GEORGIA PRECAST SOLUTIONS

Specifications for Glass Fiber Reinforced Concrete (GFRC) – Section 034900

PART1 GENERAL

1.1 SECTION INCLUDES

A Plant-cast, glass-fiber-reinforced precast concrete panels.

B. Embedded hardware and anchors.

C. Loose connection hardware.

D. Integrated steel support framing.

1.2 RELATED SECTIONS

A Section 03300 - Cast-in-Place Concrete: Building structural frame.

B. Section 04800 - Unit Masonry: Back-up masonry.

C. Section 05120 - Structural Steel: Building structural frame.

D. Section 05400 - Cold-Formed Metal Framing: Structural stud members.

E. Section 07190 - Water Repellent Coating.

F. Section 07600 - Metal flashings.

G. Section 07840 - Firestopping: Fire barrier seal between units and edge of floor slab.

H. Section 07900 - Joint Sealers: Application of backer rods or bond breakers and joint sealers.

1.3 REFERENCES

A. ASTM A 27/A 27M - Standard Specification for Steel Castings, Carbon for General Application.

B. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel.

C. ASTM A 47/A 47M - Standard Specification for Ferritic Malleable Iron Castings.

D. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip) on Iron and Steel Hardware.

E. ASTM A 108 - Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.

F. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

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G. ASTM A 283/A 283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

H. ASTM A 325- Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

I. ASTM A 500 - Standard Specification *for* Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

J. ASTM A 513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing

K. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.

L. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

M. ASTM A1003/A1003M- Standard Specification for Steel Sheet, Carbon, Metallic-and Nonmetallic-Coated for Cold-Formed Framing Members.

N. ASTM A1008/A1008M- Standard Specification for Steel, Sheet. Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

0. ASTM C 33 • Standard Specification for Concrete Aggregates.

P. ASTM C 150-Standard Specification for Portland Cement.

Q. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

R. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete.

S. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

T. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete.

U. ANSI - American Iron and Steel Institute (AISI), Specification for the Design of Cold-Formed Steel Structural Members

V. AWS D1.1 - Structural Welding Code - Steel.

W. AWS 01.3 - Structural Welding Code - Sheet Steel.

X. AWS 01.4 - Structural Welding Code - Reinforcing Steel.

Y. PCI MNL-117- Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.

Z. PCI MNL-128- Recommended Practice for Glass Fiber Reinforced Concrete Panels.

AA. PCI MNL-130 - Manual for Quality Control for Plants and Production of Glass Fiber Reinforced Concrete Products.

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BB. SSPC 2 - Hand Tool Cleaning.

CC. SSPC 3 - Power Tool Cleaning.

DD. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

EE. SSPC Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II

FF. CIELAB - International Commission of Illumination, 1976 Standards.

1.4 SYSTEM DESCRIPTION

A System: Plant fabricated glass-fiber-reinforced precast concrete panels consisting of face mix, back-up mix, steel support frame attached via pins, gravity anchors and flex anchors, steel connections for panel attachment to structure, and other inclusions for attachments to panels.

B. Design Requirements: Design glass-fiber-reinforced precast concrete panels and shapes under the supervision of a professional engineer and in accordance with procedures of PCI MNL-128, Recommended Practices for Glass Fiber Reinforced Concrete Panels using property data generated from the manufacturer's actual production.

C. Performance Requirements:
1. Provide glass-fiber-reinforced precast concrete panels and panel frames capable of withstanding gravity, wind, seismic, and erection design loads as well as the effects of thermal and moisture-induced volume changes, according to load factors and combinations established in PCI MNL 128.
2. Design Loads: As indicated.
3. Design framing systems to withstand design loads with lateral deflections no greater than 1/240 of the wall height.
4. Provide for movement of framing members without damage or overstressing, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 100 degrees F.

1.5 SUBMITTALS

A Submit under provisions of Section 01300.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Indicate dimensions, cross-sections and edge details; metal framing details, location, size and type of reinforcement, including reinforcement necessary for safe handling and erection; and connection details, and relationship to adjacent materials:
1. Design calculations demonstrating compliance with indicated loading conditions and showing flexural ultimate strengths assumed for design, stamped by a structural professional engineer registered in the location of the project.
2. Layout, dimensions, and identification of each panel segment corresponding to installation sequence.

