TRO

PROJECT MANUAL

Package 'E' – Garage Foundation and Precast
Permit Set: September 16, 2004

PROJECT

Maine Medical Center
Garage / Connector / Heliport
MMC Project No. 21845
Architect's Commission Number 4678

OWNER

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ARCHITECT

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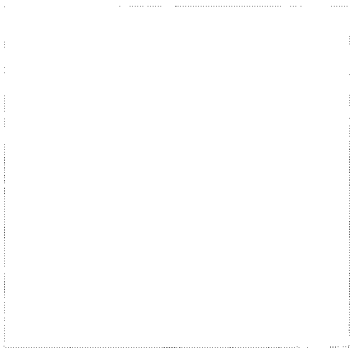

William K. Davis

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SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

B. If conflicts between documents arise, the more stringent requirements shall control, unless notified in writing by Architect.

1.02 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

B. Cast-in-place concrete described in this section includes all labor, materials, equipment, and services necessary to complete the cast-in-place concrete work as shown on the drawings and specified herein, including but not limited to the following:

1. Foundations and footings

2. Foundation walls

3. Slabs-on-grade

4. Equipment (Housekeeping) Pads

5. Concrete for infilling metal pan stairs

6. Architectural Site Walls

7. Cast-In-Place topping slabs, apron slabs, and washes within garage

C. Related Sections include the following:

1. Division 3 Section 03410, "Plant-Precast Structural Concrete."

1.03 REFERENCED STANDARDS

A. Follow the guidelines contained in the latest editions of the following codes, specifications, and standards, including references contained in each document, except where more stringent requirements are shown or specified.

B. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T260 "Methods of Sampling and Testing for Total Chloride Ion in Concrete and Concrete Raw Materials."

C. American Concrete Institute (ACI):

1. ACI 211.1, "Recommended Practice for Selecting Proportions for Normal Weight Concrete."

2. ACI 214, "Recommendation for Evaluation of Compression Test Results of Field Concrete."

3. ACI 301, "Standard Specification for Structural Concrete."

4. ACI 304, "Recommended Practice for Measuring, Mixing and Placing Concrete."

5. ACI 305, "Recommended Practice for Hot Weather Concreting."

6. ACI 306, "Recommended Practice for Cold Weather Concreting."

7. ACI 308, "Recommended Practice for Curing Concrete."

8. ACI 309, "Recommended Practice for Consolidation of Concrete."

9. ACI 311, "Recommended Practice for Concrete Inspection."

10. ACI 315, "Manual of Standard Practice for Detailing Reinforced Concrete Structures."

11. ACI 318, "Building Code Requirements for Reinforced Concrete."

12. ACI 613, "Recommended Practice for Selecting Proportions for Concrete."

D. American Society for Testing and Materials (ASTM):

1. ASTM C31, "Standard Method of Making and Curing Concrete Test Specimens in the Field."

2. ASTM C33, "Standard Specification for Concrete Aggregates."

3. ASTM C39, "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens."

4. ASTM C94, "Standard Specification for Ready-Mixed Concrete."

5. ASTM C143, "Standard Method of Test for Slump of Portland Cement Concrete."

6. ASTM C150, "Standard Specification for Portland Cement."

7. ASTM C173, "Standard Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method."

8. ASTM C192, "Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Laboratory."

9. ASTM C231, "Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method."

10. ASTM C260, "Standard Specification for Air-Entraining Admixtures for Concrete."

11. ASTM C309, "Standard Specification for Liquid Membrane – Forming Compounds for Curing Concrete."

12. ASTM C494, "Standard Specifications for Chemical Admixtures of Concrete."

13. ASTM C595, "Standard Specification for Blended Hydraulic Cement."

14. ASTM E329, "Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction."

E. National Ready Mixed Concrete Association (NRMCA):

1. NRMCA Check List for Certification of Ready Mixed Concrete Production Facilities.

1.04 SUBMITTALS

A. General:

1. All submissions shall be in accordance with the submission schedule, which shall be developed and agreed between the Architect and Construction Manager at the commencement of the project.

2. Submittals shall be made in compliance with the Conditions of the Contract and Division 1 Specification Section 01300, "Submittals and Substitutions."

3. Review of submittals is of a general nature only, and the responsibility for conformance with intent of drawings shall remain with the Contractor. Review does not imply or state that the fabricator has correctly interpreted the construction documents.

B. Submit the following action submittals for review and approval:

1. Concrete mix design for each type of concrete. The Contractor shall warrant by the submission of the design mixes that such mixes are totally representative of the concrete that he intends to supply to meet the requirements of the Contract Documents. Submit new design mixes for

review and approval when any change in materials is required or needed. Include the following information for each concrete mix design:

a. Method used to determine the proposed mix design (per ACI 301, Article 3.9).

b. Compressive strength at 7 and 28 days: Submit strength test records, mix design materials, conditions, and proportions for concrete used for record of tests, standard deviation calculation, and determination of required average compressive strength.

c. Gradation of fine and coarse aggregates: Testing data confirming proposed coarse aggregate meets ASTM C33 class designation. Include ASTM test results for aggregates subject to freeze-thaw environment.

d. Proportions of all ingredients including all admixtures to be added either at the time of batching or at the job site.

e. Water-cement ratio.

f. Slump tested in accordance with ASTM C143.

g. Air content of freshly mixed concrete by the pressure method, ASTM C231, or the volumetric method, ASTM C173.

h. Unit weight of concrete ASTM C138.

i. Mill test reports of fly ash chemical and physical analysis and certification of compliance with ASTM C618 Class C or F, if used.

j. Manufacturer's Spec Data Sheets of each concrete admixture, including brand name, manufacturer, and dosage rate range.

k. Shop drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

2. Product Data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, curing compounds, and others if requested by the Architect.

3. Proposed methods for curing Cast-in-Place concrete

C. Submit the following informational submittals for record:

1. Health and Safety Data Sheets for each concrete admixture.

2. Proposed Schedule of Concrete Placement. Contractor shall keep a permanent log of the dates and times of concrete placement and where on the project the concrete was cast. This log shall be made available to the Architect for inspection, upon request.

3. Qualifications of Concrete Foreman showing five years experience with this type of concrete installation.

4. Tickets for each batch of concrete delivered to the jobsite containing the following information:

   a. The compressive strength of the concrete being delivered.

   b. The volume of concrete in the delivery truck.

   c. The time the concrete was batched (i.e. the time that water was discharged into the delivery truck to mix with the cement and aggregates).

   d. List of admixtures.

   e. Slump of concrete as placed.

   f. Volume of water added to the delivery truck after initial batching.

   g. Location where the concrete is being placed (i.e., foundation walls along grid line A, between grids 1 and 4).

D. If, upon reaching the job site, the concrete cannot be placed within the time limits stated, or if the type of concrete delivered is incorrect, the Owner's Testing Laboratory will reject the load.

1.05 QUALITY CONTROL

A. The Contractor shall perform all work in strict accordance with all applicable laws and regulations of the building code and with all other authorities having jurisdiction. All such requirements shall take precedence over the requirements of the Specifications except in cases where the requirements of the Specifications are more exacting or stringent.

B. Concrete Mix Design: The Contractor shall employ an independent testing laboratory, acceptable to the Owner, to perform material evaluation tests and to design concrete mixes or, when acceptable to the Engineer, provide copies of recently made material tests and mix designs.

1. If, at any time during construction, the concrete resulting from the approved mix design deviates from Specification requirements, the Contractor shall have his laboratory modify the design, subject to approval, until the specified concrete is obtained.

C. Testing of materials and inspections of installed work shall be completed throughout the duration of the project, as directed by the Engineer. Contractor shall provide free and safe access to material stockpiles and facilities for inspectors.

1. Retesting of rejected materials or reinspection of deficient work, shall be done at the Contractor's expense.

D. The Contractor is responsible for correction of concrete work that does not conform to the specified requirements, including strength, mix proportions, air void system, tolerances, and finishes. Correct deficient concrete as directed by the Engineer.

E. A minimum of one concrete finishing crewmember shall be an ACI Certified Concrete Flatwork Finisher for all slabs-on-grade. The certified finisher shall have input to the crew's placement and finishing procedures regarding the application of ACI Standards for quality flatwork. The ACI Standards that shall be observed are contained in the ACI "Concrete Craftsman Series."

F. The Architect will reject Cast-in-Place Concrete that exhibits the following defects:

1. Bulging: Concrete surfaces that bulge due to insufficiently secured formwork, undersized ties, or flat bar clamps.

2. Wavy Concrete: Concrete surfaces that exhibit waves along plywood joints due to moisture migration into unsealed cuts of plywood sheets causing swellings.

3. Spalling: Concrete spalling due to shale, alkali reactivity, rusting steel too close to the surface, carbonation, improper removal of formwork, expansion of cast-in steel during the welding process, or other reasons.

4. Cracking and Crazing: Concrete cracking and crazing due to lack of control joints or high water/cement ratio above 0.50.

5. Air holes: Air holes resulting from improper vibration and excessive heights of individual layers of pours between vibration. Air holes due to spreading of concrete with vibrators rather than moving buckets or hoses.

6. Honeycombing: Concrete honeycombing including loss of fines from leaking formwork or other causes.

7. Discoloration: Concrete discoloration caused by any reason, including inconsistent concrete mix, different sources of cement and aggregates, temperature variation between individual pour and curing phases, improper and inconsistent use of vibrators, variation of time span of concrete in formwork, form oils, and migration of plasticizer into concrete from exposed sealant beads on formwork and around cast-in items such as electrical outlet boxes.

8. Visible Pour Joints: Visible pour joints in concrete resulting from leaking formwork due to lack of gaskets and insufficient overlap with old concrete

preventing proper tightening of formwork. Placement of concrete layers in excessive heights and spreading concrete with vibrator.

9. Debris in Concrete: Concrete that includes debris, whether caused by insufficient cleaning of formwork or lack of cleanout and access doors at base of formwork.

G. The Contractor shall schedule a Concrete Preconstruction Meeting at least 30 days prior to placement of any concrete. Attendance at the meeting shall include the Construction Manager, Ready-Mix Supplier, Concrete Pumping Subcontractor, Field Testing Laboratory, and the Engineer of Record (EOR). The agenda of the meeting shall be prepared by the Contractor and shall include, but not be limited, to the following:

1. Review of concrete mix designs.

2. Field testing and quality control.

3. Concrete placing sequence and schedule.

4. Formwork, shoring, reshoring, and stripping.

5. Placing, jointing, and finishing procedures.

6. Curing and protection procedures.

1.06 QUALITY ASSURANCE

A. Foreman's Qualifications: Concrete work shall be done under the supervision of an experienced concrete foreman having at least five years of foreman experience with "Cast-in-Place" concrete, similar to that used on this project.

B. The Owner shall employ an independent Testing Agency to perform a Program of Structural Tests and Inspections for compliance with Chapter 17 of the 2003 International Building Code. The testing agency shall prepare a statement of structural tests and inspections, specifying the tests and inspections to be performed throughout the construction of this project. Submission and approval of this statement must be complete prior to beginning construction.

1. The Testing Agency will organize and direct the test and inspection program. All inspection and test reports shall be submitted to the Contractor, Construction Manager (CM), the Owner's Representative and the Structural Engineer of Record (SER). The Contractor shall be responsible for understanding the test and inspection program and notifying the Testing Agency and the SER when work is ready for tests and/or inspections in accordance with Section 01410, "Testing Laboratory Services." The Contractor will provide access to the Testing Agency and the SER in accordance with Section 01410, "Testing Laboratory Services" and ACI 301. Inspections and tests by the Testing Agency will not relieve the Contractor of responsibility for supervision, testing, and inspection for quality control of the work.

