

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, polyvinyl chloride foundation drains, polyethylene vapor retarders, reinforcement, concrete materials, mixture design, placement procedures-and decorative concrete finishes.

1.2 SUSTAINABLE DESIGN REQUIREMENTS

- A. See Specification Section 013510 Sustainable Design Requirements for project requirements applicable to this Section.

1.3 SUBMITTALS

- A. Submittal Procedures: See section 013300 Submittals, section 014000 Quality Requirements and section 016000 Product Requirements for submittal and product procedures.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
- E. Welding certificates.
- F. Material certificates.
- G. Material test reports.
- H. Floor surface flatness and levelness measurements.
- I. Product Data: Submit product data and manufacturer's installation instructions for Geotextile Gas Vapor Barrier system and accessories.
- J. Installer Qualifications: Submit evidence that the Geotextile Gas Vapor Barrier Installer is qualified and approved by the Geotextile Gas Vapor Barrier Manufacturer.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code - Reinforcing Steel."
- D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete Sections 1 through 5 and Section 7, "Lightweight Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- E. Concrete Testing Service: Owner to engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- F. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver reinforcement to the site bundled, tagged and marked with metal tags indicating bar size, lengths and other information corresponding to markings on the drawings.
- B. Haul time shall comply with ASTM C94.
- C. Deliver concrete to the site in exact proportions required by design mix. Should extra water be required before depositing concrete and water/cement ratio of accepted mix has not been exceeded, Contractor's superintendent shall have sole authority to authorize addition of water, subject to limits of ACI 301. Indicate additional water added to mix after leaving batch plant on truck ticket signed by person responsible. When extra water is added to concrete it shall mix thoroughly for 40 revolutions of drum or 3 ½ minutes at mixing speed, whichever is greater. Redosage with superplasticizer may be done with prior acceptance of Engineer regarding dosage and time periods.
- D. Deliver specified accessory products in original unopened containers with legible manufacturer's identification and information and store in conditions recommended by the manufacturer.
- E. Unload and store reinforcing bars to keep clean.

1.6 SUBSTITUTIONS

- A. See Section 01600 Project Requirements for substitution procedures.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150 Type I. Supplement with the following:
 - 2. Blended Hydraulic Cement: ASTM C 595, Type I (SM), slag-modified portland cement.
- B. Normal-Weight Aggregates: ASTM C 33, graded, approved by the local jurisdiction and obtained from same source throughout the project.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal or as indicated.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size or as indicated.
- D. Water: ASTM C 94 and potable.

2.4 AUTOCLAVE AERATED CONCRETE

- A. See Section 034400 Reinforced Autoclaved Aerated Concrete Panels for autoclaved aerated concrete requirements.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260 certified by the manufacturer to be compatible with the other admixtures.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. Manufacture's submittal must include long-term (minimum one year) non-corrosive test data certified by independent testing laboratory, using electrical potential measures or other acceptable accelerated corrosion test methods.
 - 1. Water-Reducing Admixture: ASTM C 494, Type A.
 - 2. Retarding Admixture: ASTM C 494, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
 - 7. Accelerating Admixture: ASTM C494, Type C, non-corrosive.

2.6 CONCRETE ACCESSORIES

- A. Bonding Agent: ASTM C 1059, Type II acrylic non-redispersable type.
- B. Waterstop: Provide CETCO Waterstop RX101 by CETCO, Set waterstop in Cetseal adhesive in accordance with the manufacturer's recommendations.
- C. Cast-Metal Abrasive Nosings: Cast gray iron, ASTM A 48, Class 20, with an integral abrasive finish.
 - 1. Manufacturers:
 - a. American Safety Tread Co., Inc.
 - b. Balco Inc.
 - c. Barry Pattern & Foundry Co., Inc.
 - d. Granite State Casting Co.
 - e. Safe-T-Metal Co.
 - f. Wooster Products Inc.
 - g. Owner approved equal.
 - 2. Apply a factory applied coating to concealed bottoms, sides, and edges of units set into concrete.

