



AIA Provider #: S003



Glass Guardrails

Course #

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#ChiCSI



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Course Description

Discussion of glass guardrails and considerations when designing these railings. Review of the code requirements for the loading, glass types, and heights. Considerations for the project requirements including pedestrian comfort and uplift. Discussion of issues surrounding the glass railings.

Learning Objectives

1. Review different configurations of glass that can be used in a guardrail
2. Discuss the different types of safety glass that is available
3. Discuss different load requirements on the guardrail
4. Analyze the different code requirements for the glass in the different configurations of guardrails

GUARDRAIL CONFIGURATIONS WITH GLASS

GLASS INFILL GUARDRAILS

Something other than the glass transfers the loads to the structure. Glass does not provide the support of the guard or handrail.



*Images from CR Laurence website

GLASS GUARDRAILS

GUARDRAIL CONFIGURATIONS WITH GLASS

GLASS BETWEEN SUPPORTS

Something other than the glass transfers the loads to the structure. Glass does not provide the support of the guard or handrail.



*Images from CR Laurence website

GLASS GUARDRAILS

GUARDRAIL CONFIGURATIONS WITH GLASS

CANTILEVERED GLASS GUARDRAILS

Glass is a structural element supporting the handrail and guardrail.



*Images from CR Laurence website



*Images from CR Laurence website

GLASS GUARDRAILS

GUARDRAIL CONFIGURATIONS WITH GLASS

CANTILEVERED GLASS GUARDRAILS

No horizontal element – code compliant?



GLASS GUARDRAILS

GUARDRAIL GLASS TYPES

TEMPERED GLASS

- Safety glass - only allowed in structural guardrails in earlier codes and in certain locations.
 - Infill panels
 - Structural in locations without walking surface below
- Breaks into small pieces
- Falls out of opening when broken
- Potential for spontaneous breakage
- 4x strength of annealed float glass

GLASS GUARDRAILS

GUARDRAIL GLASS TYPES

LAMINATED GLASS – GLASS TYPES

- Safety glass
- Increased strength, used for windborn-debris-impact resistance
- Stays in opening when broken

HS/HS

- 2x strength of annealed float glass
- Cutting is an option
- Reduced spontaneous breakage concern

TEMPERED/TEMPERED

- 4x strength of annealed float glass
- Breaks into small pieces
- No cutting
- Spontaneous breakage concern

GLASS GUARDRAILS

GUARDRAIL GLASS TYPES

LAMINATED GLASS – TYPICAL INNERLAYER TYPES

PVB - Standard

- Multiple Manufacturers
- Multiple Colors
- Digital Printing Options

IONOPLAST (Sentry Glass)

- Limited Manufacturers
- Limited Color Selection
- Better Edge Delamination
- Better structural performance

Others: EVA, Polyurethane, cast-in-place, stiff PVB, Acoustical PVB

GUARDRAIL GLASS TYPES

Colored Interlayers

PVB

- Clear
- Translucent White
- Colors (red, yellow, green, etc.)

Ionoplast

- Clear
- Translucent White

GUARDRAIL CODE REQUIREMENTS

2009 IBC

1013.1 Location:

More than 30" above another surface

Within a 36" distance of edge

1013.2 Height: 42"

1607.7.1 50 lb/lf(plf) applied in any direction at the top.

1607.7.1.1 Concentrated Load Handrails and Guards:

200 lb applied in any direction at the top.

1607.7.1.2 Component Infill: 50 lb on an area of 1 sq.ft.

2406.2 Impact Test: Comply with CPSC 16 CFR 1201 or ANSI Z97.1

2407.1 Tempered or laminated glass

2407.1.1 Safety factor of 4

2407.1.2 Each handrail or guard section shall be supported by a minimum of three glass balusters or shall remain in place should one baluster panel fail

2407.1.4 Wind-Borne Debris Regions: Laminated glass required

2408 Glazing in Athletic Facilities

GLASS GUARDRAILS

GUARDRAIL CODE REQUIREMENTS

2012 IBC – Similar to 2009 IBC

2015 IBC - Similar to 2012 IBC with the following changes:

2407.1 Laminated glass is required complying with Cat. II or CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1

Glazing in railing in-fill panels can be tempered safety glass.
Exception to allow tempered in no walking surfaces below.

Chicago Building Code – Similar to 2015 IBC

July 8, 2016 Memo on glass as structural material

1. Follow chapter 24 of 2015 IBC.
2. All glass used in guardrail and handrail shall be laminated except tempered is allowed if no walking surface below.
3. Top or side mounted handrail to be structurally continuous across a min. of 3 adjacent balusters of glass.
4. Finite element analysis of glass is required to be submitted.

GUARDRAIL CODE REQUIREMENTS



Trosifol / Kuraray Video

GLASS GUARDRAILS

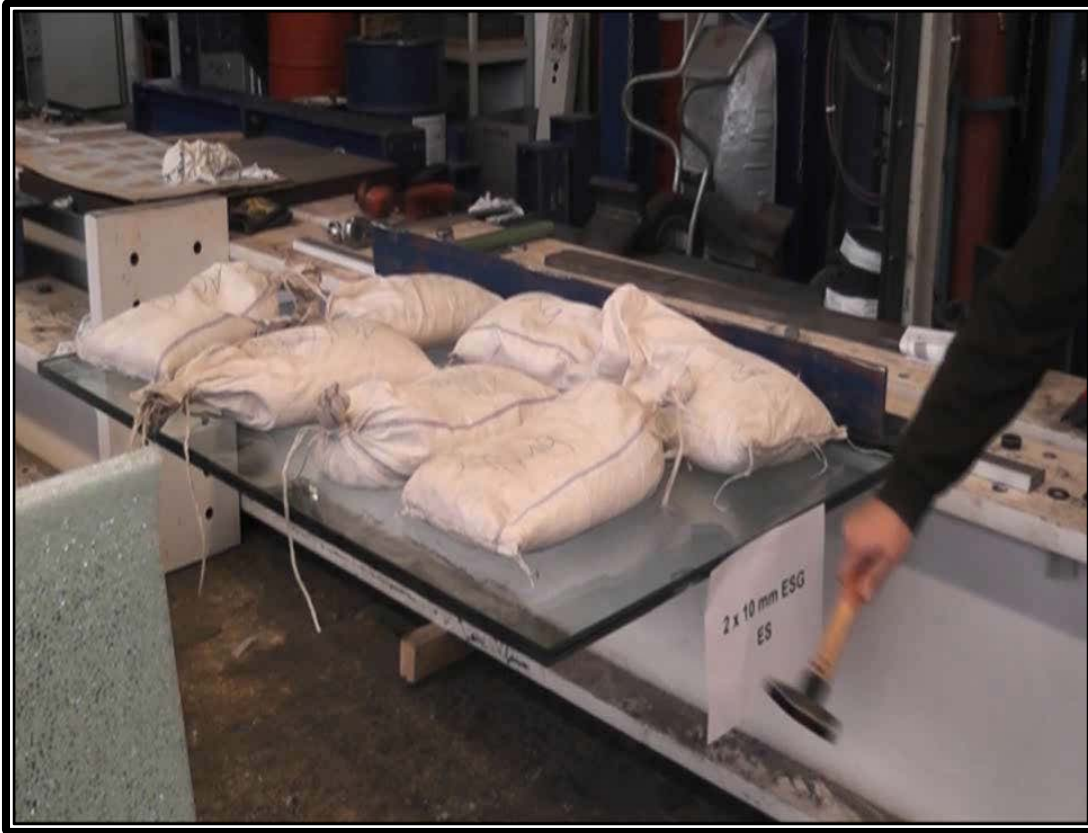
GUARDRAIL CODE REQUIREMENTS



Trosifol / Kuraray Video

GLASS GUARDRAILS

GUARDRAIL CODE REQUIREMENTS



Trosifol / Kuraray Video

GLASS GUARDRAILS

GUARDRAIL CODE REQUIREMENTS

WIND LOADING

Guardrails taller than 42" high and guardrails at higher wind load pressures also need to comply with wind load requirements.

GLASS GUARDRAILS

GUARDRAIL – OTHER CONSIDERATIONS

Laminated glass edge tolerances at exposed edges

Horizontal Exposed Laminated Edges – Edge Delamination

Pedestrian Comfort – Taller wind guards

Uplift – opens less than 2”, the railing is considered a solid parapet

Drinks on guardrails

Items rolling off a deck

Lightning protection



This concludes The American Institute of Architects
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Questions and Comments???