2. The Owner's Representative will provide testing and inspection reports to the local building official when requested by the local building official. Upon completion of the construction, the independent Testing Agency will make a final report on the satisfactory completion of the Program for Structural Tests and Inspection to the building official and to the Owner's Representative.

PART 2 – PRODUCTS

2.01 FORM MATERIALS

A. Forms for Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

B. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

C. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 60, deformed.

B. Welded Wire Fabric (WWF): ASTM A185, fabricated from as-drawn steel wire into flat sheets.

C. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place.

1. Use wire bar-type supports with plastic tips, complying with CRSI specifications.

2. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type I.

1. Use one cement type and source throughout Project. No change in brand without prior written acceptance from Architect.

2. Normal-Weight Aggregates: ASTM C33

B. Water: Potable.

C. Admixtures General

1. Acceptable: Concrete supplier and Contractor shall use manufacturer's product identified in this Section or submit alternate manufacturer product for approval by Architect.

2. Concrete supplier and Contractor shall certify compatibility of all ingredients in each mix design. Use admixtures in strict accordance with manufacturer's recommendations.

3. Concrete supplier and Contractor shall account for admixture volume in the concrete mix proportions in accordance with admixture manufacturer's recommendations.

4. General: Provide concrete admixtures that contain not more than 0.1% chloride ions.

D. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. Air-Tite, Cormix Construction Chemicals.

b. Air-Mix or Perma-Air, Euclid Chemical Co.

c. Darex AEA or Daravair, W.R. Grace & Co.

d. MB-VR or Micro-Air, Master Builders, Inc.

e. Sealtight AEA, W.R. Meadows, Inc.

f. Sika AER, Sika Corp.

E. Water-Reducing Admixture: ASTM C494, Type A.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. Chemtard, ChemMasters Corp.

b. PSI N, Cormix Construction Chemicals.

c. Eucon WR-75, Euclid Chemical Co.

d. WRDA, W.R. Grace & Co.

e. Pozzolith Normal or Polyheed, Master Builders, Inc.

f. Metco W.R., Metalcrete Industries.

g. Prokrete-N, Prokrete Industries.

h. Plastocrete 161, Sika Corp.

F. Water-Reducing and Retarding Admixture: ASTM C494, Type D.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. PSI-R Plus, Cormix Construction Chemicals.

b. Eucon Retarder 75, Euclid Chemical Co.

c. Daratard-17, W.R. Grace & Co.

d. Pozzolith R, Master Builders, Inc.

e. Protard, Prokrete Industries.

f. Plastiment, Sika Corporation.

G. Water-Reducing, Accelerating Admixture: ASTM C494, Type E.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. Q-Set, Conspec Marketing & Manufacturing Co.

b. Lubricon NCA, Cormix Construction Chemicals.

c. Accelguard 80, Euclid Chemical Co.

d. Daraset, W.R. Grace & Co.

e. Pozzutec 20, Master Builders, Inc.

f. Accel-Set, Metalcrete Industries.

H. High Range Water-Reducing Admixture: ASTM C494, Type F or Type G.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. Super P, Anti-Hydro Co., Inc.

b. Cormix 200, Cormix Construction Chemicals.

c. Eucon 37, Euclid Chemical Co.

d. WRDA 19 or Daracem, W.R. Grace & Co.

e. Rheobuild or Polyheed, Master Builders, Inc.

f. Superslump, Metalcrete Industries.

g. PSPL, Prokrete Industries.

h. Sikament 300, Sika Corp.

2.04 RELATED MATERIALS

A. Moisture-Retaining Cover: One of the following, complying with ASTM C171.

1. Waterproof paper.

2. Polyethylene film.

3. Polyethylene-coated burlap.

B. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. m when applied at 200 sq. ft./gal.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. A-H 3 Way Sealer, Anti-Hydro Co., Inc.

b. Spartan-Cote, The Burke Co.

c. Conspec #1, Conspec Marketing & Mfg. Co.

d. Sealco 309, Cormix Construction Chemicals.

e. Day-Chem Cure and Seal, Dayton Superior Corp.

f. Eucocure, Euclid Chemical Co.

g. Horn Clear Seal, A.C. Horn, Inc.

h. L&M Cure R, L&M Construction Chemicals, Inc.

i. Masterkure, Master Builders, Inc.

j. CS-309, W.R. Meadows, Inc.

k. Seal N Kure, Metalcrete Industries.

l. Kure-N-Seal, Sonneborn-Chemrex.

m. Stontop CS2, Stonhard, Inc.

C. Water-Based Acrylic Membrane Curing Compound: ASTM C309, Type I, Class B.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.

2. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. Highseal, Conspec Marketing and Mfg. Co.

b. Sealco - VOC, Cormix Construction Chemicals.

c. Safe Cure and Seal, Dayton Superior Corp.

d. Aqua-Cure, Euclid Chemical Co.

e. Dress & Seal WB, L&M Construction Chemicals, Inc.

f. Masterkure 100W, Master Builders, Inc.

g. Vocomp-20, W.R. Meadows, Inc.

h. Metcure, Metalcrete Industries.

i. Stontop CS1, Stonhard, Inc.

D. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. Aquafilm, Conspec Marketing and Mfg. Co.

b. Eucobar, Euclid Chemical Co.

c. E-Con, L&M Construction Chemicals, Inc.

d. Confilm, Master Builders, Inc.

e. Waterhold, Metalcrete Industries.

2.05 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301 and ACI 318. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

1. Do not use the same testing agency for field quality control testing.

2. Limit use of fly ash to not exceed 25% of total cementitious content by weight.

B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed and approved by Architect.

C. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:

1. Columns and Walls:

a. 5000 psi, 28-day compressive strength

2. All other Cast-in-Place Concrete elements:

a. 4000 psi, 28-day compressive strength

3. Water-cement ratio: 0.40 for freezing, thawing and moisture exposure.

D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 3 in.

2. Reinforced foundation systems: Not less than 2 in. and not more than 4 in..

3. Concrete containing high-range water-reducing admixture (super-plasticizer): Not more than 8 in. after adding admixture to site-verified 2 - 3 in. slump concrete.

4. Other concrete: Not more than 4 in.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

2.06 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (super-plasticizer) in concrete, as required, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 40 deg F.

C. Use high-range water-reducing admixture in pumped concrete and concrete with water-cement ratios below 0.45.

D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of +/- 1% within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:

a. 5.5% (severe exposure) for 1-1/2 in. maximum aggregate.

b. 6.0% (severe exposure) for 1 in. maximum aggregate.

c. 6.0% (severe exposure) for 3/4 in. maximum aggregate.

d. 7.0% (severe exposure) for 1/2 in. maximum aggregate.

E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.07 CONCRETE MIXING

A. Ready-Mixed Concrete: All concrete shall be ready-mixed complying with requirements of ASTM C94, and as specified.

1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 – EXECUTION

3.01 GENERAL

A. Coordinate the installation of joint materials, floor drains, and other related materials with placement of forms and reinforcing steel.

B. Cast in Place Contractor shall coordinate with Structural Precast Concrete Fabricator's reviewed and approved shop drawings for placement of dowels connecting cast-in-place concrete elements to structural precast concrete elements. Contractor shall use templates, provided by Precast Fabricator, for placing dowels within specified tolerances.

3.02 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete shelves and surfaces receiving brick or precast concrete elements.

2. Provide Class C tolerances for other concrete surfaces.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

D. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

E. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.03 PLACING REINFORCEMENT

A. General: Comply with CRSI's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

D. Place reinforcement to maintain minimum coverage as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Locate reinforcing splices for wall-beams, beams and slabs only where specified on the drawings.

3.04 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect. Joints at wall-beams, beams and slabs shall be at mid-span only.

B. Provide keyways at least 1-1/2 in. deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

3.05 INSTALLING EMBEDDED ITEMS

A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

1. It shall be the responsibility of the Contractor to coordinate and verify the installation of all embedded items, including those furnished and installed by Subcontractors. He shall be responsible for avoiding, or reconciling, interferences between locations of inserts for all purposes, subject to the approval of the Architect.

2. In addition, the Contractor shall provide all items shown on the drawings but not required to be provided by a Subcontractor, including anchors for fastening items to the concrete.

B. Install dovetail anchor slots in concrete structures as indicated on drawings.

C. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.06 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.07 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

1. In all cases, the Contractor shall give the Architect at least 24 hours notice of intended concrete placement and no placement shall begin until the Engineer has approved the condition of foundations, forms, reinforcement, and embedded items

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 in. and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 in. into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.

2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.08 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 in. in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. 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.

3.09 MONOLITHIC SLAB FINISHES

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.

1. After placing slabs, finish surface to tolerances of F(F) 15 (floor flatness) and F(L) 13 (floor levelness) measured according to ASTM E1155. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.

1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness)

measured according to ASTM E1155. Grind smooth any surface defects that would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.

E. Nonslip Broom Finish: Apply a nonslip broom finish to driving surfaces, exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, 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 shown or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.11 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

D. Provide moisture curing by the following methods:

1. Keep concrete surface continuously wet by covering with water.

2. Use continuous water-fog spray.

E. Provide moisture-retaining cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 in. and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

I. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.12 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

3.13 REUSING FORMS

A. 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-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.14 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 in. in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 in. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 in. wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

3. Correct low areas in unformed surfaces 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. Proprietary underlayment compounds may be used when acceptable to Architect.

4. Repair defective areas, except random cracks and single holes not exceeding 1 in. in diameter, by cutting out and replacing with fresh concrete. Remove

defective areas with clean, square cuts and expose reinforcing steel with at least 3/4 in. clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes 1 in. or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

3.15 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Owner will employ an independent Testing Agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Architect.

1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.

a. Slump: ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

b. Air Content: ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

c. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F and below, when 80 deg F and above, and one test for each set of compressive-strength specimens.

d. Compression Test Specimen: ASTM C31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

e. Compressive-Strength Tests: ASTM C39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

3. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.

4. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

C. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, Contractor and Construction Manager within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.

END OF SECTION

SECTION 03410

PLANT-PRECAST STRUCTURAL CONCRETE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

B. If conflicts between documents arise, the more stringent requirements shall control, unless notified in writing by Engineer/Architect.

1.02 GENERAL PRECAST CONCRETE REQUIREMENTS

A. It is the intent of this Specification to secure, and the responsibility of the Contractor to provide, the design, fabrication, and erection of the precast concrete parking garage at the Maine Medical Center, hereafter referred to as the "Project."

B. The Contract Drawings for the precast concrete portions of the parking garage are general in nature and are based on performance type design for precast superstructure. The Precast Fabricator shall retain a qualified registered professional engineer legally licensed in the State of Maine, to perform the structural design of the precast concrete components, details and connections and to provide additional specifications necessary for fabrication and construction of all precast concrete pieces and required accessories.

C. Contractor shall cooperate and coordinate with all other trades in executing the work described in this section.

1.03 SUMMARY

A. Terminology used in this Section

1. Owner: Maine Medical Center

2. Architect of Record: The Ritchie Organization

3. Structural Engineer of Record: Simpson Gumpertz & Heger Inc.

4. Construction Manager: William A. Berry and Son, Inc.

5. "Precast Fabricator:" PCI Certified firm responsible for the design and fabrication of the precast portions of the Project.

6. "Precast Erector:" PCI Certified firm responsible for the erection and installation of the precast portions of the Project.

7. "Engineer/Architect:" Structural Engineer/Architect of Record for the Project.

8. "Precast Engineer:" Registered engineer responsible for the precast concrete portions of the Project, hired by or employed by the Precast Fabricator.