2.7 POLYETHYLENE VAPOR RETARDERS

- A. Sheet Vapor Retarder for use below slab on grade:
 - 1. Basis of Design: Polyethylene sheet, ASTM E 1745, reinforced Class A vapor retarder; 10 mils thick.

2.8 FOUNDATION DRAINS

- A. Foundation Drains: Provide perforated polyvinyl chloride (PVC) foundation drain pipes meeting ASTM D 2729 requirements for footing drains. See the Architectural and Structural Drawings for locations.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- F. Concrete Sealer: Provide Scofield Revive solvent-borne sealer by Scofield Systems, 800-800-9900, www.scofield.com, for exposed concrete floor surfaces. Color to be selected by the Owner.
- G. Concrete Stain: Provide stained concrete in locations indicated on the drawings. See the Public Area Finish Schedule on drawing ID-002 for materials, colors and locations.

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1752.
- B. Floor Expansion Joint: Provide an interior floor expansion joint where concrete floors abut wood floors in corridors, model 75FCE-1 with mill finished aluminum by Balco, Inc. 316-945-9328, www.balcousa.com, or an approved equal. Filler color shall be selected by the Owner.

2.11 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

- B. Cementitious Materials: Use fly ash, pozzolan, and ground granulated blast-furnace slag, as needed to reduce the total amount of portland cement, which would otherwise be used, by not more than 25 percent. The percentages of fly ash, pozzolans, granulated blast furnace slag and silica fume may be further limited based upon the exposure of the concrete (e.g. severe weathering location and exposure to de-icing chemicals – see IBC Chapter 19 and ACI 318 Chapter 4.) This will be reviewed and noted by the structural engineer where required.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture 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 water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
- D. Proportion normal-weight concrete mixture as follows:
 - 1. Maximum Water-Cementitious Materials Ratio: 0.40 unless otherwise indicated.
 - 2. Slump Limit: 4 inch plus and minus 1 inch, unless otherwise indicated on Drawings.
 - 3. Air Content, where required: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
 - 4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- E. Proportion structural lightweight concrete mixture as follows:
 - 1. Calculated Equilibrium Unit Weight: 115 lb/cu. ft., plus or minus 3 lb/cu. ft. as determined by ASTM C 567.
 - 2. Slump Limit: 4 inches, plus or minus 1 inch, unless otherwise indicated on Drawings.
 - 3. Air Content, where required: 6 percent, plus or minus 2 percent at point of delivery for nominal maximum aggregate size greater than 3/8 inch.
 - 4. Air Content, where required: 7 percent, plus or minus 2 percent at point of delivery for nominal maximum aggregate size 3/8 inch or less.
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- F. Compressive Strength: See the Structural Drawings for concrete compressive strength requirements.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Coordinate concrete stair and metal railing sleeves and anchorage installation prior to placing concrete.

3.3 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with the manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at 25'-0" on center or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
- C. Cold-Weather Placement: When placing concrete after first frost or when mean daily temperatures are below 40 degrees F, comply with ACI 306.1.
1. When mean temperature is below 40 degrees F, concrete shall have minimum temperature of 70 degrees F.
 2. Maintain concrete temperatures at a minimum of 50 degrees F for not less than seven days (three days for high early strength concrete) after placing. Maintain forms in place for a minimum of 72 hours after depositing concrete and until concrete reaches design strength.
 3. Subject to acceptance by the Architect and Engineer, high early strength concrete (achieved by use of type III cement f type I cement plus non-corrosive accelerator) **MAY BE USED**. The concrete shall not contain calcium chloride or admixtures containing more than 0.05 percent chloride ions.
 4. Do not place concrete without acceptance of Architect on days when temperatures at 9:00 a.m. is below 32 degrees F until, in the opinion of the Architect, the necessary precautions a have been taken and necessary equipment supplied to prevent concrete from freezing.
- D. Hot-Weather Placement: Comply with ACI 301.
1. Temperature of concrete shall not exceed 85 degrees F.
 2. When air temperatures are expected to exceed 90 degrees F, obtain acceptance from Architect on procedures to be used in protecting, depositing, finishing and curing of concrete. Water reducing admixture may be used upon acceptance of proposed mix design.
 3. Protect to prevent rapid drying. Start finish curing as soon as possible.

