PROJECT MANUAL

for the General Construction of

Mille Lacs Band of Ojibwe
Warehouse Condenser Canopies

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SECTION 01 11 00 - SUMMARY OF THE WORK

PART I GENERAL

1.01 CONDITIONS OF THE CONTRACT

Requirements of Sections in Division 0 and Division 1 extend and apply to all work and material supplied by the Contractor, subcontractors, material suppliers, and equipment vendors and shall be included as part of each section of this Project Manual.

Where the term “include” is used under a description of the scope of work in subsequent Sections of this Project Manual, it shall be interpreted to mean items of work therein listed may be a part, but not necessarily the limit, of work required under that Section. The Contractor shall examine the Drawings and Specifications to determine the full scope of work required to comply with the intent of the Contract Documents.

1.02 SCOPE OF WORK

Work to be performed under this Contract shall be shown on the Drawings, defined in the Technical Sections of the Project Manual, and governed by the requirements stipulated in Division 0 and Division 1 as listed in the Table of Contents, and any addenda. It is the bidder’s sole responsibility to verify that they have received all sheets of Drawings and Specifications. No claim for additional compensation will be allowed due to lack of complete information at time of bid.

- Scope of the project includes but is not limited to the following: Construction of protective canopies over AC condenser units at two separate sites.
    - Site 1: DII Housing Warehouse (20898 360th St, McGregor, MN 55760) requires 4 new bollards to be placed (footings poured, bollards filled solid), construction of wood columns/posts, bracing, roof structure, and metal roof that matches the existing building. Exposed wood members to be clad in composite wood siding and/or metal flashing.
    - Site 2: DIII Housing Warehouse (45700 Grace Lake Rd, Sandstone, MN 55076) requires 2 new bollards to be placed (footings poured, bollards filled solid), modification of 2 bollards, removal and patching of asphalt, columns/posts, bracing, roof structure, and metal roof that matches the existing building. Exposed wood members to be clad in composite wood siding and/or metal flashing.

Bids are to be received under a single Base Bid and any Alternate Bids which may be identified on the official Bid Forms issued by the Owner’s Purchasing Agents. The Owner has the right to award Base Bid and any or all Alternates to the Base Bids in any order deemed acceptable by the Owner.

Equipment or work indicated on Plans to be “by Owner” or “N.I.C.” is not to be in the bid for the construction contract. However, there may be work required to provide base construction or mounting devices, for work by others, which is to be part of the Contract.

1.03 FORM OF AGREEMENT

All work on this Project shall be awarded to a Prime Contractor as stipulated in this Project Manual. The Agreement for the work will be written on the Mille Lacs Band of Ojibwe Construction Contract.

1.04 START OF WORK

All products shall be ordered immediately upon award of the contracts. Fabricated items shall be scheduled to allow delivery and installation when related work is complete.

All work shall be substantially completed by the date indicated in the Invitation to Bid.

In no event shall work commence until insurance certificates have been received and approved by the Architect and forwarded to the owner for their review and acceptance. Though the scheduled completion date carries no penalty for default, contractors are urged to recognize their responsibility to complete the work on or ahead of schedule.

1.05 SUBSTANTIAL COMPLETION

The Architect will inspect the work to issue a **Certificate of Substantial Completion** and any related memorandum of incomplete or incorrect work which will allow Owner occupancy and full use of the renovated space.

1.06 USE OF SITE

The Contractor's operations and storage of materials and equipment shall be organized and secured to minimize establishment of an attractive nuisance and to prevent vandalism. The Contractor will assume the responsibility for protection of the work and any stored or stockpiled equipment and material.

The Contractor will designate and maintain, in coordination with the Owner, specific areas where material is to be stored and equipment set up. The Contractor will be required to ensure that infringement on adjacent spaces is avoided during progress of the work and that damage occurring to adjacent spaces shall be corrected immediately at no additional cost to the Owner. The Contractor shall confine the operations within the property owned, to include any roads or drives through public thoroughfares. Any damage to adjacent property, public or private, shall be corrected to the satisfaction of the injured party at no additional cost to the Owner.

1.07 ARCHITECT AND CONSULTANTS

The Architect for the Project is **Busch Architects, Inc.**, 807 Broadway St NE, Suite 20, Minneapolis, Minnesota 55413. Telephone: (612) 333-2279.

1.08 PERMITS, FEES AND NOTICES

Building Permit. The General Contractor will secure and pay for all required building permits for the Project. The Contractor will not be allowed to commence work on the Project until all permits are received. Fees shall include the building permit fees, plan check fees, State surcharge, and other fees customarily charged for the building permit. The Contractor and all Subcontractors are to include permits and fees in their bids. Applicable permits include, but may not be limited to, general building, electrical, mechanical, plumbing, sewers, and work within the street right-of-way.

Other Permits and Fees. Each contractor shall secure and pay for all other permits and governmental fees, licenses and inspections necessary for the proper execution of the Contract and which were legally required at the time the bids were received.

1.09 INSPECTION OF WORK OF OTHERS

Each Contractor shall inspect work of others which will receive or is adjacent to his Work before commencing his Work. Do not proceed until conditions which would result in a less than first class installation are satisfactorily corrected. Commencing work shall be constructed as acceptance of the work of others by the contractor as satisfactory to receive his Work.

1.10 INSPECTIONS AND TESTS

Where Contract Documents require inspections, tests or approvals of the Work to be made by an independent testing agency or laboratory or an independent professional consultant, the independent testing agency or laboratory or independent professional consultant shall be satisfactory to the Owner and the Architect.

End of Section

SECTION 01 23 00 - ALTERNATES

1.01 GENERAL INFORMATION

Bidders shall submit bids for each item listed below. See Bid Form for additional information. The amount of each alternate shall be stipulated in the space provided below.

The Owner reserves the right to reject all alternates or accept any alternates in any order or combination.

The following descriptions of the alternates describe the extent of the Work in general and are not intended to be a complete tabulation of the Work which may be affected by the alternates. Bidders shall carefully examine the Contract Documents and satisfy themselves as to the exact extent of the Work affected by the alternates. Contractor will be required to coordinate the related work and modify surrounding work as required. Detailed requirements may be specified in the various Sections of the Specifications.

1.02 ALTERNATES

Description of Alternates:
All items below are add or deduct alternates. Alternate bids will be accepted or rejected in any order that the Owner deems satisfactory to meet the project requirements, with bid amounts to be added to or deducted from the Lump Sum Base Bid.

1. **Alternate Bid No.** 1: In lieu of asphalt patching at bollard installation. Install 4" thick concrete pad w/ epoxy coated rebar. Perimeter of concrete pad to match canopy overhang. See section 03 30 00 Cast-in-place concrete. Provide price for each site as separate line item.

Bid Alt. #1 (Site 1) $_____
Bid Alt. #1 (Site 2) $_____

End of Section

SECTION 03 11 00 – ROUND CONCRETE FORMING

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 cast-in-place concrete column forms including earthwork, formwork, concrete materials, mixture design, placement procedures, and accessories, for the following:

1. Bollard/Post Footings

1.3 REFERENCES

A. ACI 301 – Standard Specification for Structural Concrete.

1.4 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Waterstops.
6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Semirigid joint filler.
11. Joint-filler strips.
12. Repair materials.

1.6 QUALITY ASSURANCE

A. Column Formwork and Form Accessories: ACI 301, unless otherwise specified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage:

1. Store forms in accordance with manufacturer's instructions.
2. Store forms vertically in dry area.

3. If forms stored horizontally, elevate a minimum of 10 inches above ground on supports running length if forms.
4. Protect forms from rain and excess moisture.
5. Do not dent, scratch, or damage interior coating.
6. Do not drop forms.

C. Handling: Protect forms during handling and erecting to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Sonoco, 1 N Second St, Hartsville, SC 29550 or approved equal

2.2 ROUND CONCRETE COLUMN FORMS

A. Concrete Column Forms: Sonotube Concrete Forms or approved equal.

1. Description: Multiple layers of 100 percent recycled paperboard, spirally wound, and laminated with adhesive.
2. Interior Surface: Smooth with spiral seam. Alathon release and moisture barrier coating.
3. Exterior Surface: Micryl moisture barrier coating.
4. Spiral Mark: Impart visible spiral mark on concrete columns.
5. 1-piece, 1-time-use forms.
6. Recyclable.
7. Inside Diameter: 12”- 18” (as indicated on Drawings).

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.

D. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

E. Deformed-Steel Wire: ASTM A 496/A 496M.

F. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

G. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:
   a. Fly Ash: ASTM C 618, Class F or C.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33. Provide aggregates from a single source.