B. Related Sections include the following:

1. Division 3 Section 03300, "Cast-in-Place Concrete."

2. Division 7 Section 07840, "Firestopping" for joint filler materials for fire-resistance-rated construction.

3. Division 7 Section 07920, "Joint Sealant" for elastomeric joint sealants and sealant backings.

4. Division 7 Section 07100, "Dampproofing and Waterproofing."

5. Division 7 Section 07190, "Water Repellent."

1.04 SCOPE OF WORK

A. These specifications cover precast, precast prestressed and architectural finishes on the precast concrete. It includes precast component and connection design, fabrication, storage, transportation and erection.

1. All precast concrete pieces and connections shall be designed by the Precast Engineer, unless noted otherwise on Drawings.

B. Furnish and install all embedded and attached items in the precast work including, but not limited to, bearing pads, bearing plates, base plates, inserts, embedments, nuts, bolts, washers, clamps and shims. Furnish all anchorage devices that are to be embedded in the cast-in-place concrete with templates required for accurate placement.

C. Plant-precast structural concrete components include the following:

1. Double tees.

2. Precast girders.

3. Precast spandrel beams to comply with architectural finish requirements, specified herein.

4. Precast columns to comply with architectural finish requirements, specified herein.

5. Precast shear walls to comply with architectural finish requirements, specified herein.

6. Solid slab units.

D. The drawings identify certain special connections and certain typical connections but do not identify all connections. The Precast Fabricator is responsible for identifying and designing all necessary connections including, but not limited to the following:

1. Column restraining connections to double tee flanges.
2. Column restraining connections to precast girders.
3. Flange connections between double tees.
4. Double tee connections to girders.
5. Double tee connections to shear walls.
6. Spandrel connections to double tee flanges.
7. Spandrel connections to columns.
8. Spandrel connections to cast-in-place walls.
9. Girder connections to shear walls.
10. Girder connections to cast-in-place walls.
11. Shear wall connections to cast-in-place walls.
12. Stair/Elevator tower connections to spandrel beams.
13. Stair/Elevator tower connections to shear walls.
14. Column splice connections.
15. Double tee bearing plates and pads.
16. Spandrel beam bearing plates and pads.
17. Girder bearing plates and pads.

E. Refer to the drawings for further definition of location and extent of the work described herein.

1. Drawings show precast member sizes assumed and used as basis for Architectural Drawings and Details and foundation design. Alternate member sizes will be accepted only if structurally required and if they have a negligible effect on foundations and architecture.

F. All work specified under Division 7 Section 07920 "Joint Sealant" shall be furnished and installed as part of the work specified in this Section. The Precast concrete supplier shall be responsible to the Owner and to the Construction Manager for the quality and performance of the joints, joint sealants and sealers specified in Division 7 Section 07920 "Joint Sealants."

1.05 PERFORMANCE REQUIREMENTS

A. Future Expansion: Design parking structure for future vertical expansion of 3 additional levels above the 7 stories shown in the Drawings. Future parking structure to have 10 stories total.

B. Structural Performance: Provide precast structural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Governing Building Code: 2003 International Building Code (IBC 2003):

a. Design shall comply with the IBC 2003 and all applicable references including, but not limited to, those listed in the "Codes and Reference Standards" Section of this specification.

2. Dead Loads:

a. Maximum self weights using normal weight concrete for all pieces.

b. Superimposed Load: 10psf uniform on all driving surfaces.

3. Live Loads:

a. Driving surfaces: 50 psf uniform

b. Stairs/Elevator Towers: 100 psf uniform

c. Concentrated member loads per IBC 2003.

4. Snow Loads:

a. Ground Snow Load: 60 psf

b. Exposure: Partially Exposed

c. Thermal Factor, 1.2 (unheated)

d. Importance Factor: 1.0

e. Flat Roof Snow Load: 51 psf

5. Wind Loads:

a. Basic Wind Speed:

(1) 100 mph (3-second gust speed)

(2) 80 mph (fastest mile wind speed)

b. Importance Factor: 1.0

c. Exposure Category: B

d. Mean Roof Height: 105 ft (For 10-Story tall structure)

6. Seismic Loads:

a. Occupancy Importance Factor: 1.0

b. Seismic Use Group: I

c. Site Class: D

d. 0.2 sec Spectral Response Acceleration, S_s: 0.40

e. 1.0 sec Spectral Response Acceleration, S_1: 0.10

f. Site Coefficient, F_a: 1.48

g. Site Coefficient, F_v: 2.40

h. Seismic Design Category: C

i. Structural Systems:

(1) North-South Direction: Ordinary Reinforced Concrete Shear Wall, Non-Load Bearing

(2) East-West Direction: Ordinary Reinforced Concrete Shear Wall, Load Bearing

(3) Response Modification Coefficient:

(a) North-South Direction, R: 5.0

(b) East-West Direction, R: 4.5

(4) Deflection Amplification Factor:

(a) North-South Direction, C_D: 4.5

(b) East-West Direction, C_D: 4.0

C. System described here is intended to perform in ACI 362.1R-97 Zone III environment without long-term corrosion or other distress. If maintained per manufacturer's recommendations, system is expected to function satisfactorily for 40 yrs.

D. Design structural reinforcement required in precast components to resist handling, shipping, and erection stresses.

1. Minimum concrete cover for reinforcement, prestressing strands, etc. shall be based on ACI 318, Sections 7.7.2a, 7.7.3.1a, 7.7.3.1b and 7.7.3.2.

E. Design all spandrel components to withstand the vehicle barrier load requirements prescribed in IBC 2003 as follows:

1. Beams functioning as a vehicle barrier shall be designed to resist a single concentrated impact load of 6,000 lbs applied horizontally as per Section 1607.7.3 in IBC 2003.

2. This load shall be applied at a minimum height of 1 ft – 6 in. above the floor level on an area not to exceed 1 sq. ft.

F. See Architectural Drawings and subsequent sections of this specification for special architectural finishes.

G. All pieces shall have fire ratings as required by the Building Code.

H. Minimum Durability Design Requirements:

1. Double tee flange connectors and anchorages: Stainless steel alloy meeting requirements of ASTM A304.

2. Excluding tee to tee connections, galvanize entire assembly of all connection hardware and end bearing plate assemblies.

   a. Touch up galvanizing with "Z.R.C. Cold Galvanizing" by Z.R.C. Chemical Products, Quincy, Massachusetts or equivalent approved by Engineer/Architect.

3. Provide extra reinforcing around all openings, including door openings, as follows:

   a. Add 2 #5 bars on all 4 sides of openings and extend 2 ft beyond each corner of opening.

   b. Add 2 #5 bars 4 ft long as diagonal bars at each corner of opening.

4. Steel connectors: Provide welded plate or angle connectors at the following locations as minimum unless other method(s) accepted in writing by Engineer/Architect:

   a. Typical Exterior Columns: Minimum of 2 per column to tee flange, 1 in each column face parallel to spandrel.

   b. Interior Columns/Panels: Minimum of 4 per column to tee flange, 2 in each face of column that is perpendicular to double tee spans.

   c. Corner Columns: Minimum of 2 per column to tee flange, 1 in each interior column face.

   d. Exterior Spandrels: Minimum of 1 at each double tee stem in load bearing spandrels and minimum of 1 every 4 ft on center for non-bearing spandrels to tee flange.

5. Diaphragm Reinforcing: Precast Engineer shall perform diaphragm analysis and design diaphragm connection details for lateral design loads.

I. Precast System Design Criteria

1. Double Tees:

a. Design shall include type, number, and location of strands, flange reinforcement, shear reinforcement, cast-in-place concrete topping reinforcement (if any), end bearing plate and confinement reinforcement. Entire assembly of end bearing plates shall be hot dipped galvanized.

b. Design flanges to support design dead load and either uniform (design) live load or 3,000 lb concentrated wheel live load acting on an area of 4.5 in. by 4.5 in. (located to produce maximum stress condition), whichever produces greatest stresses.

c. As determined by project conditions, design as "restrained" or "unrestrained" pieces for purposes of fire rating requirements. Use ASTM E119 to determine restraint conditions. Minimum cover of reinforcement, prestressing strands, etc., and other fire rating design criteria shall be based on this premise.

d. Surfaces to receive concrete topping shall be rough to allow proper bond per ACI 318, Section 17.5.

e. Flange edge connections shall be stainless steel alloy A304 "Vector Connector" by JVI, Inc., or approved equivalent.

f. Flange reinforcement shall be epoxy coated.

2. Beams: Exterior and Interior "L," inverted Tee, Exterior load bearing walls, and Spandrel (Non-Load Bearing):

a. Design shall include type, number, and location of longitudinal reinforcement, shear torsion reinforcement, end bearing plates and confinement reinforcement, connection requirements, and ledge reinforcement. Ledge reinforcement shall be designed per PCI MNL 120-99, Design Handbook, Fifth Edition, Section 4.5. Continuity shall be maintained between both faces of reinforcement at ends of pieces. Inverted tee beams and L-beams may be designed as composite sections, but overhanging flanges shall not be considered as part of the effective section.

b. If piece is to be prestressed, maximum tensile stress in concrete for dead load plus reduced live load (30 psf minimum) shall not exceed limits stated in ACI 318, Section 16.4.

c. Torsion design shall be per PCI MNL 120 "Design Handbook, Fifth Edition," Section 4.4 and ACI 318 Section 11.6.

d. Skew ends of beams as required for sloping bays.

3. Columns:

a. Design shall include number and location of vertical reinforcement, vertical reinforcement splices, shear reinforcement, concrete haunch (corbel) design, including bearing plates and anchor bolts at foundation

b. Corbels and pockets shall be sloped as required for beam bearings.

c. Splice locations shall be placed as shown on the Contract Drawings or at alternate locations as approved by Engineer/Architect.

d. Live loads may be reduced as permitted by IBC 2003, up to a maximum of 20% for members supporting two or more floors.

4. Connections:

a. Connections shown on Contract Drawings are minimum required and are intended to establish standard of performance. Engineer/Architect reserves right to accept or reject alternate details. Design connection to transfer gravity loads, lateral loads, torsion forces and forces due to volume change effects between structural members. Design shall meet or exceed recommendations in PCI MNL 120, "Design Handbook – Precast Prestressed Concrete," Fifth Edition.

b. Use minimum additional load factor of 1.2 for design of all superstructure connections. Restraint developed by friction between bearing pads and connection pieces shall not be considered to contribute to connection capacities. Positive connections shall be made by welds, bolts, or cast-in-place reinforcement.

c. Bearing pads shall be provided by precast subcontractor as shown on Contract Drawings. Refer to Part 2 Article "Connection Materials" for additional information.

d. Beam to column bearing pads shall not extend under beam ledge unless ledge is designed for bearing or recessed to prevent bearing.

e. Design column and wall base plates and shims so that base plate grouting is not needed prior to erection of pieces supported by column or wall.

1.06 SUBMITTALS

A. Design Documents:

1. Precast Engineer shall prepare, sign and seal final structural design drawings, design calculations, shop drawings, and specifications (hereinafter referred to as Design Documents).

2. The Design Documents shall be submitted to Engineer/Architect for review and approval before any fabrication or construction of Project.

   a. Design Documents, prepared, signed and sealed by Designer, may be submitted in "stages" to allow for phased construction.

3. Precast Engineer shall prepare, sign and seal drawings, and calculations for submittal to proper governing authorities as required.

B. Precast Engineer's Insurance and Certificate:

1. Precast Engineer shall be required to furnish Owner a Certificate of Professional Liability Insurance in minimum amount of $1,000,000 per claim. All Design Documents prepared by Precast Engineer shall be certified (bear seal and signature of Precast Engineer registered in the State of Maine before they are submitted for review).

C. Product Data: For each type of product listed in this specification.

D. Concrete Design Mixes: For each concrete mix, prior to the fabrication of the precast concrete units, submit to Engineer/Architect.