3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. All concrete surfaces exposed to public view, or to be covered with a coating or covering material applied directly to concrete shall receive a Class B finish or better per the American Concrete Institute (ACI) standards.
- C. 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.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

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

3.9 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.10 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Testing agency shall report test results to the Architect in writing within 24 hours of the test. Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

C. Compressive Strength Tests: ASTM C 39. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.

D. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

E. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C 143.

- F. Strength Level: Considered satisfactory if average of all three sets of consecutive strength test results equal or exceed specified strength and no individual strength test result falls below specified strength by more than 500 psi.
- G. Core Tests: Testing and inspection agency will perform additional tests of in-place concrete at Contractor's expense when test results indicate slump, air entrainment, compressive strengths or other requirements have not been met, as directed by the Architect.

3.12 LOADING CONCRETE SLABS AND FOUNDATION

- A. Do not load concrete members until concrete reaches 75% of specified strength.
 - 1. Podium transfer slabs shall not be loaded until concrete reaches 100% of specified strength.

END OF SECTION

SECTION 034400 - REINFORCED AUTOCLAVED AERATED CONCRETE PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Design, fabrication, transportation and erection of Reinforced Autoclave Aerated Concrete wall panels.

1.2 SUSTAINABLE DESIGN REQUIREMENTS

- A. See Specification Section 013510 Sustainable Design Requirements for project requirements applicable to this Section.

1.3 DEFINITIONS

- A. Reinforced Precast AAC panels: Reinforced Precast Autoclaved Aerated Concrete panels.
- B. Strength Class: Classification that defines the physical properties of the AAC, designated as AAC-2 (290psi), AAC-4 (580psi), or AAC-6 (870psi). All reinforcing wire shall have corrosion protection in compliance with ASTM C1452 and ASTM C1694, as applicable.

1.4 SYSTEM DESCRIPTION

- A. Design requirements:
 - 1. Basic reinforcement requirements: Reinforce for handling/transportation loads and design loads indicated in Contract Documents.
 - a. Maximum deflection: Limit deflection of precast concrete panels to L/500.
 - b. Wall panels; wind load: L/240.
 - c. Design for structures supporting AAC roof, floor, and wall panels: L/360 maximum total deflection.
 - d. Design precast concrete panels to withstand own weight, erection forces, and live and dead loads in accordance with Building Code.
 - e. Provide adjustment to accommodate misalignment of structure without permanent distortion of precast concrete panels.
- B. Wall System Fire-Resistance Rating: Provide components suitable for use in [2][3] or [4] hour rated assembly per U210 tested to UL 263.

1.5 REFERENCE STANDARDS

- A. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

- C. ASTM C33 (2016) Standard Specification for Concrete Aggregates.
- D. ASTM C143- Standard Test Method for Slump of Portland Cement Concrete.
- E. ASTM C1452 - Standard Specification for Reinforced Autoclaved Aerated Concrete Elements.
- F. ASTM C1693 - Standard Specification for Autoclaved Aerated Concrete (AAC).
- G. ASTM C1694 (2009) Standard Specification for Reinforced Autoclaved Aerated Concrete (AAC) Elements
- H. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
 - 1. UL - UL 263- Standard Fire Tests for Building Construction Materials
- I. ACI 523.4R - Guide for Design and Construction with Autoclaved Aerated Concrete Panels
- J. ACI 530 - Building Code Requirements and Specification for Masonry Structures and Related Commentaries

1.6 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Prior to installation of reinforced AAC panels, schedule and hold a pre-installation conference to review scope of the work, trade sequencing, delivery, handling, and storage of reinforced AAC wall panels, installation requirements, and protection after installation. Attendees shall include a representative from each subcontractor involved with reinforced AAC panels and adjacent construction material installation.
- B. Sequencing and scheduling of the AAC panel installations.
- C. Coordination:
 - 1. Work required under this section may include chases and routing for the trades. Coordinate installation with trade work installations accordingly.
 - 2. Filling of routed areas and chases as required to maintain wall fire resistance ratings shall be provided and coordinated prior to enclosure.

