
GLASS PANEL RAILINGS: 2019 CBC

Disciplines: Structural, Fire & Life Safety**History:** Revised 05/12/20 Under 2019 CBC
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Division of the State Architect (DSA) documents referenced within this publication are available on the [DSA Forms](#) or [DSA Publications](#) webpage.

PURPOSE

This Interpretation of Regulations (IR) clarifies requirements for glass panel railings to be accepted for use on construction projects under DSA jurisdiction. DSA provides the following three options for meeting code prescribed structural requirements for these panels:

- Design Option – Described in Section 2 below.
- Test Option – Described in Section 3 below.
- Evaluation Report Option – Described in Section 4 below.

SCOPE

This IR is applicable to the design and construction of glass panel railings. Glass panel railing refers to a railing assembly, consisting of glass panels cantilevered from a base with or without a continuous rail at the top.

BACKGROUND

California Building Code (CBC) Section 2407 addresses glass used in handrails and guards including material properties and other requirements. CBC Section 1607A.8 defines live load requirements for handrails and guards. When used in exterior applications, glass panel railings are also subject to wind loads prescribed by CBC Section 1609A and American Society of Civil Engineers (ASCE) 7. Multiple paths are available to demonstrate the compliance of glass panel railings with these provisions.

1. GENERAL

Glass panel railings shall be designed and constructed in accordance with CBC Section 2407. The system shall be designed so that the top rail remains in place in the event of failure of an individual glass panel.

Note: CBC does not require a continuous rail at the top if certain requirements are met per the exceptions in CBC Section 2407.1.2.

Glazing in railing panels shall be an approved safety glazing material that conforms to CBC Sections 2406.1.1 and 2407.1.

Glass panel railings shall **not** be used in locations where they may be subject to vehicle impact, in accordance CBC Section 2407.1.3.

Glass panel railing systems shall be designed for all the applicable loads combined in accordance with CBC Section 1605A.

1.1 Live Loads

The required vertical and horizontal live loads for glass panel railings are prescribed in CBC Section 1607A.8.1 including distributed and concentrated loads.

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1.2 Wind Loads

For exterior installations, design shall account for wind loads as required by CBC Section 1609A and ASCE 7.

1.3 Deflection Criteria

The largest deflection at the top rail resulting from either the horizontal live loads per Section 1.1 above or any applicable wind loads per Section 1.2 above shall be less than the following limits when subject to allowable stress design load combinations. Refer to CBC Section 2403.3.

- Cantilever elements: Lesser of height/90 or 3/4"
- Simple span elements: Lesser of span/175 or 3/4"

2. DESIGN OPTION

The glass elements of the handrail assembly and the connections thereto shall be designed for a safety factor of four (4) in accordance with CBC Section 2407.1.1. Compliance with the latest version of the Engineering Structural Glass Design Guide published by the National Council of Structural Engineers Association (NCSEA) is an acceptable means of substantiating the structural adequacy of glass panel railings. Mechanical properties of the glass upon which the design is based, such as modulus of rupture, modulus of elasticity, allowable stress, etc. shall be specified on the construction documents.

3. TEST OPTION

Glass panel railings may be accepted by test. Tests may be conducted in the field or in the laboratory. Mock-ups tested as evidence of acceptability shall be exact duplicates of each railing configuration or design.

All tests shall be performed by a DSA-accepted testing laboratory. Tests shall be observed and results recorded in a report signed by a California registered civil or structural engineer per CBC Section 2403.2.

3.1 Test Protocol

An acceptable test for the entire completed glass railing assembly shall meet the following minimum criteria:

3.1.1 Strength Test: Apply test loads at right angles to the top rail. ←

3.1.1.1 For glass elements, test to four (4.0) times the maximum horizontal loads per Section 1 above based on allowable stress design load combinations.

3.1.1.2 For non-glass elements, test to two and one-half (2.5) times the horizontal loads per Section 1 above based on allowable stress design load combinations.

3.1.1.3 Alternately, glass and non-glass elements may be tested together using the test loads for glass elements in Section 3.1.1.1 above.

3.1.1.4 Top rail shall recover to the original position upon release of the test loadings. |

3.1.2 Deflection Test: Apply test loads at right angles to the top rail. ←

3.1.2.1 Test to one (1.0) times the horizontal loads per Section 1 above based on allowable stress design load combinations.

3.1.2.2 The measured deflections shall meet the criteria in Section 1.3 above. ←

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3.2 Construction Documents

3.2.1 Drawings shall clearly identify the quantity and types of glass panel railings to be tested. At least one test shall be performed for each railing configuration or design.

3.2.2 Drawings shall identify the locations of in-situ glass panel railings to be tested or for which an equivalent mock-up is to be made for testing purposes.

3.2.3 Drawings shall clearly define the magnitude, location, direction, rate and duration of loads to be applied for the testing protocols defined in Sections 3.1.1 and 3.1.2 above.

3.2.4 Testing procedures for glass panel railings shall be indicated on the form *DSA-103: List of Required Structural Tests and Special Inspections*.

4. EVALUATION REPORT OPTION

DSA will accept a qualified evaluation report issued by a certified product evaluation organization if the report meets the requirements of *IR A-5: Acceptance of Products, Materials, and Evaluation Reports* and states that the product complies with International Code Council Evaluation Service (ICC-ES) Acceptance Criteria AC439. In addition, structural calculations shall demonstrate the deflection criteria in Section 1.3 above are met.

REFERENCES

2019 California Code of Regulations (CCR) Title 24

Part 2: California Building Code (CBC), Sections 1605A, 1607A.8.1, 1609A, 2403.2, 2406.1.1, 2407

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.

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