C. Lightweight Aggregate: ASTM C 330.

D. Water: ASTM C 94/C 94M.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: 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 calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive column forms. Notify Architect if areas are not acceptable. Do not begin erection until unacceptable conditions have been corrected.

3.2 ERECTION

A. Place and brace column forms in accordance with manufacturer's instructions.

B. Erect forms at locations and to elevations as indicated on the Drawings.

C. Erect column forms plumb.

D. Avoid damaging interior surface of forms.

E. Waterproof and reinforce openings cut into forms.

F. Do not use forms that are out-of-round, deformed, damaged, or contain defects that could impair concrete surface.

G. Protect forms from rain and snow if work is delayed and forms have been positioned for placing concrete.

H. Place waterproof sheeting over top of forms to prevent dance to interior surface by rain or snow.

I. Do not allow forms to stand in water or snow before placing concrete.

3.3 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that are 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."

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. 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/D 1.4M, where required.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. 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.

3.5 PLACING CONCRETE

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 high-range water-reducing admixtures to mixture.

C. 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.

D. Cold-Weather Placement: Comply with ACI 306 R.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 for three successive days, 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.

E. Hot-Weather Placement: Comply with ACI 301 (ACI 305 R) and as follows:

1. 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. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.6 PROTECTION

A. Protect concrete columns during remaining construction by placing form halves loosely around columns and securing. Ensure concrete surface is fully dry.

End of Section 03 11 00

SECTION 03 30 00
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, including formwork, reinforcement, vapor retarder, joint dowels, concrete materials, mixture design, placement procedures, finishes and all related accessories, for the following:

1. Slabs-on-grade/Concrete Equipment Pad

B. Related Sections:
1. 03 11 00 Round Concrete Forming

1.3 REFERENCES

A. American Association of State Highway and Transportation Organization (AASHTO): M182 Burlap Cloth made from Jute or Kenaf.

B. American Concrete Institute (ACI):
1. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 214 - Recommended Practice for Evaluation of Strength Test Results of Concrete.
3. ACI 301 - Specifications for Structural Concrete for Buildings.
4. ACI 302 – Guide for Concrete Floor and Slab Construction.
5. ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete.
6. ACI 305 - Hot Weather Concreting.
7. ACI 306 - Cold Weather Concreting.
8. ACI 308 – Standard Practice for Curing Concrete.
9. ACI 308.1 – Standard Specification for Curing Concrete.
10. ACI 309 - Guide for Consolidation of Concrete.
11. ACI 318 - Building Code Requirements for Structural Concrete.

C. American Institute of Steel Construction (AISC): Code of Standard Practice for Buildings and Bridges.

D. American National Standards Institute (ANSI): NSF Standard 61.

E. American Plywood Association (APA) - Product Standard PS1, Construction and Industrial Plywood.

F. American Society for Testing and Materials (ASTM).

G. Council of American Structural Engineers of Minnesota (CASE/MN): Guideline for Special Structural Inspection and Testing.

H. Concrete Reinforcing Steel Institute (CRSI):

1. Manual of Standard Practice.
2. Placing Reinforcing Bars.

I. International Building Code (IBC).

J. Minnesota State Building Code (MSBC).

K. National Ready Mixed Concrete Association (NRMCA): Certification of Ready Mixed Concrete Production Facilities.

L. Portland Concrete Association (PCA): Sandblasting of Concrete Surfaces IS 180T.

1.4 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag; 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. Waterstops.
5. Bonding Agents.
6. Adhesives.
7. Synthetic fibers.

B. Shop Drawings: Submit in accordance with ACI 315, “Standards on Details and Detailing of Concrete Reinforcement”.
1. Provide 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. 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).
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 and other additions.

5. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

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

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

C. Joint Sealers and Curing Materials: Deliver in original factory packaging and unopened containers and protect from damage and contamination.

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, approved equal products may be incorporated into the Work
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. 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.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

C. 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.

D. 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.

2.3 STEEL REINFORCEMENT

A. Epoxy-Coated Reinforcing Bars: #4 ASTM A 615, Grade 60, deformed bars, ASTM A 775, epoxy coated.
   1. Install #4 epoxy coated bars every 1'-0" each way.
   2. Install between 2"-3" from slab base. Ensure minimum of 3" from top of slab.

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 epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

C. 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.

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.

2.6 CONCRETE MATERIALS

A. Cementitious and Pozzolanic Materials: Use the following materials, of the same type, brand, and source for each required type of concrete and on which selection of concrete proportions was based:
   1. Portland Cement: ASTM C 150, Type IL.
      a. Use white Portland cement where indicated for decorative concrete such as, colored concrete, or other applications noted by Architect.
      b. For exposed concrete, use same brand throughout.

   2. Fly Ash: ASTM C 618, Class C or F, and as specified herein.
      a. Available Alkalis, as Na_2O equivalent: 1.5% maximum
      b. Loss On Ignition (LOI): 1% maximum
      c. Calcium Oxide Limit (CaO): 20% maximum
   3. Replacement Ratio: Portland cement shall be replaced on an equal mass (not weight) basis. Material replacements shall be expressed as a percent, by mass, of the total

cementitious materials content, with proportions selected for 28 day compressive strengths equal to those specified. The change in volume resulting from the substitutions shall be determined and an adjustment in both coarse and fine aggregate proportions shall be determined in order to ensure a unit volume.

a. Fly Ash replacement shall not exceed 30% for Class C, 20% for Class F, or as specified for a particular mix design.

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

1. Coarse Aggregate: Minimum Class Designation:
   a. Class 3S Typical
   b. Class 4S Exterior horizontal concrete
      1) Maximum absorption 1.7%
   c. Class 5S Exterior exposed architectural concrete
      1) Maximum absorption 1.7%
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94 and potable.

2.7 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.

C. Water-Reducing Admixture (WRA): ASTM C 494, Type A.

D. Mid-Range Water-Reducing Admixture (MRWRA): ASTM C 494, Type A.

E. Polycarboxylate High-Range Water-Reducing Admixture (HRWRA): ASTM C 494, Type F.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type B and D.

G. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E.

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

2.8 CURING, CLEANING, AND SEALING MATERIALS

A. Water Cure:

1. Waterproof paper.
2. Reef Industries: Transguard Economy Grade. (ASTM C 171, 20-mils thick, polypropylene sheet with nonperforforated 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.

B. Water: ASTM C 94 and potable.

C. 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. ChemMasters; Spray-Cure & Seal Plus.
      b. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
      c. Euclid Chemical Company; Super Diamond Clear.
      d. L&M Construction Chemicals, Inc.; Lumiseal Plus.
      e. Meadows, W. R., Inc.; CS-309/30.
      f. SpecChem, LLC; Cure & Seal 25 UV

D. 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.
      g. SpecChem, LLC; Cure & Seal WB 25

2.9 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. Interior Joint Sealer: Mameco, Vulkem 45.

E. Interior Bond Breaker Joint: 30 pound asphalt felt, unperforated.

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 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.
7. Water shall not be added to the mix after any supplemental water reducing admixtures have been dosed into the mixer.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. 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 Exterior 0.47 Interior
Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F GGBFS	 85% maximum 0% - 40% 0% - 20%
Minimum Top Size Aggregate	¾" inch
Coarseness Factor	52 - 70
Workability Factor	32 - 40
Air Content (at point of placement) for slabs exposed to freezing and thawing	5.5% (± 1.5%)

B. 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	 85% maximum 15% 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 FORMWORK

A. 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. Contractor's licensed specialty structural engineer shall design formwork to satisfy applicable codes and all imposed loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class C, 1/2 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. 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.

F. Chamfer exterior corners and edges of permanently exposed concrete.

G. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.4 REMOVING AND REUSING FORMS

A. General: Formwork for sides of footings, foundation walls, 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 12 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

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.

3.5 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."

3.6 REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" and accepted shop drawings for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. 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.

D. 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.

E. Maximum bolster spacing shall not exceed 36 inches for #4 support bar or 48 inches for #5 support bar.

F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

G. Steel reinforcement partially embedded in concrete shall not be field bent, except as indicated or permitted by Structural Engineer.

3.7 REINFORCEMENT 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.

3.8 JOINTS

A. 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. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

B. 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. 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.

2. Provide cleanly cut, straight joints in toppings over joints in base slab.

C. 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, 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.

3.9 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 allow concrete to drop freely more than 4 feet.
4. Use approved chutes equipped with suitable hoppers for placing where required.
5. Place at rate that concrete is always plastic and flows readily into every space.

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. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
5. Maintain reinforcement in position on chairs during concrete placement.
6. Do not insert vibrators to bottom of slabs-on-grade with underfloor vapor retarders to avoid damaging this membrane.
7. Screed slab surfaces with a straightedge and strike off to correct elevations.
8. Slope surfaces uniformly to drains where required.
9. 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. 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.

G. 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.

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

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

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

3.10 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.

3.11 HOT WEATHER CONCRETING

A. Hot-Weather Placement: Comply with ACI 305 and as follows:
   1. When high temperature, measured on jobsite at concrete placement area, is expected to rise above 90 deg F, maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. When temperature of steel reinforcement, embeds, subgrade, or forms is greater than 120 degrees F, fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
   3. Protect concrete from wind and direct sunlight to avoid rapid drying.
   4. Apply evaporation retarder to unformed concrete surfaces if the air temperature exceeds 80 degrees F, the wind speed exceeds 10 mph, or the relative humidity is less than 40%. Apply according to manufacturer's written instructions immediately after placing and screeding.
   5. Apply moisture retaining covers or wet cure in accordance with concrete curing and protection methods as specified.

3.12 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. Wetting the concrete surface during finishing operations is prohibited.

C. Power floating with troweling machines equipped with normal trowel blades is prohibited.

D. Protect finished surfaces from damage. Keep free of abrasive materials.

E. 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. Slope exterior slabs ¼” where allowed by equipment tolerances. Slope a minimum of 1/8” away from building perimeter.

F. 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 1/8-inch.

G. 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.

H. General Finishing Requirements: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces as appropriate to attain slab finish specified.

3.13 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. 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.

3.14 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. 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.

3.15 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. Formed Surfaces: Cure formed concrete 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.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, and other surfaces.

D. 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 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.

E. 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.

F. Curing and Sealing Compounds shall not be used on concrete surfaces to receive adhered coverings without prior manufacturer certification that it will not interfere with bonding of floor covering and warranties of flooring installer are validated.

G. 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.

3.16 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 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 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

END OF SECTION 03 30 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

This Section includes all labor, material, equipment, and related services necessary to furnish and install all Rough Carpentry as indicated on the drawings or specified herein.

The following work is specified under separate Sections:

1. Concrete formwork: Section 03 11 00 - Cast-in-Place Concrete.

This Section includes but is not limited to:

1. Roof sheathing and fascia.
2. Exterior framing and sheathing.
3. Miscellaneous wood framing and wall sheathing.
4. Wood blocking.

1.02 REFERENCES

1. ALSC: American Lumber Standards Committee: Softwood Lumber Standards.
2. APA: American Plywood Association.
3. AWPA: American Wood Preservers Association; C1 - All Timber Products Preservative Treatment by Pressure Process.
4. NFPA: National Forests Product Association.
5. SPIB: Southern Pine Inspection Bureau.
6. WCLIB: West Coast Lumber Inspection Bureau.
7. WWPA: Western Wood Products Association.

PART 2 - PRODUCTS

2.01 LUMBER

Lumber shall conform to U.S. Product Standard PS20-70 and shall be grade stamped by an agency certified by the board of review of the American Lumber Standards Committee. Lumber shall be new, sound and thoroughly seasoned.

Moisture content of dimension lumber 2" or less in thickness shall be 19% or less at the time of installation and moisture content of finish lumber shall be not less than 14%. Lumber shall be dressed S4S, unless otherwise specified. Grades and species of lumber shall be as follows:

Blocking, nailers, blind fascia, and framing lumber: Standard light framing grade Douglas Fir larch, Douglas Fir (South) Hem-Fir, Spruce-pine-Fir, Western Hemlock, or other approved and comparable wood.

Boards/Beams/Posts: No. 2 and Better Common or Construction Grade Ponderosa Pine, Sugar Pine, or other approved and comparable wood.

All exterior use lumber is to be pressure treated for above grade conditions.

2.02 PLYWOOD

Plywood shall conform to "U.S. Product Standard for Construction and Industrial Plywood", PS 1`-83. Performance rated panels shall conform to the applicable American Plywood Association (APA) performance standard contained in the "Performance Standards and Policies for Structural-use Panels", Form No. E445, November 1982. Panels shall bear the appropriate APA Trademark.

Plywood with any face or edge permanently exposed to the weather shall be Exterior Grade.

Grade and type shall be as follows:

Roof Sheathing: APA Rated Sheathing, Exposure 1, 48/24, all veneer plywood, 3/4" thick as shown on drawings.

2.03 ROUGH HARDWARE

Provide rough hardware of the proper size, type and strength for the intended use and the material to be fastened. Use non-corrosive, non-staining rough hardware for exterior applications.

Rough Hardware shall conform to the appropriate Federal Specifications.

Provide anchor bolts indicated on the drawings or otherwise required to attach wood plates and bucks to concrete. Bolts shall be 1/2" in diameter and threaded one end with a 1.5" right-angle bend on the opposite end. Coordinate installation of bolts with masonry or concrete Contractors and deliver to the site promptly to be built in as the work progresses.

Metal Fasteners: All fasteners, anchors, and hangers to be exterior-rated intended for the conditions in which they are to be installed.

Manufacturer: Simpson Strong-Tie or approved equal.
Products: Included but not limited to KBS1Z, LPCZ, EPCZ, LUS28(-2), ABA66Z or approved equal.

2.04 PRESERVATIVE TREATMENT

Lumber and plywood listed below shall be pressure impregnated with a water-born preservative in accordance with the American Wood Preservative Bureau (AWPB) Standard LP - 2-80.

1. Lumber used as plates in or on exterior walls.
2. Lumber or plywood where indicated on the drawings to be preservation treated.
3. Lumber or plywood installed against concrete or masonry surfaces.
4. Lumber or plywood required to be preservation treated by the Building Code.

Fabricate lumber insofar as possible before treatment. Dry lumber to a moisture content of not less than 19% after treatment.

PART 3 - EXECUTION

3.01 WORKMANSHIP

Work shall be accurately constructed, square, true to required levels and lines and securely fastened and anchored to produce a sturdy, rigid system of sufficient strength to support the loads. Application of plywood shall be in accordance with the recommendations of the American Plywood Association.

Plywood sheathing over wood stud: Install plywood sheathing vertically. Edge joints shall occur over studs. Leave a 1/8" space between panel edges. Nail to studs using 8d coated nails 6" on center at panel edges and 12" on center at intermediate studs.

Plywood roof sheathing over wood beams/roof structure: Install plywood sheathing perpendicular to beams. Edge joints shall occur over chords. Leave a 1/8" space between panel edges. Nail to beams using 10d coated nails 6" on center at panel edges and 12" on center at intermediate studs.

Plywood roof sheathing shall be blocked under all edge joints.

Blocking: Furnish and install wood blocking, bucks, nailers, and similar items securely, accurately, and ready to receive the intended finish.

Furnish and install wood curbs, cants, fascias, blocking and other similar items in conjunction with roofing and sheet metal work. Materials and installation shall meet the requirements of the roofing and sheet metal subcontractors.

Protect curbs, cants, and blocking with a weathertight covering until finishes are securely in place.

End of Section

SECTION 07 31 00 - ASPHALT MATERIALS

PART 1 - GENERAL

1.01 CONDITIONS OF THE CONTRACT

Drawings and general provision of Contract, including General and Supplementary Conditions and other Division 0 and 1 Specification Sections, apply to work of this section.

1.02 SUMMARY

A. This Section includes all labor, material, equipment, and related services necessary to furnish and install all asphalt shingles indicated on the Drawings or specified herein.

The following work is included in this section:

1. Installation of new shingles, underlayment, and flashings.
2. Installation of ridge vent and flashing around roof penetrations.

Related Sections:

1. Section 07 62 00 - Flashing and Sheet Metal.

1.03 STANDARDS

American Society for Testing and Materials (ASTM) – Annual Book of ASTM Standards

Work shall conform to the National Roofing Contractors Association (NRCA) "Steep Roofing Manual" Latest Edition, unless otherwise specified herein.

1. ASTM A 653/A 653M – Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM D 3018 - Standard Specification for Class A Asphalt Shingles Surfaced with Mineral Granules.
4. ASTM D 3161 - Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method).
5. ASTM D 3462 – Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.
6. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
7. ASTM D 7158 - Standard Test Method for Wind-Resistance of Sealed Asphalt Shingles (Uplift Force/Uplift Resistance Method).
8. UL 997 - Wind Resistance of Prepared Roof Covering Materials.
9. UL 2218 – Impact Resistance of Prepared Roof Covering Materials.
10. UL 790 – Standard Test Methods for Fire Test of Roof Coverings

B. Asphalt Roofing Manufacturers Association (ARMA)
C. National Roofing Contractors Association (NRCA)
D. American Society of Civil Engineers (ASCE)

1. ASCE 7 – Minimum Design Loads for Buildings and Other Structures.

1.04 RELATED WORK

A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual for definitions of roofing terms related to this section.

1.05 SUBMITTALS

A. Submit copies of product data sheets, manufacturer’s warranty, detail drawings and samples for each type of roofing product.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide all primary roofing products, including shingles, leak barrier, ridge and exhaust vent, and accessories, by a single manufacturer.
B. The Manufacturer shall provide a document that states, in effect: “All roofing products are free of asbestos fibers.”
C. Installer Qualifications: Roofing systems shall be installed by a Manufacturer Trained/Certified Installer/Contractor only, in a manner that will maintain the manufacturer’s warranty.
D. Installer must be approved for installation of all roofing products to be installed under this section.

1.07 REGULATORY REQUIREMENTS

A. Provide a roofing system achieving an Underwriters Laboratories (UL) Class B fire classification.
B. Install all roofing products in accordance with all federal, state, and local building codes.
C. All work shall be performed in a manner consistent with current OSHA guidelines.

1.08 DELIVERY, STORAGE, AND HANDLING

A. No storage is available on site overnight without Owner’s written permission. Any items allowed to be stored on site overnight shall be stored only in Contractor’s locked shipping container, or similar.
B. Store all products in the manufacturer’s unopened, labeled packaging until they are ready for installation.
C. One parking space for a securely locking storage trailer will be allowed overnight for the Contractor’s on-site storage. Coordinate with Owner. The contractor shall provide according to their needs. This is incidental to the Work.
D. Store products in a covered, ventilated area, at a temperature of not more than 110 degrees F (43 degrees C): do not store near steam pipes, radiators, or in direct sunlight.
E. Store bundles on flat surface. Maximum stacking height shall not exceed GAF®’s recommendations. Store all rolls on end.
F. Store and dispose of solvent-based material, and all removals, is in accordance with all federal, state, and local regulations.

1.09 WEATHER CONDITIONS

A. Proceed with work only when existing and forecasted weather conditions will permit work to be performed in accordance with Manufacturer’s recommendations.

1.10 WARRANTY

Shingle Roof System (Shingles, leak barrier, and related components):

1. Provide to the Owner a Manufacturer’s Warranty for Manufacturing defects: Furnish a manufacturer’s 40-year Limited Warranty including 5-year Smart Choice Protection Period.
2. Shingles shall be warranted against algae discoloration for 10 years.

B. Provide a one-year corrective work warranty for all manufacturer and workmanship errors: 100% coverage for all roof issues, to be corrected at Contractor’s expense, for two years.

PART 2 – PRODUCTS

2.01 MATERIALS

APPROVED MANUFACTURERS: GAF®, 1361 Alps Rd. Wayne NJ 07470. Tel: 1-973-628-3000; Certainteed or Owens-Corning.

Basis of Design: GAF® Deck-Armor or an equal approved in writing by the Architect.

HIP AND RIDGE SHINGLES: N/A.

STARTER STRIP: N/A.

ICE AND WATER SHIELD (LEAK BARRIER): N/A.

SYNTHETIC FELT: GAF "DECKARMOR," premium breathable roof deck protection or equal approved by Architect. Polypropylene, UV stabilized, ASTM D226 and D4869.

BITUMINOUS PLASTIC CEMENT: N/A.

NAILS: N/A.

SHEET METAL EDGE, EAVE, VALLEY, AND STEP FLASHING: N/A.

SHEET METAL GUTTERS: N/A.

ROOF VENTS: N/A.

ROOF JACKS: N/A.

STORM COLLARS: N/A.

MANUFACTURER'S TOUCH-UP PAINT: N/A.

PART 3 - EXECUTION

3.01 APPLICATION OF SHINGLES

Protect existing construction and landscaping as required to minimize wear.

At the end of each day, remove all roofing debris from work area. Run a magnetic iron detector to collect loose nails and metal clippings from the site. Store all materials, equipment, and work aides securely minimizing disruption to site events and activities.

UNDERLAYMENT: Install GAF® DECKARMOUR, or an equal approved by the Architect, as shown on drawings and required by the Minnesota Building Code. Install Synthetic Felt over entire roof, including all valleys, hips, ridges, and eaves. Begin Ice and Water Shield at the lowest point of the sloped roof and lap over the proceeding layer a minimum of 6". At valleys install a 3'-0" wide section of Synthetic Felt beginning at the bottom of the valley and extend it up the valley centering the section at the center of the valley. Lap horizontal eave Ice and Water Shield over the valley section a minimum of 6". At vent pipes, install a 24-inch square piece of over-lapping leak barrier, seal tightly to pipe. At vertical roof edges, install over-lapping leak barrier around entire vertical structure extending at least 6 inches up the wall and 12 inches on to the roof surface.

VALLEYS: N/A.

SHINGLES: N/A.

RIDGE and VERTICAL WALL VENTILATION: N/A.

EDGE, STEP AND EAVE FLASHING: N/A.

PLIMBING VENTS AND MECHANICAL EQUIPMENT: N/A.

GUTTERS: N/A.

HIPS: N/A.

CLEANING, PROTECTION AND DAMAGE REPAIR: N/A.

TOUCH-UP: N/A.

REPAIRS: N/A.

EXTRA STOCK: N/A.

End of Section

SECTION 07 41 13 - METAL ROOF PANELS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Architectural metal roof panels, including trim accessories.

B. Related Sections: Section(s) related to this section include:

1. 06 10 00 Rough Carpentry
2. 07 62 00 Sheet Metal Flashing

1.2 REFERENCES

A. General: Standards listed by reference form a part of this specification section. Standards listed are identified by issuing authority, abbreviation, designation number, title or other designation. Standards subsequently referenced in this Section are referred to by issuing authority abbreviation and standard designation.

B. ASTM International:

1. ASTM A 792 - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
2. ASTM D 2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
3. ASTM D 4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
4. UL 263 - Fire Tests of Building Construction and Materials.
5. UL 580 - Tests For Uplift Resistance of Roof Assemblies.
6. UL 790 - Standard Test Methods for Fire Tests of Roof Coverings.
7. UL 2218 - Impact Resistance of Prepared Roof Covering Materials.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Conduct preinstallation meeting to clarify Project requirements, substrate conditions, manufacturer’s installation instructions and manufacturer’s warranty requirements.

1.4 ACTION SUBMITTALS

A. Product Technical Data: For each type of product required, including manufacturer's preparation recommendations, storage and handling requirements, and recommended installation methods.

B. Samples: Selection and verification samples for finishes, colors and textures. Submit two complete sample sets of each type of panel, trim, clip and fastener required.

C. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.

D. Test and Evaluation Reports: Showing compliance with specified performance characteristics and physical properties.

E. Qualifications Statements: For manufacturer and installer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For installed products including maintenance methods and precautions against cleaning materials and methods detrimental to finishes and performance.

B. Warranty: Warranty documents required in this section.

1.6 MAINTENANCE MATERIAL

A. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 01 Closeout Submittals Section.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Provider of advanced installer training.
2. Provider of products produced in a permanent factory environment with fixed roll-forming equipment.

B. Installer Qualifications: Experienced installer with successfully completed projects of a similar nature and scope.

1.8 DELIVERY, STORAGE AND HANDLING

A. General: Comply with manufacturer’s current printed product storage recommendations.

B. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Storage: Store materials above ground, under waterproof covering, protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer. Provide proper ventilation of metal panel system to prevent condensation build-up between each panel and trim or flashing component. Tilt stack to drain in wet conditions. Remove strippable plastic film before storage under high-heat conditions. Store products in manufacturer's unopened packaging until just prior to installation.

D. Handling: Exercise caution in unloading and handling metal panel system to prevent bending, warping, twisting and surface damage.

1.9 WARRANTY

A. Special Exposed Panel Finish Warranty: Manufacturer's standard form PVDF (Fluorocarbon) System Warranty for film integrity, chalk rating and fade rating in which manufacturer agrees to repair or replace panels that show evidence of deterioration within specified warranty period.

1. Deterioration shall include but is not limited to:

a. Color fading of 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. Warranty Period: Film integrity for 45 years and chalk and fade rating for 35 years from date of Substantial Completion.
3. Manufacturer's warranty may exclude surface deterioration due to physical damage and exposure to salt air environments.

PART 2 - PRODUCTS

2.1 METAL ROOF PANELS

A. Basis of Design Product: Subject to compliance with requirements provide Metal Sales Manufacturing Corporation; PBR-Panel.