1. Submit concrete test reports, based on guidelines in PCI MNL 116, on a semi-monthly basis during fabrication of precast concrete units. Submit for review, test reports for concrete used in the precast concrete units, to the Engineer/Architect.

E. Shop Drawings: Detail fabrication and erection of precast structural concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, openings, and types of reinforcement, including special reinforcement and lifting devices necessary for handling and erection.

1. Indicate identification of each precast component corresponding to sequence and procedure of installation.

2. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories and construction at openings in precast components.

3. Indicate locations and details of anchorage devices to be embedded in other construction, (i.e. CIP foundation walls and pedestals.) Furnish templates if required for accurate placement.

4. Instead of submitting shop drawings for all piece marks, Precast Fabricator may elect to submit shop drawings for typical pieces and each unique piece, along with reinforcing detail drawing for corresponding calculations.

5. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation.

a. Include calculated fire-resistance analysis showing compliance with applicable building code requirements.

F. Erection Plan

1. Submit to the Engineer/Architect for review, prior to construction, erection procedure, erection sequence, calculations and details for guying, staying and shoring all precast components to assure structural stability during the construction stage before completed permanent structural connections are in place.

2. Provide, in the erection plan, for removal replacement, or relocation of guying, bracing and shoring of the structure during the construction stage to accommodate the Work of other trades.

3. If during construction, modifications are necessary to accommodate other trades, revise and resubmit the erection plan to the Engineer/Architect for review and approval.

4. The erection plan shall be prepared and certified by a registered professional engineer in the State of Maine.

5. Review of the erection plan by the Engineer/Architect does not relieve the Precast Erector of responsibility for the stability and safety of the structure during the construction stage.

G. Samples: For each type of finish indicated on exposed surfaces of precast structural concrete units, in sets of 3, illustrating quality of finishes, colors, and textures; approximately 12 by 12 by 2 in.

1. Thin Brick Samples:

a. For each thin brick unit required, submit three sample bricks including special shapes, showing the full range of colors, textures, and dimensions expected.

b. Submit three samples of form liner templates for thin brick facings; approximately 24 in. by 24 in.

c. Pointing Mortar: Color charts consisting of actual sections of mortar showing the manufacturer's full range of colors.

2. Clearly label samples on the back or tagged to indicate: Name of Project, Construction Manager, Owner, Precast Fabricator or source, sample number, type and intended building location.

H. Samples of bearing pads.

I. Welding Certificates: Copies of certificates for welding procedures and personnel.

J. Qualification Data: For firms and persons specified in "Quality Control and Quality Assurance" Section to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

K. Material Certificates: Signed by Manufacturer certifying that each of the following items complies with requirements:

1. Concrete materials.

2. Reinforcing materials and Prestressing tendons.

3. Admixtures.

4. Bearing pads.

L. Proof of Professional Engineering Registration in the State of Maine for the Precast Fabricator's design professional engineer.

M. Proof of Professional Engineering Registration in the State of Maine for the professional engineer who prepares the precast concrete erection plan, if different than item "L" above.

N. Proof of certification of precast concrete supplier's plant under Precast/Prestressed Concrete Institute plant certification program in category C3A, or C4A if required, before award of contract.

O. Letter of Qualification, furnished by Precast/Prestressed Concrete Institute confirming that Precast Erector is fully qualified in Structure Category S2.

P. Proof of precast erector qualification under PCI Field Qualification Program.

Q. Proof of precast erector's superintendent's qualification as Certified Field Auditor.

R. Confirmation by a Maine Registered Surveyor that the erected structure deviates from plumb by less than the allowable tolerances.

S. Resubmittals: Engineer/Architect will review each of the Contractor's shop drawings and/or submittal data the initial time and, should resubmittal be required, one additional time to verify that reasons for resubmittal have been addressed by the Contractor and corrections made. Resubmittal changes/revisional corrections shall be circled. Engineer/Architect will review only circled items and will not be responsible for non-circled changes/revisions/corrections and additions. Should additional resubmittals be required, Contractor shall reimburse Owner for all costs incurred including the costs of Engineer/Architect's services made necessary to review such additional submittals. Owner will in turn reimburse Engineer/Architect.

T. Engineer/Architect reserves the right to reject any Request for Information (RFI) that the Engineer/Architect, at their sole discretion, deems frivolous or already answered by the Contract Documents. The RFI process shall not be used for requesting substitutions.

1.07 QUALITY CONTROL AND QUALITY ASSURANCE

A. Fabricator Qualifications

1. A firm that complies with the following requirements and is experienced, minimum of 5 years, in manufacturing precast structural concrete units similar to those indicated for this Project and with a record of successful in-service performance.

a. Assumes responsibility for engineering precast structural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

b. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of precast structural concrete that are similar to those indicated for this Project in material, design, and extent.

c. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group C, Category C3A, or C4A if required.

d. Has sufficient production capacity to produce required units without delaying the work.

B. Erector Qualifications

1. An experienced, minimum of 5 years, erector who has completed precast structural concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance. Precast concrete erector shall be fully qualified in Structure Category S2 by Precast/Prestressed Concrete Institute prior to beginning work.

C. Testing Agency Qualifications

1. An independent testing agency, acceptable to authorities having jurisdiction, selected and hired by the Precast Fabricator, qualified according to ASTM C1077 and ASTM E329 to conduct the testing indicated.

D. Design Standards: Comply with ACI 318 and the design recommendations of PCI MNL 120, "PCI Design Handbook – Precast and Prestressed Concrete."

E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and camber and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products."

F. Quality Assurance

1. The Owner may employ a separate testing agency to evaluate Precast Fabricator's quality control and testing procedures.

2. The Precast Fabricator shall allow the Owner's testing agency access to all areas used to produce, store and test the precast units and their constituent parts.

3. The Precast Fabricator will provide samples of materials or mixes requested by the Owner or the Owner's testing agency.

4. The Precast Fabricator will cooperate with the Owner's agent for the purpose of checking tolerances.

G. Product Options: Drawings indicate size, profiles, and dimensional requirements of precast concrete units and are based on the specific types of units indicated. Other fabricators' precast concrete units complying with requirements may be considered. Refer to Division 1 Section 01630 "Product Substitution Procedures."

H. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code – Steel"; and AWS D1.4, "Structural Welding Code – Reinforcing Steel."

I. Calculated Fire Resistance: Where indicated, provide precast structural concrete floor units whose fire resistance has been calculated according to PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete," and is acceptable to authorities having jurisdiction.

J. Fire-Test-Response Characteristics: Provide precast structural concrete units that comply with the following requirements:

1. Fire-response testing performed by UL, ITS, or another testing and inspecting agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.

2. Fire-resistance-rated assemblies, which are indicated by design designations from UL's "Fire Resistance Directory," from ITS's "Directory of Listed Products," or from the listings of another testing and inspecting agency, are identical in materials and construction to those tested per ASTM E119.

3. Products are identified with appropriate markings of applicable testing and inspecting agency.

K. Mockups: Before fabricating precast structural concrete units, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Engineer/Architect.

2. Architectural Finish Sample Panels:

a. Before fabricating precast concrete units, produce sample panels for each type of finish (i.e. thin brick, exposed aggregate, sand-blast, etc.) to establish the approved range of selections made under sample Submittals.

b. Precast Fabricator shall make 2 ft sq. samples for finish selection only. If rejected, another set of samples shall be made for review, until acceptable sample is made.

3. Sample Exterior Spandrel Panels:

a. After acceptance of finish sample, Precast Fabricator shall produce a minimum of 3 sets of full-scale sample panels, approximately 48 in. long by full height, for each type of exterior spandrel panel designated "architectural precast concrete" on Drawings to demonstrate the expected range of finish, color, and texture variations.

(1) In presence of Architect, damage part of an exposed-face surface for each finish, color, and texture, including thin brick facing, and demonstrate materials and techniques proposed for repair of surface blemishes to match adjacent undamaged surfaces.

b. Sample panel will be reviewed at precast plant by Engineer/Architect. If rejected, another set of sample panels shall be made for review, until acceptable samples are made. If accepted, sample panel shall be held at plant until production is complete, then shipped to site (if required) and held there until completion and acceptance of project, when Contractor shall remove it from site.

4. Production Exterior Spandrel:

a. After acceptance of sample exterior spandrel panel, manufacture 2 full size precast units matching the approved samples for final approval and continued reference. These production samples shall be typical of average production pieces including returns, slopes, etc.

b. After approval, these units will serve as the standard of reference for quality for all production units, and shall be displayed at a convenient location at the plant throughout the life of the contract.

c. Production of units shall not proceed until the full size sample units have been approved by Engineer/Architect.

d. Full size samples shall contain same reinforcement and be of the same thickness as production units, and shall be cast in same position, same manner and same rate as production units.

e. The full size sample units may be used for the building, but shall not be shipped from the precast fabrication plant until all units of that type have been fabricated.

5. Notify Engineer/Architect seven days in advance of dates and times when mockups will be constructed.

6. At Precast Fabricator's plant, maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

7. Demolish and remove mockups when directed.

L. Concrete Testing:

1. Perform and pay for compression tests for all precast concrete work with in-house Quality Control personnel. Testing is subject to observation by Testing Agency hired by Owner. Use certified test equipment. Unless otherwise specified, conform with PCI MNL 116.

2. Precast Structural Concrete Testing: Sample, test and report concrete results in accordance with PCI MNL 116, with following exceptions:

a. Placement is defined as 50 cu. yd. (or fraction thereof) placed for each day of production.

b. Make six cylinders per placement: 3 at beginning (labeled "A") and 3 at end of placement (labeled "B").

c. Only 1 "A" and 1 "B" cylinder made for each placement need be cured per PCI MNL 116. Test these cylinders to verify concrete compressive strength at transfer of prestress.

d. Other cylinders may be moist cured and tested at 28 days to verify design compressive strength of concrete.

e. Discard remaining cylinders after 56 days upon approval in writing by the Engineer/Architect.

M. Precast Fabricator shall provide casting schedule to Engineer/Architect with first shop drawings submittal. Precast Fabricator shall notify Engineer/Architect 48 hours in advance of casting of each piece type (tees, L-beams, spandrel beams, inverted tee beams, columns, wall panels, or other pieces) so that Engineer/Architect may review reinforcement fabrication at Precast Fabricator's plant before casting. Engineer/Architect may request notification for specific piece marks.

N. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section 01310 "Project Meetings."

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver precast structural concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Precast Fabricator's plant to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.

B. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

1.09 SEQUENCING

A. Furnish anchorage items to be embedded in other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

B. Contractor shall coordinate manufacturing, delivery and erection schedules.

C. Allow adequate time for curing of precast pieces prior to erection as required by Part 3 of this Specification.

1.10 CODES AND REFERENCE STANDARDS

A. Comply with provisions of the following codes, specifications, and standards, except as otherwise indicated. Standard specifications of technical societies, manufacturer's associations and agencies shall include all amendments current as of the date of issue of these specifications.

B. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M251, "Plain and Laminated Elastomeric Bridge Bearings.""

C. American Concrete Institute (ACI):

1. ACI 301, "Standard Specification for Structural Concrete."

2. ACI 305R, "Hot Weather Concreting"

3. ACI 306.1, "Standard Specification for Cold Weather Concreting."

4. ACI 318, "Building Code Requirements for Structural Concrete."

5. ACI 362.1 R-97, "Guide for the Design of Durable Parking Structures." Recommendations, not specifications.

D. American Society of Civil Engineers(ASCE):

1. ASCE 7-02, "Minimum Design Loads for Buildings and Other Structures."

E. American Society for Testing and Materials (ASTM):

1. ASTM A36, "Standard Specification for Carbon Structural Steel."

2. ASTM A47, "Standard Specification for Ferritic Malleable Iron Castings."

3. ASTM A82, "Standard Specification for Steel Wire, Plain, for Concrete Reinforcement."

4. ASTM A108, "Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished, Standard Quality."

5. ASTM A123, "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."

6. ASTM A153, "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware."

7. ASTM A167, "Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip."

8. ASTM A184, "Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement."

9. ASTM A185, "Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete."

10. ASTM A276, "Standard Specification for Stainless Steel Bars and Shapes."

11. ASTM A304, "Standard Specification for Carbon and Alloy Steel Bars Subject to End-Quench Hardenability Requirements."