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3. Location and details of anchorage devices embedded in panels and shapes, and connection details to building.

D. Samples:
1. Selection Samples: For each finish product specified, two complete sets of color sample, minimum size 6 inches (150 mm) square. representing manufacturer's full range of available colors and patterns for the exposed face of panels.
2. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns for the exposed face of panels.
3. Do not start fabrication until samples are approved.

E. Maintain plant records and quality control program during production of units. Make records and access to plant available to Architect upon request.

F_ Submit certificates of compliance for the following:
1. Admixtures.
2. Portland Cement: Identify the cement brand name, type and mill location used for the quality control sample.
3. Glass Fibers: Submit evidence that glass composition, Portland cement matrix, or both have been designed for glass-fiber reinforced precast concrete panel applications.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with PCI MNL 128, Recommended Practice for Glass Fiber Reinforced Concrete Panels

B. Manufacturer Qualifications: Provide panels and shapes only from a manufacturer who has demonstrated capability to produce products of the quality and scope required for this project, and with not less than 5 years of successful experience in manufacturing glass-fiber reinforced precast concrete panels and shapes and follows Architectural Precast Association's standards for production of GFRC.
1. Retains licensed Professional Engineer for plant and record inspection indicating production, testing and quality control methods comply with PCI MNL-130, Manual for Quality Control: Glass Fiber Reinforced Concrete.

C. Installer Qualifications: A firm which has specialized in erection of glass-fiber reinforced precast concrete panels or architectural precast concrete items similar to those required on this project for not less than 5 years and who is acceptable to manufacturer of glass-fiber reinforced precast concrete panels.

D. Welder Qualifications: Use welders who have been qualified in accordance with AWS D1.1 and AWS D1.4 within the last year.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

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3. Refinish mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, ANO HANDLING

A. Deliver units to the project site palletized, safely wrapped, packed and labeled and retain until erected.

B. Store materials in a dry location off the ground, and in such a manner to prevent damage or intrusion of foreign matter.

C. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses or damage.

D. Store units to protect them from contact with soil, staining, and from physical damage.

E. Place stored units so that identification mar1<s is easily readable.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Georgia Precast Solutions, LLC, 1324 Southern Road, Morrow, Georgia 30260, Phone: (770) 960-6704. www.georgiaprecast.com.

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 MATERIALS

A. Aggregates:
1. Back up Mix: Washed and dried silica sand or other sand having a history of successful use in glass-fiber-reinforced precast concrete panel construction; passing through a No. 20 sieve.
2. Facing Mix: Fine and coarse aggregate for face mix shall conform to ASTM C 33 except for gradation. Aggregates shall be clean, hard, strong, durable, inert, and free of staining and deleterious materials. Provide aggregate in colors and sizes as required to achieve the panel finish texture and colors indicated on the Drawings.

B. Portland Cement: ASTM C 150, Type I, II or Ill. Use the same type, brand and color of Portland cement for all panels and shapes. Color shall be as required to obtain the panel facing color indicated.

C. Admixtures:
1. Air-entraining admixtures, ASTM C 260. ASTM C260, ASTM C494, ASTM C618 or acrylic thermoplastic copolymer dispersion conforming to PCI MNL-130, Appendix E.
2. Polymer Compound: Conform to requirements of PCI MNL-128, Appendix L.

D. Coloring Agent ASTM C 979; shall have no adverse effects to glass-fiber-reinforced precast concrete panel set and strength; shall be stable at high temperature; and shall be sunlight fast and alkali-resistant. Color shall be as required to obtain panel facing color selected.

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E. Water for Mixing Concrete: Use potable water.

F. Glass Fiber: Conforming to PCI MNL-130, Appendix D and specifically designed to be compatible with the aggressive alkaline environment of Portland cement based composites or fibers with a history of successful use in Portland cement based composites that has been modified to be compatible with the fiber.

G. Anchors and Loose Attachment Hardware:
1. Structural Steel: ASTM A 36/A 36M.
2. Cold Drawn Wire:
3. Anchor Bolts: ASTM A 325.
4. Pipe: ASTM A 500 Grades A or B.
5. Tube Steel: ASTM A 500 Grade **A** or B.
6. Carbon-Steel Rods: ASTM A 108, cold drawn
7. Carbon-Steel Plate: ASTM A 283/A 283M.
8. Malleable-Steel Castings: ASTM A 47/A 47M.
9. Carbon-Steel Castings: ASTM A 27/A2.7M, Grade 60-30.
10. Finish: Galvanized in accordance with ASTM A 153/A 153M.

H. Panel Frame Materials:
1. Cold-Formed Steel Framing: Manufacturer's standard C-shaped steel studs, complying with AISI "Specification for the Design of Cold-Formed Steel Structural Members," minimum uncoated steel thickness of 0.0538 inch (1.37mm) of web depth indicated, with stiffened flanges, V-shaped steel track, and of the following steel sheet:
   a. Metallic-Coated Steel Sheet: ASTM A 653/A653M, structural-steel sheet, of grade required by structural performance of framing and with zinc coating thickness of:
      1) G60 (Z180).
      2) G90 (Z275).
   b. Painted, Nonmetallic-Coated Steel Sheet ASTM AIOII/AIOIIM hot rolled or ASTM AIO08/ Al008M cold rolled; nonmetallic coated according to ASTM A 1003/ A 1003M; of grade required by structural performance of framing.
2. Hollow Structural Sections: Steel tubing, ASTMA500, Grade B, or ASTM A5I3. Finish hollow structural sections with wall thickness Jess than 3/16 inch (4.76 mm) as follows:
   a. Organic Zinc-Rich Primer: SSPC-Paint 20 on surfaces prepared to comply with SSPC-SP6/NACE No.3, "Commercial Blast Cleaning."
   b. Primer: SSPC-Paint 25 on surfaces prepared to comply with SSCP-SP 2, Hand Tool Cleaning," or better.
3. Steel Channels and Angles: ASTM A36/ A36M**,** finished as follows:
   a. Organic Zinc-Rich Primer: SSPC-Paint 20 on surfaces prepared to comply with SSPC-SP6/NACE No.3, "Commercial Blast Cleaning."
   b. Primer: SSPC-Paint 25 on surfaces prepared to comply with SSCP-SP 2, "Hand Tool Cleaning," or better.

I. Form Materials: Provide form materials that will produce panels having the profile, dimensions and tolerances indicated. Use release agents which are compatible with finish specified and joint sealants proposed for use.

J. Mixes: Portland cement, water, glass fibers and sand mixed in proportions determined in accordance with PCI MNL-128.

2.3 FABRICATION

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A. Fabricate panels in general compliance with PCIMNL-128 and MNL-130.

B. Molds:
   1. Rigid and constructed of materials that will result in finished products conforming to the profiles, dimensions and tolerances indicated on the Drawings.
   2. Release agents; apply and use according to manufacturer's instructions.

C. Proportioning and Mixing:
   1. Carefully measure mix constituents in a manner to achieve the desired mix proportions
   2. Meter the glass fiber and cement slurry to the spray head at rates to achieve the desired mix proportion and glass content. Check rates in accordance with standard procedures described in PCI MNL-128.
   3. Maintain cleanliness of equipment and working procedures at all times.

D. Hand Spray Application:
   1. Spray apply a mist coat consisting of the matrix without fiber. Applied coating not to exceed 1/8inch thick in order to avoid an unreinforced surface.
   2. Spray or place face mix in thickness shown on shop drawings.
   3. Spray-up main body of material before the mist coat has set.
   4. Apply by spraying such that uniform thickness and distribution of glass fiber and cement matrix is achieved during the application process.
   5. Consolidate by rolling or such other techniques as necessary to achieve complete encapsulation of fibers and compaction.
   6. Control thickness by using a pin gauge or other approved method. Perform a minimum of 2 measurements per 5 square feet of panel surface with at least 3 measurements per panel.
      Perform hand forming of intricate details, incorporate formers or infill material and overspray before the material has achieved its initial set so as to insure complete bonding.

E. Premix Application

   1. AR glass fiber is pre-chopped to lengths that can range from ¼"to 1-1/2". The chopped AR glass fibers are weighed and mixed with cement slurry prior to placement into mold. This takes place after mist coat application as described in 2.3 D. 1. Steps 5 thru 7 above to follow.

F. Inserts and Embedments:
   1. Property embed inserts in built up homogeneous glass-fiber reinforced precast concrete panel bosses to develop their strength. Waste material or overspray is not acceptable to encapsulate inserts or for bonding pads.
   2. Test inserts to establish test data and reduce test values by the appropriate safety factors to determine connection strength to be used in design.
   3. Rigid embedded items bonded to the glass-fiber reinforced precast concrete panel shall not create undesirable restraint to volume changes.

G. Panel Frame Fabrication:
   1. Fabricate panel frames and accessories plumb, square, true to line, and with components securely fastened in accordance with design requirements
      a. Fabricate panel frames using jigs or templates.
      b. Cut cold-formed metal framing members by sawing or shearing do not torch cut.

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c. Fasten cold-formed metal framing members by welding. Comply with AWS D1.3 requirements and procedure for welding, appearance and quality of welds, and methods used in correcting welding work.
d. Fasten framing members of hollow structural sections, steel channels, or steel angles by welding. Comply with AWS DI.I requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
e. Weld flex, gravity, and seismic anchors to panel frames.

2. Reinforce, stiffen, and brace framing assemblies, if necessary, to withstand handling, delivery, and erection stresses. Lift fabricated assemblies in a manner that prevents damage or significant distortion.
3. Galvanizing Repair: Touch up accessible damaged galvanized surfaces according to ASTMA 780.

H. Finish of Exposed Faces: Panel faces shall be free of honeycombs, form marks, concrete droppings or other blemishes that would telegraph through the panel. Provide a finish surface free of laitance, grease, form release treatments, efflorescence, curing compounds or other foreign material that would adversely affect bonding of any subsequent coating.
1. Color and texture of exposed face surfaces shall match Architect's design reference panel.
2. Color and texture of exposed face surfaces shall match_____.
3. Color and texture of exposed face surfaces shall match one of the manufacturers standard finishes as selected by the Architect.

I. Dimensional Tolerances of Finished Units: Provide in accordance with PCI MNL-117 and PCI MNL-128.

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

K. Curing:
1. Immediately after the completion of spraying of the panel, cure panels using a method to ensure sufficient strength for removing the units from the form.
2. After initial curing, remove panel from form and place in a controlled curing environment.
3. An acrylic thermoplastic copolymer dispersion may be used as a curing admixture. Only copolymers shown to eliminate the need for moist curing through independent laboratory test data shall be used.

L. Panel Identification:
1. Mark each glass-fiber reinforced precast concrete panel to correspond to identification mark on shop drawings for panel location.
2. Mark each glass-fiber reinforced precast concrete panel with date on which it was cast.
3. Apply markings on surface that will not be exposed in the finished construction.

2.4 SOURCE QUALITY CONTROL

A. Independent Testing:
1. Allow Owner's testing agency access to material storage areas. concrete production equipment, concrete placement, and curing facilities.
2. Cooperate with Owner's testing agency and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.

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3. Test glass-fiber reinforced precast concrete panel units in accordance with PCI MNL-130.

B. Plant Testing:
   1. Test glass-fiber reinforced precast concrete panel units in accordance with PCI MNL-130.
   2. Perform testing by an independent testing agency capable of performing the specified tests. Submit copies to the Architect and designated authorities.

C. Acceptability of Appearance:
   1. Finished construction in place shall present a uniform, pleasing appearance when viewed in good typical lighting with the naked eye at a distance of 10 feet and shall show no imperfections at a distance of 20 feet.
   2. The range of total acceptable color (lightness. color saturation and hue) variation shall not exceed CIELAB 3.0 provided that the difference in hue alone does not exceed CIELAB 1.0 as defined by the International Commission of Illumination, 1976 Standards.

PART 3 EXECUTION

3.1 EXAMINATION

A Check placement of structural support system to assure a true and level surface for attachment of panels. Do not begin construction until discrepancies that could adversely affect installation of panels have been corrected.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A Clean surface 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 in accordance with manufacturer's instructions.

B. Setting:
   1. Lift glass-fiber reinforced precast concrete panel units with suitable lifting devices at points provided by the manufacturer.
   2. Set glass-fiber reinforced precast concrete panel units level, plumb, square and true within the allowable tolerances.
   3. Site cutting of panels is not permitted.

C. Supports and Bracing: Provide temporary supports and bracing required to maintain position, stability, and alignment as units are being permanently connected.

D. Fastening:
   1. Fasten glass Fiber reinforced precast concrete panel units in place by bolting or welding or both as shown on erection drawings.

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2. Field welding shall be done by qualified welders using equipment and materials compatible with the base material.
3. Use non-combustible shields during welding operations to protect adjacent Work.

E. Tolerances of Erected Units:
1. Tolerances for location of glass-fiber reinforced precast concrete panel units shall be noncumulative and as listed below. For erection tolerances not listed below, those listed in PCI MNL 117 shall apply.
2. Face width of joint
   a. Panel dimension 10 feet or less plus 3116 inch.
   b. Panel dimension 10 to 20 feet plus 3/16inch, minus 1/4 inch.
   c. Panel dimension greater than 20 feet plus 1/4 inch, minus 5/16inch
3. Warpage: Maximum permissible warpage of one comer out of plane of the other three shall be 1/16 inch per foot of distance from the nearest adjacent corner or 1/8-inch total after installation.
4. Bowing: Not over U360, where **L** is the panel length.

3.4 PATCHING AND CLEANING

A. Patch and clean panels using methods and materials in accordance with manufacturer's instructions.

B. Patching blemishes using a patching mixture matching the color and texture of surrounding surface.

C. Use extreme care to prevent damage to panel surfaces and to adjacent materials. Provide protection of adjacent surfaces if required.

D. Surface must be thoroughly rinsed with clean water immediately after using cleaner.

3.5 FIELD TESTS AND INSPECTION

A Quality Control Program: Panel manufacturer shall have an established quality control program if effect at the plant or shall employ an independent testing laboratory approved by the Architect to monitor glass content, spray rate, physical properties and curingperiod and conditions.

B. Sampling and Testing:
1. Prepare test specimens and use test procedures in accordance with PCI MNL-128, Chapter 8 and Appendix A.
2. Prepare a minimum of 2 test boards per work shift until a production uniformity acceptable to the quality control personnel has been achieved. At such time frequency may be reduced to one board per work shift.
3. For each board determine glass content by the washout test, flexural ultimate strength and flexural yield strength.
4. Glass content shall be considered satisfactory if within minus 0.5 and plus1.0 percent. by weight, of the glass content in the design mix.
5. Flexural yield strength shall be considered satisfactory if both of the following requirements are met.
   a. The average of all sets of 3 consecutive strength tests equal or exceed assumed ultimate flexural strength for design purposes.
   b. No individual test (average of 6 coupons) fall below required assumed ultimate flexural strength for design purposes by more than 10 percent.

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6. Submit reports giving proportions, test results, inspection results, unit identification numbers and casting date for each work shift.

C. Rejection:

1. Panels in place may be rejected for any one of the following product defects or installation deficiencies:
   a. Non-repairable damage incurred during construction operations.
   b. Ragged or irregular edges.
   c. Visible form joints or irregular surfaces.
   d. Panels not conforming to tolerance requirements.
   e. Foreign material embedded in the face.
   f. Visible repairs.
   g. Cracks visible at a distance of 10 feel
   h. Panels do not meet design strength requirements.

3.6 PROTECTION

A Protect installed products until completion of project.

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

3.7 SCHEDULE

A. Item:

END OF SECTION

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