

Sculptural Fiber-Reinforced Concrete Rainscreen Panels

PART 1 –GENERAL

NOTE: EDIT THE FOLLOWING ARTICLE TO SUIT THE PROJECT IF DIVISION 1 - GENERAL REQUIREMENTS IS NOT USED, DELETE APPROPRIATE TEXT

1.01 RELATED DOCUMENTS

- A. Drawings, Conditions of the Contract and Division 1 Specifications sections, apply to work of this section.

1.02 SUMMARY

- A. Section Includes: sculptural fiber-reinforced concrete rainscreen panels and hardware.

1.03 RELATED SECTIONS

NOTE: IN PARAGRAPHS BELOW, INSERT SECTION NUMBERS AND TITLES OF SECTIONS WHICH CONTAIN SPECIFICATIONS RELATED TO INSTALLATION OF SCULPTURAL FIBER-REINFORCED CONCRETE RAINSCREEN PANELS FOR THIS PROJECT DELETE PARAGRAPHS WHICH ARE NOT APPLICABLE TO THIS PROJECT.

- A. Division 03 Section “Cast-in-Place Concrete”
- B. Division 05 Section “Structural Steel Framing”
- C. Division 05 Section “Cold-Formed Metal Framing”
- D. Division 06 Section “Sheathing”
- E. Division 07 Section “Thermal Insulation”
- F. Division 07 Section “Fluid-Applied Membrane Air Barriers”
- G. Division 07 Section “Joint Protection”
- H. Division 08 Section “Glazed Aluminum Curtain Wall”

1.05 REFERENCE STANDARDS

- A. ASTM C947: Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam with Third-Point Loading)
- B. ASTM C672: Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals
- C. ASTM C531-18: Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
- D. ASTM C666-97: Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
- E. ASTM E488/E488M-15: Standard Test Methods for Strength of Anchors in Concrete Elements
- F. ASTM E119: Standard Test Methods for Fire Tests of Building Construction and Materials
- G. NFPA 285: Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components

NOTE: BASED ON PROJECT SCOPE, DETERMINE WHETHER OR NOT DESIGN IS COMPLEX AND STRUCTURALLY CRITICAL ENOUGH TO WARRANT REQUIRING THAT THE DESIGN BE PREPARED BY A CERTIFIED STRUCTURAL OR CIVIL ENGINEER. DETAILED ENGINEERING CALCULATIONS AND DESIGN SKETCHES MAY BE WAIVED FOR SMALL NON-STRUCTURAL PIECES.

1.06 DESIGN RESPONSIBILITY

A. The manufacturer shall be responsible for the structural design of sculptural fiber-reinforced concrete rainscreen panels.

NOTE: IF DETAILED ENGINEERING CALCULATIONS ARE WAIVED, DELETE PARAGRAPH B BELOW.

- B. Structural design of the sculptural fiber-reinforced concrete rainscreen panels shall be prepared by certified structural or civil engineer licensed in the state where the Project is located and experienced in the use and design of sculptural fiber-reinforced concrete rainscreen panels.
- C. The panel manufacturer shall provide data relating to specific materials for use in design considerations. Data shall be based upon testing of actual fabrications by the panel manufacturer using material equivalent to those required for this Project.

1.07 DESIGN REQUIREMENTS

- A. Structural Requirements: Engineering calculations shall account for the following loads:
1. Dead Loads: Include the weight of the sculptural fiber-reinforced concrete rainscreen panels and attached items.
 2. Live Loads: As required by applicable code.
 3. Wind Loads: As required by applicable code. Consider wind loads as an inward pressure and as an outward suction.
 4. Snow Loads: As required by applicable codes.
 5. Seismic Design Forces: As required by applicable code.
 6. Load Combinations: Consider applicable load combinations. Do not combine wind loads with seismic loads.
- B. Provisions for Movement
1. Design and detail anchorages, connections, and joints to allow for dimensional changes of the sculptural fiber-reinforced concrete rainscreen panels due to thermal and similar effects.
 2. Where the piece is restrained, allow for effects of restraint in design.
- C. Anchorages and Connections
1. Suggested anchorages and connections are shown on the design drawings. Proposed substitutions may be submitted for review. Substitutions shall satisfy the function of the connection as indicated or implied on the drawings and shall not vary indicated building loading.
 2. Anchorages and connection designs shall consider tolerances and eccentricities of load applications. Provide proper edge and end distances for inserts.
- D. The project Structural Engineer will verify that the building structure will accept transmitted loads as shown in the calculations.

