

SECTION 034900 - GLASS-FIBER-REINFORCED CONCRETE (GFRC)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes glass-fiber-reinforced concrete (GFRC) wall panels, column covers, fascia units, cornices, and soffits.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include GFRC design mixes.
- B. Shop Drawings: Show fabrication and installation details for GFRC panels including the following:
 - 1. Panel elevations, sections, and dimensions.
 - 2. Thickness of facing mix, GFRC backing, and bonding pads for typical panels.
 - 3. Finishes.
 - 4. Joint and connection details.
 - 5. Erection details.
 - 6. Panel frame details for typical panels including sizes, spacings, thicknesses, and yield strengths of various members.
 - 7. Locations and details of connection hardware attached to structure.
 - 8. Sizes, locations, and details of flex, gravity, and seismic anchors for typical panels.
 - 9. Other items sprayed into panels.
 - 10. Erection sequence for special conditions.
 - 11. Relationship to adjacent materials.
 - 12. Description of loose, cast-in, and field hardware.
- C. Samples for Verification: Representative of finish, color, and texture variations expected, approximately 12 by 12 inches (305 by 305 mm) by actual thickness.
- D. Delegated-Design Submittal: For GFRC panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification data.
- B. Welding certificates.
- C. Source quality-control program.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Designated a PCI-certified plant for Group G - Glass Fiber Reinforced Concrete.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," and AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Handle and transport GFRC panels supported on nonstaining material and with nonstaining resilient spacers between panels.
- B. Store GFRC panels off of ground on firm, level, and smooth surfaces supported on nonstaining material and with nonstaining resilient spacers between panels. Place stored panels so identification marks are clearly visible.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, Basis of Design – Casting Designs, Inc. or approved substitute:
 - 1. Casting Designs, Inc. (CDI)
David Sahaida, 314.846.6200
- B. Source Limitations: Obtain GFRC panels from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design GFRC panels, including panel frames, anchors, and connections.
- B. Structural Performance: GFRC panels, including panel frames, anchors, and connections, shall withstand the following design loads as well as the effects of thermal- and moisture-induced dimensional changes within limits and under conditions indicated:
 - 1. Loads: As indicated.

- C. PCI Manuals: Comply with requirements and recommendations in the following PCI manuals unless more stringent requirements are indicated:
 - 1. PCI MNL 128, "Recommended Practice for Glass Fiber Reinforced Concrete Panels."
 - 2. PCI MNL 130, "Manual for Quality Control for Plants and Production of Glass Fiber Reinforced Concrete Products."
- D. AISI Specifications: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- E. AISC Specifications: Comply with AISC 360, "Specification for Structural Steel Buildings."

2.3 GFRC MATERIALS

- A. Portland Cement: ASTM C 150/C 150M; Type I, II, or III.
 - 1. For surfaces exposed to view in finished structure, use same type, brand, and source throughout GFRC production.
- B. Metakaolin: ASTM C 618, Class N.
- C. Glass Fibers: Alkali resistant, with a minimum zirconia content of 16 percent, 1 to 2 inches (25 to 50 mm) long, specifically produced for use in GFRC, and complying with ASTM C 1666/C 1666M.
- D. Sand: Washed and dried silica, complying with composition requirements in ASTM C 144; passing a No. 20 (0.85-mm) sieve with a maximum of 2 percent passing a No. 100 (0.15-mm) sieve.
- E. Facing Aggregate: ASTM C 33/C 33M, except for gradation, and PCI MNL 130, 1/4-inch (6-mm) maximum size.
- F. Coloring Admixture: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.
- G. Water: Potable; complying with chemical limits in PCI MNL 130.
- H. Polymer-Curing Admixture: Acrylic thermoplastic copolymer dispersion complying with PCI MNL 130.
- I. Air-Entraining Admixture: ASTM C 260/C 260M, containing not more than 0.1 percent chloride ions.
- J. Chemical Admixtures: ASTM C 494/C 494M, containing not more than 0.1 percent chloride ions.

2.4 ANCHORS, CONNECTORS, AND MISCELLANEOUS MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

- B. Carbon-Steel Bars: ASTM A 108, Grade 1018, not less than 1/4 inch (6 mm) in diameter.
- C. Bolts: ASTM A 307 or ASTM A 325 (ASTM F 568M or ASTM A 325M).

2.5 PANEL FRAME MATERIALS

- A. Cold-Formed Steel Framing: Manufacturer's standard C-shaped steel studs, complying with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members," with minimum uncoated steel thickness of 0.053 inch (1.35 mm).
- B. Hollow Structural Sections: Steel tubing, ASTM A 500/A 500M, Grade B, or ASTM A 513.
- C. Steel Channels and Angles: ASTM A 36/A 36M.