C. Product Options:

1. Panel coverage: 36 inches (914.4 mm).
2. Rib Height: 1-1/4 inches (31.8 mm).
3. Material: Aluminum-zinc alloy-coated steel sheet, ASTM A 792
4. Minimum Roof Slope Capability: 1:12.
5. Attachment: Exposed direct fastened panel.
6. Application: Designed for application over open framing or solid substrate.
7. Rib Configuration: Trapezoidal.
8. Surface Finish: provide samples for approval.
9. Color: match to existing roof/fascia/flashing. Provide samples from standard available options for approval by owner.
10. Fire Resistance Rating: Comply with UL 263 and UL 790 Class A Fire Resistance Ratings**.**
11. Wind Uplift Resistance: Comply with UL 580, Class 90 Wind Uplift, Construction #161.
12. Impact Resistance: Comply with UL 2218, Class 4.
13. Code and Testing Agency Approvals:

2.2 NOT USED

2.3 UNDERLAYMENT MATERIALS

A. Products: APOC 9mil Gator-Skin Synthetic Roof Underlayment or approved equal

2.4 NOT USED

2.5 NOT USED

2.6 SOURCE QUALITY CONTROL

A. Source: Obtain architectural metal roof panels, trim and other accessories from a single manufacturer.

B. Quality Control: Obtain architectural metal roof panels, trim and other accessories from a manufacturer capable of providing on-site technical support and installation assistance.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Examine metal panel system substrate and supports with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panel installation

3.2 PREPARATION

A. Substrate Board: Install substrate boards over roof deck and sheathing over entire roof surface using recommended fasteners.

B. Miscellaneous Framing: Install furring, eave angles, subpurlins, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's recommendations.

3.3 UNDERLAYMENT INSTALLATION

A. Apply slip sheet over underlayment prior to installing metal roof panels.

B. Install flashing in compliance with requirements in 07 62 00 Sheet Metal Flashing.

3.4 NOT USED

3.5 ARCHITECTURAL METAL ROOF PANEL INSTALLATION

A. General: Comply with panel manufacturer’s installation instructions including but not limited to special techniques, interface with other work, and integration of systems.

B. Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and using proper fasteners as recommended by panel manufacturer.

3.6 ACCESSORY INSTALLATION

A. General: Install accessories using techniques recommended by manufacturer and which will assure positive anchorage to building and weather tight mounting. Provide for thermal movement. Coordinate installation with flashings and other components.

B. Flashing and Trim: Comply with performance requirements and manufacturer's written installation instructions.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: If requested by Owner, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.8 CLEANING

A. Remove temporary coverings and protection of adjacent work areas.

B. Repair or replace any installed products that have been damaged.

C. Clean installed panels in accordance with manufacturer's instructions prior to Owner's acceptance.

D. Remove and lawfully dispose of construction debris from Project site.

3.9 PROTECTION

A. Protect installed product and finish surfaces from damage during construction.

END OF SECTION

SECTION 07 46 43 – ENGINEERED WOOD SIDING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   a. Panel and Lap Siding
   b. Vertical siding
   c. Trim and Fascia
   2. Accessories

B. Related Requirements:

   1. Section 061000 “Rough Carpentry” for wood stud substrate support framing

1.02 DEFINITIONS

A. Treated Engineered Wood: Engineered wood product manufactured for exterior use treated with manufacturer’s proprietary process to resist fungal decay and termite damage.

1.03 COORINATION

A. Coordination engineered wood siding installed with flashing, trim, and construction of other adjoining work to ensure proper sequencing, construction progress, and to provide a leakproof, secure, and noncorrosive installation.

1.04 PREINSTALLATION MEETINGS

A. Coordination with Section 013100 “Project Management and Coordination”

B. Preinstallation Conference: Conduct conference at DII HHS Clinic in McGregor, MN
   1. Attendees: Installer and representative 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, to attend the meeting. Advise Architects, Construction Manager, and Owner of scheduled meeting dates and times a minimum of 14 days prior to meeting.
   2. Agenda: Review progress of other construction activities and preparation for the particular activity under consideration, including requirement for the following:
   a. Schedule
   b. Responsibilities
   c. Critical path items
   d. Submittals

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product and component included in engineered wood siding system. Include the following:

   1. Construction details, material descriptions, dimensions of individual components and profile, and finishes or each type of product and accessory included in siding system.
   2. Installation methods, including nailing patterns
   3. Siding manufacturer’s requirements for products to be installed by others.
   4. Maintenance and periodic inspection recommendations.

B. Shop Drawings: For engineered wood siding.
   1. Include plans, elevation, section and attachment details
   2. Detail expansion joints, material joints, angles changes, flashing, and abutment to adjacent Work.
C. Samples for Initial Selection: For engineered wood siding, including related accessories
D. Samples for Verification: For each type, color, texture, and pattern required
   1. 6-inch (152 mm) long Sample of engineered wood siding and trim
E. Sustainable Design Submittals:
   1. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer
   2. Environmental Product Declaration (EPD): For each product.

1.06 INFORMATION SUBMITTALS

A. Qualifications: For Installer
B. Product Test Report: For each product, APA test performed by a qualified testing agency.
C. Evaluation Reports: For engineered wood siding system, from ICC-ES in compliance with AC321.
D. Sample warranties

1.07 CLOSEOUT SUBIMITTALS

A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.08 QUALITY ASSURANCE

A. Installer Qualification: Installers trained by siding manufacturer
B. Panel to comply with HUD-UM-40c – HUD Building Product Standards and Certification Program for Plywood and Other Performance Rated Wood-Based Structural-Use Panels

1.09 MOCKUPS

A. Building mockups to verify selection made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation
   1. Building mockup of typical wall area as indicated on Drawings including corner, trim, fascia, supports, attachments, and accessories
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver components and other manufactured items so as not to be damaged or deformed. Package components for protection during transportation and handling with manufacturer’s name and identification of products.
B. Unload, store, and erect components in a manner to prevent bending, wrapping, twisting, and surface damage. Maintain slip sheet until piece is being prepared for installation.
C. Store components on flat surfaces clear of the ground. Store under roof or covered with suitable weathertight and ventilated covering, and in accordance with manufacturer's written instructions.

1.11 WARRANTY

A. Manufacturer's Trim and Siding Limited Warranty: Manufacturer agrees to repair or replace components of engineered wood siding against substrate damage within specified warranty period.
   1. Substrate damage is defined as deterioration, buckling, and overlay issues caused by manufacturing defects or termite damage.
   2. Hail damage is defined as a crack or chip in the surface overlay, or product substrate dent exceeding 3/8 inch (10mm) in length or diameter and is caused by hail.
   3. Limited Warranty Period: 50 years from date of installation and written to Owner on date of installation

B. Manufacturer's Trim and Siding Pre-finish Limited Warranty: Manufacturer agrees to repair or replace component of pre-finished engineered wood siding against finish and substrate damage within specified warranty period.
   1. Substrate damage is defined as deterioration, buckling, or overlay issues caused by manufacturing defects or termite damage.
   2. Hail damage is defined as cracks or chips in the surface overlay or dent in the substrate of the product that exceeds 3/8 inch (10mm) in length or dimeter, and is caused by hail.
   3. Finish damage is defined as, under normal conditions and use, discoloring due to chalking, peeling, blisters, cracks; erosion to the extent of exposing the substrate; or yellowing or color fade change from light exposure not to exceed 5 Delta E CMC (2:1).
   4. Limited Warranty Period for Substrate: 50 years from date of installation and communicated to Owner on date of Substantial Completion.
   5. Limited Warranty Period for Finish: 15 years from date of installation and communicated to Owner on date of Substantial Completion.

C. Manufacturer's Accessories and Non-Standard Applications Limited Warranty: Manufacturer agrees to repair or replace components of manufacturer's accessories and when used in approved non-standard applications against substrate and finish damage within specified warranty period.
   1. Substrate damage is defined as deterioration, buckling, or overlay issues caused by manufacturing defects or termite damage.
   2. Hail damage is defined as cracks or chips in the surface overlay or dent in the substrate of the product that exceeds 3/8 inch (10mm) in length or diameter, and in caused by hail.
   3. Finish damage is defined as, under normal conditions and use, discoloring due to chalking, peeling, blisters, cracks; erosion to the extent of exposing the substrate; or yellowing or color fade change from light exposure not to exceed 5 Delta E CMC (2:1)
   4. Limited Warranty Period for Substrate and Finished: 10 years from date of installation and communication to Owner on date of Substantial Completion

PART 2 PRODUCTS

2.01 SOURCE LIMITATIONS

A. Provide components and materials specified in this Section from single manufacturer for a complete and compatible assembly

2.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide engineered wood siding systems tested to APA PS2 and PRP 10, in compliance with [IBC Section 2308.9.3, Table 2308.9.3(5)] [IRC Section R602.10, Table

R602.10.2], and certified to be without permanent deformation or failure of structural members in accordance with design wind velocities for Project geographic location and probability of occurrence based on data from wind velocity maps provided in ASCE 7 and as approved by authorities having jurisdiction (AHJ)

1. Design Loads: As indicated on Drawings.

B. Structural: Test in accordance with FL TAS 202 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits
2. Minimum test duration in accordance with FL TAS 202 is 10 seconds, which is historically U.S. practice.
3. Test Duration: As required by design wind velocity, but not less that 10 seconds.