1.08 SUBMITTALS

A. Product Data: Submit manufacturer's data on sculptural fiber-reinforced concrete rainscreen panels.

NOTE: IF SPECIFIC COLOR, TEXTURE AND FINISH HAVE BEEN SPECIFIED, KEEP THE PARAGRAPH BELOW

- B. Product Samples: Submit minimum 8 inch x 8 inch samples in specified color, texture and finish.

NOTE: IF ARCHITECT HAS PROVIDED SAMPLE TO BE MATCHED, USED PARAGRAPH BELOW.

- C. Product Samples: Submit minimum 8 inch x 8 inch sample. Match sample provided by Architect.
- D. Shop Drawings: Submit drawings indicating:
 - 1. Panel shapes and dimensions;
 - 2. Panel surface finish;
 - 3. Part numbers;
 - 4. Jointing and connection details;
 - 5. Adjacent structure details;
 - 6. Hardware location and details; and
 - 7. Lifting and erection details.

NOTE: DELETE THE PARAGRAPH BELOW, IF ENGINEERING CALCULATION REQUIREMENTS ARE WAIVED.

- E. Engineering Calculations: Submit load, stress and design calculations prepared by a certified structural or civil engineer.
- F. Manufacturer's Instructions: Submit manufacturer's instructions and recommendations for:
 - 1. Product delivery, storage and handling.
 - 2. Erection, lifting and connecting of sculptural fiber-reinforced concrete rainscreen panels.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Handle, store and transport panels according to manufacturer's recommendations and in a manner that prevents cosmetic and structural damage.
 - 1. Do not subject panels to undue stress.
 - 2. Brace and stabilize panels to prevent warping.
 - 3. Place non staining resilient spacers between panels.
 - 4. Support panels on non staining material during shipment.
 - 5. Protect panels from dirt and damage during handling and transport.
- B. Store sculptural fiber-reinforced concrete rainscreen panels to protect from contact with soil, staining, and physical damage.
 - 1. Verify that areas where panels will be unloaded are clear of obstructions and well-drained.
 - 2. Store panels with non staining resilient supports in the same positions as when transported.
 - 3. Store panels on firm, level, and smooth surfaces.
 - 4. Place stored panels so identification marks are clearly visible.

NOTE: THE PARAGRAPH BELOW MAY BE USED TO AVOID CONFLICT, IF PROJECT SCHEDULING/PHASING IS SUCH THAT INSTALLED PANELS WILL BE EXPOSED TO DAMAGE FOR AN EXTENDED PERIOD PRIOR TO PROJECT COMPLETION.

NOTE: EDIT PARAGRAPHS BELOW. INSERT "ARCHITECT", "ARCHITECT/ENGINEER" "CONSTRUCTION MANAGER", "OWNER'S REPRESENTATIVE" AS APPLICABLE TO PROJECT.

- C. Damage Responsibility: Except for damage caused by others, the installer is responsible for chipping, cracking, or other damage to panels after delivery to the job site and until installation is completed and inspected and approved by the *****.

1. Damage may be repaired at time and material by Branch employee or approved method.
2. Damaged panels require installer to return panels to Branch for shop repair or Branch to specify and approve field repair methods to be carried out by installer.

1.10 QUALITY ASSURANCE

- A. Manufacturer: Provide panels manufactured by a firm specializing in the fabrication of sculptural fiber-reinforced concrete rainscreen panels with a minimum of three years experience.

NOTE: DELETE ARTICLE BELOW, IF BOLTED CONNECTIONS ARE USED.

1.11 WELDERS' QUALIFICATIONS

- A. Arc or gas welding of connecting structure shall be done by welders qualified by the American Welding Society "Standard Qualification Procedure."

NOTE: UNLESS REQUIRED BY PROJECT COMPLEXITY, DELETE THE ARTICLE BELOW. IF MANUFACTURERS MUST ATTEND IT WILL ADD TO COST

1.12 PRE-INSTALLATION CONFERENCE

- A. Convene a pre-installation conference prior to commencing panel installation.
- B. Require attendance of parties directly affected by work of this Section.
- C. Review conditions of installation, installation procedures and coordination required with related work.

NOTE: WHEN A WARRANTY IS REQUIRED THAT EXTENDS BEYOND THE NORMAL "ONE YEAR" WARRANTY THAT IS INCLUDED IN THE MOST COMMONLY USED CONTRACT CONDITIONS, DO NOT INCREASE THE NUMBER OF YEARS WITHOUT VERIFYING THE COST AND AVAILABILITY OF A LONGER WARRANTY WITH MANUFACTURER. THE PARAGRAPH BELOW MAY BE DELETED, IF ONE YEAR WARRANTY FOR OVERALL PROJECT IS INCLUDED IN CONTRACT CONDITIONS.

1.13 WARRANTY

- A. Warrant sculptural fiber-reinforced concrete rainscreen panels to be free from defects due to materials and workmanship for one year.

PART 2 - PRODUCTS

NOTE: LIST ACCEPTABLE MANUFACTURERS. VERIFY THAT LISTED MANUFACTURERS PRODUCE SPECIFIED PRODUCTS.

2.01 ACCEPTABLE MANUFACTURERS

- A. Branch Technology, Inc
1530 Riverside Drive
Suite B
Chattanooga, TN 37406
423-682-8800

- B. Or Equal product, method, performance, engineering, & design approved 7 days prior to bid.

2.02 MATERIAL CHARACTERISTICS

- A. BranchMatrix: Carbon fiber reinforced ABS polymer formulated for structural freeform spaceframe.
 - 1. Color: Black
 - 2. Cellular density: Nominal 2” average cell size
 - 3. Weight: 2.4 lb/ft³ with average cellular density
- B. Insulation:
 - 1. Closed cell polyurethane foam insulation
 - 2. Nominal 2.5 lb/ft³ (40 kg/m³)
- C. Fiber Reinforced Concrete:
 - 1. 28 day compressive strength: 10,730psi
 - 2. Thickness: ¾”-1”
 - 3. Concrete Surface Profile: CSP-1 through CSP-4
- D. Fiber-Reinforced Concrete Finish
 - a. Finish Texture: Sandy [knock down, sponge, or spray]
 - b. 3/16” maximum thickness
- E. Exterior Finish Coat
 - 1. Integrally colored polymer modified exterior finish coat
 - 2. Color: selected from Sto Lotusan Standard colors
 - 3. Texture: selected from Sto Lotusan Standard finish textures

NOTE: PROPERTIES LISTED ARE AVERAGE BASED ON RANGE AVAILABLE WITH SCULPTURAL FIBER-REINFORCED CONCRETE RAINSCREEN PANELS. THESE ARE NOT MAXIMUMS OR MINIMUMS.

2.03 PANEL PERFORMANCE CHARACTERISTICS:

TEST METHOD	PROPERTY	VALUE
ASTM C947	Flexural Strength	1,350 psi
ASTM C672	Resistance to Scaling by Deicing Chemicals	0-35 cycles, no scaling; 35-50 cycles, very slight scaling
ASTM C531-18	Linear Shrinkage and Coefficient of Thermal Expansion	1.45E-05 (in./in./oC), 8.05E-06 (in./in./oF)
ASTM C666-A	Resistance of Concrete to Rapid Freezing/Thawing	surface Scaling at top coat only
ASTM E488/E488M-15	1/4" Bolt Shear, after ASTM C666-A	2,826 lbf

ASTM E488/E488M-15	1/4" Bolt Direct Tension, after ASTM C666-A	1,707 lbf
ASTM E119	Fire Tests of Building Construction and Materials	complies with 1hr non-load bearing exterior wall assemblies and 1hr load bearing exterior wall assemblies with added layer of 5/8" Type X gyp
NFPA 285	Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components	passed

NOTE: CERTAIN APPLICATIONS MAY BE BEST SUITED TO INCREASED/DECREASED CELLULAR DENSITY TO MEET SPECIFIC PERFORMANCE CRITERIA.

2.04 FINISH

NOTE: IF COLOR HAS BEEN SELECTED, INSERT IN THE PARAGRAPH BELOW -IF NOT, USE THE SECOND OPTION.

- A. Color: _____
- B. Color as selected by: _____
- C. Finish: _____

2.05 PANEL TOLERANCES

- A. Length: + or - 1/4 inch in 10 feet.
- B. Overall thickness tolerance: +1/4"
- C. Overall flatness tolerance: +/- 1/4"
- D. Location of inserts, bolts, pipe sleeves, and other connecting hardware: +/- 1/4"
- E. Location of flashing reglets: +/- 1/4"
- F. Variation from Square: 1/4" in 10 feet.

2.06 IDENTIFICATION

- A. Identify each part with a permanent serial number.
- B. Number parts to coordinate with shop drawings.

2.07 CURING AND CLEANING

- A. Cure and clean components prior to shipment and remove materials which may be incompatible with adjacent building materials.

2.08 HARDWARE

- A. Metal Anchors and Fasteners: Provide anchors and fasteners as recommended by panel manufacturer and conforming to the following standards of the American

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Society for Testing and Materials:

1. Structural steel: ASTM A36;
2. Cold drawn wire: ASTM A580, Type 304, Cond. A;
3. Stainless steel: ASTM A666, Type 304, grade ;
4. Carbon steel plate: ASTM A283, grade ;
5. Malleable iron castings: ASTM A47, grade ;
6. Carbon steel castings: ASTM A27, grade 60-30; and
7. Anchor bolts ASTM A307 or ASTM A325.

2.09 RAINSCREEN CARRIAGE SYSTEM

- A. Aluminum Support Structure:
 1. Complete extruded aluminum sub-frame assembly to support and anchor sculptural fiber-reinforced concrete rainscreen panels. Aluminum support structure to be anchored to building structure.
- B. Components:
 1. Horizontally-oriented concealed fastener attachment system support bracket/angle bracket anchored directly to building structure.
 2. Vertical L or T profile shelf shimming extrusions that fasten into open end of support bracket and supports.
 3. Horizontal support rails: Aluminum C shaped rails attached to L or T profile which provides means to suspend sculptural fiber-reinforced concrete rainscreen panels.
 4. Fasteners: Corrosion-resistant stainless steel fasteners and anchors of type, size and spacing required for type of substrate and project conditions.

PART 3 – EXECUTION

3.01 INSTALLER'S PRE-INSTALLATION INSPECTION

- A. Observe field conditions and verify that building lines, centers, and grades will allow proper installation of sculptural fiber-reinforced concrete rainscreen panels.
- B. Verify that bearing surfaces are true and level.
- C. Verify that support framing has been constructed to allow accurate placement and alignment of anchor bolts, plates, dowels, or other connections on the structure.
- D. Check field dimensions affecting the installation of sculptural fiber-reinforced concrete rainscreen panels.

NOTE: EDIT PARAGRAPHS BELOW. INSERT "ARCHITECT," "ARCHITECT/ENGINEER" "CONSTRUCTION MANAGER," "OWNER'S REPRESENTATIVE" AS APPLICABLE TO PROJECT.

- E. Report discrepancies between design dimensions and field dimensions, which could adversely affect installation, to the *****.
- F. Do not proceed with installation until discrepancies are corrected, or until installation requirements are modified and approved by the *****.

3.02 ERECTION

- A. Install fabrications in accordance with manufacturer's instructions and approved shop drawings.

Unloading: Use equipment that will prevent delays in the installation process. Do not block

access to panel installation area or other construction areas with equipment and materials.

- B. Lifting and Positioning:
 - 1. Lift sculptural fiber-reinforced concrete rainscreen panels with suitable lifting devices at points as recommended by the manufacturer.
 - 2. Set panels level, plumb, square, and true within the allowable tolerances.
 - 3. Temporarily support and brace panels as required to maintain position, stability and alignment during and until permanent connection.
- F. Fastening:
 - 1. Fasten sculptural fiber-reinforced concrete rainscreen panels as shown on approved shop drawings.

NOTE: DELETE PARAGRAPH BELOW, IF BOLTED CONNECTIONS ARE USED.

- 2. Perform arc or gas welding in accordance with sculptural fiber-reinforced concrete rainscreen panels fabricator's instructions and approved shop drawings using materials compatible with the base material.

3.03 ALLOWABLE TOLERANCES FOR ERECTED PANELS

- A. Tolerances for Location of sculptural fiber-reinforced concrete rainscreen panels:
Non-cumulative.
- B. Warpage: Maximum permissible warpage of one corner out of the plane of the other three shall be 1/4"/ft distance from the nearest adjacent corner, or 3/8" total after installation.
- C. Bowing: Less than L/200 with a maximum of 1" where L is the panel length in the direction of the bow. Differential bowing between adjacent members of the same design shall be <1/4".
- D. Width of joint: 1/4" to 3/4" depending upon engineering criteria.
- E. Gap tolerances between joints for panel dimensions of:
 - 1. <10 ft +/- 3/16"
 - 2. 10 ft. - 20 ft... +/- 3/8"

3.04 CLEANING OF SCULPTURAL FIBER-REINFORCED CONCRETE RAINSCREEN PANELS

- A. Clean soiled panels using cleaning methods and materials approved by panel manufacturer.

3.05 PROTECTION OF INSTALLED SCULPTURAL FIBER-REINFORCED CONCRETE RAINSCREEN PANELS

- A. Comply with manufacturer's recommendations and instructions for protecting installed panels during construction activities.

END OF SECTION