1.7 SUBMITTALS

- A. Submittal Procedures: See section 013300 Submittals, section 014000 Quality Requirements and section 016000 Product Requirements for submittal and product procedures.
- B. Product Data: Provide Product Data showing all test reports, fire resistance and hose stream testing, acoustical performance and material physical characteristics including but not limited to:
 - 1. Compressive Strength
 - 2. Moisture Content
 - 3. Dry Bulk Density
 - 4. Drying Shrinkage
 - 5. Modulus of Elasticity
- C. Certifications:

1. AAC Panel Manufacturer.
 2. Installer qualifications
 3. Welder qualifications / license (if applicable).
- D. Provide a copy of manufacturers handling and installation requirements.
- E. Shop Drawings: Indicate the following:
1. Indicate loads used for the design of reinforced AAC panels.
 2. Indicate dimensions of panels, arrangement of joints, reinforcement, and erection details. Include location of openings (fabricated and field cut) in precast concrete panels.
 3. Identify reinforced AAC panels with mark used on shop drawings. Identifying marks shall be located on surfaces not visible in installed configuration.
 4. Indicate Strength Class.

1.8 QUALITY ASSURANCE

- A. Furnish reinforced AAC panels from single manufacturer
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience. Material and panels should be manufactured in accordance with ASTM C1693 and ASTM C1694.
- C. Fabricator Qualifications: Manufacturer shall be a certified manufacturer with a minimum of five years experience in the production of AAC panel systems.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with minimum five years of documented construction experience.
- E. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.9 PERFORMANCE REQUIREMENTS

- A. AAC elements shall be designed in accordance with the ACI 523.4R.
- B. Wall elements shall be designed in accordance with ACI 530- Chapter 11 - "Strength of Autoclaved Aerated Concrete Masonry"
- C. Weld-Point shear strength in the reinforcement of AAC panels shall be determined in accordance with ASTM C1694, Section 8 and shall conform to ASTM C1694, Table 2.
- D. UL Fire-Resistance Listing and Label: evidence of conformance to UL 210 and other standards noted in the contract documents shall be provided according to building code requirements. Units shall bear the UL Label and or markings..

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Packing and shipping: Transport and handle AAC panels in a manner prescribed by the manufacturer and with equipment designed to protect panels from strain, warping, cracking, chipping, or staining. Placing reinforced AAC panels in direct contact with earth is prohibited.
- B. Store AAC panels as directed by the manufacturer under cover and elevated above grade.
- C. Store to protect from strain, warping, cracking, or chipping.
- D. Store reinforced AAC panels in same position as transported.
- E. Store reinforced AAC panels on firm, level, smooth surface.
- F. Place so identification marks are easily discernible.