C. Fire-Resistance Performance: Comply with ASTM E119 for testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency acceptable to AHJ.

1. Surface-Burning Characteristics: Provided engineered wood siding system with a Class C flame-spread index of 76 to 200 or less and a smoke-developed index of 0 to 450 or less when tested in accordance with ASTM E84 and UL 723

D. Ther mal Movement Performance: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.

E. Certified Wood: Wood products to be labeled in accordance with the AF&PA's Sustainable Forestry Initiative, or be certified and labeled in accordance with the standards of the Programme of Endorsement of Forest Certification.

F. Certified Wood: Wood products to be certified in accordance with the American Tree Farm System "AAF Standard," the AF&PA's Sustainable Forestry Initiative, or the standards of the Programme for Endorsement of Forest Certification.

G. Composite Wood Product to be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emission from Composite Wood Product" or made with no added formaldehyde.

H. Composite Wood Product: Products to be made without added urea formaldehyde.

2.03 ENGINEERED WOOD SIDING

A. Basis-of-Design Product: Subject to compliance with requirements, provide Louisiana-Pacific Corporation; LP SmartSide Trim & Siding and ExpertFinish Trim & Siding or comparable product by one of the following:

1. Allura
2. James Hardie

B. Treated Engineered Wood Panel Siding: Exterior-grade, resin-saturated, paper overlay laminated to EPA-registered zinc-borate-treated engineered wood siding. Exposed edge beveled and sealed for moisture resistance. Manufacturer's acrylic finish.

1. Basis-of-Design product: Subject to compliance with requirements, provide Louisiana-Pacific Corporation; LP SmartSide Panel Siding, [38] [76] [190] Series or comparable product
2. Thickness: 0.345 inch (8.9mm)
3. Edges: Square
4. Color: to match existing; obtain owner approval
5. Texture: Cedar

2.04 ACCESSORIES

A. Fasteners: Hot-dipped galvanized nails, with 0.092 inch (2.3 mm) diameter shank, in length required to penetrate [wood structural panels and] structural framing a minimum of 1-1/2 inches (38mm), as recommended in writing by composite siding system manufacturer suitable for and compatible with system materials. Larger diameter fasteners may be required depending on wind pressure, wind speed, and wind exposure category limitation for structures in product approvals PR-N124 or ESR-1301

B. Sealant: ASTM C920, minimum Class 25 sealant

C. Water-Resistive Barrier: ASTM D226 or other approved water-resistive barrier

D. Air Barrier: ASTM E1677

1. Seam Tape: Air barrier manufacturer's standard product

E. Non-Compressible Drainable Housewrap:

1. Non-compressible type with a minimum 40-mil (1mm) drainage gap not reduced by force of fastening during siding installation
2. Drainable housewrap type that removes bulk water by creating a minimum 40-mil (1mm)
3. Drainage gap (air gap) at individual measurement points between housewrap and back of siding

F. Flashing

1. Provide flashing at window and door heads and where indicated on Drawings. Refer to Division 07 for sheet metal flashing
2. Material: Aluminum
   a. Finish: Siliconized polyester coating
   b. Finish: High-performance organic finish
   c. Finish: Factory-prime coating

PART 3 INSTALLATION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, engineered wood siding system supports, and other conditions affecting performance of the work

1. Examine all framing to verify that support member and anchorage have been installed within alignment tolerances required by engineered wood siding manufacturer
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by engineered wood siding manufacturer
   a. Verify that air and moisture barrier has been installed over sheathing substrate to prevent air infiltration and water penetration

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

3.02 INSTALLATION

A. General: Install engineered wood siding in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated. Anchor engineered wood siding and other components of the work securely in place.

1. Shim or otherwise plumb substrates receiving engineered wood siding system.
2. Flash engineered wood siding at perimeter of all openings
3. Locate and space fastenings in uniform vertical and horizontal alignment
4. Seal engineered wood substrate exposed in weather to prevent moisture intrusion and water buildup
   a. Seal around penetrations
   b. Seal each exposed cut of siding and trim. It is not recommended to field spray-applied coatings on cuts
   c. Seal each butt joint from weather by covering with joint moldings, sealant, or factory prefinished ends
5. Install flashing and trim as engineered wood siding work proceeds
6. Align bottom of engineered wood siding
7. Provide weathertight escutcheons for pipe and conduit-penetrating engineered wood siding system.

B. Mental Protection: Where dissimilar metal flashing contact each other or corrosive substrates, protect against galvanic action as recommended in writing by siding manufacturer

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashing and other components.

D. 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. Install work with laps, joints, and seam that are permanently watertight
   1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and level indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance

E. Replace engineered wood siding components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 62 00 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SUMMARY

This Section includes all labor, material, equipment, and related services necessary to furnish and install all flashing and sheet metal indicated on the Drawings or specified herein.

The following work is included in this section:

1. Pre-finished metal flashing.
2. Synthetic underlayment

1.02 REFERENCES

ASTM A525 - Steel Sheet, Zinc coated, (Galvanized) by the hot-dip process.

NAAM - Metal Finishes Handbook.

NRCA (National Roofing Contractor's Association) - Roofing Manual.

SMACNA - Architectural Sheet Metal Manual.

1.03 SUBMITTALS

Submit shop drawings and product data. Describe material profile, jointing pattern, joining details, fastening methods, finish information and installation details. Submit color samples of actual sheet metal match recommendations for owner review/approval.

1.04 QUALITY ASSURANCE

Perform work in accordance with SMACNA standard details and requirements.

1.05 WARRANTY

Installer: Flashing and sheet metal work shall be warranted by the installer for five years. The contractor shall maintain systems and repair all defects that result from faulty workmanship or defective materials without further cost to the university, including replacing any wet insulation or other damaged materials caused by such defects.

Manufacturer: Provide a 20-year written manufacturer’s warranty for pre-finished sheet metal to cover color fade, chalk, and film integrity.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sheet Metals:

- **a.** Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable temporary protective film during fabrication, delivery, storage, and installation.
- **b.** **Manufacturers**: Dalsin Industries, Foremost Manufacturing or approved equal.
- **c.** Zinc-Coated (Galvanized) Steel sheet
  - **i.** G90 coating designation
  - **ii.** 24 ga

iii. Pre-painted via coil-coating process to comply with ASTM A755
iv. Color: Match existing fascia/flashing. Provide samples from standard color options for owner review/approval.

d. Furnish manufacturer's standard touch-up paint for field touch up of fasteners and abrasions.

B. Underlayment Materials: APOC 9mil Gator-Skin Synthetic Roof Underlayment or approved equal

C. Miscellaneous Materials:

a. Provide materials and type of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufacturered items unless otherwise indicated.
b. Screws and other fasteners for use with prefinished sheet metal shall be galvanized steel rated for exterior use/exposure. Furnish matching coated rivets and screws.
c. **Polyurethane Sealant** shall be a one component polyurethane sealant conforming to Fed Spec. TT-S-00230C (2): Mameco VULKEM 116, Siks SIKAFLEX-1a or Sonneborn SONALASTIC NP1.

2.02 FABRICATION

Custom fabricate sheet metal flashing and trim to comply with recommendations is SMACNA's " Architectural Sheet metal Manual" that apply to design, dimensions, geometry, metal thickness and other characteristics of time indicated. Fabricate items at the shop to greatest extend possible.

Obtain field measurements for accurate fit before shop fabrication.

Work shall be accurately formed with brakes straight, true, and sharp. Plain surfaces shall be free from waves and buckles. Profiles shall match evenly and exactly at connections.

Exposed edges shall be beaded or returned for strength and appearance. Provide ribs, cleats, and reinforcement necessary to make the sections rigid and substantial. Allow for expansion and contraction.

Seams shall overlap in the direction of flow. Finished width of lock seams and soldered lap seams shall not be less than 1" and finished width of unsoldered lap seams shall be not less than 3".

Locate joints of sheet metal flashings exposed to view with respect to windows, control joints and other architectural features as indicated on the Drawings or directed by the Architect. Use concealed cover plates.

Generally, shop joints in prefinished sheet metal shall be lapped and riveted. Field joints shall be designed to permit expansion. Use joint covers or lapped joints with "s" clips, and do not solder.

Corners shall be shop formed pieces. Shop joints of prefinished sheet metal shall be lapped, riveted, and caulked. Field joints shall be located not less than 12" or more than 3 feet from actual corner.

Fabricate prefinished sheet metal to be installed using concealed clips or other concealed fasteners where possible. Form joints and hem edges to conceal uncoated edges of metal. Handle prefinished sheet metal with care to prevent scratching or damaging the coating.

PART 3 - EXECUTION

3.01 INSTALLATION

Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement so that completed sheet metal flashing and trim shall not rattle, leak, or loosen and shall remain watertight. Use fasteners solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

Coordinate work with other contractors, and properly schedule sheet metal work.

Install sheet metal work neatly and securely anchor into place. Anchor work and form joints properly to permit expansion and contraction. Overlap seams in direction of flow, and slope horizontal surfaces for drainage. Seal all metal joints. Finished work shall be neat and weathertight.

Dissimilar metals shall not be placed in contact or in position where drainage will occur across them.

Install prefinished sheet metal with concealed clips and other concealed fasteners. Form joints and hem edges to conceal uncoated edges.

Space cleats not more than 12” apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

Install underlayment wrinkle free. Comply with temperature restrictions of underlayment manufacture for installation. Apply in shingle fashion to shed water, with end laps of not less than 6” staggered 24” between courses. Overlap side edges not less than 3.5”. Roll laps with roller. Cover underlayment within 14 days of install. Provide temporary slip sheets following install.

Seal joints as shown and as required for watertight construction. Clean and prime surfaces and apply sealant strictly according to the sealant manufacturer's recommendations.

After installation of prefinished metal is complete, touch up scratches, abraded areas, and exposed fasteners with manufacturer's touch up paint.

Remove temporary protective coverings and strippable films as installed unless otherwise indicated in manufacturer’s written installation instructions. Clean and neutralize flux materials. Clean off excess solder and sealants. Clean exposed surfaces with mild soap and water as necessary to remove dirt and stains

End of Section

SECTION 32 10 00

PLANT MIX BITUMINOUS PAVEMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
  1. Plant mix bituminous pavement

1.02 SUBMITTALS

A. Submit a job mix formula to the Engineer at least 7 days in advance of plant mix bituminous paving, indicating conformance with the specifications. It shall be prepared by the Minnesota Department of Transportation or a commercial laboratory and signed by a registered Professional Engineer verifying that the job mix and the mix aggregate meet the specifications contained herein.

1.03 REFERENCES

A. Minnesota Department of Transportation (MNDOT) Materials Supplemental Specifications for Construction, Current Edition
  1. Section 2360, Plant Mixed Asphalt Pavement.
  2. Section 2357, Bituminous Tack Coat.
  3. Section 3139, Graded Aggregate for Bituminous Mixtures.

B. AASHTO M226, Viscosity Graded Asphalt Cement.
AASHTO T304, Uncompacted Void Content of Fine Aggregate.
AASHTO T176, Test Method for Plastic Fines in Graded Aggregates and Soil by use of the Sand Equivalent.

C. ASTM C131, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

D. ASTM D1559, Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

E. ASTM D2041, Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.

F. ASTM D3203, Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.

G. ASTM D4791, Test Method for Flat or Elongated Particles in Course Aggregate.

H. ASTM D5821, Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.

I. International Building Code, Chapter 11.

J. International Code Council A117.1, Accessible and Usable Buildings and Facilities.

K. Minnesota Accessibility Code, Minnesota Rules Chapter 1341.

1.04 QUALITY ASSURANCE

A. Quality assurance personnel shall remain at the project site on a full-time basis during plant mix bituminous placement.

B. Compaction shall be by the Ordinary Compaction Method, unless stated otherwise.

1.05 WARRANTY

A. Provide a warranty for the paving work against failure of defects for a period of one year after the final acceptance of the project by the Owner. Repair or replace, to the satisfaction of the Owner and Engineer, failed or defective work that occurs during the warranty period at no cost to the Owner.

PART 2 PRODUCTS

2.01 PLANT MIXED ASPHALT PAVEMENTS AGGREGATE GRADATIONS

Broad Band Aggregate Gradation for Asphalt Mixtures
(% passing of total washed aggregate)

Sieve Size	A	B	C	D
1”			100	
3/4”		100[1]	85-100	
1/2”	100[1]	85-100	45-90	
3/8”	85-100	35-90	-	100
No. 4	60-90	30-80	30-75	65-95
No. 8	45-70	25-65	25-60	45-80
No. 200	2.0-7.0	2.0-7.0	2.0-7.0	3.0-8.0

[1]With the approval of the Engineer, the gradation broadband for the maximum aggregate size may be reduced to 97% passing for mixtures containing RAP, when the oversize material comes from the RAP source. The virgin material must remain 100% passing the maximum aggregate sieve size.

2.02 MIXTURE AGGREGATE REQUIREMENTS

Aggregate Blend Property	Traffic Level 2	Traffic Level 3	Traffic Level 4	Traffic Level 5
20-year Design ESAL’s	<1 million	1-3 million	3-10 million	10-30 million
Min. Coarse Aggregate Angularity (ASTM D5821)				

(one face / two face), %-Wear (one face / two face), %-Non-Wear	30/- 30/-	55/- 55/-	85/80 60/ -	95/90 80/75
Min. Fine Aggregate Angularity (FAA) (AASHTO T304, Method A) %-Wear %-Non-Wear	 40 40	 42 40	 44 40	 45 40
Flat and Elongated Particles, Max % by weight, (ASTM D4791)	-	10 (5:1 ratio)	10 (5:1 ratio)	10 (5:1 ratio)
Min. Sand Equivalent (AASHTO T 176)	-	-	45	45
Max. Total Spall in fraction retained on the #4 sieve Wear Non-Wear	 5.0 5.0	 2.5 5.0	 1.0 2.5	 1.0 2.5
Maximum Spall Content in Total Sample Wear Non-Wear	 5.0 5.0	 5.0 5.0	 1.0 2.5	 1.0 2.5
Maximum Percent Lumps in fraction retained on the #4 sieve	0.5	0.5	0.5	0.5
Class B Carbonate Restrictions				
Maximum % -#4 Final Lift/All Other Lifts	100/100	100/100	80/80	50/80
Maximum % +#4 Final Lift/All Other Lifts	100/100	100/100	50/100	0/100
Max. allowable scrap shingles – MWSS (1) Wear/Non-Wear	5/5	5/5	5/5	5/5
Max. allowable scrap shingles – TOSS (1) Final Lift/All other Lifts	5/5	5/5	0/5	0/0

(1) MWSS is manufactured waste scrap shingle and TOSS is tear-off scrap shingle

2.03 MIXTURE REQUIREMENTS

	Traffic Level 2	Traffic Level 3	Traffic Level 4	Traffic Level 5
20-year Design ESAL's	<1 million	1-3 million	3-10 million	10-30 million
Gyratory Mixture Requirements				
Gyrations for N_{design}	40	60	90	100
% Air voids at N_{design}, wear	4.0	4.0	4.0	4.0
% Air voids at N_{design}, Non-wear and all shoulder	3.0	3.0	3.0	3.0
Adjusted Asphalt Film Thickness, minimum µ	8.5	8.5	8.5	8.5
TSR*, *minimum %*	75 (1)	75 (1)	85 (2)	85 (2)
Fines / effective asphalt	0.6 – 1.2	0.6 – 1.2	0.6 – 1.2	0.6 – 1.2

* Use 6 inch [150 mm] specimens in accordance with 2360.2.I, "Field Tensile Strength Ratio (TSR)."

(1) MNDOT Min = 65, (2) MNDOT Min = 70

2.04 REQUIREMENTS FOR RECYCLED MATERIALS

A. Control recycled materials used in mixture by evaluating the ratio of new added asphalt binder to total asphalt binder in accordance with Mn/DOT 2360.E.7, and as shown in the following table.

Requirements for Ratio of Added Asphalt Binder to Total Asphalt Binder, min %			
Specified Asphalt Grade	Recycled Material		
	RAS Only	RAS + RAP	RAP Only
PG XX-28, PG 52-34, PG 49-34, PG 64-22 Wear Non-Wear	 70 70	 70 70	 70 70
PG 58-34, PG 64-34, PG 70-34 Wear & Non-wear	 80	 80	 80

2.05 PLANT-MIXED BITUMINOUS SURFACE / WEAR COURSE MNDOT 2360

A. The bituminous mix designs for the surface or wear course shall be as follows:
   1. SP 12.5 with 30% maximum RAP (SPWEB340B).

2.06 PLANT-MIXED BITUMINOUS BASE / NON-WEAR COURSE MNDOT 2360

A. The bituminous mix designs for the base or non-wear courses shall be as follows:
   1. SP 12.5 with no restrictions (SPNWB330B).

2.07 PERFORMANCE GRADE ASPHALT BINDER

A. Only Performance Grade (PG) Asphalt Binder is approved for use. The inspection, sampling and testing of PG Asphalt Binder shall conform to the Schedule of Materials Control and the Combined State Binder Group Method of Acceptance for Asphalt Binders.
   1. Grade B Binder = PG 58S-28.

2.08 TACK COAT

A. Tack coat to be used where plant mix pavement will be in contact with previously constructed asphalt or Portland cement concrete shall be CSS-1 or CSS-1H. Dilution of the emulsion to 7 parts emulsion to 3 parts water is only allowed by the supplier. No field dilution is allowed. Residual asphalt content must meet the requirements as set forth in MNDOT 2357.

Residual Asphalt Content		
	Minimum Residual Asphalt Content	
Emulsion	Undiluted	Diluted (7:3)
CSS-1 or CSS-1h	57%	40%

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Do not begin paving until deficient areas have been corrected and are ready to receive paving.

B. Pavement surfaces must be dry and completely free of dust, dirt, debris, and all loose materials and vegetation.

C. Apply a uniform tack coat to the existing asphalt or concrete surface and the surface of each lift constructed. Tack each lift when placing multiple lifts in the same day. Apply the bituminous tack coat within the application rates shown in table below.

	Application Rates (gallons/square yard)	
Surface Type	Undiluted Emulsion	Diluted Emulsion (7:3)
New Asphalt	0.05-0.07	0.08-0.10
Old Asphalt and PCC	0.08-010	0.13-0.15
Milled Asphalt and Milled PCC	0.07-0.11	0.10-0.13

D. Complete all reconstruction repairs in accordance with the specifications.

3.02 PLANT MIX BITUMINOUS

A. Plant Mix Bituminous: The aggregate grading shall conform to the specification limits. Asphalt cement content shall be within 0.3 percent of the job mix formula optimum asphalt content.

B. The trucks for hauling bituminous mixtures shall have tight, clean and smooth beds that have been sprayed with a minimum amount of approved anti-adhesive agent to prevent the mixture from adherence to the beds. Provide each truck with a cover of suitable material and size to protect the mixture from the weather.

3.03 PLANT MIX BITUMINOUS TEMPERATURE CONTROL

A. The minimum laydown temperature in all courses (as measured behind the paver of spreading machine) of the bituminous mixture shall be in accordance with the temperature requirements specified herein:

	Compacted Lift Thickness			
Air Temp	**1 inch**	**1 ½ inch**	**2 inch**	**3 inch or more**
32 - 40	-	265	255	250
41 - 50	270	260	250	245
51 - 60	260	255	245	240
61 - 70	250	245	240	235
71 - 80	245	240	235	235
81 - 90	235	230	230	230
91 - up	230	230	230	225

B. The plant mix bituminous mixture shall not exceed 310 degrees F. or the load will be rejected at Contractor's expense.

3.04 PLANT MIX BITUMINOUS PLACEMENT

A. General: Place the plant mix bituminous on a prepared surface with a paver. Place inaccessible and small areas by hand. Place each course to the required elevation, cross-section, and compacted thickness. The in-place compacted thickness shall be plus or minus 1/4 inch of the planned thickness. Any area, which is constructed to less than the required minimum thickness, may be removed and replaced by the Contractor at the discretion of the Engineer, and at the Contractor's expense.

B. Equipment: All equipment furnished by the Contractor shall be maintained and in sound mechanical condition capable of performing the work.

C. Placement: The mixture shall be delivered to, and spread by, the plant mix bituminous paver. The mixture shall be laid in strips to minimize the number of longitudinal joints required.

D. Paver:

1. The paver shall be a self-contained, power-propelled unit provided with adjustable activated screed or strike-off assembly, heated, and capable of spreading and finishing courses of plant mix bituminous material. The paver must be capable of laying the plant mixed bituminous in widths applicable to the typical section and thickness shown on the Plans.
2. Equip the paver with a control system capable of automatically maintaining elevations as specified. The control system shall be automatically actuated from either a reference line or surface through which a system of mechanical sensors will maintain the paver screed at a predetermined slope at the proper elevation to obtain the required surface. When directed, the transfer slope control system shall be made inoperative and the screed shall be controlled by sensor directed automatic mechanisms, which will independently control the screed elevation from the reference line or surface.

E. Joints: Make joints between old and new pavements, or between a successive day's work, to ensure a continuous bond between the adjoining work. Construction joints shall be vertical and have the same texture, density, and smoothness as other sections of the bituminous course. Contact surfaces shall be clean and a tack coat applied.

F. Wear Course: Place the surface wear course in maximum 2-inch lifts unless otherwise specified by the Engineer.

G. Restrictions: No MNDOT bituminous mixtures shall be placed after November 1.

H. ADA Compliance: Paved slopes in handicap accessible parking stalls and access aisles shall not exceed 2% in any direction.

3.05 COMPACTION/ROLLING

A. Compact the plant mix bituminous mixture as quickly as possible after placement. Breakdown rolling shall immediately follow the paver. Intermediate rolling shall follow behind the breakdown rolling. Compaction of the pavement shall continue until in-place air voids are within the specified range. Finish rolling shall be performed at as high a temperature as practical and shall eliminate all the marks left from breakdown and intermediate rolling. All rolling must be completed before the bituminous mixture cools below 180 degrees F.

B. Rollers:

1. Steel-wheeled: Self-propelled and capable of reversing without backlash, weighing not less than 8 tons, and exerting a pressure on the rear drum of not less than 250 pounds per linear inch. When vibratory rollers are used, they shall operate at a frequency of 8 to 10 impacts per foot.
2. Pneumatic-tired: Self-propelled, with a minimum of 7 tires, and exerting a pressure of not less than 200 pounds per inch of rolling width.
3. Trench: Self-propelled, exerting a pressure of not less than 250 pounds per linear inch of rear roll.

C. Rolling:

1. Unless otherwise directed, begin rolling at the side and proceed longitudinally parallel to the paving lane centerline, overlapping each trip half the roller width, and gradually progressing to the crown of the parking lot or roadway.
2. When the pavement abuts a previously placed lift, roll the longitudinal joint first followed by regular rolling procedures.
3. On sloped sections, begin rolling at the low side and progress to the high side, by overlapping the longitudinal trips parallel to the paving lane centerline.
4. Along forms, curbs, headers, walls, and other places not accessible to rollers, thoroughly compact the mixture with hot hand tampers or with mechanical tampers.
5. The pavement shall be rolled so that no roller marks, ridges, porous spots or impressions are visible and the resulting surface has the required elevation and surface smoothness requirements.

D. Compaction shall be obtained by the Ordinary Compaction Method. Uniformly compact each course until there is no further evidence of consolidation and all roller marks are eliminated. A minimum of two rollers shall be on the site at all times. A vibratory steel roller shall be used for breakdown and finish rolling and a pneumatic roller shall be used after breakdown, unless directed otherwise by the Engineer.

E. Protection: Erect barricades to prohibit vehicular traffic from the pavement after final rolling until it has fully hardened and cooled to the same temperature as the surrounding soil or original asphalt pavement.

3.06 FIELD QUALITY CONTROL

A. The plant mix bituminous pavement will be tested for compliance with the following project requirements. The tests and all costs shall be provided by the Owner.

1. Asphalt Cement Content.
2. Plant mix bituminous density requirements, if necessary.
3. Thickness requirements, as specified, +/- ¼ inch.
4. Surface Smoothness, +/- 1/8 inch in 10 feet measured in any direction.

B. Test Frequency: the plant mix bituminous pavement shall be tested for mat thickness and surface smoothness during laydown.

C. The surface of the pavement when finished shall be of uniform texture, smooth, true to crown and elevation and free from defects to the satisfaction of the Engineer. When tested with a 10-foot straight edge in any direction, the maximum deviation of the surface shall not exceed 1/8 inch. Unsatisfactory joints, as determined by the Engineer, will be rejected and replaced at the Contractor's expense. Areas showing deviations greater than 1/8 inch or where surface water ponding will result, shall be milled, tack coated and repaved with bituminous.

D. Remove and replace areas mixed with foreign materials or defective areas as directed by the Engineer. Sawcut the areas, remove the existing bituminous and replace with new, hot plant mix bituminous. Compact the area by rolling to the air voids and smoothness specified. The removal and replacement of contaminated plant mix bituminous shall be done at no cost to the Owner.

END OF SECTION