12. ASTM A307, "Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength."

13. ASTM A416, "Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete."

14. ASTM A480, "Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip."

15. ASTM A496, "Specification for Steel Wire, Deformed, for Concrete Reinforcement."

16. ASTM A497, "Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete."

17. ASTM A500, "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes."

18. ASTM A615, "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement."

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

20. ASTM A706, "Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement."

21. ASTM A767, "Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement."

22. ASTM A775, "Standard Specification for Epoxy-Coated Steel Reinforcing Bars."

23. ASTM A884, "Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement."

24. ASTM A934, "Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars."

25. ASTM A1008, "Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability."

26. ASTM B633, "Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel."

27. ASTM C33, "Standard Specification for Concrete Aggregates."

28. ASTM C42, "Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete."

29. ASTM C67, "Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile."

30. ASTM C94, "Standard Specification for Ready-Mixed Concrete."

31. ASTM C144, "Standard Specification for Aggregate for Masonry Mortar."

32. ASTM C150, "Standard Specification for Portland Cement."

33. ASTM C157, "Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete."

34. ASTM C173, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method."

35. ASTM C231, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method."

36. ASTM C260, "Standard Specification for Air-Entraining Admixtures for Concrete."

37. ASTM C265, "Standard Test Method for Water-Extractable Sulfate in Hydrated Hydraulic Cement Mortar."

38. ASTM C31, "Standard Practice for Making and Curing Concrete Test Specimens in the Field."

39. ASTM C42, "Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete."

40. ASTM C143, "Standard Test Method for Slump of Hydraulic Cement Concrete."

41. ASTM C311, "Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete."

42. ASTM C330, "Standard Specification for Lightweight Aggregates for Structural Concrete."

43. ASTM C457, "Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete."

44. ASTM C494, "Standard Specification for Chemical Admixtures for Concrete."

45. ASTM C595, "Standard Specification for Blended Hydraulic Cements."

46. ASTM C618, "Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete."

47. ASTM C881, "Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete."

48. ASTM C989, "Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars."

49. ASTM C1077, "Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation."

50. ASTM C1088, "Standard Specification for Thin Veneer Brick Units Made From Clay or Shale."

51. ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)."

52. ASTM C1202, "Standard Test Method for Electrical Indication of Concretes Ability to Resist Chloride Ion Penetration."

53. ASTM C1218, "Standard Test Method for Water-Soluble Chloride in Mortar and Concrete."

54. ASTM C1240, "Standard Specification for Use of Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout."

55. ASTM D412, "Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension."

56. ASTM E119, "Standard Test Methods for Fire Tests of Building Construction and Materials."

57. ASTM E329, "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction."

58. ASTM F593, "Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs."

F. American Welding Society (AWS):

1. AWS D1.1, "Structural Welding Code – Steel."

2. AWS D1.4, "Structural Welding Code – Reinforcing Steel."

3. AWS WZC (D19.0), "Welding Zinc-Coated Steel."

G. Concrete Reinforcing Steel Institute (CRSI):

1. CRSI MSP, "Manual of Standard Practice."

H. International Code Council (ICC):

1. IBC 2003, "2003 International Building Code"

I. Prestressed Concrete Institute (PCI):

1. PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."

2. PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

3. PCI MNL 120-99, "Design Handbook – Precast and Prestressed Concrete, Fifth Edition." Recommendations, not specifications.

4. PCI MNL 129, "Parking Structures – Recommended Practice for Design and Construction." Recommendations, not specifications."

1.11 ALTERNATES

A. Alternate structural systems, if proposed, shall conform in basic concept to Base Bid as detailed. Structure shall be totally precast with 4 in. thick flange, pre-topped double tee deck pieces, column sizes and locations shall remain as shown, and all clearances shall be provided as shown in Drawings.

B. Precast Engineer shall perform design of any alternates to Engineer/Architect's design of precast superstructure. Designer shall submit Design Documents for alternates according to Submittals Section of this Specification.

C. Drawings showing construction details for any alternate must be submitted to Engineer/Architect for review before alternates will be considered with the Bid. At the time of bidding these submittals shall include sufficient detail to show all deviations from the Contract Documents and shall include a listing of all deviations and the add or deduct cost associated with each change.

D. Contractor shall be responsible for engineering fees and any increased construction cost resulting from review process and modifications for Alternate precast superstructure design of the Project.

1.12 PRODUCT WARRANTY

A. Provide warranty similar to sample below:

1. Precast Fabricator warrants that all materials furnished have been manufactured in accordance with the specifications for this project. Precast Fabricator further warrants that if erection of said material is to be performed by those subject to this control and direction, work will be completed in accordance with the same specifications.

2. In no event shall Precast Fabricator be held responsible for any damages, liability or costs of any kind or nature occasioned by or arising out of the actions or omissions of others, or for work, including design, done by others, or for material manufactured, supplied or installed by others; or for inadequate construction of foundations, bearing walls, or other units to which materials furnished by the Precast Fabricator are attached or affixed.

3. Period of this warranty shall be 5 years beginning at date of beneficial occupancy. Should any defect (other than hairline cracks: defined as not more than 0.003 in. wide) be discovered after acceptance and occupancy of Project, which can be directly attributed to defect in product material or workmanship not evident at time of initial occupancy, then Precast Fabricator shall, upon written notice, correct defects or replace products without expense to Owner, Engineer/Architect or Construction Manager. In sole judgment of Engineer/Architect, any defects resulting from issues outlined in paragraph above, or resulting from normal wear and tear, product color changes or improper maintenance procedures are not considered responsibility of Precast Fabricator.

1.13 REPAIR WARRANTY

A. Furnish Owner with written total responsibility guarantee that repairs will be free of defects, water penetration and deterioration related to repair design, workmanship or material deficiency.

B. Warranty period shall be 5 years commencing with date of acceptance of repair.

C. Perform any repair under warranty at no cost to Owner.

D. Before construction, Precast Fabricator shall provide Engineer/Architect with sample of final warranty.

PART 2 – PRODUCTS

2.01 FABRICATORS

A. Subject to compliance with requirements, provide all structural precast concrete products shown on drawings.

2.02 MOLD MATERIALS

A. Provide molds and, where required, form-facing materials of metal, plastic, wood, or another material that is non-reactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes

B. Connection Blockouts, Covers, Sleeves, Caps:

1. Acceptable manufacturer:

a. High Concrete Accessories, Lancaster, PA 17605, or approved equivalent.

2. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. "Grouted Connection Tube."

b. "Double Tee Stem Blockout."

c. "Spandrel to Column Connector Sleeve and Closure Cap."

2.03 REINFORCING MATERIALS

A. Double tee flange reinforcement shall be epoxy coated.

B. Reinforcing Bars: ASTM A615, Grade 60, deformed.

C. Epoxy-Coated Reinforcing Bars: ASTM A775 or ASTM A934, as follows:

1. Steel Reinforcement (ASTM A615, Grade 60), deformed.

D. Steel Bar Mats: ASTM A184, assembled with clips, as follows:

1. Steel Reinforcement: (ASTM A615, Grade 60), deformed bars.

E. Epoxy-Coated-Steel Wire: ASTM A884, Class A coated, plain.

F. Plain-Steel Welded Wire Fabric (WWF): ASTM A185, fabricated from as-drawn steel wire into flat sheets.

G. Epoxy-Coated-Steel Welded Wire Fabric (ECWWF): ASTM A884, Class A coated, plain.

H. Structural Synthetic Fiber may be used in addition to WWF to provide resistance against cracking due to impact, temperature, and shrinkage. Fiber dosage designated herein.

I. Accessories: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place according to CRSI's "Manual of Standard Practice," PCI MNL 116, and as follows:

1. For uncoated reinforcement, use all-plastic bar supports.

2. For epoxy-coated reinforcement, use all-plastic bar supports.

3. For zinc-coated reinforcement, use all-plastic bar supports.

J. Reinforcing Bar Splices:

1. Products: Subject to compliance with requirements, provide the following, or approved equivalent:

2. NMB Splice Sleeve System.

2.04 PRESTRESSING TENDONS

A. Prestressing Strand: ASTM A416, Grade 270, uncoated, 7-wire, low-relaxation strand.

2.05 CONCRETE MATERIALS

A. Ready Mixed Concrete: Obtain concrete from plant with current certification from:

1. Concrete Materials Engineering Council.

2. Maine Department of Transportation.

3. National Ready Mixed Concrete Association.

4. Prestressed Concrete Institute.

B. Portland Cement (ACI 301, Paragraph 4.2.1.1):

1. Portland Cement: ASTM C150, Type I or Type III. Use one cement type and source throughout project. No change in brand without prior written acceptance from Engineer/Architect.

2. Blended Cement: ASTM C595, Type IP(A) only with prior written acceptance from Engineer/Architect.

C. Face-Mix Course Aggregates

1. 60% – 1/2 in. gray granite.

2. 40% – 1/2-inch pink feldspar

D. Face-Mix Fine Aggregates.

1. Crushed gray granite

E. Normal-Weight Aggregates (ACI 301, Paragraph 4.2.1.2):

1. Coarse aggregate: Crushed and graded limestone or approved equivalent conforming to ASTM C33 complying with Class 5S. Provide course aggregate from a single source for exposed concrete.

   a. Normal maximum size number 67, (3/4 in. to No. 4 sieve), conforming to ASTM C33, Table 2.

   b. No deleterious materials such as, but not limited to, chert or opaline.

2. Fine aggregate: Natural sand conforming to ASTM C33 and having preferred grading shown for normal weight aggregate in ACI 302.1R, Table 4.2.1. Provide fine aggregate from a single source for exposed concrete.

3. Chloride Ion Level: Chloride ion content of aggregates shall be tested by laboratory making trial mixes.

F. Water:

1. Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

G. Fly Ash:

1. Permitted in all parts of structure.

2. ASTM C618, Class C or F

3. Testing: ASTM C311.

4. Percentage of fly ash in mix design shall be by weight, not by volume. Water/cement ratio will be calculated as water/cementitious (total cement and fly ash) ratio.

5. Prohibited: Fly ash in same mix with Type IP blended cement.

6. Submit all fly ash concrete mix designs per ACI 301.

7. If strength or air content varies from value specified by more than specified tolerances, Engineer or designated representative shall reject that concrete.

H. Ground Granulated Blast-Furnace Slag (GGBF):

1. ASTM C989, Grade 100 or higher.

2. Percentage of GGBF slag in mix design shall be by weight, not by volume. Water-cement ratio shall be calculated as water-cementitious (total Portland cement + GGBF slag) ratio.

3. Prohibited: GGBF slag in same mix with cementitious materials other than Portland cement.

4. Submit all GGBF slag concrete mix designs per ACI 301.

5. If strength or air content varies from value specified by more than specified tolerances, Engineer or designated representative shall reject that concrete.

I. Storage of Materials (ACI 301, Paragraph 4.1.4)

1. Cementitious Material: Store and handle aggregate in a manner that will avoid segregation and prevent contamination with other material or other sizes of aggregates. Store aggregates to drain freely. Do not use aggregates that contain frozen lumps.

2. Water and Ice: Protect mixing water and ice from contamination during storage and delivery.

3. Admixtures: Protect stored admixtures against contamination, evaporation, or damage. Provide agitating equipment for admixtures used in the form of suspensions or nonstable solutions to ensure thorough distribution of the ingredients. Protect liquid admixtures from freezing and from temperature changes which would adversely affect their characteristics.

2.06 ADMIXTURES

A. Acceptable: Concrete supplier and fabricator shall use manufacturer's product identified in this Section or submit alternate manufacturer product for approval by Engineer/Architect.

B. Concrete supplier and fabricator shall certify compatibility of all ingredients in each mix design. Use admixtures in strict accordance with manufacturer's recommendations.

C. Concrete supplier and fabricator shall account for admixture volume in the concrete mix proportions in accordance with admixture manufacturer's recommendations.

D. Prohibited Admixtures: Calcium chloride or admixtures containing more than 0.15% chloride ions, by weight of admixture, are not permitted. Additionally, each admixture shall not contribute more than 5 PPM, by weight, of chloride ions to total concrete constituents.

1. Chloride Ion Content in concrete mix shall be limited as specified in Section "Concrete Mixes" of this Specification.

E. Use water-reducing admixture or high-range water-reducing admixture (super-plasticizer) in concrete as required for placement and workability.

F. Use high-range water-reducing admixture (HRWR) in pumped concrete, and for concrete with water/cement ratio of 0.45 or less.

G. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of +/- 1%

H. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. "Air-Mix," or "'AEA-92, Euclid Chemical Co.

b. "Micro-Air," or "MB-VR," or "MBAE-90," Master Builders. Inc.

c. Daravair Series or Darex Series, W.R. Grace & Co.

d. "AE 260," Axim Concrete Technologies.

I. Water-Reducing Admixture: ASTM C494, Type A.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. "Eucon Series," Euclid Chemical Co.

b. "Pozzolith Series," or "Polyheed Series," Master Builders, Inc.

c. "WRDA Series," W.R. Grace & Co.

d. "1000 N," Axim Concrete Technologies.

J. Retarding Admixture: ASTM C494, Type B.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. "Eucon Series," Euclid Chemical Co.

b. "Pozzolith Series," Master Builders, Inc.

c. "Daratard Series," W.R. Grace & Co.

d. Catexol Series" Axim Concrete Technologies.

K. Water-Reducing and Retarding Admixture: ASTM C494, Type D.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. "Eucon Retarder-75," Euclid Chemical Co.

b. "Pozzolith 100XR," Master Builders, Inc.

c. "Daratard-17" or "Recover," W.R. Grace & Co.

d. "Catexol 1000 R," Axim Concrete Technologies.

L. High Range Water-Reducing Admixture (Super-plasticizer): ASTM C494, Type F.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. "Eucon 37 or 1037," Euclid Chemical Co.

b. "Rheobuild 1000," or "Rheobuild 2000FG," Master Builders, Inc.

c. "Daracem" series or "ADVA" series, W.R. Grace & Co.

d. "Catexol Superflux 2000 PC," Axim Concrete Technologies.

e. "1000 SP-MN," Axim Concrete Technologies.

M. High Range Water Reducing and Retarding Admixture (Super-plasticizer), ASTM C494 Type G.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. "Eucon 537," Euclid Chemical Co.

b. "Rheobuild 716," Master Builders, Inc.

c. "Daracem 100," W.R. Grace & Co.

N. Silica Fume Admixture: ASTM C1240

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. "Eucon MSA," by The Euclid Chemical Company, Cleveland, OH.

b. "Force 10,000 D or S," by W.R. Grace & Co., Cambridge, MA.

c. "MB-SF Slurry," Master Builders, Inc., Cleveland. OH.

d. "MB-SFI 100" dry compacted silica fume, Master Builders Inc., Cleveland, OH.

O. Non-Chloride, Non-Corrosive Water-Reducing, Accelerating Admixture: ASTM C494, Type C or E.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

   a. "Accelguard 80", "Accelguard NCA" or "Accelguard 90," Euclid Chemical Co.

   b. "Pozzutec 20" or "Pozzolith NC 534," Master. Builders, Inc.

   c. "PolaraSet", "Lubricon NCA", "DCI" or "Gilco," W.R. Grace & Co.

   d. "2000 RHE," Axim Concrete Technologies.

P. Corrosion Inhibiting Admixture capable, of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

   a. "Eucon CIA," The Euclid Chemical Company.

   b. "DCI" or "DCI-S," W.R. Grace.

   c. "Rheocrete CNI," Amix Master Builders, Inc.

   d. "Catexol 1000 CN-CI," Axim Concrete Technologies.

2. Add at rate which shall inhibit corrosion to 9.9 lb of chloride ions per cu. yd. of concrete.

Q. Alkalai-Silica Reaction Inhibiting Admixture.

1. Products: Subject to compliance with requirements, provide the following, or approved equivalent:

   a. "ASRx," Master Builders, Inc.

R. Shrinkage Reducing Admixture to reduce the drying shrinkage in concrete members.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

   a. "Eclipse," W.R. Grace & Co.

   b. "Tetraguard," Master Builders, Inc.

2. Dosage to be at 1.5 gal./cubic yard of concrete and shall conform to ASTM C157, maximum drying shrinkage level of 0.04%.

2.07 THIN BRICK

A. Thin Brick Units: ASTM C 1088, Grade SW, Type TBX, not less than 3/4 inch thick, and as follows:

1. Product: #102 Red Flashed Smooth, as manufactured by I-XL Industries Ltd., Medicine Hat, Alberta, Canada.

a. Distributor: Consolidated Brick and Building Supplies, Avon, MA (508) 587-6600

2. Face Size: Standard, 2-1/4 in. high by 7-5/8 in. long.

3. Special Shapes: Include corners, edge corners, and end edge corners.

4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."

5. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing per ASTM C67 with no observable difference in the applied finish when viewed from 10 ft.

6. Brick Coating: Wax or nox-crete brick coating shall be applied to each brick face to facilitate the cleaning of the cast brick surfaces. Do not allow coating to contact back of brick during manufacture, shipping or handing.

2.08 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A36.

B. Carbon-Steel Structural Tubing: ASTM A500, Grade B

C. Carbon-Steel Headed Studs: ASTM A108, AISI 1018 through AISI 1020, cold finished; AWS D1.1, Type A or B, with arc shields.

D. Malleable Steel Castings: ASTM A47.

E. Deformed-Steel Wire or Bar Anchors: ASTM A496 or ASTM A706.

F. Carbon-Steel Bolts and Studs: ASTM A307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened stool washers.

G. Slotted Inserts and strap anchors:

1. Provide sizes per design requirement.

2. Strength: ASTM A1008, Grade 50.

3. Corrosion Protection: Hot dipped galvanized (ASTM A123), or electrodeposited coating (ASTM B633 Type II).

4. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

   a. General Inserts: JVI, Inc., Lincolnwood, IL

   b. Multi-Directional Inserts: Connection Specialties, Inc., Boystown, NE.

H. Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A123, after fabrication, and ASTM A153, as applicable.

1. Galvanizing Repair Paint: Subject to compliance with requirements, provide the following, or approved equivalent:

   a. "Z.R.C. Cold Galvanizing" by Z.R.C. Chemical Products, Quincy, Massachusetts.

I. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in FS TT-P-664 according to SSPC-PA 1.

J. Welding Electrodes: Comply with AWS standards.

K. Accessories: Provide clips, hangers, plastic shims, and other accessories required to install precast structural concrete units.

2.09 STAINLESS-STEEL CONNECTION MATERIALS

A. Double tee flange edge connectors and chord reinforcement connections shall be stainless steel.

B. Electrodes for Welding Type 304 stainless-steel: E308

C. Flange-to-flange field connection plates: ASTM A666, Type 304, of grade suitable for application.

2.10 BEARING PADS

A. Provide bearing pads for precast structural concrete units as follows:

1. Elastomeric Pads: AASHTO M251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size from a molded sheet, 70 +/- Shore A durometer, minimum tensile strength 2250 psi per ASTM D412.

2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer.

3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer.

4. Frictionless Pads: Tetrafluoroethylene, glass-fiber reinforced, bonded to mild-steel plate, of type required for in-service stress.

5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

B. Beams: Horizontal bearing pads.

1. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer, unless noted otherwise on Drawings.

a. "Sorbtex," Voss Engineering Co., Chicago, IL

b. "Capralon," JVI, Inc., Skokie, IL.

c. "Viblon," Korolath of New England, Inc., Hudson, MA.

C. Double Tee Stems: Horizontal bearing pads:

1. Elastomeric Pads: AASHTO M251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size from a molded sheet, 70 +/- 5 Shore A durometer, minimum tensile strength 2250 psi per ASTM D412.

2. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. "Neosorb," Voss Engineering Co., Chicago, IL.

b. "Newlon," JVI, Inc., Skokie, IL.

D. Engineered random oriented fiber reinforced bearing pads with properties tested to be orthotropic in pad plane may be substituted for beam and double tee stem bearing pads where shown on Drawings, and if accepted in writing by Engineer.

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. "Masticord," JVI, Inc., Skokie, IL.

b. "Fiberlast," Voss Engineering, Inc., Chicago, IL.

c. "Korolath R.O.F. Bearing Pads," Korolath of New England, Inc., Hudson, MA

E. Joints between precast pieces: Non-load bearing vertical spacers only:

1. Fiber impregnated elastomeric bearing pads.

2. Durometer hardness 80 minimum.

3. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

   a. "Vossco," Voss Engineering Co., Chicago, IL

   b. "Comcord," JVI Inc., Skokie, IL.

F. Hollow or solid core precast plank:

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

   a. Bearing strips: "Korolath," Koro Corp., Hudson, MA.

   b. Bonding Adhesives:

      (1) Shim to Shim: "Bostik #3050."

      (2) Shim to Carbon Steel: "Bostik #3050."

      (3) Shim to Stainless Steel: "Bostik #3050."

      (4) Shim to Concrete: "Bostik #7087."

G. Shims for bearing pads:

1. Products: Subject to compliance with requirements, provide one of following, or approved equivalent:

   a. Galvanized or epoxy-coated ASTM A36 steel. Do not stack steel shims more than 3 high. Tack weld multiple shims together on at least 2 faces or corners. Touch up galvanizing or epoxy coating damaged by welding.

   b. "Korolath," by the Koro Corporation, Hudson, Massachusetts.

H. Slide Bearing Systems at Expansion Joints:

1. Beam and double tee bearings shall be reinforced polytetrafluoroethylene (PTFE): 100% virgin tetrafluoroethylene polymer and ground glass fiber reinforcing aggregate, pre-bonded to stainless steel and/or preformed fabric bearing pads (see paragraph "Bearing Pads" above). Subject to compliance with requirements, provide one of following, or approved equivalent:

   a. "Fluorogold," Seismic Energy Products, LP, Pine Brook, New Jersey.

   b. "Balco," Balco, Inc., Wichita, Kansas.

c. "Dura-Slide," Tobi Engineering, Inc., Elk Grove Village, Illinois.

d. "Dynalon Slide Bearings with Masticord," JVI, Inc., Skokie, Illinois.

2. Slab and plank bearing shall be ultrahigh molecular weight, high-density polyethylene resin. Subject to compliance with requirements, provide one of following, or approved equivalent:

a. "Korolath PE," Korolath Corporation, Hudson, Massachusetts.

b. "Tivar-100," Poly-Hi/Menasha Corporation, Fort Wayne, Indiana.

c. "UHMW Econ-o-Shim," Deslausiers, Inc., Bellwood, Illinois.

3. Backing material for reinforced PTFE slide bearing systems: Subject to compliance with requirements, provide one of following, or approved equivalent:

a. Galvanized steel.

b. Stainless steel.

c. Reinforced elastomer, having durometer hardness of 90 +/- 5 and meeting requirements of Article 2.10.3(L) of AASHTO Standard Specifications for Highway Bridges (1983).

2.11 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C150, Type I, and clean, natural sand, ASTM C144. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, of consistency suitable for application. Subject to compliance with requirements, provide one of following, or approved equivalent:

1. "Hi-Flow Grout" by The Euclid Chemical Company.

2. "Masterflow 928" by Master Builders.

C. Epoxy Grout: ASTM C881, 2-component epoxy resin, of type, grade, and class to suit requirements.

D. Backer rod for grouted and sealed joints: Division 7 Section 07100, "Dampproofing and Waterproofing."

2.12 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

2. Compressive Strength (28 Days):

a. f'c = 6,000 psi for columns and shear wall members

b. f'c = 5,000 psi for double tees, beams, planks and any members other than columns or shear walls.

3. Slump: Tested in accordance with ASTM C143

a. 2 – 3 in. before addition of water reducing admixtures.

b. 6 – 10 in. after addition of water reducing admixtures.

4. Water-Cementitious Materials Ratio: 0.40 maximum.

5. Air Content: Total entrained air content of 6-1/2% with a tolerance of +/- 1%.

a. The air void system of the hardened concrete shall have a spacing factor of 0.0080 in. maximum, a specific surface of 600 sq. in. per cubic in., and the number of air voids per in. shall be 1-1/2 to 2 times the numerical value of the entrained air content percentage, as determined by ASTM C457.

B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at Precast Fabricator's option.

C. Cementitious Materials:

1. For concrete exposed to deicers, limit percentage, by total weight, of cementitious materials other than portland cement according to ACI 301 Section 4.2.2.8 requirements.

2. Limit percentage by weight, in aggregate, of cementitious material:

a. Combined Fly Ash and Pozzolans: not to exceed 25% of total cementitious weight.

b. Ground Granulated Blast-Furnace Slag: not to exceed 50% of total cementitious weight.

c. Silica Fume: not to exceed 7% of total cementitious weight.

d. Combined Fly Ash, Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: not to exceed 50% of total cementitious

weight; portland cement shall be 50% of total cementitious weight minimum; fly ash or pozzolans shall not exceed 25% and silica fume shall not exceed 7% of total cementitious weight.

D. Chloride Ion Content of Mix:

1. Water soluble chloride ion content of mix (including all constituents) shall not exceed 0.06% chloride ions by weight of cement for prestressed concrete and 0.15% for reinforced concrete.

2. Concrete chloride ion content shall be determined by Testing Agency, according to ASTM C1218, prior to placement. Cast samples from current production of concrete mix proposed for Project.

3. Use of calcium chloride or admixtures containing chloride ions is not permitted.

E. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (super-plasticizer) in concrete, as required, for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use high range water-reducing admixture in pumped concrete, concrete for parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio of 0.45 or less.

4. Use corrosion-inhibiting admixture in concrete mixes for all driving surfaces.

5. Use polypropylene/polyethylene synthetic structural fiber in concrete mixtures where indicated.

F. Engineer's acceptance of mix design shall not relieve Precast Fabricator from responsibility for any variation from requirements of Contract Documents unless Precast Fabricator has in writing called Engineer's attention to each such variation at time of submission and Engineer has given written approval of each such variation.

G. Adjustment to Concrete Mixes: Mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant, as accepted by Engineer/Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer/Architect before using for Project.

2.13 FABRICATION

A. Fabrication procedures shall be in general compliance with ACI 318 and PCI MNL 116.

B. Formwork: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances.

1. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial-formula, form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's written instructions.

2. Unless forms for precast, prestressed concrete units are stripped before detensioning, design forms so stresses are not induced in precast concrete because of deformation or movement of concrete during detensioning.

3. After stripping, keep precast units in a surface damp condition at a minimum temperature of 50 deg. F. Protect units from exposure to the weather until the strength of the concrete has reached 3500 psi minimum. Do not ship precast units to the project site until the strength of the concrete has reached 85% of specified compressive strength or until the unit can safely support the superimposed dead loads of other precast units, whichever is greater.

4. Never allow the weight of stored materials placed on a precast unit to exceed the total design load of that unit or of that portion of the unit loaded by the stored materials.

C. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or concrete placement. Do not relocate bearing plates in units unless approved by Engineer/Architect.

D. Cast-in openings larger than 10 in. diameter or 10 in. square according to Shop Drawings. Smaller holes may be field cut by trades requiring them, as approved by Engineer/Architect.

E. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the band with concrete.

2. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete-placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.

3. Place reinforcement to obtain at least the minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports to hold

reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps and adjoining widths to prevent continuous laps in either direction.

F. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.

1. Delay detensioning until concrete has reached at least 70% of its compressive strength as established by test cylinders cured under the same conditions as concrete.

a. Release strength for f'c = 6,000 psi concrete is: 4,200 psi minimum.

b. Release strength for f'c = 5,000 psi concrete is: 3,500 psi minimum.

2. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.

3. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

G. Mix concrete according to PCI MNL 116 and requirements in this Section. After concrete batching, no additional water may be added.

H. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 116 for measuring, mixing, transporting, and placing concrete.

I. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 116.

J. Comply with ACI 306.1 procedures for cold-weather concrete placement.

K. Comply with ACI 305R recommendations for hot-weather concrete placement.

L. Identify pickup points of precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint casting date on each precast concrete unit on a surface that will not show in finished structure.

M. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.

N. Product Tolerances: Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product tolerances.

O. Form edges of double tee flanges to conform with configurations shown on Drawings:

1. Coordinate joints with expansion joint and control joint sealant system.

2. Dry saw unacceptable formed joints with 3/16 in. carborundum blade.

P. Architectural Precast Finishes

1. Finish exposed-face surfaces of precast concrete units to match Architect's reference sample and as follows:

a. PCI and APA's "Architectural Precast Concrete – Color and Texture Selection Guide," of plate numbers indicated, except with aggregate size of 1/2-inch, as specified above.

(1) Exposed Aggregate: No. 347 R-M.

(2) Sand-Blast Finish: No. 348 SB-L.

b. Retarded Finish: Use chemical retarding agents applied to concrete forms and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.

c. Sand-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.

Q. Structural Precast Finishes:

1. Finish surfaces of precast structural concrete in accordance with PCI MNL 116 as indicated for each type of unit and as follows:

a. Standard Formed Finish: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.

b. Commercial Formed Finish: Remove fins and large protrusions and fill large holes. Rub or grind ragged edges. Faces are to be true, well-defined surfaces.

c. Grade B Formed Finish: Fill air pockets and holes larger than 1/4 in. in diameter with sand-cement paste matching color of adjacent surfaces. Grind smooth form offsets or fins larger than 1/8 in.

d. Grade A Formed Finish: Fill air pockets and holes larger than 1/4 in. in diameter with sand-cement paste matching color of precast concrete. Grind smooth form offsets or fins larger than 1/8 in. Float-apply a neat cement-paste coating to exposed surfaces. Rub dried paste coat with burlap to remove loose particles

e. Screed finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections.

(1) Substitute: Precast Fabricator may substitute steel trowel finish for unformed surfaced with written approval of Engineer/Architect.

(a) Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.

2. Formed Surfaces: Grade B finish

3. Unformed Surfaces: Screed finish

4. Columns:

a. Face unformed surface, screed finish, toward inside of parking structure.

5. Spandrel Beams:

a. Interior face: Screed finish, or textured finish per accepted sample.

b. Exterior face, ends, bottom and top: smooth dense surface standard finish.

6. Double Tees:

a. Tee areas without cast-in-place concrete topping:

(1) Top surface shall have medium broom finish in longitudinal direction.

(2) All sides, ends and bottom: Smooth dense standard finish.

b. Top surface of block outs for pour strips:

(1) After initial strike-off, transversely scarify/rake surface to provide ridges with approximately 1/4 in. depth minimum to insure bond of topping.

c. Depressor holes: Filled with non-shrink, non-staining grout.

7. Wall panels:

a. Stair walls, interior faces: Screed finish.

b. Shear walls, interior faces: Screed finish.

8. Solid Slab Units:

a. Areas without cast-in-place concrete topping:

(1) Top surface on interior of Project shall have medium broom finish in longitudinal direction.

(2) Top surface to be used as roof member shall have smooth dense standard finish.

(3) All sides, ends and bottom: Smooth dense standard finish.

9. Stair treads:

a. Horizontal surfaces in final orientation shall have non-slip finish.

b. Top surfaces of recesses to accept cast-in-place topping (landings): Transverse rake to a minimum depth of 1/4 in. to insure proper bonding of topping.

10. Patching will be acceptable providing the structural adequacy of the product and the appearance are not impaired.

R. Recess prestressing tendons a minimum of 1/2 in., fill recesses with grout, and apply a sack finish to vertical ends of precast concrete units.

1. For protection against corrosion, coat exposed ends of prestressing strands in all prestressed pieces with one of the following or approved equivalent:

a. Sonneborn "Hydrocide 600, 700, or 700B," or equivalent by Engineer/Architect.

S. Locate lift loops and erection inserts so as not to be visible in completed construction. Provide all lift loops and erection inserts with 1-1/2 in. minimum concrete or grout cover in completed construction. Any lift loops or erection inserts that must be located in areas that will be exposed to public view in completed construction or are in elevator shafts shall be recessed and patched with:

1. Minimum of 1-1/2 in. drypack, latex modified concrete grout to match surrounding concrete.

T. Galvanize entire assembly of all inserts, angles and other cast-in-steel devices exposed on surface of precast concrete where shown on Drawings.

U. Welding:

1. Use proper preheat for welding high-strength steel.

2. Welding processes shall not reduce the cross-sectional area of the concrete reinforcement.

3. Obtain prior written authorization of the Engineer/Architect for welding concrete reinforcement.

V. Permit access by Engineer/Architect. Owner and Owner's representatives to all parts of manufacturing facility.

W. Mark each piece of precast concrete for identification and date of casting recorded. Marks shall not be visible after erection and completion of Work.

X. Fabrication Tolerances:

1. Tolerances for the fabrication and erection of precast concrete are not accumulative.

2. Except as modified herein, tolerances for fabrication of precast concrete members shall be in accordance with PCI MNL 116.

3. Block-outs:

a. Position– beams and spandrel panels: +/- 1/4 in.

b. Dimensions – all precast units: +/- 1/4 in.

4. Sleeves and Inserts:

a. Position – all precast units: +/- 1/4 in.

5. Weld Plates:

a. Position – all precast units: +/- 1/2 in.

6. Base Plates and Bearing Plates:

a. Position – all precast units: +/- 1/8 in.

7. Anchor Bolts in Base Plates:

a. Position – all precast units: +/- 1/8 in.

8. Bearing Surface:

a. Deviation from specified plans – all precast units: +/- 1/8 in.

9. Handling Devices:

a. Position – all precast units: +/- 3 in.

10. Length:

a. Beams, columns and spandrel panels:

(1) Per 10 ft of length, +/- 1/8 in. Maximum 1/2 in.

b. Double tee units: +/- 1/2 in.

11. End deviation from square or designated skew:

a. Columns

(1) Per 12 in. of width, any cross section: 1/8 in.

(2) Maximum, any cross section: 1/4 in.

(3) Any end (with longitudinal centerline): 1/4 in.

b. Double tee units, beams and spandrel panels:

(1) Horizontal and Vertical: 1/4 in.

c. Flat wall panels

(1) Per 10 ft of length, +/- 1/16 in. Maximum 1/4 in.

