

GLASS FIBER REINFORCED CONCRETE (GFRC) PANELS: 2025 CBC

Disciplines: Structural

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Division of the State Architect (DSA) documents referenced within this publication are available on the [DSA Forms](#) or [DSA Publications](#) webpages.

PURPOSE

This Interpretation of Regulations (IR) clarifies requirements for glass fiber reinforced concrete (GFRC) panels used on construction projects under DSA jurisdiction.

SCOPE

This IR is applicable to GFRC panels fabricated by the spray-up or premix processes and covers design, quality control, and inspection requirements. This IR is not applicable to polymer modified E-glass fiber reinforced concrete.

BACKGROUND

Glass fiber reinforced concrete is the term applied to products manufactured from a cement/aggregate slurry thoroughly mixed with alkali-resistant glass fiber reinforcement. GFRC is typically used in thin-walled architectural cladding panels. The Precast/Prestressed Concrete Institute (PCI) provides guidance for GFRC design and construction through various publications. California Building Code (CBC), Section 1903A.2 requires GFRC to comply with the PCI publication Specification for Glass Fiber Reinforced Concrete Panels (PCI-128).

GFRC is traditionally fabricated by the spray-up or premix process. PCI-128 generally addresses both processes, while presenting requirements specific to the premix process in Chapter 7. GFRC panels are fabricated with a minimum thickness of ½ inches and are typically supported by a steel panel frame.

1. APPROVAL PROCESS

The approval of GFRC panels on a specific project can be achieved by the deferred submittal process in compliance with California Administrative Code (CAC), Section 4-317(g) when permitted by the DSA regional office with jurisdiction over the project. The deferred submittal process is described in Section 1.3 below.

As an alternative to the deferred submittal process, when elected by the project applicant or required by DSA, the GFRC panels may be incorporated into the primary construction documents. In this case, the review and approval of the GFRC panel drawings is combined with the initial review and plan approval of the project.

1.1 GFRC Engineer

The design of GFRC panels is commonly delegated to an engineer retained by the manufacturer as defined in the Glossary below.

1.1.1 The GFRC engineer shall stamp and sign all GFRC drawings in accordance with *IR A-19: Design Professional Stamp (Seal) and Signature on Documents*.

1.1.2 The GFRC engineer shall provide complete calculations demonstrating the structural

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adequacy of the panels, including but not limited to the following:

1.1.2.1 Skin anchors with consideration of buckling limit states.

1.1.2.2 Structural members of the panel frame.

1.1.2.3 Sub-frame supporting the panels.

1.2 Project Design Professionals

The project design professionals, as defined in the Glossary below, are responsible for the design of the building upon which the GFRC panels will be installed.

1.2.1 The design professional in general responsible charge shall stamp the GFRC drawings or sign a statement of general conformance in accordance with *IR A-18: Use of Construction Documents Prepared by Other Design Professionals*.

1.2.2 The structural engineer of record listed on line 24a of form *DSA 1: Application for Approval of Plans and Specifications* shall verify the following:

1.2.2.1 Adequacy of the building structural members and their connections to resist the applied vertical, lateral, and torsional loads imposed by the GFRC panels as determined in accordance with Section 2.1 below.

1.2.2.2 Compatibility of the panel anchor connections designed by the GFRC engineer with the building structure to which it attaches, including all parameters upon which the calculated capacity of the connection depends.

1.2.2.3 Spacing and size of joints between panels and between structural members and panels. The joints must be sufficient to accommodate the in-plane and out-of-plane movements of the panels and provide deformation compatibility as described in Section 2.1 below.

1.3 Deferred Submittal Review and Approval

When the deferred submittal process is used, the GFRC system is reviewed and approved by DSA as described in this section. There are specific requirements and responsibilities for the GFRC manufacturer, GFRC engineer, project design professionals, and DSA in each phase. The review and approval of the GFRC system is performed after the construction contract has been awarded and a qualified GFRC manufacturer selected. The sequence of events is as follows:

1.3.1 The project design professionals work with DSA to submit and obtain approval of the construction documents. The DSA-approved construction documents must define the complete design criteria of the GFRC system, including material properties, dimensions, applied loads, deformation compatibility demands, support conditions, and all nonstructural performance requirements.

1.3.2 The manufacturer, working in a coordinated effort with the project design professionals, prepares the GFRC submittal package in accordance with the requirements of the DSA-approved construction documents.

1.3.3 If changes to the DSA-approved construction documents are required during the preparation of the GFRC submittal package, the project design professional shall prepare and submit a construction change document (CCD) to DSA for review and approval in accordance with *IR A-6: Construction Change Document Submittal and Approval Process*. Depending on the nature and extent of changes, DSA may require the revised documents be submitted and processed as a Revision. When a CCD or Revision is required, it must be approved prior to or concurrent with approval of the GFRC submittal package.

1.3.4 The manufacturer submits the GFRC submittal package to the project design

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professionals for review and approval. This step may take multiple exchanges between the project design professionals and the manufacturer to obtain the project design professionals' approval and finalize the package for submission to DSA.

1.3.5 The design professional submits the GFRC submittal package to DSA for review. In accordance with *Procedure (PR) 18-04: Electronic Plan Review for Design Professionals*, Section 5, the GFRC submittal package will be organized into two separate electronic files. The approval document file contains the GFRC drawings. The supporting document file contains information that is not directly approved by DSA but is necessary to substantiate the GFRC design, including the structural calculations, evaluation reports, proprietary product data, etc.

1.3.6 The review by DSA commonly results in plan review comments that require action by the manufacturer, the GFRC engineer, the project design professionals, or some combination thereof.

1.3.7 When required as a result of the plan review, the GFRC submittal must be revised and additional information provided as required to resolve all plan review comments. The project design professional shall coordinate with the manufacturer and DSA as necessary to resolve plan review comments, submit a revised submittal package, and obtain DSA approval.

1.3.8 When the GFRC drawings are complete and code compliant, DSA will affix its approval stamp. Fabrication is not permitted until the GFRC drawings are approved by DSA.

2. DESIGN

GFRC panels shall be designed in compliance with the California Building Code (CBC), American Society of Civil Engineers (ASCE) Standard 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7), and PCI-128.

2.1 Design Criteria

The GFRC engineer shall consider each of the following in the design of GFRC panels. Structural calculations must demonstrate adequacy of the design for strength, stiffness, and deformation compatibility under both in-plane and out-of-plane load effects.

2.1.1 Panels must be adequate to resist all loads and environmental conditions required by the CBC and standards identified above.

2.1.2 Anchors and connections of exterior panels must comply with the earthquake induced drift and force requirements of ASCE 7 Section 13.5.3.

2.1.3 Exterior wall systems must be designed with adequate deformation compatibility as required by ASCE 7 Sections 13.3.2 and 13.5.3. The drift demand of the building must be defined by the project design professional on the DSA-approved construction drawings

2.2 Project Specifications

In addition to requiring compliance with PCI-128, the project specifications prepared by the design professional must require compliance with the following:

2.2.1 Panel design and fabrication in accordance with PCI-128.

2.2.2 Quality control program in accordance with PCI-128 Chapter 5 and the Manual for Quality Control for Plants and Production of Glass Fiber Reinforced Concrete Products (PCI MNL-130) published by PCI.

2.2.3 Mix design for the backing material as specified, including the following:

2.2.3.1 Cement/sand ratio in the range of 1:1 to 1:2.

2.2.3.2 Minimum five percent nominal fiber content by weight.

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2.2.3.3 Minimum strength and shrinkage requirements.

2.2.4 Glass fibers complying with American Society for Testing and Materials (ASTM) C1666: Standard Specification for Alkali Resistant (AR) Glass Fiber for GFRC and Fiber Reinforced Concrete and Cement.

2.2.5 Submittal requirements in accordance with Section 3.1 below.

2.3 GFRC Drawings

Whether processed as a deferred submittal or incorporated into the project construction documents, drawings for the GFRC panels must include the following information:

2.3.1 Details for skin and panel anchors including the following:

2.3.1.1 Dimensions and thickness of bonding material.

2.3.1.2 Embedment dimension of skin anchors in bonding material.

2.3.1.3 Dimension for weld sizes and lengths in panel frame connections and connections to the building structure.

2.3.2 Details showing and dimensioning the joints between GFRC cladding elements. Joint widths must be adequate in consideration of the panel size, structural tolerance, anticipated movement, story drift, joint materials, and adjacent surface types.

2.3.3 Connection (per Glossary below) details indicating the size of oversized or slotted holes and the required clearance between connectors and the sides of holes to accommodate both erection tolerances and the drift compatibility requirements of ASCE 7 Section 13.5.3.

2.3.4 Orientation of rectangular hollow structural sections when used.

2.3.5 Identification of the boundary and interface between GFRC panels and the structural members supporting them as designed by the project design professional and specified on the structural drawings of the construction documents.

3. QUALITY CONTROL, TESTING, AND INSPECTION

The requirements of this section apply to all GFRC panels regardless of the fabrication process (i.e., spray-up or premix). The form *DSA 103: Listing of Structural Tests and Special Inspections* for the project shall clearly indicate GFRC testing and inspection requirements in the “C6 | Other Concrete” section.

3.1 Manufacturer’s Quality Control

GFRC panels must be fabricated in accordance with PCI-128 Chapters 2 and 4 (and 7 if applicable). The manufacturer shall have an established quality control program that meets the requirements of PCI MNL-130, including the inspection, testing, record keeping, and laboratory requirements of Division 5 and the test procedures of Appendix H.

3.1.1 When the manufacturing plant holds a current Group G certification issued by PCI, the manufacturer shall submit documentation of the PCI certification to the project design professional and DSA.

3.1.2 When the manufacturing plant does not hold a current Group G certification issued by PCI, the manufacturer shall submit its quality control manual to the project design professional for review and acceptance.

3.2 Testing Requirements

Any required structural material tests shall be performed by the project’s laboratory of record (LoR) who is employed by the school district and qualified by the DSA Lab Evaluation and Acceptance program.

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3.2.1 The manufacturer shall provide quality control testing as required by PCI MNL-130 Division 5, Section 5.2 and Appendix H. Test reports must be submitted to the project inspector and the LoR.

3.2.2 Skin anchor pull-off and shear tests must be conducted in accordance with ASTM C1230: Standard Test Method for Performing Tension Tests on Glass-Fiber Reinforced Concrete (GFRC) Bonding Pads and the frequency requirements and acceptance criteria of PCI MNL-130 Division 5, Section 5.2.5.

3.2.3 The testing program for GFRC fabricated by the premix process may be modified as it applies to specific panels.

3.3 Shop Fabrication

The fabrication of GFRC panels is subject to continuous inspection by a special inspector meeting the criteria required by CAC Section 4-335(f).

Exception: In-plant special inspection is not required for the fabrication of GFRC panels in plants holding a current Group G certification issued by PCI. However, any work identified in Section 3.4 below that is performed in the shop, rather than in the field, is not exempt from special inspection.

3.3.1 The special inspector shall provide detailed daily special inspection reports in accordance with *IR 17-12: Special Inspection Reporting Requirements*.

3.3.2 The special inspector shall mark all panels with their identification mark, and a list of approved panels must be provided to the project inspector and DSA.

3.4 Field Special Inspection

Any special inspection required of field work (e.g., welding, bolt installations, etc.) shall be performed by a special inspector meeting the criteria required by CAC Section 4-335(f). The special inspector shall provide detailed daily inspection reports in accordance with IR 17-12.

REFERENCES:

2025 California Code of Regulations (CCR) Title 24

Part 1: California Administrative Code (CAC), Sections 4-316, 4-317, 4-335.

Part 2: California Building Code (CBC), Section 1903A.2.

This IR is intended for use by DSA staff and by design professionals to promote statewide consistency for review and approval of plans and specifications as well as construction oversight of projects within the jurisdiction of DSA, which includes State of California public schools (K-12), community colleges and state-owned or state-leased essential services buildings. This IR indicates an acceptable method for achieving compliance with applicable codes and regulations, although other methods proposed by design professionals may be considered by DSA.

This IR is subject to revision at any time. Please check DSA's website for currently effective IRs. Only IRs listed on the webpage at www.dgs.ca.gov/dsa/publications at the time of project application submittal to DSA are considered applicable.

GLASS FIBER REINFORCED CONCRETE (GFRC) PANELS: 2025 CBC**GLOSSARY****Connection**

Welding or bolting that attaches the skin to the panel frame or the panel frame to the building structure.

GFRC Engineer

A California registered professional engineer retained by the GFRC manufacturer who is responsible for the design of the panel, panel frame, panel anchors, and panel connections. The GFRC engineer stamps and signs the GFRC drawings.

Panel

As defined in PCI-128 Section 1.2.

Panel Anchor

Anchor that connects the panel frame to the building structure.

Panel Frame

As defined in PCI-128 Section 1.2.

Project Design Professional

The architect or structural engineer in general responsible charge of a project in accordance with CAC Section 4-316(a) and the structural engineer with delegated responsibility in accordance with CAC Section 4-316(b). These individuals are sometimes referred to as the architect of record and structural engineer of record, and both are intended when this term is used in the plural form in this IR.

Skin

As defined in PCI-128 Section 1.2.

Skin Anchor

Anchor that is bonded to the skin by the bonding pad and connects the skin to the panel frame. The three typical types of skin anchors are flex anchors, flat plate gravity anchors, and truss rod gravity anchors. The strength of skin anchors shall be determined in accordance with PCI-128, Section 3.5 based on tests per Section 3.2.2 above.