As indicated on drawings.
 - 2. Retain one of two subparagraphs below. First subparagraph is based on SDI specifications. Select second subparagraph if showing requirements on Drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated on drawings, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Fasten with a minimum of 1-1/2-inch- long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with end joints as indicated on drawings.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.4 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified special inspector and independent testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with Section 01 45 33 – Structural Testing and Special Inspections.
- B. Inspections:
 - 1. Visually inspect size, location, length and burn-through for 100% of puddle welds on metal deck, per AWS D1.3, Section 6.
 - 2. Visually inspect size, location, and seating for 100% of powder-actuated or pneumatically driven fasteners on metal deck, per AWS D1.3, Section 6.
 - 3. Report inspection results promptly and in writing to Contractor and Architect.
- C. Deck panels shall be clean, dry, and in firm contact with substrate prior to welding.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on bottom surface of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on bottom surface of prime-painted deck exposed to view immediately after installation, and apply repair paint of same color as adjacent shop-primed deck.
 - 1. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 09.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05360

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

**SECTION 05400 - COLD-FORMED
METAL FRAMING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior load-bearing wall framing.
 - 2. Interior load-bearing wall framing.
 - 3. Exterior non-load-bearing wall framing.
 - 4. Engineered design by Contractors Specialty Structural Engineer.
- B. Related Requirements:
 - 1. Section 01 45 33 – Structural Testing and Special Inspections.
 - 2. Section 03 30 00 – Cast-In-Place Concrete.
 - 3. Section 05 12 00 – Structural Steel Framing.
 - 4. Section 05 50 00 – Metal Fabrications.
 - 5. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
 - 6. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 REFERENCES

- A. AISI – North American Specification for the Design of Cold-Formed Steel Structural Members.
- B. AWS D1.1 – Structural Welding Code.
- C. AWS D1.3
- D. LGSEA's Technical Note 551e, "Design Guide for Permanent Bracing of Cold-Formed Steel Trusses."

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated on drawings
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than indicated on the drawings.
 - 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure,

undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of $L/360$ where L is the span in inches.
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.6 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Welding certificates.
- C. Calculations: For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by Qualified Professional Engineer responsible for their preparation.
- D. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 1. Steel sheet.
 2. Expansion anchors.
 3. Power-actuated anchors.
 4. Mechanical fasteners.
 5. Vertical deflection clips.
 6. Horizontal drift deflection clips
 7. Miscellaneous structural clips and accessories.
- E. Research / Evaluation Reports: For cold-formed metal framing.
- F. 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 percentages by weight of postconsumer and preconsumer recycled content.

2. Include statement indicating costs for each product having recycled content.

1.7 CLOSEOUT SUBMITTALS

- A. Sustainable Design Closeout Documentation.

1.8 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Minnesota and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- E. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel," and AWS D1.3, "Structural Welding Code - Sheet Steel."
- F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
 2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- H. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."
- I. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
1. AllSteel Products, Inc.
 2. Clark Steel Framing.
 3. Dale/Incor.
 4. Dietrich Metal Framing; a Worthington Industries Company.
 5. MarinoWare, a division of Ware Industries.
 6. SCAFCO Corporation
 7. The Steel Network.
 8. Super Stud Building Products, Inc.
 9. United Metal Products, Inc.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
1. Grade: ST33H minimum or as required by structural performance.
 2. Coating: G60 or equivalent.
- B. Steel Sheet for Vertical Deflection or Drift Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:
1. Grade: As required by structural performance.
 2. Coating: G60.

2.3 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 18 gage (0.0428 inch).
 2. Flange Width: Minimum 1-5/8 inches with ½ inch returns.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
1. Minimum Base-Metal Thickness: 18 gage (0.0428 inch).
 2. Flange Width: 1-1/4 inches.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 18 gage (0.0428 inch).
 2. Flange Width: Minimum 1-5/8 inches with ½ inch returns.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 18 gage (0.0428 inch).
 2. Flange Width: Minimum 1-5/8 inches with ½ inch returns.

- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 18 gage (0.0428 inch).
 - 2. Flange Width: [1-1/4 inches].
- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. Available Manufacturers: As per Section 2.1.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 - 1. Available Manufacturers: As per Section 2.1.
 - 2. Minimum Base-Metal Thickness: 18 gage or (0.0428 inch).
 - 3. Flange Width: 1 inch plus twice the design gap.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers, knee braces, and girts.
 - 9. Joist hangers and end closures.
 - 10. Hole reinforcing plates.
 - 11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.
- B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

- C. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: [SSPC-Paint 20 or DOD-P-21035] [ASTM A 780].
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. At openings in all exterior or bearing walls, provide additional studs as indicated on drawings.
- K. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: As shown on drawings.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - 1. Stud Spacing: As indicated.

- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
 - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced as indicated on Shop Drawings. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches deep.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated.

- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single-leg deflection tracks and anchor to building structure
 - 2. Connect vertical deflection clips to bypassing studs and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - a. Install solid blocking at centers indicated on Shop Drawings.
 - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.6 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified special inspector and independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

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

**SECTION 05500 – METAL
FABRICATIONS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel framing and supports for mechanical and electrical equipment.
 - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 3. Miscellaneous steel columns.
- B. Products furnished, but not installed, under this Section:
 - 1. Loose steel lintels.
 - 2. Anchor bolts, steel pipe sleeves, slotted-channels inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Sections:
 - 1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 - 2. Division 04 Masonry sections for installing loose lintels, anchor bolts, and other items built into unit masonry.
 - 3. Division 05 Section "Structural Steel Framing."
 - 4. Division 05 Section "Pipe and Tube Railings."

1.2 PERFORMANCE REQUIREMENTS

- A. Thermal Movements; Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F (67deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Paint products.
 - 2. Grout
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- D. Qualification Data: For qualified structural engineer.

1.4 QUALITY ASSURANCE

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

1.5 PROJECT CONDITIONS

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

1.6 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Delivery such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

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

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- D. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm).
 - 2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0677 inch (1.7 mm) minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/1 47M, unless otherwise indicated.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicates; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- D. Eyebolts: ASTM A 489.
- E. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- F. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).
- G. Wood Screws: Flat head, ASME B18.6.1.
- H. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- I. Lock Washers: Helical, spring type, ASME B17.21.1 (ASME B18.21.2M).
- J. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six (6) times the load imposed when installed in unit masonry and four (4) times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- K. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 194M), Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- L. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

- B. Shop Primers: Provide primers that comply with Division 09 Section, "Painting."
- C. Galvanized Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Non-shrink, Non-metallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum twenty-eight (28) day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to the greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces with straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and method that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6 inch (150 mm) embedment and 2 inch (50 mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 1. Fabricate units from slotted channel framing where indicated.
 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with primer specified in Division 09 Section "Painting."

2.7 MISCELLANEOUS STEEL COLUMNS

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Fabricate steel columns with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
- C. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
- D. Prime miscellaneous steel columns with primer specified in Division 09 Section "Painting."

2.8 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of opening equal to 1/12 of clear span but not less than 8 inches (200 mm) unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesives.
 - 2. Galvanized Repair Paint: Where shop-applied galvanized coating is damaged, burned, abraded, or otherwise removed from the substrate, provide galvanizing repair compound with minimum 95% zinc content.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, ZRC Worldwide "Galvtite Galvanizing Repair Compound."
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Division 09 Section, "Painting."
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3 "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Division 09 Section "High-Performance Coatings:" SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSOPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitation. Do not weld, cut or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws and other connectors.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

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

3.3 INSTALLING MISCELLANEOUS COLUMNS

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plates before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instruction for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.4 ADJUSTING AND CLEANING

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

1. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and repair galvanizing to comply with ASTM A 780. Apply Galvanizing Repair Compound in accordance with manufacturer's recommendations.
1. Apply by brush or spray to provide a minimum 1.5 mil (0.04 mm) dry film thickness.

END OF SECTION 05500

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

**SECTION 05510 - METAL
STAIRS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preassembled steel stairs with concrete-filled treads.
 - 2. Industrial-type stairs with steel floor plate and/or grating treads.
 - 3. Ornamental steel-framed stairs.
 - 4. Steel tube railings attached to metal stairs.
 - 5. Steel tube handrails attached to walls adjacent to metal stairs.
 - 6. Railing gates at the level of exit discharge.
- B. Related Requirements:
 - 1. Section 01 45 33 – Structural Testing and Special Inspections.
 - 2. Section 03 30 00 – Cast-In-Place Concrete.
 - 3. Section 05 50 00 – Metal Fabrications: For metal treads and nosings not installed in metal stairs and miscellaneous steel fabrications.
 - 4. Section 09 90 00 – Painting.
 - 5. Section 09 96 00 – High Performance Coatings.
 - 6. Division 05 Section "Pipe and Tube Railings" for pipe and tube railings.
 - 7. Division 06 Section Rough Carpentry for wood blocking for anchoring railings.
 - 8. Division 10 Section "Wire Mesh Partitions" for wire mesh security partitions and doors.