2.6 GFRC MIXES

- A. Mist Coat: Portland cement, sand slurry, and admixtures; of same proportions as backing mix without glass fibers.
- B. Face Mix: Proportion face mix of portland cement, sand, facing aggregates, and admixtures to comply with design requirements.
- C. Backing Mix: Proportion backing mix of portland cement, glass fibers, sand, and admixtures to comply with design requirements. Provide nominal glass-fiber content of not less than 5 percent by weight of total mix.

2.7 PANEL FRAME FABRICATION

- A. Fabricate panel frames and accessories plumb, square, true to line, and with components securely fastened.
 - 1. Fasten cold-formed metal framing members by welding. Comply with AWS D1.3/D1.3M.
 - 2. Fasten framing members of hollow structural sections, steel channels, or steel angles by welding. Comply with AWS D1.1/D1.1M.
 - 3. Weld anchors to panel frames.
- B. Reinforce framing assemblies, as necessary, to withstand erection stresses.

2.8 GFRC FABRICATION

- A. Proportioning and Mixing: For backing mix, meter sand/cement slurry and glass fibers to spray head at rates to achieve design mix proportions and glass-fiber content according to PCI MNL 130 procedures.
- B. Spray Application: Comply with general procedures as follows:
 - 1. Spray mist coat over molds to a nominal thickness of 1/8 inch (3 mm) on planar surfaces.

2. Spray or place face mix in thickness indicated on Shop Drawings.
 3. Proceed with spraying backing mix before [face mix] [mist coat] has set, using procedures that produce a uniform thickness and even distribution of glass fibers and matrix.
 4. Consolidate backing mix by rolling or other technique to achieve complete encapsulation of glass fibers and compaction.
 5. Measure thickness with a pin gage or other acceptable method at least once for every 5 sq. ft. (0.5 sq. m) of panel surface. Take no fewer than six measurements per panel.
- C. Hand form and consolidate intricate details, incorporate formers or infill materials, and overspray before material reaches initial set to ensure complete bonding.
- D. Attach panel frame to GFRC before initial set of GFRC backing, maintaining a minimum clearance of 1/2 inch (13 mm) from GFRC backing, and without anchors protruding into GFRC backing.
- E. Build up homogeneous GFRC bonding pads over anchor feet, maintaining a minimum thickness of 1/2 inch (13 mm) over tops of anchor feet, before initial set of GFRC backing. Measure bonding pad thickness at 25 percent of anchor locations.
- F. Inserts and Embedments: Build up homogeneous GFRC bosses or bonding pads over inserts and embedments to provide enough anchorage and embedment to comply with design requirements.
- G. Curing: Employ initial curing method that ensures sufficient strength for removing units from mold. Comply with PCI MNL 130 procedures.
- H. GFRC Finish: As indicated

2.9 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Establish and maintain a quality-control program for manufacturing GFRC panels according to PCI MNL 130.

PART 3 - EXECUTION

3.1 ERECTION

- A. Install clips, hangers, and other accessories required for connecting GFRC panels to supporting members and backup materials.
- B. Install GFRC panels level, plumb, square, and in alignment. Provide temporary supports and bracing as required to maintain position, stability, and alignment of panels until permanent connections are completed.
1. Maintain horizontal and vertical joint alignment and uniform joint width.
 2. Remove projecting hoisting devices.

- C. Connect GFRC panels in position by bolting or welding, or both, as indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as possible after connecting is completed.
- D. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.3/D1.3M requirements for welding, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect GFRC panels from damage by field welding or cutting operations, and provide noncombustible shields as required.
- E. At bolted connections, use lock washers or other acceptable means to prevent loosening of nuts.
- F. Erect GFRC panels to comply with PCI MNL 130 recommendations.

3.2 REPAIRS

- A. Repairs are permitted provided structural adequacy of GFRC panel and appearance are not impaired, as approved by Architect.
- B. Remove and replace damaged GFRC panels when repairs do not comply with requirements.

3.3 CLEANING AND PROTECTION

- A. Perform cleaning procedures, if necessary, according to GFRC manufacturer's written instructions. Clean soiled GFRC surfaces with detergent and water, using soft fiber brushes and sponges, and rinse with clean water. Prevent damage to GFRC surfaces and staining of adjacent materials.

PART 4 – WARRANTY

- A. Manufacturer will warrant all materials against defect for one (1) year after acceptance of materials.
- B. Installer will warrant installation of installed materials for one (1) year after acceptance of materials.
- C. The manufacturer will, at his discretion, repair or replace defective pieces subject to approval of architect.

END OF SECTION 034900