1.11 PROJECT CONDITIONS

- A. Cold and hot weather installation practices for panels installed utilizing thin bed mortar joints:
 - 1. Cold weather precautions for AAC panel work:
 - a. When temperature of AAC panel is below 20 F, do not install panels.
 - b. Remove visible ice on AAC panel prior to installation.
 - c. Heat mortar sand or mixing water to produce mortar temperatures between 40 deg F and 120 deg F at time of mixing. Maintain mortar temperature above freezing until placed.
 - d. Ambient temperature requirements:
 - 1) Between 25 deg F and 20 deg F: Use heat sources on both sides of AAC panels under construction. Install wind breaks when wind velocity is in excess of 15 mph.
 - 2) Below 20 deg F: Provide enclosure for AAC panels under construction. Use heat sources to maintain temperatures above 32 deg F within enclosures.
 - e. Daily mean temperature requirements:
 - 1) Between 40 deg F and 32 deg F: Protect completed AAC panels from rain or snow by covering with weather resistive membrane for a minimum of 24 hours after construction.
 - 2) Between 32 deg F and 25 deg F: Completely cover completed AAC panels with weather resistive membrane for a minimum of 24 hours after construction.
 - 3) Between 25 deg F and 20 deg F: Completely cover completed AAC panels with insulating blankets or equal protection for a minimum of 24 hours after construction.
 - 4) Below 20 deg F: Maintain AAC panel construction above 32 deg F for 24 hours after completion by enclosure with supplementary heat, electric heating blankets, infrared heat lamps, or other acceptable methods outlined to Architect.
 - 2. Hot weather precautions for AAC panel work:
 - a. When erected in ambient air temperature of 100 deg F or ambient air temperature of 90 deg F with wind velocity in excess of 8 mph, implement the following:
 - 1) Spreading mortar beds more than 4'-0" ahead of AAC panels is prohibited.
 - 2) Installing AAC panel more than two minutes after spreading mortar is prohibited

1.12 SEQUENCING AND SCHEDULING

- A. Loading AAC wall panels is prohibited prior to the following:
 - 1. Uniform floor or roof loads: 12 hours, minimum.
 - 2. Concentrated loads: Three days, minimum.

- B. Construction activities coordination specified in other Sections for work built into panels:
 - 1. Work required under this Section includes chase and routing coordination with construction activities specified in other Sections.
 - 2. As panel installation is completed, coordinate with work required in other Sections for chases or routing areas required in AAC panels for electrical, plumbing, and other items.
 - 3. Request relevant construction activities to mark actual routing or chase locations; include required depth.
 - 4. Filling in chases and routed areas specified in other Sections.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Xella Aircrete North America Inc. U210 and U920 by Thermacrete LLC
 - 1. Acceptable manufacturer: Contract documents are based on products by Thermacrete LLC.; 214 W. Sheridan Place, Lake Bluff, IL 60044; Telephone (847)577-7400, Fax: (847)660-6324,
 - 2. Thermacrete.
 - 3. Substitutions: Under provisions of Division 01.

- B. See the drawings for locations of autoclav aerated concrete. Coordinate fabrication with design intent and comply with requirements of referenced fire and sound assemblies.

2.2 MANUFACTURED PANELS

- A. Reinforced AAC panels:
 - 1. Composition: Autoclaved aerated concrete mixture consisting of quartz sand, lime, cement, proprietary additives, water, and reinforcement.
 - a. Reinforcing: Plain steel wire, ASTM A82/A82M
 - b. Nominal dimensions:
 - 1) a Nonload Bearing Wall panels, reinforced: [2] or [3] inches thick x 24 inches wide x [8] or [10] feet long, and [4] inches thick x 24 inches wide x [7][8][10] or [20] feet long, or as indicated on Drawings. [2] and [3] inch thick AAC panel shall be minimum AAC-4, 580psi density with single cage steel reinforcement. [4] inch thick AAC panel shall be minimum AAC-6, 870psi density with double-cage steel reinforcement.
 - 2. Fire ratings: In accordance with UL 263, UL 1479 and UL 2079.

2.3 ACCESSORIES

- A. Key joint and bond beam reinforcement: ASTM A 615, Grade 60; deformed type for #3 and larger bars;
 - 1. actual sizes indicated on Contract Drawings.
- B. Fasteners and Anchors: Compatible with AAC materials. Extruded aluminum burn clips in accordance with UL U210 Design requirements.
 - 1. Joint sealant: Elite Cement Products, Inc., Atlanta GA; Flex W or equivalent.
 - a. Headers and frames:
 - 1) Headers at penetrations in floor and roof systems: Designed and detailed by AAC Panel Manufacturer.
 - (a) Supplemental steel framing at openings in wall systems: Designed and detailed by Project Engineer of Record.
 - 2) Thin Bed Mortar: In accordance with UL Design requirements for AAC masonry, manufactured in accordance with ASTM 1660-10.