1.3 REFERENCES

- A. NAAMM Stair Standards

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following non-reducible loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf / sq. ft.
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/240 or 1/2 inch, whichever is less.

- B. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails:
 - a. Uniform load of 50 lbf / ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Top Rails of Guards:
 - a. Uniform load of 50 lbf / ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 3. Infill of Guards:
 - a. Concentrated load of 200 lbf applied horizontally on an area of 1 sq. ft.
 - b. Uniform load of 25 lbf / sq. ft. applied horizontally.
 - c. Infill load and other loads need not be assumed to act concurrently.

1.5 ACTION SUBMITTALS

- A. Product Data: For metal stairs and the following:
1. Prefilled metal-pan stair treads.
 2. Precast concrete treads.
 3. Epoxy-resin-filled stair treads.
 4. Nonslip aggregates and nonslip-aggregate finishes.
 5. Abrasive nosings.
 6. Metal floor plate treads.
 7. Paint products.
 8. Grout.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Provide templates for anchors and bolts specified for installation under other Sections.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design.
- D. Samples for Verification: For the following products, in manufacturer's standard sizes:
1. Precast concrete treads.
 2. Epoxy-resin-filled stair treads.
 3. Stair treads with nonslip-aggregate surface finish.
 4. Metal floor plate treads.
 5. Grating treads.
 6. Abrasive nosings.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs and railings.
1. Test railings according ASTM E 894 and ASTM E 935.

1.6 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Welding certificates.
- C. Calculations: For installed products indicated to comply with design loads, include structural analysis data signed and sealed by Qualified Professional Engineer responsible for their preparation
- D. 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 percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.

1.7 CLOSEOUT SUBMITTALS

- A. Sustainable Design Closeout Documentation.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. Preassembled Stairs: Commercial class.
 - 2. Industrial-Type Stairs: Industrial class.
 - 3. Ornamental Stairs: Architectural class.
- C. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.9 COORDINATION

- A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

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. Products: Subject to compliance with requirements, provide one of the products specified.
3. 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.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METALS, GENERAL

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

2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36
- B. Steel Tubing: ASTM A500
- C. Steel Bars for Grating Treads: ASTM A 36
- D. Wire Rod for Grating Crossbars: ASTM A 510.

2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts for exterior stairs and stairs indicated to be galvanized.
- D. Machine Screws: ASME B18.6.3.
- E. Lag Bolts: ASME B18.2.1.
- F. Plain Washers: Round, ASME B18.22.1.
- G. Lock Washers: Helical, spring type, ASME B18.21.1.
- H. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 09 painting Sections.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
- G. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
- H. Welded Wire Fabric: ASTM A 185, 6 by 6 inches--W1.4 by W1.4, unless otherwise indicated.

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 1. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld connections to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.7 STAIR RAILINGS

- A. Comply with applicable requirements in Division 05 Section Pipe and Tube Railings for railings

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
 3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.
- H. Install precast concrete treads with adhesive supplied by manufacturer.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.
- B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonmetallic, nonshrink grout, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING STEEL TUBE RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - 1. Anchor posts to steel by welding directly to steel supporting members.
 - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Use type of bracket with predrilled hole for exposed bolt anchorage.
 - 3. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

4. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
5. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05510

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

**SECTION 05530 - METAL
GRATINGS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Metal bar gratings.
- B. Related Sections include the following:
 - 1. Division 05 Section "Structural Steel Framing" for structural-steel framing system components.
 - 2. Division 05 Section "Metal Stairs" for grating treads and landings of steel-framed stairs.
 - 3. Division 05 Section "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Gratings: Provide gratings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Floors: Uniform load of 100 psf or concentrated load of 300 lbf, whichever produces the greater stress.
 - 2. Walkways and Elevated Platforms Used as Exits: Uniform load of 100 psf
 - 3. Limit deflection to L/240 or 1/4 inch, whichever is less.

1.4 SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Provide templates for anchors and bolts specified for installation under other Sections.
 - 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code - Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating gratings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

- A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following (or approved equal):
 - 1. Metal Bar Gratings:
 - a. Alabama Metal Industries Corporation.
 - b. All American Grating, Inc.
 - c. Barnett/Bates Corp.
 - d. Borden Metal Products (Canada) Limited.
 - e. Fisher & Ludlow.
 - f. Grupo Metelmex, S.A. de C.V.
 - g. IKG Industries; a Harsco Company.
 - h. Marwas Steel Co.; Laurel Steel Products Division.
 - i. McNichols Company
 - j. Ohio Gratings, Inc.
 - k. Seidelhuber Metal Products, Inc.
 - l. Tru-Weld.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Wire Rod for Grating Crossbars: ASTM A 510.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Plain Washers: Round, ASME B18.22.1.
- E. Lock Washers: Helical, spring type, ASME B18.21.1.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.
- B. Shop Primers: Provide primers that comply with Division 09 painting Sections.
- C. Select paragraph above or one of two paragraphs and associated subparagraphs below if gratings are to be painted. Because paint wears off easily under foot traffic, it should generally not be relied on to provide protection from corrosion.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.

- E. Welding: Comply with AWS recommendations and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
 - 1. Toeplate Height: 4 inches, unless otherwise indicated.

2.6 METAL BAR GRATINGS

- A. Welded Steel Grating:
 - 1. Bearing Bar Spacing: As indicated on drawings.
 - 2. Bearing Bar Depth: As indicated on drawings.
 - 3. Bearing Bar Thickness: As required to comply with structural performance requirements.
 - 4. Crossbar Spacing: As required to comply with structural performance requirements.
 - 5. Grating Mark: As indicated.
 - 6. Traffic Surface: As indicated.
 - 7. Steel Finish: As indicated by Architect.
- B. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
 - 1. Provide not less than 4 saddle clips for each grating section composed of rectangular bearing bars 3/16 inch or less in thickness and spaced 15/16 inch or more o.c., with each clip designed and fabricated to fit over 2 bearing bars.
 - 2. Furnish threaded bolts with nuts and washers, self-drilling fasteners with washers, or galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports.
 - a. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Grate-Fast" by Lindapter North America, Inc.
- C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
 - 1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- D. Do not notch bearing bars at supports to maintain elevation.

2.7 STEEL FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish gratings, frames, and supports after assembly.

- C. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with ASTM A 123/A 123M.
- D. Apply shop primer to uncoated surfaces of gratings, frames, and supports, except those with galvanized finishes and those to be embedded in concrete or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- B. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

3.2 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05530

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

**SECTION 05720 - ORNAMENTAL
HANDRAILS AND RAILINGS**

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 aluminum, glass and wood ornamental handrails and railings where shown on the drawings.
- B. Related Sections include the following:
 - 1. Division 5, Section 05500 - METAL FABRICATIONS for handrails and railings associated with metal stairs.

1.3 PERFORMANCE REQUIREMENTS

- A. General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:
 - 1. Aluminum: AA 30, "Specifications for Aluminum Structures."
- B. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections:
 - 1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lbf applied at any point and in any direction.
 - b. Uniform load of 50 lbf / ft. applied horizontally and concurrently with uniform load of 100 lbf / ft. applied vertically downward.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 - 2. Handrails Not Serving As Top Rails: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lbf applied at any point and in any direction.
 - b. Uniform load of 50 lbf / ft. applied in any direction.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 - 3. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 200 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.
 - a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.

- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

- A. Product Data: For manufacturer's product lines of handrails and railings assembled from standard components.
 - 1. Include Product Data for grout, anchoring cement, and paint products.
- B. Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, details, and attachments to other Work.
 - 1. For installed handrails and railings indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for products with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
 - 1. 6-inch-long sections of each different linear railing member, including handrails, top rails, posts, and balusters.
 - 2. Fittings and brackets.
 - 3. Assembled Samples of railings, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.
- E. Product Test Reports: Indicating products comply with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of handrails and railings that are similar to those indicated for this Project in material, design, and extent.
- B. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- C. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- D. Mockups: Before installing handrails and railings, build mockups to verify selections made under sample Submittals and 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. Build mockups in the location indicated or, if not indicated, as directed by Architect.
 - 2. Build mockups as shown on Drawings.

3. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length.
4. Notify Architect seven days in advance of dates and times when mockups will be constructed.
5. Obtain Architect's approval of mockups before fabricating ornamental handrails and railings.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.
8. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 STORAGE

- A. Store handrails and railings in a dry, well-ventilated, weathertight place.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 COORDINATION

- A. Coordinate installation of anchorages for handrails and railings. Furnish Setting Drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.9 SCHEDULING

- A. Schedule installation so handrails and railings are mounted only on completed walls. Do not support temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Bloomcraft.
 2. Wylie Systems.
 3. Sterling Dula Architectural Products.

2.2 METALS

- A. General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

- B. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy and temper designated below for each aluminum form required.
 - 1. Extruded Bar and Tube: ASTM B 221, alloy 6063-T5/T52.
 - 2. Extruded Structural Pipe and Tube: ASTM B 429, alloy 6063-T6.
 - 3. Drawn Seamless Tube: ASTM B 210, alloy 6063-T832.
 - 4. Plate and Sheet: ASTM B 209, alloy 6061-T6.
 - 5. Die and Hand Forgings: ASTM B 247, alloy 6061-T6.
 - 6. Castings: ASTM B 26/B 26M, alloy A356-T6.
- C. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
 - 1. Provide formed steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.

2.3 GLASS PRODUCTS AND GLAZING MATERIALS

- A. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent glass, flat), Quality q3 (glazing select). Provide products complying with requirements indicated below for class, thickness, and manufacturing process that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR, Part 1201 for Category II materials.
 - 1. Tinted Glass: Class 2 (tinted, heat absorbing, and light reducing), manufacturer's standard tint color indicated below:
 - a. Green, etched as shown on drawings.
 - 2. Thickness: 3/8 inch.
 - 3. Manufacturing Process: Manufacture fully tempered glass by vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option.
- B. Glazing Cement and Accessories: Provide glazing cement and related accessories recommended or supplied by railing manufacturer for bonding glass to metal subrails.

2.4 MISCELLANEOUS MATERIALS

- A. Wood Handrails and Rails: Hardwood handrails and rails of species and profile indicated; bonded to aluminum subrail.
 - 1. Species and Profile: Cherry, in profiles shown on drawings, stained and finished to match other wood work on project.

2.5 FASTENERS

- A. Fasteners for Anchoring Handrails and Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.
 - 1. For aluminum handrails and railings, use fasteners fabricated from Type 304 or Type 316 stainless steel.
- B. Fasteners for Interconnecting Handrail and Railing Components: Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless otherwise indicated.
- C. Cast-in-Place and Postinstalled Anchors: Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 1. Cast-in-place anchors.
 2. Chemical anchors.
 3. Expansion anchors.

2.6 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- B. Interior Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.

2.7 FABRICATION

- A. Assemble handrails and railings in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- B. Form changes in direction of railing members as follows:
 1. As detailed.
- C. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- D. Mechanical Connections: Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 1. Fabricate splice joints for field connection using epoxy structural adhesive where this is manufacturer's standard splicing method.
- E. Brackets, Flanges, Fittings, and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.
- F. Provide inserts and other anchorage devices to connect handrails and railings to concrete. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

- G. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.
- H. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
- I. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.
- J. Provide weep holes or another means to drain entrapped water in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.
- K. Fabricate joints that will be exposed to weather in a watertight manner.
- L. Close exposed ends of railing members with prefabricated end fittings.

2.8 GLAZING PANEL FABRICATION

- A. Glass Panels: Cut tempered glass to final size and shape before heat treatment; provide for proper edge clearance and bite on glass. Provide thickness indicated, but not less than that required to support structural loads.
 - 1. Factory-bond glass to aluminum base and top-rail channels in railing manufacturer's plant using glazing cement to comply with manufacturer's written specifications.
- B. Straight Panels: Provide tempered glass panels for straight sections.

2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- 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 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.

2.10 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Powder-Coated Finish: Apply manufacturer's standard polyester powder coating complying with AAMA 605.2.
 - 1. Color and Gloss: As selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing handrails and railings. Set handrails and railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Corrosion Protection: Coat concealed surfaces of aluminum and copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust handrails and railings before anchoring to ensure alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of handrails and railings.

3.3 ANCHORING POSTS

- A. Cover anchorage joint with a flange of same metal as post, attached to post by set screws.
- B. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8-inch build-up, sloped away from post.
- C. Anchor posts to metal surfaces with flanges, angle or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For aluminum railings, attach posts as indicated using fittings designed and engineered for this purpose.

3.4 ANCHORING RAIL ENDS

- A. Anchor rail ends to metal surfaces with flanges bolted to metal surfaces.
 - 1. Connect flanges to rail ends using nonwelded connections.

3.5 INSTALLING GLASS PANELS

- A. Post-Supported Glass Handrails and Railings: Install assembly to comply with railing manufacturer's written instructions. Erect posts and other metal railing components, then set factory-cut glass panels. Do not cut, drill, or alter glass panels in field. Protect edges from damage.

3.6 CLEANING

- A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Clean and polish glass.

3.7 PROTECTION

- A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05720

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

**SECTION 06100 - ROUGH
CARPENTRY**

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:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Wood furring, grounds, nailers, and blocking.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 6, Section 06402 - INTERIOR ARCHITECTURAL WOODWORK for interior woodwork specially fabricated for this project.

1.3 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other sections and generally not exposed, unless otherwise specified.

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for the following products:
 - 1. Insulating sheathing.
 - 2. Construction adhesives.
- C. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee's (ALSC) Board of Review.
- D. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:
 - 1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - 2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
 - 3. Warranty of chemical treatment manufacturer for each type of treatment.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
 - 1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wood-Preservative-Treated Materials:
 - a. Baxter: J. H. Baxter Co.
 - b. Chemical Specialties, Inc.
 - c. Continental Wood Preservers, Inc.
 - d. Hickson Corp.
 - e. Hoover Treated Wood Products, Inc.
 - f. Osmose Wood Preserving, Inc.

2.2 LUMBER, GENERAL

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by American Lumber Standard Committee's (ALSC) Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
 - 1. SPIB - Southern Pine Inspection Bureau.
 - 2. WWPA - Western Wood Products Association.
 - 3. NELMA - Northeastern Lumber Manufacturers Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
- D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 1. Provide dressed lumber, S4S, unless otherwise indicated.
 - 2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWWA C2 (lumber)

and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.

1. Do not use chemicals containing chromium or arsenic.
- B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 3. Wood framing members less than 18 inches above grade.
 4. Wood floor plates installed over concrete slabs directly in contact with earth.
- C. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft.
- D. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.
- E. Do not use oil borne pentachlorophenol for surfaces that are to be painted and surfaces in contact with roofing.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of Southern pine-SPIB or Douglas fir south-WWPA, unless otherwise indicated.

2.5 PLYWOOD, GENERAL

- A. Plywood Panel Standard: Provide plywood panels complying with DOC PS 1, "U.S. Product Standard for Construction and Industrial Plywood."
- B. Trademark: Factory mark plywood panels with APA trademark evidencing compliance with grade requirements.

2.6 PLYWOOD PANELS FOR BACKING

- A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide plywood panels with grade C-D Plugged Exposure 1 in thickness indicated or, if not otherwise indicated, not less than 15/32 inch thick. Provide fire-retardant paint coating equivalent to PPG "Speedhide Latex Fire Retardant Paint" or Flame Control Coatings, Inc. "No. 20-20 Flat Latex Intumescent Fire Retardant Paint". Follow manufacturer's instructions and recommendations for application and dry film thickness. Coat both sides and all edges.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A153 or of Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO National Evaluation Report NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers.

2.8 MISCELLANEOUS MATERIALS

- A. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbonate (IPBC) as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum number of joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. CABO NER-272 for power-driven staples, P-nails, and allied fasteners.

2. "Recommended Nailing Schedule" of referenced framing standard and with AFPA's "National Design Specifications for Wood Construction." Comply with requirements of applicable codes and of authorities having jurisdiction.
- F. Use hot-dip galvanized nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
 - G. Countersink nail heads on exposed carpentry work and fill holes.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screening or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

3.3 INSTALLATION OF PLYWOOD PANELS

- A. General: Comply with applicable recommendations contained in APA Form No. E30, "APA Design / Construction Guide: Residential & Commercial," for types of plywood panels and applications indicated.
 1. Comply with "Code Plus" provisions of above-referenced guide.
- B. Fastening Methods: Fasten panels as indicated below:
 1. Plywood Backing Panels: Nail or screw to supports.

END OF SECTION 06100

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

**SECTION 06220 - INTERIOR
PREFINISHED
WALL SURFACING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes decorative interior wall surfacing systems and trim, casework paneling, cubicle panels and toilet partition panels.
- B. Related sections include the following:
 - 1. Division 9, Section 09260 - GYPSUM BOARD ASSEMBLIES.

