SECTION 03500

STRUCTURAL PRECAST CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes. This section covers Prestressed or Precast concrete member construction, including product design not shown on contract drawings, manufacture, transportation, erection, and other related items such as anchorage, bearing pads, storage and protection of precast concrete.

B. General Requirements. Prestressed concrete members shall be furnished and installed complete with all embedments, accessories and special construction specified and shown on the Drawings.

1.02 REFERENCES

A. Requirements of Regulatory Agencies. All local codes plus the following specifications, standards and codes are a part of these specifications:

1. ACI 318 – Building Code Requirements for Structural Concrete.

2. AWS D1.1—Structural Welding Code— Steel.

3. AWS D1.4—Structural Welding Code— Reinforcing Steel.

4. CRSI—Manual of Standard Practice

1.03 SUBMITTALS

A. Shop drawings

1. Erection drawings
   a. Member piece marks and completely dimensioned size and shape of each member.
   b. Plans and/or elevations locating and defining all products furnished by manufacturer.
   c. Sections and details showing connections, cast–in items and their relation to the structure.
   d. Relationship to adjacent material.
   e. Joints and openings between members and between members and structure.
   f. Description of all loose, cast–in and field hardware.
   g. Field installed anchor location drawings.
   h. Erection sequences, when required to satisfy stability, and handling requirements.
   i. All dead, live and other applicable loads used in the design.

2. Production drawings
    a. Elevation view of each member.
    b. Sections and details to indicate quantities and position of reinforcing steel, anchors, inserts, etc.
    c. Handling devices.
    d. Dimensions and finishes.
    e. Prestress for strand.
    f. Concrete strengths.
    g. Estimated cambers.
    h. Methods for storage and transportation.

B. Product design criteria:

1. Loadings for design:
    a. Initial handling and erection stress limits.
    b. All dead and live loads as specified on the contract drawings.
    c. All other loads specified for member, where applicable.
    d. Provide continuous unistrut embedded into bottom of all precast double tee stems. Hold back 12 inches from each end of double tee stem. Design load shall be 500 pound concentrated load as part of collateral dead load, not in addition. Unistrut shall be hot dipped galvanized.

2. As directed on the contract drawings, design calculations of products shall be performed by a registered engineer experienced in precast, prestressed concrete design and submitted for approval with production drawings.

3. Design shall be in accordance with applicable codes, ACI 318 or AASHTO Standard Specifications for Highway Bridges.

C. Permissible design deviations:

1. Design deviations will be permitted only after the architect/engineer's written approval of the manufacturer's proposed design supported by complete design calculations and drawings.

2. Design deviations shall provide an installation equivalent to the basic intent without incurring additional cost to the owner.

D. Test reports: Reports of tests on concrete and other materials upon request.

1.04 QUALITY ASSURANCE

A. Manufacturer qualifications: The precast concrete manufacturing plant shall be certified by the Precast/Prestressed Concrete Institute Plant Certification Program. Manufacturer shall be certified at the time of bidding.

B. Erector qualifications: Regularly engaged in the erection of precast structural concrete similar to the requirements of this project.

C. Welder qualifications: In accordance with AWS D1.1.

D. Testing: In general compliance with testing provisions in MNL–116, *Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.*

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery and handling:

1. Precast concrete members shall be lifted and supported during manufacturing, stockpiling, transporting and erection operations only at the lifting or supporting points, as shown on the shop drawings, and with suitable lifting devices. Lifting inserts shall have a minimum safety factor of 4. Reusable lifting hardware and rigging shall have a minimum safety factor of 5.

2. Transportation, site handling, and erection shall be performed with acceptable equipment and methods, and by qualified personnel.

B. Storage:

1. Store all units off ground.

2. Place stored units so that identification marks are discernible.

3. Separate stacked members by battens across full width of each bearing point.

4. Stack so that lifting devices are accessible and undamaged.

5. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland cement: ASTM C 150 – Type I or III

B. Other cementitious materials:

1. Fly ash or natural pozzolans: ASTM C 618.

2. Ground granulated blast furnace slag: ASTM C 989.

3. Silica fume: ASTM C 1240.

C. Admixtures:

1. Air–entraining admixtures: ASTM C 260.

2. Water reducing, retarding, accelerating, high range water reducing admixtures: ASTM C 494 or C 1017.

3. Calcium chloride or admixtures containing chlorides shall not be used.

D. Aggregates: ASTM C 33 or C 330

E. Water: Potable (see ACI 318)

F. Reinforcing Steel

1. Bars
   a. Deformed billet–steel: ASTM A 615.
   b. Deformed low–alloy steel: ASTM A 706.
   c. Galvanized reinforcing bars: ASTM A 767.
   d. Epoxy coated reinforcing bars: ASTM A 775.

2. Wire
   a. Plain: ASTM A 82.
   b. Deformed: ASTM A 496.

3. Welded wire reinforcement
   a. Welded plain steel: ASTM A 185.
   b. Welded deformed steel: ASTM A 497.

4. Coatings
   a. Epoxy bars: ASTM A 775.
   b. Galvanized bars: ASTM A 767.
   c. Epoxy welded wire reinforcement: ASTM A 884.

G. Strand: Uncoated, 7-wire strand: ASTM A 416 – Grade 250 or 270

H. Anchors and inserts

1. Materials:
   a. Structural steel: ASTM A 36.
   b. Malleable iron castings: ASTM A 47.
   c. Stainless steel: ASTM A 666, Type 304.
   d. Carbon steel plate: ASTM A 283.
   e. Bolts: ASTM A 307 or A 325.
   f. Welded headed studs: ASTM A 108.
   g. Deformed bar anchors: ASTM A 496 or A 706.

2. Finish
   a. Shop primer: Manufacturer's standards.
   b. Hot dipped galvanized: ASTM A 123.
   c. Zinc–rich coating: DOD–P–21035, self curing, one component, sacrificial.
   d. Cadmium coating: ASTM B 766.

I. Grout

1. Cement grout: Portland cement, sand, and water sufficient for placement and hydration.

2. Non–shrink grout: Premixed, packaged ferrous or non–ferrous aggregate shrink–resistant grout.

3. Epoxy–resin grout: Two–component mineral–filled epoxy–resin: ASTM C 881 or FS MMM–A–001993.

J. Bearing pads:

1. Chloroprene (Neoprene): Conform to Division II, Sect. 18 of AASHTO Standard Specifications for Highway Bridges.

2. Random oriented fiber reinforced: Shall support a compressive stress of 3000 psi with no cracking, splitting or delaminating in the internal portions of the pad.

3. Duck layer reinforced: Conform to Division II, Sect. 18.10.2 of AASHTO Standard Specifications for Highway Bridges or Military Specification MIL–C–882D.

4. Plastic: Multimonomer plastic strips shall be non–leaching and support construction loads with no visible overall expansion.

5. Tetrafluoroethylene (TFE): Reinforced with glass fibers and applied to stainless or structural steel plates.

2.02 MIXES

A. 28–day compressive strength: Minimum of 5000 psi.

B. Release strength: Minimum of 3500 psi.

2.03 MANUFACTURED UNITS

A. Manufacturing procedures shall be in general compliance with PCI MNL-116.

B. Manufacturing tolerances shall comply with PCI MNL–116 except as modified herein. Prestressed members will be rejected for any of the following:

1. Length and variation in excess of ½" (¼" at each end) of adjacent units or 1" maximum between the longest and shortest units.

2. Edges varying from a straight line more than 3/16" and from parallel within a maximum between the longest and shortest units.

3. Edges not straight and parallel.

4. Deviation from design camber, differential camber between adjacent members of the same design, or warp or camber which cannot be controlled by the fastening system between members.

5. Improperly placed accessories or blockouts.

6. Unsatisfactory surface finish.

7. Exposure of wire mesh, reinforcing steel, or prestressing strand, except where cut off at the ends.

8. Honeycomb.

9. Fractures, cracks, chips or spalls which cannot be repaired to the satisfaction of the Engineer.

10. Irregularities resulting from damaged forms.

C. Finishes:

1. Standard underside: Resulting from casting against approved forms using good industry practice in cleaning of forms, design of concrete mix, placing and curing. Small surface holes caused by air bubbles, normal color variations, normal form joint marks, and minor chips and spalls shall be tolerated, but no major or unsightly imperfections, honeycomb, or other defects shall be permitted.

2. Standard top: Result of vibrating screed and additional hand finishing at projections. Normal color variations, minor indentations, minor chips and spalls shall be permitted. No major imperfections honeycomb, or defects shall be permitted.

3. Vertical ends:
   a. When exposed to view, strands shall be recessed a minimum of 2 in., the holes filled with grout and the ends of the member shall receive sacked finish.
   b. When not exposed to view, protruding ends of prestressing strand shall be cut off flush with the concrete and coated or finished to prevent rusting.

D. Openings: Primarily on thin sections, the manufacturer shall provide for those openings 10 in. round or square or larger as shown on the structural drawings.

Other openings shall be located and field drilled or cut by the trade requiring them after the precast, prestressed concrete products have been erected. Openings shall be approved by the architect/engineer before drilling or cutting.

E. Patching: Shall be acceptable providing the structural adequacy of the product and the appearance are not impaired.

F. All plates, inserts and other accessories as detailed or required by the contract drawings are required to be embedded in the members at the time of manufacture. All embedded items shall be accurately positioned and shall be rigidly held in position during concrete placement. It is essential that bearing plates be installed in exact and true position.

G. Each member shall have shop markings, painted or labeled at a place not be finally exposed, to indicate location and position in the structure in accordance with the manufacturer's layout drawings.

H. Concrete shall be cured by continuous surface saturation or inundation, exposure to steam or saturated air in a tightly closed room or chamber, or other method acceptable to the Engineer. Moist curing shall be maintained for at least seven days when Type I cement is used, or 48 hours when Type III cement is used. The minimum steam curing period shall be 18 hours for either type of cement.

PART 3 EXECUTION

3.01 ERECTION

A. General contractor shall be responsible for providing suitable access to the building, proper drainage and firm, level bearing for the hauling and erection equipment to operate under their own power.

B. General contractor shall be responsible for:

1. Providing true, level bearing surfaces on all field placed bearing walls and other field placed supporting members.

2. Placement and accurate alignment of anchor bolts, plates or dowels in column footings, grade beams and other field placed supporting members.

3. All shoring required for composite beams and slabs.

C. Installation of precast, prestressed concrete shall be performed by the manufacturer or a competent erector. Members shall be lifted by means of suitable lifting devices at points provided by the manufacturer. Temporary shoring and bracing, if necessary, shall comply with manufacturer’s recommendations.

D. Prestressed concrete members shall be handled carefully in a manner which will cause no damage, and shall be kept from contact with adjacent concrete members. Members shall be stored off the ground on timber skids and leveled to avoid twisting or introduction of other undesirable stresses. Members shall not be moved from the fabricator's yard until completion of specified curing period.

E. Prestressed concrete members shall be set in position in accordance with the manufacturer's approved layout and the Drawings. Members shall rest solidly upon the supports without rocking.

F. Members in final position shall be loaded as necessary so that adjacent top edges are even and the joints welded as indicated on the Drawings. Loading shall be acceptable to the Engineer. After all joints have been welded and leveling loads removed, the member shall be anchored to the supports as indicated on the Drawings.

3.02 WELDING

A. Welding shall be done by qualified welders possessing valid certificates under the qualification procedures of the American Welding Society. Care shall be exercised to avoid overheating and cracking the concrete adjacent to the anchorage plates. All members damaged during welding shall be removed and replaced with new undamaged members by and at the expense of the Contractor.

3.03 FIELD CUTTING

A. Holes, within the manufacturer's limitations and not requiring cutting of prestressing strands, shall be cut in the field by the erector in accordance with the manufacturer's standard recommendations. Holes requiring cutting of prestressing strands shall be made during manufacture; prestressing strands shall not be cut in the field.

B. All cutting of concrete sections shall be done with suitable concrete saws or core drilling equipment in a manner that will provide smooth, even cut surfaces.

C. All lifting loops shall be cut off flush with the top surface of the member before any covering materials are placed.

3.04 JOINTS

A. The underside of joints that will be permanently exposed to view after the work has been completed shall be caulked.

3.05 ATTACHMENTS

A. Subject to approval of the architect/engineer, precast, prestressed concrete products may be drilled or “shot” provided no contact is made with the prestressing steel. Should spalling occur, the repair of the spall shall be the responsibility of the trade doing the drilling or the shooting.

3.06 FIELD QUALITY CONTROL

A. Final inspection and acceptance of erected precast, prestressed concrete shall be made by the architect/engineer within a reasonable time after the work is completed.

PART 4 MEASUREMENT AND BASIS OF PAYMENT

Where items are specifically included on the bid schedule, they will be paid for by the unit given. All other items in this section that are essential to the project but for which there are no specific pay items, will not be measured and paid for separately but shall be included in the project.

END OF SECTION