SECTION 03 41 00 - PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Columns and bearing saddles.

B. Beams, spandrels, girders, purlins.

C. Floor double tees and channel slabs.

D. Wall panels with integral insulation.

E. Grout packing.

F. Connection and supporting devices.

G. Lintels and bond beams.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: For concrete foundations and connection anchor placement.

1.3 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2200 - Unit Prices, for additional unit price requirements.

B. Precast Columns and Walls:

1. By the unit.
2. By the linear foot.
3. Includes unit member placed and anchored.

C. Finish To Precast Column and Walls: By the square foot. Includes unit member finished to specified finish.

1.4 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

F. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

G. ASTM A416/A416M - Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.

H. ASTM A497/A497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.

I. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals.

J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.

K. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

L. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

M. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.

N. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

O. ASTM C150/C150M - Standard Specification for Portland Cement.

P. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

Q. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

R. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

S. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars.

T. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

U. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy Coated Reinforcing Steel Bars; 2001 (Reapproved 2007).

V. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars.

W. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.

X. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

Y. AWS D1.1/D1.1M - Structural Welding Code - Steel.

Z. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel.

AA. ICC-ES AC320 - Acceptance Criteria for Fiber-Reinforced Composite Connectors Anchored in Concrete; 2009.

BB. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.

CC. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete.

DD. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete.

EE. PCI MNL-124 - Design for Fire Resistance of Precast Prestressed Concrete.

FF. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction.

GG. UL (FRD) - Fire Resistance Directory.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a pre-installation conference at least one week prior to commencing work of this section.

1. Discuss site walls, mock-up and construction.

2. Discuss infill walls, mock-up and construction.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate standard component configurations, design loads, deflections, cambers, and bearing requirements.

C. Shop Drawings: Indicate layout, unit locations, fabrication details, unit identification marks, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials. Indicate design loads, deflections, cambers, bearing requirements, and special conditions.

1. Submit reviewed shop drawings and design data to authorities having jurisdiction for approval.

D. Welders' Certificates.

E. Design Data: Submit design data reports indicating calculations for loadings and stresses of fabricated, designed framing.

F. Designer's Qualification Statement.

G. Welders' Certificates.

H. Fabricator's Qualification Statement.

I. Erector's Qualification Statement.

J. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

K. Design Data: Submit design data reports indicating calculations to meet Factory Mutual components and cladding loadings according to FM design guidelines 1-28 and 1-29 for all fabricated and designed framing.

L. Sustainable Design Reporting: If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete, mix design(s) used showing the quantity of Portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used; use Material Content Form.

M. Welders' Certificates.

1.7 QUALITY ASSURANCE

A. Designer Qualifications: Design precast concrete members under direct supervision of a Professional Structural Engineer experienced in design of precast concrete in the state of the project.

B. Fabricator Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

C. Insulated Panel System Manufacturer Qualifications: Company specializing in manufacturing integrally insulated panel system specified in this section, with not less than three years of documented experience and approved by system manufacturer.

D. Erector Qualifications: Company specializing in erecting products of this section with minimum 5 years of documented experience.

E. Welder Qualifications: Qualified within previous 12 months in accordance with AWS D1.1 and AWS D1.4.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Handle precast members in position consistent with their shape and design. Lift and support only from support points.

B. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

C. Protect members to prevent staining, chipping, or spalling of concrete.

D. Mark each member with date of production and final position in structure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Structural Precast Concrete:

1. Premier Stoneworks, LLC : www.premier-stoneworks.com/#sle.
2. Any manufacturer holding a PCI Group C Plant Certification for the types of products specified; see www.pci.org/find/manufacturer.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.2 PRECAST UNITS

A. Precast Structural Concrete Units: Comply with PCI MNL-116, PCI MNL-120, PCI MNL-123, PCI MNL-135, ACI 318 and applicable codes.

1. Design components to withstand FM loads in the configuration indicated on drawings and as follows:
   a. Exterior Vertical Assembly: See drawings for component and cladding load requirements for positive and negative wind loads.
   b. Columns: Loads indicated on drawings.
2. Calculate structural properties of framing members in accordance with ACI 318.
3. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with strength requirements.
4. Design members exposed to the weather to provide for movement of components without damage, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to seasonal or cyclic day/night temperature ranges.
5. Design system to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.

2.3 MATERIALS

A. Cement: White Portland type, conforming to ASTM C150, Type I.

B. Other Cementitious Materials:

1. Fly Ash or Natural Pozzolans: Comply with ASTM C618.
2. Ground Granulated Blast Furnace Slag: ASTM C989/C989M.
3. Silica Fume: Comply with ASTM C1240.

C. Aggregate, Sand, Water, Admixtures: Determined by precast fabricator as appropriate to design requirements and PCI MNL-116.

2.4 REINFORCEMENT

A. Tensioning Steel Tendons: ASTM A416/A416M, Grade 250 (1725); seven-wire stranded steel cable; low-relaxation type; full length without splices; uncoated.

B. Reinforcing Steel: ASTM A615/A615M Grade 40 (280).

1. Plain billet-steel bars.
2. Unfinished.
3. Galvanized in accordance with ASTM A767/A767M, Class I.

4. Epoxy coated in accordance with ASTM A775/A775M.

C. Steel Welded Wire Reinforcement: ASTM A 185/A 185M plain type, ASTM A 497/A 497M deformed type, ASTM A 185/A 185M plain type, or ASTM A 497/A 497M deformed type; in flat sheets; unfinished.

2.5 REVEAL AND ACCENT STRIPS

A. Manufacturers:

1. Nox-Crete Inc; Clean Line Reveal: www.nox-crete.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Material: Non-staining, non-reactive, high-density polyethylene.

C. Profile(s): As selected by Architect from manufacturer's standard range.

D. Profile(s): As indicated on drawings.

2.6 ACCESSORIES

A. Connecting and Supporting Devices: Plates, angles, items cast into concrete, and inserts conforming to PCI MNL-123, and as follows:

1. Material: Carbon steel conforming to ASTM A 36/A 36M.
2. Finish: Prime painted, except where device surfaces will be in contact with concrete or will require field welding.

B. Specialty Adhesives:

1. Segmental Bridge Adhesive: ASTM C881/C881M, Type VI; two-component, 100 percent solids, non-sag, moisture-insensitive epoxy.
2. Products:
   a. Dayton Superior Corporation; PRO-POXY Segmental Bridge Adhesive: www.daytonsuperior.com.
   b. Substitutions: See Section 01 6000 - Product Requirements.

C. Grout:

1. Non-shrink, non-metallic, minimum yield strength of 10,000 psi at 28 days.
2. Epoxy.

D. Bearing Pads: High density plastic, Vulcanized elastomeric compound molded to size, Neoprene (Chloroprene), or Tetrafluoroethylene(TFE); Shore A Durometer 80+/-5; 1/8 inch thick, smooth both sides.

E. Bolts, Nuts and Washers: High strength steel type recommended for structural steel joints.

F. Prime Paint: Zinc rich alkyd type.

2.7 FABRICATION

A. Conform to fabrication procedures specified in PCI MNL-116.

B. Fabricate and handle epoxy-coated reinforcing bars in accordance with ASTM D3963/D3963M.

C. Maintain plant records and quality control program during production of precast members. Make records available upon request.

D. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on shop drawings.

E. Tension reinforcement tendons as required to achieve design load criteria.

F. Provide required openings with a dimension larger than 10 inches and embed accessories provided under other sections of the specifications, at indicated locations.

G. Exposed Ends at Stressing Tendons: Fill recess with non-shrink grout, trowel flush.

H. Integrally Insulated Panel System: Comply with manufacturer's written installation instructions.

I. Cast rigid insulation into wall panel units. Cut drainage channels in exterior face of insulation to route moisture to exterior. Position weep drains to suit. Maintain drainage channels clear.

2.8 FABRICATION TOLERANCES

A. Conform to fabrication tolerances specified in PCI MNL-135, except as specifically amended below.

1. Variation From Nominal Dimension: Plus or minus 1/2 inch.
2. Variation From Intended Camber: Plus or minus 1/4 in per 10 ft, plus or minus 5/8 inch maximum.
3. Variation from End Squareness: Plus or minus 1/8 inch/12 in, maximum 3/8 in.
4. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch.
5. Sweep: Plus or minus 1/4 inch.

2.9 FINISHES

A. Ensure exposed-to-view finish surfaces of precast concrete members are uniform in color and appearance.

B. Cure members under identical conditions to develop required concrete quality, and minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

C. Finish members to PCI MNL-116 Commercial grade.

D. Plant Finish (Finish): Normal plant finish; surface may contain small surface holes caused by air bubbles, minor chips or spalling at edges or ends, without major discoloration.

E. Exposed-to-View Finish (Finish): Normal plant finish with fins and protrusions removed, ground edges and ends, flat face surfaces.

F. Architectural Finish (Finish): Surface holes or bubbles over 1/4 inch filled with matching cementitious paste, fins or protrusions removed and surface ground smooth.

2.10 ACCESSORIES

A. Connecting and Supporting Devices; Anchors and Inserts: Plates, angles, items cast into concrete, items connected to steel framing members, and inserts conforming to PCI MNL-123 and as follows:

1. Material: Carbon steel conforming to ASTM A36/A36M.
2. Finish: Prime painted, except where device surfaces will be in contact with concrete or will require field welding.

B. Specialty Adhesives:

1. Segmental Bridge Adhesive: ASTM C881/C881M, Type VI; two-component, 100 percent solids, non-sag, moisture-insensitive epoxy.
2. Products:
   a. Dayton Superior Corporation; PRO-POXY Segmental Bridge Adhesive: www.daytonsuperior.com/#sle.
   b. Pecora; Dynapoxy Healer/Sealer: www.pecora.com/#sle.
   c. Pecora; Dynapoxy Low-Mod Epoxy: www.pecora.com/#sle.
   d. Substitutions: See Section 01 6000 - Product Requirements.

C. Grout: Non-shrink, non-metallic, minimum yield strength of 10,000 psi at 28 days.

1. Type: Epoxy.

D. Bearing Pads: High density plastic, Vulcanized elastomeric compound molded to size, Neoprene (Chloroprene), or Tetrafluoroethylene(TFE); Shore A Durometer 80+/-5; 1/8 inch thick, smooth both sides.

E. Bolts, Nuts and Washers: High strength steel type recommended for structural steel joints.

F. Prime Paint: Zinc rich alkyd type.

2.11 FABRICATION TOLERANCES

A. Conform to fabrication tolerances specified in PCI MNL-135 , except as specifically amended below.

1. Variation From Nominal Dimension: Plus or minus 1/2 inch.
2. Variation From Intended Camber: Plus or minus 1/4 in per 10 ft, plus or minus 5/8 inch maximum.
3. Variation from End Squareness: Plus or minus 1/8 inch/12 in, maximum 3/8 in.
4. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch.
5. Sweep: Plus or minus 1/4 inch.

2.12 SOURCE QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Provide mix design for concrete.

B. Provide shop inspection for site walls and columns and infill wall panels.

C. Test samples in accordance with applicable ASTM standard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that site conditions are ready to receive work and field measurements are as shown on shop drawings.

3.2 PREPARATION

A. Prepare support equipment for the erection procedure, temporary bracing, and induced loads during erection.

3.3 ERECTION

A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.

B. Align and maintain uniform horizontal and vertical joints, as erection progresses.

C. Maintain temporary bracing in place until final support is provided. Protect members from staining.

D. Provide temporary lateral support to prevent bowing, twisting, or warping of members.

E. Install bearing pads.

F. Level differential elevation of adjoining horizontal members with grout to maximum slope of 1:12.

G. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers.

H. Grout underside of column bearing plates.

I. Secure units in place. Perform welding in accordance with AWS D1.1.

3.4 TOLERANCES

A. Erect members level and plumb within allowable tolerances.

B. Conform to PCI MNL-135 for erection tolerances, except as specifically amended below.

1. Plan Location from Building Grid Datum: Plus or minus 3/4 in.
2. Top Elevation from Building Elevation Datum at Plank Ends: Plus or minus 1/2 inch.
3. Maximum Jog in Alignment of Matching Ends: Plus or minus 1/2 inch.
4. Exposed Joint Dimension: Plus or minus 3/8 inch.
5. Differential Top Elevation As Erected: Plus or minus 3/8 inch.
6. Bearing Length in Span Direction: Plus or minus 3/8 inch.
7. Differential Bottom Elevation of Exposed Members: Plus or minus 3/16 inch.

C. When members cannot be adjusted to conform to design or tolerance criteria, cease work and advise Engineer. Execute modifications as directed.

3.5 PROTECTION

A. Protect members from damage caused by field welding or erection operations.

B. Provide non-combustible shields during welding operations.

3.6 CLEANING

A. Clean weld marks, dirt, or blemishes from surface of exposed members.

END OF SECTION 03 41 00