12. Differential camber between adjacent members of the same design:

a. Pretopped double tee units:

(1) Per 10 ft of length, +/- 1/8 in. Maximum 3/8 in.

13. Variation in cross-sectional dimension:

a. Columns: +/- 1/4 in.

b. Beams and Spandrel Panels:

(1) Dimensions less than 6 in.: +/- 1/8 in.

(2) Dimensions 6 in. to 18 in.: +/- 3/16 in.

(3) Dimensions 18 in. to 36 in.: +/- 1/4in.

(4) Dimensions greater than 36 in.: +/- 3/8 in.

14. Vertical or horizontal alignment (deviation from a straight line parallel to longitudinal centerline of member):

a. Columns, beams and spandrel members:

(1) Up to 40 ft lengths: 1/4 in.

(2) 40 ft to 60 ft lengths: 3/8 in.

(3) Greater than 60 ft lengths: 1/2 in.

b. Flat wall panels:

(1) Per 10 ft of length: 1/16 in.

(2) Maximum: 1/4 in.

15. Bowing

a. Beams and spandrel panels:

(1) Up to 40 ft lengths: 1/4 in.

(2) 40 ft to 60 ft lengths: 3/8 in.

(3) Greater than 60 ft lengths: 1/2 in.

16. Warping (One corner out of plane with the other three)

a. Beams and spandrel panels: 1/4 in.

17. Ledge Width:

a. Beams and spandrel panels: +/- 1/4 in.

18. Haunches and Pockets – Columns:

a. Position: +/- 1/4 in.

b. Dimensions: +/- 1/4 in.

c. Bearing surface deviation from specified plane: 1/8 in.

d. Difference in relative position of adjacent haunch and/or pocket bearing surfaces from specified relative position: 1/4 in.

2.14 SOLID SLAB UNITS

A. Type: Provide plant fabricated solid, monolithic, precast concrete units.

B. Furnish units free of voids and honeycombs.

C. Provide finish as outlined in Section "Finishes" above.

D. Reinforce units to resist transportation and erection stresses.

E. Include cast-in weld plates where required.

F. Coordinate with other trades for installation of cast-in items.

2.15 SOURCE QUALITY CONTROL

A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements.

B. Strength of precast concrete units will be considered deficient If units fail to comply with PCI MNL 116 requirements, including the following:

1. Units fail to comply with compressive-strength test requirements.

2. Units fail to comply with entrained air content test requirements.

3. Reinforcement and prestressed tendons of units do not comply with fabrication requirements.

4. Concrete curing and protection of units against extremes in temperature fail to comply with requirements.

5. Units are damaged during handling and erecting.

C. Testing: If there is evidence that the strength of precast concrete units may be deficient or may not comply with PCI MNL 116 requirements, Owner will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42.

1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Engineer/Architect.

2. Cores will be tested in an air-dry condition per ACI 301 if units will be dry under service conditions.

3. Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength is equal to at least 85 percent of the 28-day design compressive strength and no single core is less than 75 percent of the 28-day design compressive strength.

4. Test results will be made in writing on the same day that tests are performed, with copies to Engineer/Architect, Contractor, and Precast Fabricator. Test reports will include the following:

a. Project identification name and number.

b. Date when tests were performed.

c. Name of precast concrete fabricator.

d. Name of concrete testing agency.

e. Identification letter, name, and type of precast concrete unit or units represented by core tests; design compressive strength; type of break; compressive strength at break, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

D. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mix that has no coarse aggregate, and finish to match adjacent precast concrete surfaces

E. Dimensional Tolerances: Units with dimensions smaller or large than required and not complying with tolerance limits may be subject to additional testing.

1. Precast concrete units with dimensions larger than require will be rejected if the appearance or function of the structure is adversely affected or if larger dimensions interfere with other construction. Repair or remove and replace rejected units, as required, to comply with construction conditions.

F. Quality Control: Precast Fabricator's Quality Control inspector shall inspect all pieces immediately after pieces have received final finish.

1. Pieces shall be inspected and defects numbered on back of control tags attached to the back of each piece according to the following system:

a. Foreign material in face.

b. Bug holes.

c. Rough or chipped edges.

d. Cold joints.

e. Form Lines.

f. Cornice details.

g. Uniformity of finish.

h. Uniformity of retarder.

i. Finish at retarder surround.

j. Finish on return surfaces.

2. Precast Fabricator's finishers shall correct defects in Precast Fabricator's plant or yard.

3. As pieces are loaded for shipment, Precast Fabricator's Quality Control inspector shall reinspect pieces to verify completion of corrections and initial

the piece for final approval. Pieces with uncorrected defects shall not be shipped.

G. Defective Work: Precast concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for erection tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with erection only after unsatisfactory conditions have been corrected.

3.02 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Yard 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.

B. Delivery and Handling

1. Precast concrete members shall be lifted and supported during fabrication, stockpiling, transporting and erection operations only at the lifting or supporting points, or both, as shown on the production drawings, and with approved lifting devices. All lifting devices shall be performed with acceptable equipment and methods, and by qualified personnel.

3.03 ERECTION

A. Erection of precast concrete Work shall be performed by workers skilled in this type of Work under the direction of a supervisor having at least 5 years of experience in similar Work and approved by the Engineer/Architect.

B. List members with suitable equipment at lifting points provided by the Precast Fabricator.

C. Temporary shoring and bracing, if required, shall comply with manufacturer's recommendations.

D. Set each member in position to which it is assigned on erection drawings, carefully plumbing and leveling it and anchoring it securely in place.

E. Temporarily guy and brace the erected structure in accordance with the Engineered erection plan.

F. Bearing Pads: Install bearing pads as precast concrete units are being erected. Set pads on true, level, and uniform bearing surfaces and maintain in correct position until precast concrete units are placed.

G. Install precast structural concrete. Shore and brace precast units to maintain location, stability, and alignment until permanent connections are installed.

H. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.

1. Protect precast concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.

2. Repair damaged galvanized metal surfaces by cleaning and applying a coat of galvanized repair paint to galvanized surfaces.

I. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units unless approved by Engineer/Architect.

J. Before erection, permanently fasten bearing and spacer pads to precast concrete members with epoxy, contact cement, tape or mechanical fastener as follows:

1. Columns: bearing surfaces to receive precast beams.

2. Double Tees: stems at beam bearing.

3. Girders: ends at vertical joints between precast members.

K. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at keyways, connections, and joints as follows:

1. Provide forms or other approved method to retain grout in place until hard enough to support itself. Where required, pack spaces with nonshrink, dry-pack grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

L. Erection includes all receiving shimming, welding, shoring, removal of lifting hooks, and patching.

3.04 ERECTION TOLERANCES

A. Erection Tolerances: Install precast concrete units level, plumb, square, and true, without exceeding the recommended erection tolerances in PCI MNL 127, "Recommended Practice for Erection of Precast Concrete" or limits of this Section.

1. Structure shall be brought within tolerances, and tolerances for deviation for plumb and shall be checked by Construction Manager-employed Maine Registered Surveyor before placement of any cast-in-place concrete on superstructure.

B. Erect precast concrete units to the following tolerances:

1. Variation from specified location in plan: 1/2 in.

2. Deviation in plan from straight lines parallel to specified linear building lines:

a. Members less than 20 ft apart: 1/40 in per ft.

b. Members 20 ft or more apart: 1/2 in.

c. Structural tee units: 1/2 in.

3. Deviation from plumb:

a. Per 10 ft of height: 1/4 in.

b. Maximum for the entire height:

(1) Flat wall panels: 1/2 in.

(2) All other members: 1 in.

4. Variation in elevation of bearing surfaces from specified elevation:

a. Any member location : 1/2 in.

5. Deviation in elevation of bearing surfaces from lines parallel to specified grade lines:

a. Adjacent members less than 20 ft apart: 1/40 in. per ft.

b. Adjacent members 20 ft or more apart: 1/2 in.

6. Variation of specified clearance from adjacent independent member or from specified joint width: +/- 1/4 in.

7. Jog in alignment of matching edges of wall panels, beams and spandrel panels: 1/4 in.

8. Jog in alignment of adjoining flanges of structural tee units:

a. Untopped decks: 1/4 in.

b. Topped decks: 1/2 in.

9. Variation from the specified bearing on supports – beams and spandrel panels:

a. Length on support: +/- 3/4 in.

b. Width on support: +/- 1/2 in.

10. Variation from specified bearing on supports – structural tee deck units:

a. Length on support: +/- 3/4 in.

b. Width on support: +/- 1/2 in.

11. Deviation of top of spandrel panels from specified elevation

a. Any panel: 1/2 in.

12. Difference in relative position of adjacent column from specified relative position:

a. At any deck level: 1/2 in.

13. Additional requirements for structural tee deck units:

a. Deviation in plan from straight line parallel to specified linear building line:

(1) Any tee: 1/2 in.

b. Variation in elevation from specified elevation:

(1) Any tee, any end: +/- 3/4 in.

c. Deviation in elevation from line parallel to specified grade line:

(1) Longitudinal: 3/4 in.

(2) Transverse: 3/8 in.

3.05 REPAIRS

A. Repair exposed exterior surfaces of precast concrete units to match color, texture, and uniformity of surrounding precast concrete if permitted by Architect.

B. Remove and replace damaged precast concrete units if repairs do not comply with requirements.

3.06 FIELD QUALITY CONTROL

A. As pieces arrive at jobsite, Construction Manager's Quality Control inspector shall check the production control tag for each piece to verify that the piece is complete and correct.

B. Any defective work that cannot be repaired to satisfaction of Engineer/Architect, whether found on site or at shop at any time before completion and acceptance of Project, will be rejected regardless of previous reviews and shall be remade or reconstructed to satisfaction of Engineer/Architect. However, finishes accepted at shop will not be rejected at site.

C. Improperly located bearing pads or those incorrect materials will not be accepted by Engineer/Architect and shall be relocated or modified at expense of Contractor, regardless of when rejected.

D. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections during erection of precast units.

1. Testing Agency has authority to reject materials, welds, connections and precast pieces not meeting Specifications.

2. Testing Agency will report test results promptly and in writing to Construction Manager, Engineer/Architect, and Precast Erector.

3.07 PERFORMANCE REQUIREMENTS

A. The Precast Subcontractor shall conduct inspections, perform testing, and make repairs or replace unsatisfactory precast pieces as required.

B. Limitation as to amount of patching permitted is subject to acceptance of Engineer/Architect.

C. In addition to above, in-place precast pieces may be rejected for any one of the following:

1. Exceeding specified installation tolerances.

2. Damaged during construction operations.

3. Exposed-to-view surfaces which develop surface finish deficiencies.

4. Other defects as listed in PCI MNL 116.

D. Repairs and repaired pieces shall be subject to 5 year warranty provided by Precast Fabricator. See Part 1 heading "Repair Warranty."

E. Welds and high-strength bolt connections are subject to inspection and testing by Testing Agency. As minimum, following testing shall be performed:

1. Welds: Visually inspect all welds.

a. Double tee flange-to-flange connections: Test 5% of welds, if at discretion of Inspector, visual inspection inconclusive.

b. All other welds: Test 25% of all field fillet welds and 5% of all shop welds.

c. Testing: Penetrating dye or magnetic particle at Inspector discretion.

d. One spot test per partial penetration weld using magnetic or ultrasonic testing.

2. Bolted Connections: Visual inspection of all connections.

a. Check proper torque with calibrated torque wrench at minimum of 2 bolts of every connection.

3.08 CLEANING

A. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.

1. Wash and rinse according to Precast Fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.

2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.

B. At completion of Work or at such times as directed by Engineer/Architect, remove all rejected and surplus material, rubbish or apparatus from premises and deliver Work in a clean and sound condition to the satisfaction of the Engineer/Architect.

END OF SECTION