SECTION 034900 GLASS FIBER REINFORCED CONCRETE (GFRC)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Glass-fiber-reinforced concrete (GFRC) panels without panel frames.

B. Related Requirements:

1. Cast-in-Place Concrete - Section 033000.
2. Section 033300 "Architectural Concrete" for general building applications of specially finished formed concrete.

1.3 REFERENCE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced.

1. Precast/Prestressed Concrete Institute MNL-130-09: "Manual for Quality Control for Plants and production of Glass Fiber Reinforced Concrete Products."

1.4 REFERENCES

A.	ASTM	C 150	Portland Cement
B.	ASTM	C 144	Sand
C.	ASTM	C 979	Concrete Pigment
D.	ASTM	C 1666	Alkali Resistant (AR) Glass Fibers
E.	ASTM	C 618-N	Metakaolin

1.5 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. Panel corner details.

6. Other items sprayed or cast in GFRC product.
7. Locations and details of connection hardware attached to structure.
8. Sizes, locations, and details of flex, gravity, and seismic anchors for typical panels. Sequence of erection for special conditions.
9. Relationship to adjacent material.
10. Description of all loose, cast-in, and field hardware

C. Samples: Actual sample of finished products representative of GFRC finish, color, and texture variations.

1. Prior to commencement of manufacture, submit samples representative of finished face showing typical range of color and texture.
2. Sample size shall be approximately 12 inches x 12 inches and of appropriate thickness, representative of the proposed finished product.

1.6 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Welding certificates.
2. Steel Sheet Certificates: For steel sheet used in cold-formed steel panel framing, mill certificates signed by manufacturers of steel sheet, or test reports from a qualified testing agency, indicating that steel sheet used in cold-formed metal panel framing complies with requirements including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and galvanized-coating thickness.
3. Mill Certificates: For structural-steel shapes and hollow structural sections used in panel framing.

B. Source Quality-Control Test Reports: For GFRC, inserts, and anchors.

C. Qualification Statements: For GFRC manufacturer.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be regularly engaged and experienced in glass fiber reinforced concrete projects of the quality and scope required for this project.

B. Installer Qualifications: Regularly engaged and experienced in the installation of glass fiber reinforced concrete or precast concrete units.

C. Tolerances: Manufacture and install GFRC panels so that tolerances for dimensions and appearance shall be as indicated in MNL-130.

D. Records: Keep quality control records available for two years after final acceptance.

1.8 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.

1.9 WARRANTY

A. The GFRC contractor shall furnish a written warranty against manufacturing defects in materials or workmanship for a period of one (1) year after substantial completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Concreteworks East, 349 Dunhams Corner, East Brunswick, N.J. 08816. 732-390-9944. www.concreteworkseast.com, or approved equal.

B. Source Limitations: Obtain GFRC panels from single source from single manufacturer.

2.2 GFRC MATERIALS

A. Cement: Type I, II, or III White Portland Cement of one type, brand, source and lot throughout project, meeting requirements of ASTM C150.

B. 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.

C. Water: Fresh, clean, potable and free of any deleterious matter that would interfere with color, setting or strength of concrete.

D. Glass Fibers: High zirconia content (minimum 16%), alkali resistant glass fibers specifically designed for use in concrete and in compliance with ASTM C1666.

E. Concrete Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.

F. Metakaolin: ASTM C 618, Class N.

G. Polymer Admixture: Acrylic thermoplastic copolymer dispersion complying with PCI MNL 130.

H. Chemical Admixtures: ASTM C 494/C 494M, containing not more than 0.1 percent chloride ions.

2.3 PRODUCT CHARACTERISTICS

A. Typical Mixes

1. Face Mix: Proportion face mix of portland cement, sand, facing aggregates, and admixtures to comply with design requirements.
2. 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 4 percent by weight of total mix.

B. Typical Range of GFRC Properties at 28 days:

1. Density: Minimum of 105 pcf.
2. Compressive Strength (Edgewise): Over 5000 psi (34 MPa).
3. Flexural Strength (Yield): 1000 to 1800 psi (6.9 to 12.4 MPa).
4. Flexural Strength (Ultimate): 1200 to 2000 psi (8.3 to 13.8 MPa).
5. Surface Burning Characteristics:Flame spread index of 0, Class A/Class 1 when tested in accordance with ASTM E 84.

C. Facing Mix: Thickness shall generally be the minimum possible to achieve the desired finish.

2.4 MOLD FABRICATION

A. Construct molds that result in finished GFRC complying with profiles, dimensions, and tolerances indicated, without damaging GFRC during stripping. Construct molds to prevent water leakage and loss of cement paste.

1. Coat contact surfaces of molds with form-release agent.

2.5 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. Proceed with spraying or pouring backing mix before face mix has set, using procedures that produce a uniform thickness and even distribution of glass fibers and matrix.
3. Consolidate backing mix by rolling or other technique to achieve complete encapsulation of glass fibers and compaction.
4. 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. Curing: Employ initial curing method that ensures sufficient strength for removing units from mold. Comply with PCI MNL 130 procedures.

E. GFRC Finish: To match approved sample.

F. Manufacturing Tolerances: Manufacture GFRC panels so each finished unit complies with PCI MNL 130 for dimension, position, and tolerances.

G. Cover: Provide embedded anchors, inserts, and other sprayed-in items with sufficient anchorage and embedment for design requirements.

H. Panel identification

1. Mark each GFRC panel to correspond to identification marks on shop drawings for panel location.
2. Mark each GFRC panel with date cast.

I. Acceptance: GFRC units which do not meet the color and texture range or the dimensional tolerances may be rejected at the option of the architect if they cannot be satisfactorily corrected.

2.6 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 PRE-INSTALLATION/INSPECTION

A. General Contractor's Responsibility

1. The general contractor shall provide building lines, center and grades in sufficient detail to allow installation of the GFRC units.
2. The General Contractor shall provide true, level load-bearing surfaces.
3. Clear, well-drained unloading areas and road access around and in the building (where appropriate) shall be provided and maintained by the general contractor to a degree that hauling and erection equipment for the GFRC units are able to operate under their own power.

B. Installer Responsibility

1. Verify that all parts of the supporting structure are complete and ready to receive the panels or the GFRC product and that site conditions are conducive to proper installation.
2. Prior to installation of the units, the installer shall check the jobsite dimensions affecting the work under his contract. Any discrepancies between design dimensions and field dimensions which could adversely affect installation of the GFRC product shall be brought to the attention of the general contractor and architect.
3. If discrepancies exist, installation shall not proceed until they are corrected or until installation requirements are modified and reviewed by the architect and/or Engineer.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

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.

3.4 REPAIRS

A. Method: Mix and place patch mixture to match color and texture of surrounding concrete. If patching is not possible or if unacceptable to architect, GFRC unit is to be replaced.

B. Structural Adequacy: Patching will be permitted provided structural adequacy of the unit is not impaired.

C. Remove and replace damaged GFRC panels when repairs do not comply with requirements.

D. Damage: Damage caused by other trades that requires replacement or patching shall be performed by the GFRC manufacturer or qualified workmen and paid for by others after written authorization to perform said work.

3.5 CLEANING

A. Perform cleaning procedures, if necessary, according to GFRC manufacturer's written instructions.

3.6 PROTECTION OF WORK

A. The installer or General Contractor shall be responsible for protection of the panels or GFRC product from damage by the other trades working on-site until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion

3.7 INSPECTION AND ACCEPTANCE

A. Acceptance: Final inspection and acceptance of installed GFRC product shall be made by the architect to verify conformance with plans and specifications.

END OF SECTION 034900