1.3 REFERENCES

- A. AWI Quality Standards (Architectural Woodwork Institute).
- B. ASTM E84 (Method of test for surface burning characteristics of building materials).
- C. BHMA (Builder's Hardware Manufacturer's Association).

1.4 SUBMITTALS

- A. Provide manufacturer's product data sheets indicating compliance with specified performance characteristics and physical properties for approval.
- B. Provide manufacturer's recommended maintenance procedures to the Owner.
- C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including edge conditions, panel joints, anchorage, accessories, finish colors, patterns and textures.
- D. Samples: Submit three (3) 12" x 12" samples with finished edges for each type color, pattern and/or texture

1.5 DELIVERY, STORAGE AND HANDLING

- A. All products are to be packaged at the factory in heavy cardboard cartons. All shipments to the job site shall be made on wooden pallets.
- B. All products shall be stored flat in a cool, dry place in accordance with temperature and humidity conditions recommended by manufacturer. Do not stack cartons directly on concrete floors.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Approved Manufacturers:
 - 1. Trespa North America.
 - 2. Nevamar.
 - 3. Marlite.
 - 4. Flakeboard Co. Ltd.
- B. Other manufacturers and systems meeting the intent of this specification may be submitted for consideration.

2.2 MATERIALS

- 1. Solid phenolic panels. 3/4-inch thick or as indicated; colors and patterns to match Architect's samples. Provide color on 2 sides where indicated.
- 2. Wood veneer panels: 3/4-inch thick, square cut wood fiber substrate with manufacturer's standard veneer stained and finished to match Architect's sample.

2.3 ACCESSORIES

- A. Provide manufacturer's standard trim and anchorage where indicated in the drawings.

2.4 FABRICATION

- A. All surface systems panels, hardware and accessories shall be factory finished and ready to install.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Open cartons and carefully inspect all panels.

3.2 PREPARATION

- A. Structural walls should be finished, with building completely closed. Walls shall be thoroughly dry before starting installation. A vapor barrier should be used on exterior walls behind backing to discourage warping.
- B. Panels must be applied over a smooth solid, flat backing such as plywood or drywall. All drywall joints should be taped and finished. Walls should be primed before installation begins.
- C. Protect existing surfaces with drop cloths.

3.3 CONDITIONING

- A. All surface systems panels should be allowed to equalize to the moisture and temperature in the room environment prior to installation. This is accomplished by standing panels around the room in which they are to be installed for at least

48 hours before application. Room temperature should be approximately 70 degrees F.

3.4 INSTALLATION

A. Install all systems in accordance with the manufacturer's installation instructions.

3.5 CLEANING

A. Clean panels, trim and hardware according to manufacturer's recommendations.

END OF SECTION 06220

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

**SECTION 06402 – INTERIOR
ARCHITECTURAL
WOODWORK**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Unit Kitchens (kitchenettes).
 - 2. Closet Shelving and Rod.
- B. Related Sections include the following:
 - 1. Division 5, Section 05700 - ORNAMENTAL METALS for metal trim, sheet, etc., associated with architectural woodwork.
 - 2. Division 6, Section 06100 - ROUGH CARPENTRY for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, including cabinet hardware and accessories, and finishing materials and processes.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for items installed in architectural woodwork.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
 - 1. Plastic laminates.
- D. Samples for Verification: For the following:
 - 1. Lumber with or for transparent finish, 50 sq. in. for each species and cut, finished on 1 side and 1 edge.
 - 2. Plastic-laminate-clad panel products, 8 by 10 inches, for each type, color, pattern, and surface finish.

3. Corner pieces as follows:
 - a. Cabinet front frame joints between stiles and rail, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
 4. Exposed cabinet hardware and accessories, one unit for each type.
- E. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished comply with requirements.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.
 1. Provide AWI Quality Certification Program labels indicating that woodwork complies with requirements of grades specified.
- D. Mockups: Before fabricating and installing interior architectural woodwork, build mockups for each form of construction and finish required to verify selections made under sample Submittals and 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. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
 2. Notify Architect seven days in advance of dates and times when mockups will be fabricated and installed.
 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 4. Obtain Architect's approval of mockups before starting interior architectural woodwork fabrication.
 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Demolish and remove mockups when directed.
 7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1, Section 01200 - PROJECT MEETINGS.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions

comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products: Comply with the following:
 - 1. Hardboard: AHA A135.4.
 - 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
 - 3. Particleboard: ANSI A208.1, Grade M-2.
 - 4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 - 5. Hardwood Plywood and Face Veneers: HPVA HP-1.
- C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
 - a. Formica Corporation.
 - b. International Paper; Decorative Products Div.
 - c. Laminart.
 - d. Pioneer Plastics Corp.
 - e. Westinghouse Electric Corp.; Specialty Products Div.
 - f. Wilsonart International; Div. of Premark International, Inc.
 - g. Phenolic laminate backer sheets as manufactured by the approved laminate supplier.
- D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.2 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8, Section 08710 - FINISH HARDWARE.
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Catches: Magnetic catches, BHMA A156.9, B03141.
- D. Grommets for Cable Passage through Countertops: 1-1/4-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
- E. Paper Slots: 12 inches long by 1-3/4 inches wide by 1 inch deep; black, molded-plastic, paper-slot liner with 1/4-inch lip.
- F. Exposed Hardware Finish:
 - 1. Stainless Steel: ASTM A240, Type 304.
- G. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ASTM A240 No. 4, satin brush finish, Type 304.

2.3 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Refer to Division 6, Section 06100 - ROUGH CARPENTRY.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.4 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide Premium grade interior woodwork complying with the referenced quality standard for public areas, Custom grade for non-public areas.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening

devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

- E. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.
- F. Laminate fabrications to be completed in accordance with decorative plastic laminate association (DLPA), ANSI-A-161.2-1979 and "Architectural wood work quality standards, guide specification and quality certification program" guidelines of the architectural woodwork instituted (AWI) where applicable. All laminate fabrications shall be "balanced construction" in accordance with AWI guidelines.
- G. Install glass to comply with applicable requirements in Division 8, Section 08800 - GLAZING and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.5 PLASTIC-LAMINATE CABINETS

- A. Quality Standard: Comply with AWI Section 400 requirements for laminate cabinets.
- B. AWI Type of Cabinet Construction: Flush overlay.
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Horizontal Surfaces Other Than Tops: HGS.
 - 2. Postformed Surfaces: HGP.
 - 3. Vertical Surfaces: HGS.
 - 4. Edges: HGS.
- D. Materials for Semiexposed Surfaces: Provide surface materials indicated below:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
 - 2. Drawer Sides and Backs: Solid-hardwood lumber.
 - 3. Drawer Bottoms: Hardwood plywood.
- E. Concealed surfaces: manufacturer's phenolic laminate backer sheets
- F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. Provide Architect's selections from laminate manufacturer's full range of colors and finishes.

2.6 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Comply with AWI Section 400 requirements for high-pressure decorative laminate countertops.
- B. High-Pressure Decorative Laminate Grade: HGS.

- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. Provide Architect's selections from manufacturer's full range of colors and finishes.
- D. Edge Treatment: Same as laminate cladding on horizontal surfaces.
- E. Core Material: Particleboard.
- F. Core Material at Sinks: Exterior-grade plywood.
- G. Concealed surfaces

2.7 SOLID-SURFACING-MATERIAL COUNTERTOPS

- A. Quality Standard: Comply with AWI Section 400 requirements for countertops.
- B. Solid-Surfacing-Material Thickness: 1/2 inch.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
 - 1. Provide Architect's selections from manufacturer's full range of colors and finishes.
- D. Fabricate tops in one piece with shop-applied backsplashes and edges, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
- E. Install integral sink bowls in countertops in shop.
- F. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2.8 SHOP FINISHING

- A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.
 - 1. Grade: Provide finishes of same grades as items to be finished.
- B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative overlay.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

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

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
 - 1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.
 - 2. Install wall railings on indicated metal brackets securely fastened to wall framing.
 - 3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of cabinets with transparent finish.
 - 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
 4. Calk space between backsplash and wall with sealant specified in Division 7, Section 07920 - JOINT SEALANTS.
- H. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening, unless otherwise indicated.
1. Install flush paneling with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
- I. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06402

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

**SECTION 07210 – THERMAL
INSULATION**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Perimeter wall insulation (supporting backfill).
 - 2. Concealed building insulation.
 - 3. Vapor retarders.
- B. Related Sections include the following:
 - 1. Division 04 Section "Unit Masonry" for insulation installed in cavity walls and masonry cells.
 - 2. Division 07 Section "Self-Adhering Sheet Waterproofing" for insulation and insulated drainage panels installed with waterproofing.
 - 3. Division 07 Sections "Ethylene-Polyene-Diene-Monomer (EPDM Roofing)" and "Thermoplastic Membrane Roofing" for insulation specified as part of roofing construction.
 - 4. Division 07 Section "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.

1.2 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.3 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
 - 1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for four (4) hours at 2500-fpm (13-m/s) air velocity.
 - 2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with *Chaetomium globosum* on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E84.
 - 2. Fire-Resistance Ratings: ASTM E119.
 - 3. Combustion Characteristics: ASTM E136.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturers written instructions for handling, storing and protecting during insulation.
- B. Protect plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - 3. Complete insulation and concealment of plastic materials as rapidly as possible in each area of construction.

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. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 74 and 450, respectively:
 - 1. Manufacturers:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company.
 - c. Owens Corning.
 - d. Pactiv Building Products Division.
 - 2. Type IV, 1.60 lb / cu. ft. (26 kg/cu. m), unless otherwise indicated.

2.3 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers:
 - 1. Certain Teed Corporation.
 - 2. Guardian Fiberglass, Inc.
 - 3. Johns Manville.
 - 4. Knauf Fiber Glass.
 - 5. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- C. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
 - 1. 3-5/8 inches (92 mm) thick with a thermal resistance of 11 deg F x h x sq. ft. / Btu at 75 deg F (1.9 K x sq. m/W at 24 deg C).
 - 2. 5-1/2 inches (140 mm) thick with a thermal resistance of 19 deg F x h x sq. ft. / Btu at 75 deg F (3.3 K x sq. m/W at 24 deg C).

2.4 VAPOR RETARDERS

- A. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: Two (2) outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 22 lb. / 1000 sq. ft. (10kg/100 sq. m), with maximum permeance rating of 0.1317 per (7.56 ng/Pa x s x sq. m) and with flame-spread and smoke-developed indexes of not more than 5 and 60, respectively.
 - 1. Products:
 - a. Raven Industries Inc.; DURA-SKRIM 2FR.
 - b. Reef Industries, Inc.; Griffolyn T-55 FR.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.5 AUXILIARY INSULATING MATERIALS

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturer for sealing joints and penetrations in vapor-retarder facings.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.6 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
 - 1. Products"
 - a. AGM Industries, Inc.; Series R RACTOO Insul-Hangers.
 - b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.

- c. Gemco; Spindle Type.
- 2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (.0762 mm) thick by 2 inches (50 mm) square.
- 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.
- B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates:
 - 1. Products:
 - a. AGM Industries, Inc.; TACTT Adhesive.
 - b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
 - c. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instruction applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For performed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to product thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical foundation wall surfaces, set insulation units using manufacturer recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of twenty-four (24) inches below exterior grade line.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended in insulation manufacturer.
- C. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements
 - 1. Remove below-grade construction, including basements, foundation walls, and footings, to depths indicated.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures.
 - 4. For wood-framed construction, install mineral-fiber blankets according to ASTM c 1320 and as follows:
 - a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
 - b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarded once finish material is installed over it.

3.6 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacture.
- C. Seal joints caused by pipes, conduit, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.7 PROTECTION

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

END OF SECTION 07210

**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.
- B. Related Sections:
 - 1. Division 5 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal wall panels.
 - 2. Division 7 Section "Metal Wall Panels" for single-skin, through-the-face-fastened metal wall, liner, and soffit panels.

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. (0.3 L/s per sq. m)]** of wall area when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: **[1.57 lbf/sq. ft. (75 Pa)]**
- D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: **6.24 lbf/sq. ft. (300 Pa)**
 - 2. Water Leakage: 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. 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 330:
 - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure of **20 lbf/sq. ft. (958 Pa)**, acting inward or outward.
 - 2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than **1/240** of the span.
- F. 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 (67 deg C)**, material surfaces.
- G. Thermal Performance: Provide insulated metal wall panel assemblies with thermal-resistance value (R-value) indicated 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.
 - 1. Accessories: Include details of the following items, at a scale of not less than **1-1/2 inches per 12 inches (1:10)**:
 - a. Anchorage systems.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Wall Panels: **12 inches (305 mm)** long by actual panel width. Include fasteners, battens, closures, and other metal wall panel accessories.
 - 2. Trim and Closures: **12 inches (305 mm)** long. Include fasteners and other exposed accessories.
 - 3. Accessories: **12-inch- (305-mm-)** 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: For Installer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- D. Field quality-control reports.
- 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. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Source Limitations: Obtain each type of metal wall panel from single source from a single manufacturer.
- D. 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. 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: Ten (10) 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 (Z275)** coating designation; structural quality.
 2. Surface: **Smooth, flat finish.**
 3. Exposed Coil-Coated Finish:
 - a. Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes 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 (0.013 mm).**
- B. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.
1. Exposed Finish: Apply the following finish, as specified or indicated on Drawings.
 - a. Pre-patinated: ASTM B 882. Copper sheets artificially aged by chemical reaction to convert surface to inorganic crystalline structure with color range and durability of naturally-formed patina.
- C. 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 (13 mm) wide and 1/8 inch (3 mm) 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** **board** 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 (1.63-mm)** nominal thickness.
- C. Zee Clips: **0.079-inch (2.01-mm)** nominal thickness.
- D. Base or Sill Angles / Channels: **0.079-inch (2.01-mm)** 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- (13-mm-)** 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 (1.02-mm)** nominal thickness.
 4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, **0.062-inch- (1.52-mm-)** diameter wire, or double strand of **0.048-inch- (1.22-mm-)** 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; **CS-620, Concept Series with 3" insulated metal wrap liner panels**
 - 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. MetI-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, **[0.022-inch (0.56-mm)] [0.028-inch (0.71-mm)] [0.034-inch (0.86-mm)]** nominal thickness.
 - 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: 16 inches nominal.
4. Panel Thickness: 4 inches nominal.
5. Thermal-Resistance Value (R-Value):

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 (25-mm)** 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- (0.46-mm-)** 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. (27.9 sq. m.)** 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 (3 m)** with no joints allowed within **24 inches (605 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 (25 mm)** 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- (23-m-)** 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 07543 - THERMOPLASTIC
POLYOLEFIN (TPO) ROOFING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Adhered TPO membrane roofing system.
 - 2. Vapor retarder.
 - 3. Roof insulation.
- B. Related Sections:
 - 1. Division 06 Section "Miscellaneous 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 "Manufactured Roof Specialties" for proprietary manufactured roof specialties.
 - 4. Division 07 Section "Joint Sealants" for joint sealants, joint fillers and joint preparation.

1.2 DEFINITIONS

- A. TPO: Thermoplastic polyolefin.
- B. 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.

1.3 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.

1.4 SUBMITTALS

- A. Product Data: for each type of product indicated.
- B. 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. Insulation fastening patterns for corner, perimeter and field-of-roof locations.
- C. Maintenance Data: For roofing system to include in maintenance manuals.
- D. Warranties: Sample of special warranties.

1.5 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 approve 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.

1.6 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.

1.7 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, over Board (when required by roof system manufacturer), roofing accessories, roof expansion joints, and other components of membrane roofing system.
 2. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TPO MEMBRANE ROOFING

- A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible TPO Sheet
 1. Manufacturers: Subject to compliance with requirements:
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products Company.
 - c. GenFlex Roofing Systems.
 - d. Versico Incorporated.
 - e. Sika Sarnafil, Inc.

2. Thickness: 45 mil (1.1 mm), nominal.
3. Exposed Face Color: White.

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.
- B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheets flashing, 55 mils (1.4 mm) thick, minimum, of same color as sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard, water based.
- D. Slip Sheet: Manufacturer's standard, of thickness required for application.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- F. 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.
- G. Miscellaneous Accessories: Provide pourable sealers, performed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets and other accessories.

2.3 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, provide one of 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.

2.4 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by TPO 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. Provide pre-formed saddles, crickets, tapered edge strips and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 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.

2.6 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.

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, provide products by one of the following:
 - a. Commercial Products Group; PortalsPlus C-412.
 - b. Equal as approved by Architect.

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.
- D. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking," according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

3.3 VAPOR-RETARDER INSTALLATION

- A. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:
 1. Apply adhesive at rate recommended by vapor-retarder manufacture. Seal 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. Mechanically Fastened and Adhered Insulation: Install each layer of insulations and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter and field of roof.
 - 2. Set each subsequent 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.
- 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.
- G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

- H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
- I. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weather-tightness of transition and to not void warranty for existing membrane roofing system.
- J. Roof Expansion Joints: Install as shown on drawings and as additionally required by membrane roofing system manufacturer.

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 seam areas, overlap and firmly roll sheet flashing into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashing and mechanically anchor to substrate through termination bars.

3.7 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkways products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 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.

3.9 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 07543

**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 "Building Insulation" for roof insulation and sheet vapor retarders separate from self-adhering underlayments.
 - 2) Division 7 Section "Metal Roof Panels" for factory-formed metal soffit panels.
 - 3) Division 7 Section "Sheet Metal Flashing and Trim" for gutters, downspouts, 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. 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. 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 (300 mm) long and in required profile. Include fasteners and other exposed accessories.
 - 3) Snow Guards: Full-size Sample.
 - 4) Other Accessories: 12-inch- (300-mm-) long Samples for each type of other accessory.

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.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- 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. Custom-Fabricated Sheet Metal Roofing Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal roofing similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Roll-Formed Sheet Metal Roofing Fabricator Qualifications: Fabricator authorized by portable roll-forming equipment manufacturer to fabricate and install sheet metal roofing units required for this Project, and who maintains current UL certification of its portable roll-forming equipment.
- 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 30] [Class 60] [Class 90]** wind-uplift resistance. Maintain UL certification of portable roll-forming equipment for duration of sheet metal roofing work.
- D. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- E. Preliminary Roofing Conference: Before starting roof construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 1 Section "Project Management and Coordination."
 - 1) Review methods and procedures related to roof construction and sheet metal roofing including, but not limited to, items listed for the Preinstallation Conference.
- F. 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 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 Period: Five (5) years from date of Substantial Completion.
- B. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1) 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.
- 2) Finish 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 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1) Thickness: **0.032 inch (0.81 mm)** unless otherwise indicated.
 - 2) As-Milled Finish: Mill finish.
 - 3) Surface: Smooth, flat.
 - 4) Exposed Coil-Coated Finish:
- C. Metallic Fluoropolymer: AAMA 620. Three-coat fluoropolymer finish with suspended metallic flakes 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.
 - 1) Color: Match Architect's samples.
 - 2) Concealed Finish: Pretreat with 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 (0.013 mm).
- D. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin), with factory-applied gray preweathering.
 - 1) Products: Subject to compliance with requirements:
- E. Follansbee Steel; TCS II.
 - 1) Thickness: **0.015-inch (0.38-mm)** minimum uncoated thickness, with 0.787-mil (0.020-mm) coating thickness applied to each side.

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 for sheet metal roofing.
- B. Snap-On Seams: Provide snap-on seams integrated with panel-edge profile as recommended by portable roll-forming equipment 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 suitable fasteners 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) Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3) Fasteners for Zinc-Tin Alloy-Coated Stainless-Steel Sheet: Series 300 stainless steel.
- D. Solder:
 - 1) For Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.
- E. 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.
- F. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant as recommended by portable roll-forming equipment manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight.
- G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

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 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: **0.0250-inch-** thick stainless steel.
 - b) Zinc-Tin Alloy-Coated Stainless-Steel Roofing: Manufacturer's preformed cleats or cleats fabricated from manufacturer's thickest flat-stock sheet.
 - c) Zinc Roofing: Manufacturer's preformed stainless-steel cleats.
 - 3) Clips: Minimum 0.0625-inch- (1.6-mm-) 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-(25-mm-) 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 (0.46 mm)] <Insert thickness>** 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 finished seam height **of 1-1/2 inches (38 mm)**.
 - 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.
- 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 (300 mm)** 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 (25 mm) 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 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. 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] [at locations indicated]**, in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within fourteen (14) days.
 - 1) Roof perimeter for a distance up from eaves of **36 inches (900 mm)** beyond interior wall line.
 - 2) Valleys, from lowest to highest point, for a distance on each side of **18 inches (460 mm)**. Overlap ends of sheets not less than 6 inches (150 mm).
 - 3) Rake edges for a distance of **18 inches (460 mm)**.
 - 4) Roof to wall intersections for a distance from wall of **18 inches (460 mm)**.
- D. Install flashings to cover underlayment to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
- E. Apply slip sheet 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 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 in uniform vertical and horizontal alignment. Predrill 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.
- 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.
 - 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 CUSTOM-FABRICATED SHEET METAL ROOFING INSTALLATION

- A. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form a hem on concealed side of exposed edges unless otherwise indicated.
- 1) Install cleats to hold sheet metal panels in position. Attach each cleat with two fasteners to prevent rotation.
 - 2) Fasten cleats not more than 12 inches (300 mm) o.c. Bend tabs over fastener head.
 - 3) Provide expansion-type cleats and clips for roof panels that exceed 30 feet (9.1 m) in length.
- B. 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 (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting

- proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
- 2) Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- C. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except reduce pre-tinning where pre-tinned surface would show in completed Work.
- 1) Do not solder aluminum sheet.
 - 2) Do not pre-tin zinc-tin alloy-coated stainless steel.
 - 3) Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
- D. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.
- E. Standing-Seam Roofing: Attach standing-seam metal panels to substrate with cleats, double fastened at **12 inches (305 mm)** o.c. Install panels reaching from eave to ridge before moving to adjacent panels. Before panels are interlocked, apply continuous bead of sealant to top of flange of lower panel. Lock standing seams by folding over twice so cleat and panel edges are completely engaged.
- 1) Lock each panel to panel below with sealed transverse seam.
 - 2) Loose-lock panels at eave edges to continuous cleats and flanges at roof edge at gutters.
 - 3) Loose-lock panels at eave edges to continuous edge flashing exposed 24 inches (610 mm) from roof edge. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at **12 inches (305 mm)** o.c. Lock panels to edge flashing.

3.5 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 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 manufacturer of portable roll-forming equipment.
- 1) Install clips to substrate with self-tapping fasteners.
 - 2) Install pressure plates at locations indicated in equipment manufacturer's written installation instructions.
 - 3) Before 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 (25 mm) into sealant. Form joints to

completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), 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 (4 deg C).

- 2) Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.6 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 (25 mm) deep, and filled with butyl sealant concealed within joints.
- C. Pipe Flashing: Form flashing around pipe penetration and sheet metal roofing. Fasten and seal to sheet metal roofing as recommended by SMACNA.
- D. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet sheet metal roofing.
- E. 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.

3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal roofing within installed 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.

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.

3.9 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS **<Insert name>** of **<Insert address>**, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1) Owner: **<Insert name of Owner>**.
 - 2) Address: **<Insert address>**.
 - 3) Building Name/Type: **<Insert information>**.
 - 4) Address: **<Insert address>**.
 - 5) Area of Work: **<Insert information>**.
 - 6) Acceptance Date: **<Insert date>**.
 - 7) Warranty Period: **<Insert time>**.
 - 8) **Expiration** Date: **<Insert date>**.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
 - 1) Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

- a) Lightning;
 - b) Peak gust wind speed exceeding <Insert wind speed> mph (m/sec);
 - c) Fire;
 - d) Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e) Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f) Vapor condensation on bottom of roofing; and
 - g) Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
- 2) When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 - 3) Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 - 4) During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 - 5) During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
 - 6) Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 - 7) This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

- 1) Authorized Signature: <Insert signature>.
- 2) Name: <Insert name>.

3) Title: <Insert title>.

END OF SECTION 07610

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

**SECTION 08110 – STEEL DOORS
AND FRAMES**

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. Standard hollow metal doors and frames.
- B. Related Sections
 - 1. Division 4 Section "Unit Masonry Assemblies" for embedding anchors for hollow metal work into masonry construction.
 - 2. Division 8 Section "Stainless-Steel Doors and Frames" for hollow metal doors and frames manufactured from stainless steel.
 - 3. Division 8 Section "Steel Detention Doors and Frames" for hollow metal doors and frames for detention facilities.
 - 4. Division 8 Section "Sound-Control Door Assemblies" for packaged, acoustical hollow metal door and frame assemblies with STC ratings of 35 or more.
 - 5. Division 8 Section "Door Hardware (Scheduled by Describing Products)" for door hardware for hollow metal doors.
 - 6. Division 9 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
 - 7. Division 16 Sections for electrical connections including conduit and wiring for door controls and operators.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

4. Locations of reinforcement and preparations for hardware.
 5. Details of each different wall opening condition.
 6. Details of anchorages, joints, field splices, and connections.
 7. Details of accessories.
 8. Details of moldings, removable stops, and glazing.
 9. Details of conduit and preparations for power, signal, and control systems.
- C. Samples for Verification:
1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).
 2. For the following items, prepared on Samples about 12 by 12 inches (305 by 305 mm) to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow metal panels and glazing if applicable.
- D. Other Action Submittals:
1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
- E. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.
1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

- C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.
- D. Smoke-Control Door Assemblies: Comply with [FPA 105 or UL 1784.
- E. Preinstallation Conference: Conduct conference at Project site.
- F. Design pressure certification up to +/- 80 psf.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ceco Door Products; an Assa Abloy Group company.
 - 2. Curries Company; an Assa Abloy Group company.
 - 3. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G90 (Z180) metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Division 8 Section "Glazing."
- J. 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.

2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard, polystyrene or, polyurethane, core.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft. / Btu (1.057 K x sq. m/W when tested according to ASTM C 1363).

- 1) Locations: Exterior doors and interior doors where indicated.
 3. Vertical Edges for Single-Acting Doors: Beveled edge.
 - a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).
 4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
 5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-(1.0-mm-) thick, end closures or channels of same material as face sheets.
 6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Pre conduit frames and doors with UL rated Electro Lynx conduit and back boxes as required for electro mechanical hardware specified in Section 08710.

2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered or coped corners.
 2. Fabricate frames as full profile welded unless otherwise indicated.
 3. Frames for Level 3 Steel Doors: 0.067-inch- (1.6-mm-) thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
1. Fabricate frames with mitered or coped corners.
 2. Fabricate frames as face welded unless otherwise indicated.
 3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
 4. Frames for Wood Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
 5. Frames for Borrowed Lights: Same as adjacent door frame.
 6. Frames for all door openings over 3'6": 0.067-inch- (1.6-mm-) thick steel sheet.

- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
- E. Pre conduit frames and doors with UL rated Electro Lynx conduit and back boxes as required for electro mechanical hardware specified in Section 08710.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.8 LOUVERS

- A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other, any angle.
3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 2. All steel doors and frames receiving electro-mechanical hardware shall be factory pre wired with UL approved conduit and junction boxes with ElectroLynx quick connect system Option 3 or approved equal.
 3. Glazed Lites: Factory cut openings in doors.
 4. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. All steel doors and frames receiving electro-mechanical hardware shall be factory pre wired with UL approved conduit and junction boxes with ElectroLynx quick connect system Option 3 or approved equal.
 3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

4. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 5. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 7. Jamb Anchors: Provide number and spacing of anchors as follows:
 8. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - a) Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 5) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 6) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 7) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - 8) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 - 9) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.
 - a) Compression Type: Not less than two anchors in each jamb.
 - b) Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
 9. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.

3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow metal work.
 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.11 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb.

- Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors according to [NFPA 105] [UBC Standard 7-2].
- D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.

- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08110

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

**SECTION 09402 – RESINOUS
MATRIX TERRAZZO
FLOORING**

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. Thin-set, epoxy-resin terrazzo flooring and base.
 - 2. Precast epoxy-resin terrazzo units.
- B. Related Requirements:
 - 1. Division 7 Section "Joint Sealants" for sealants installed with terrazzo.

1.3 DEFINITIONS

- A. Aggregate: Marble chips or other types of aggregate.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to terrazzo including, but not limited to, the following:
 - a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 - b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - c. Review special terrazzo designs and patterns.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
 - 3. Product Data for Credit IEQ 4.3: For sealers, documentation including printed statement of VOC content.
 - 4. Product Data for Credit IEQ 4.3: For terrazzo flooring, documentation from an independent testing agency indicating compliance with the FloorScore Standard.

- C. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work. Show layout of the following:
 - 1. Divider strips.
 - 2. Control-joint strips.
 - 3. Accessory strips.
 - 4. Abrasive strips.
 - 5. Stair treads, risers, and landings.
 - 6. Precast terrazzo jointing and edge configurations.
 - 7. Terrazzo patterns.
- D. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare Samples of same thickness and from same material to be used for the Work, in size indicated below:
 - 1. Terrazzo: 12" square Samples.
 - 2. Accessories: 12" long Samples of each exposed strip item required.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Material Certificates: For each type of terrazzo material or product, from manufacturer.
- C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For terrazzo to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Engage an installer who is a contractor member of NTMA.
 - 2. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.
- B. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.
- C. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with sources or manufacturer's name, material or product brand name, and lot number if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.
- B. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.
- C. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.
- D. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.
- E. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.
- B. FloorScore Compliance: Terrazzo floors shall comply with requirements of FloorScore Standard.

2.2 EPOXY-RESIN TERRAZZO

- A. Epoxy-Resin Terrazzo: Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and aggregate proportions and mixing.
 - 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. Crossfield Products Corp., Dex-O-Tex Division; Cheminert Terrazzo.
 - b. General Polymers Corporation; Terrazzo 1100.
 - c. Key Resin Company; Key Epoxy Terrazzo.
 - d. Master Terrazzo Technologies LLC; Morricite.
 - e. Quadrant Chemical Corporation; Quadset Epoxy Terrazzo.
 - f. TEC Specialty Construction Brands, Inc.; Tuff-Lite Epoxy Terrazzo.

- g. Terrazzo & Marble Supply Companies; Terroxy Resin Systems.
- 2. Thickness: **3/8 inch (9.5 mm)** nominal.
- 3. Custom Mix Color and Pattern: Match Architect's sample.

B. Materials:

- 1. Flexible Reinforcing Membrane: Manufacturer's resinous membrane for substrate-crack preparation and reflective-crack reduction.
 - a. Reinforcement: Fiberglass scrim.
- 2. Primer: Manufacturer's product recommended for substrate and use indicated.
- 3. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
 - a. Physical Properties without Aggregates:
 - 1) Hardness: 60 to 85 per ASTM D 2240, Shore D.
 - 2) Minimum Tensile Strength: **3000 psi (20.7 MPa)** per ASTM D 638 for a **2-inch (51-mm)** specimen made using a "C" die per ASTM D 412.
 - 3) Minimum Compressive Strength: **10,000 psi (6.9 MPa)** per ASTM D 695, Specimen B cylinder.
 - 4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D 1308.
 - a) Distilled water.
 - b) Mineral water.
 - c) Isopropanol.
 - d) Ethanol.
 - e) 0.025 percent detergent solution.
 - f) 1.0 percent soap solution.
 - g) 10 percent sodium hydroxide.
 - h) 10 percent hydrochloric acid.
 - i) 30 percent sulfuric acid.
 - j) 5 percent acetic acid.
 - b. Physical Properties with Aggregates: For resin blended with Georgia white marble, ground, grouted, and cured per requirements in NTMA's "Terrazzo Specifications and Design Guide"; comply with the following:
 - 1) Flammability: Self-extinguishing, maximum extent of burning **1/4 inch (6.35 mm)** per ASTM D 635.
 - 2) Thermal Coefficient of Linear Expansion: **0.0025 inch/inch per deg F (0.0025 mm/mm per 0.5556 deg C)** for temperature range of **minus 12 to plus 140 deg F (minus 24 to plus 60 deg C)** per ASTM D 696.
- 4. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.
 - a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
 - b. 24-Hour Absorption Rate: Less than 0.75 percent.
 - c. Dust Content: Less than 1.0 percent by weight.
 - d. Recycled Content of Epoxy-Resin Terrazzo: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- 5. Finishing Grout: Resin based.

2.3 PRECAST EPOXY-RESIN TERRAZZO

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Precast Terrazzo Units: Comply with NTMA's written recommendations for fabricating precast terrazzo units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer. Finish exposed-to-view edges and reveals to match face finish. Ease exposed edges to **1/8-inch (3.2-mm)** radius.
 - 1. Stair treads and landings.
 - 2. Color, Pattern, and Finish: Match Architect's sample for adjacent poured-in-place terrazzo flooring.

2.4 STRIP MATERIALS

- A. Thin-Set Divider Strips: L-type angle, **1/4 inch (6.4 mm)** deep.
 - 1. Material: White-zinc alloy, Aluminum and/or Plastic, in color(s) selected, as indicated.
 - 2. Top Width: As indicated.
- B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material and color of divider strips and in depth required for topping thickness indicated.
- C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
 - 1. Base-bead strips for exposed top edge of terrazzo base.
 - 2. Edge-bead strips for exposed edges of terrazzo.
 - 3. Nosings for terrazzo stair treads and landings.
- D. Abrasive Strips: Three-line abrasive inserts at nosings. Silicon carbide or aluminum oxide, or combination of both, in epoxy-resin binder and set in channel.
 - 1. Width: **1/2 inch (12.7 mm)**.
 - 2. Depth: As required by terrazzo thickness.
 - 3. Length: **4 inches (100 mm)** less than stair width.
 - 4. Color: As selected by Architect from full range of industry colors.

2.5 MISCELLANEOUS ACCESSORIES

- A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use.
 - 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Anchoring Devices:
 - 1. Strips: Provide mechanical anchoring devices or adhesives for strip materials as recommended by manufacturer and required for secure attachment to substrate.
 - 2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.

- C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- D. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- E. Resinous Matrix Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.
- F. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
 - 1. Surface Friction: Not less than 0.6 according to ASTM D 2047.
 - 2. Acid-Base Properties: With pH factor between 7 and 10.
 - 3. Sealers shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.
- B. Concrete Slabs:
 - 1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
 - c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
- C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - 1. Moisture Testing: Perform tests indicated below.

- a. Calcium Chloride Test: Perform anhydrous calcium chloride test per ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of **3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)** in 24 hours.
- D. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.
 - 1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 EPOXY-RESIN TERRAZZO INSTALLATION

- A. Comply with NTMA's written recommendations for terrazzo and accessory installation.
- B. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."
- C. Installation Tolerance: Limit variation in terrazzo surface from level to **[1/4 inch in 10 feet (6.4 mm in 3 m)]**; noncumulative.
- D. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
- E. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
- F. Flexible Reinforcing Membrane:
 - 1. Prepare and prefill substrate cracks with membrane material.
 - 2. Install membrane to produce full substrate coverage in areas to receive terrazzo.
 - 3. Reinforce membrane with fiberglass scrim.
 - 4. Prepare membrane according to manufacturer's written instructions before applying substrate primer.
- G. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.
- H. Strip Materials:
 - 1. Divider and Control-Joint Strips:
 - a. Locate divider strips in locations indicated.
 - b. Install control-joint strips back to back directly above concrete-slab control joints and/or in locations indicated.
 - c. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
 - 2. Accessory Strips: Install as required to provide a complete installation.
 - 3. Abrasive Strips: Install with surface of abrasive strip positioned **1/16 inch (1.6 mm)** higher than terrazzo surface.

3.4 PRECAST TERRAZZO INSTALLATION

- A. Install precast terrazzo units using method recommended by NTMA and manufacturer unless otherwise indicated.
- B. Do not install units that are chipped, cracked, discolored, or not properly finished.
- C. Seal joints between units with joint compound matching precast terrazzo matrix.

3.5 REPAIR

- A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.6 CLEANING AND PROTECTION

- A. Cleaning:
 - 1. Remove grinding dust from installation and adjacent areas.
 - 2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.
- B. Sealing:
 - 1. Seal surfaces according to NTMA's written recommendations.
 - 2. Apply sealer according to sealer manufacturer's written instructions.
- C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION 09402

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

**SECTION 09514 - ACOUSTICAL
METAL PAN CEILINGS**

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 torsion-spring acoustical metal pans and the following suspension system for ceilings:
 - 1. Direct hung, exposed tee grid.
- B. Related Sections:
 - 1. Division 9 Section "Acoustical Panel Ceilings" for ceilings consisting of mineral-base and glass-fiber-base acoustical panels and exposed suspension systems.
 - 2. Divisions 13, 15, and 16 Sections for light fixtures, sprinklers, and air-distribution components.

1.3 DEFINITIONS

- A. CAC: Ceiling Attenuation Class.
- B. LR: Light Reflectance coefficient.
- C. NRC: Noise Reduction Coefficient.

1.4 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow 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): 95 °F to 40°F.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below:
 - 1. Metal Pans: Set of 12 inch square samples of each type, finish, color, pattern, and texture. Samples to be pan corners showing pan edge profiles in two directions.
 - 2. Exposed Suspension System Members, Moldings and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.
 - 3. Sound Absorber: Match size of Sample metal pan.

- C. Performance Data: For installed products indicated to comply with design loads and other criteria, include structural analysis and other analytical data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Ceiling suspension members.
 - 2. Method of attaching hangers to building structure.
 - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 4. Ceiling perimeter and penetrations through the ceiling; and trim and moldings.
 - 5. Minimum Drawing Scale: $1/16 = 1$ foot.
- E. Qualification Data: For testing agency.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical metal pan ceiling.
- G. Evaluation Reports: For each acoustical metal pan ceiling and components and anchor and fastener type.
- H. Field quality-control reports.
- I. Maintenance Data: For finishes to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations for Acoustical Metal Pan Ceilings: Obtain each combination of acoustical metal pans and exposed suspension systems from one source with resources to provide products of consistent quality in appearance, physical properties, and performance.
- C. Surface-Burning Characteristics: Complying with ASTM E 1264 for flame spread 25 + smoke developed 50 materials as determined by testing identical products according to ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for sound absorption.
- D. Seismic Standard: Provide acoustical metal pan ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - 1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
- F. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Handle acoustical metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical metal pan ceilings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use and as per manufacturers' recommendations.

1.9 COORDINATION

- A. Coordinate layout and installation of acoustical metal pans and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Metal Pans: Full-size units equal to 2 percent of quantity installed.
 - 2. Suspension System Components: Quantity of each grid and exposed molding and trim equal to 2 percent of quantity installed.
 - 3. Hold-Down Clips: Equal to 2 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL METAL CEILING PANS

- A. Acoustical Metal Pan Standard: Provide manufacturer's standard acoustical metal pans of configuration indicated that comply with ASTM E 1264 classifications as designated by types, acoustical ratings, and light reflectances unless otherwise indicated.
- B. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.
 - 1. Aluminum Sheet: Roll-formed aluminum sheet, complying with ASTM B 209 (ASTM B 209M); alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

- C. Sound-Absorbent Fabric Layer: Provide fabric layer, sized to fit concealed surface of pan, and consisting of black, nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84.
 - 1. Bond fabric layer to panels in the factory with manufacturer's standard nonflammable adhesive.
- D. Sound-Absorbent Pads: Provide width and length to completely fill concealed surface of pan, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84, and to comply with the following requirements:
 - 1. Spacer Grids: Provide manufacturer's standard aluminum grid units that provide an air cushion between metal pans and insulation pads and that act to improve sound absorption.

2.2 ALUMINUM PANS FOR ACOUSTICAL METAL PAN CEILING

- A. Aluminum Metal Pans:
 - 1. Products: Subject to compliance with requirements, provide one of the following :
 - a. Simplex Ceilings, a division of Intalite Inc.
 - b. Chicago Metallic
 - c. Spitz Industries:
- B. Classification: Units complying with ASTM E 1264 for Type XX, other types described as perforated aluminum facing (pan) units with sound-absorbent fabric backing.
 - 1. Pattern: 1 to 7 (70%).
- C. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
 - 1. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.
- D. Pan Thickness: Not less than 0.040 inch (1.0 mm).
- E. Pan Edge Detail: Manufacturer's standard edge detail.
- F. Pan Size: As indicated
- G. Pan Face Finish: Pre-painted silver lum.
- H. LR: Not less than 0.70.
- I. NRC: Not less than 0.70.
- J. CAC: Not less than 40.

2.3 METAL SUSPENSION SYSTEMS

- A. Suspension Systems: Provide systems complete with carriers, runners, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim,

retention clips, load-resisting struts, and other suspension components required to support ceiling units and other ceiling-supported construction.

- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C 635, Table 1, Direct Hung will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.
- D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1.0-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
- F. Hold-Down Clips: Manufacturer's standard hold-down clips spaced to secure acoustical metal pans in place at each pan.
- G. Exposed Metal Edge Moldings and Trim: Provide exposed members as indicated or as required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of and penetrations through ceiling, to conceal edges of pans and runners, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching acoustical metal pan ceiling units, unless otherwise indicated.
 - 1. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.

2.4 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 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. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.
 - c. <Insert manufacturer's name; product name or designation>.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

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. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
 - b. Pecora Corporation; BA-98.
 - c. Tremco, Inc.; Tremco Acoustical Sealant.

2.5 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 finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

- A. Color-Coated Finish: Manufacturer's standard enamel baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical metal pan ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical metal pan ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and Coordination Drawings.

3.3 INSTALLATION

- A. Install acoustical metal pan ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."

- B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved.
 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pans.
1. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Cut acoustical metal pan units for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
- F. Install acoustical metal pans in coordination with suspension system and exposed moldings and trim.

1. For torsion-spring-hinged pans, position pans according to manufacturer's written instructions.
 2. For snap-in pans, fit adjoining units to form flush, tight joints.
 3. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
 4. Fit adjoining units to form flush, tight joints.
 5. Install directionally patterned or textured metal pans in directions indicated.
 6. Install sound-absorbent fabric layers in perforated metal pans.
 7. Install sound-absorbent pads in perforated metal pans over metal spacer grids.
- G. Install sound attenuation panels in areas indicated by reflected ceiling plans or room finish schedules. Lay panels directly on ceiling system and close major openings to form complete coverage in required areas.
- H. Install hold-down clips where indicated.

3.4 FIELD QUALITY CONTROL

3.5 CLEANING

- A. Clean exposed surfaces of acoustical metal pan ceilings, including trim and edge moldings after removing strippable, temporary protective covering, if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 09514