2.4 FABRICATION

- A. Shop assembly:
 - 1. Fabricate reinforced AAC panels in accordance with approved shop drawings.
 - 2. Fabricate reinforced AAC panels in accordance with ASTM C1694

PART 3 EXECUTION

3.1 ERECTION

- A. Reinforced AAC panel work:
 - 1. Follow approved shop drawings for installation of work.
 - 2. Set reinforced AAC panels plumb, level, and true to line within specified erection tolerances. Dimensional tolerances shall be non-cumulative.
 - 3. Secure reinforced AAC panels in place as indicated on approved shop drawings.
 - 4. Provide temporary bracing as required to resist construction loads, including wind.
- B. Building in other work:
 - 1. Install work of other sections required to be incorporated with reinforced AAC panels as work progresses; include anchors, and accessories. Space and align built-in parts; exercise care not to disturb other materials from position.
 - 2. Fill in interior spaces around built-in items with fine grout or interior plaster.
 - 3. Fill in exterior spaces around built-in items with fine grout or stucco.
- C. Cleaning and patching: Patch spalls and chips in reinforced AAC panels in accordance with AAC panel manufacturer's recommendations.

3.2 APPLICATION

- A. Erection Tolerances:

1. Maximum variation from plumb: 1/4" in 10'-0"; not exceeding 3/8" in 20'-0".
2. Maximum variation from level: 1/4" in 20'-0"; not exceeding 1/2" in 40'-0" or more.
3. Maximum variation in linear building line from location indicated: 1/4" at base of wall.\

END OF SECTION

SECTION 035413 - GYPSUM CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes gypsum-cement-based, self-leveling underlayment for application below interior floor coverings.

1.2 SUSTAINABLE DESIGN PROJECT REQUIREMENTS

- A. See Specification Section 013510 Sustainable Design Requirements for project requirements applicable to this Section.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: Signed by manufacturers of underlayment and floor-covering systems certifying that products are compatible.
- C. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.
- B. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.
- C. Fire-Resistance Ratings: Where indicated, provide gypsum-cement underlayment systems identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

- D. Sound Transmission Characteristics: Where indicated, provide gypsum-cement underlayment systems identical to those of assemblies tested for STC and IIC ratings per ASTM E 90 and ASTM E 492 by a qualified testing agency.
- E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
 - 1. Place gypsum-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

1.8 COORDINATION

- A. Coordinate application of underlayment with requirements of floor-covering products and adhesives, to ensure compatibility of products.

PART 2 - PRODUCTS

2.1 GYPSUM-CEMENT-BASED UNDERLAYMENTS

- A. Underlayment: Gypsum-cement-based, self-leveling product that can be applied in minimum uniform thickness of 1 - inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Subject to compliance with requirements, provide one of the following:
 - a. Maxxon Corporation; Gyp-Crete 2000.
 - b. USG Corporation; Levelrock 2500.
 - c. Allied Custom Gypsum; AccuCrete.
 - 2. Cement Binder: Gypsum or blended gypsum cement as defined by ASTM C 219.
 - 3. Compressive Strength: Not less than 2500 psi at 28 days when tested according to ASTM C 109/C 109M.
 - 4. Thickness: 1 ¼" at areas with carpet; 1" with ¼" Acousti-Mat II at hard surfaces.
- B. Aggregate: Well-graded, washed gravel, 1/8 inch; or coarse sand as recommended by underlayment manufacturer.

1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70 deg F (21 deg C).
- D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
- E. Isolation Strips: Install foam isolation strips in locations according to the manufacturer's installation instructions prior to placing gypsum underlayment.
- F. Vapor Barrier: Polyethylene per the Owner's standards.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance.
 1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Prepare and clean substrate according to manufacturer's written instructions.
 1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
 1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
- C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

- A. General: Mix and apply underlayment components according to manufacturer's written instructions.
 1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.

2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
 - B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
 - C. Apply underlayment to produce uniform, level surface.
 1. Feather edges to match adjacent floor elevations.
 - D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
 - F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.
- 3.4 PROTECTION
- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION