



Glass Handrails

Discussion assumes industry standard 1/2in thick glass and fall hazard present

Load Considerations:

All handrails should be analyzed for the following loads:
Wind/Interior pressure (3 sec load)

Pedestrian Load (60 sec load) – 50lb/ft applied in any direction along the handrail or top rail.

Note: This load will also apply to interior glazing installed adjacent to a walking surface. In this case, differential deflection of two adjacent unsupported edges shall not be greater than the thickness of the panels when this force is applied. The load shall be applied horizontally to one panel at any point up to 42" above the walking surface.

Concentrated Load (1 sec load) – 200lb load applied any direction along any point on the handrail or top rail to produce the maximum load effect on the element being considered and to transfer the load through the supports to structure.

Challenge #1
Pre-break
next page

Note: Concentrated load need only be considered if handrail is also considered a guard. A handrail must be considered a guard if there is a fall hazard of 30" or larger.

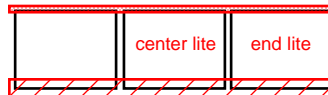
Code Considerations:

Depending on the code being considered, there are rules to follow in regards to design and construction methods of handrails:

2012 IBC or earlier

1. Glass used as a handrail assembly or a guard section shall be constructed of either single fully tempered glass, laminated fully tempered glass, ore laminated heat strengthened glass. For all glazing types, minimum nominal thickness should be 3/4".
2. A factor of safety of 4 must be used in design (24,000psi / 4 = 6,000psi)
3. Each handrail or guard shall be supported by a minimum of three glass balusters or shall be otherwise supported to remain in place should one baluster panel fail.
4. Glass balusters must be installed with a handrail or top rail that can act as such.
 - a. **Exception:** A top rail shall not be required where the glass baluster is laminated glass with two or more glass plies of equal thickness and the same glass type.
5. The guard or top rail made mention of above, must be designed to support a fall (200lb concentrated load) in the event one baluster fails (per AC439). This is true if a center or end lite fails.

Challenge #1
Post-break
next page



2015 IBC

All of the above apply, with exception to the following changes:

1. Glass used in handrail, guardrail or guard section shall be laminated glass constructed of fully tempered or heat-strengthened glass. For all glazing types, minimum nominal thickness should be 3/4".

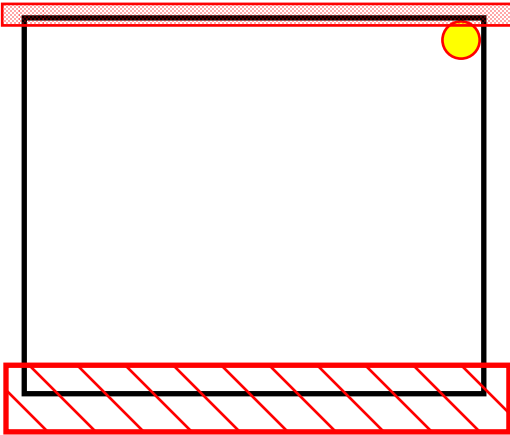
Challenge #2
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Exception: Single fully tempered glass shall be permitted to be used in handrails and guardrails where there is no walking surface beneath them or the walking surface is permanently protected from the risk of falling glass.



Glass Handrails

Challenge #1: 200lb point load in corner



- 1) Pre-break - Glass can't support this on it's own.
- 2) Post-break - Thin rail caps cant support in event glass fails.

Solutions:

- 1) Pre-break
 - a. Thicker Glass
 - b. Attach top cap to structure, or add structure (post)
 - c. Use thicker top cap and/or run down vertical edge of glass also
- 2) Post-break - Thin rail caps cant support in event glass fails.
 - a. Shorten glass length
 - b. Attach top cap to structure, or add structure (post)
 - c. Use thicker top cap



Glass Handrails

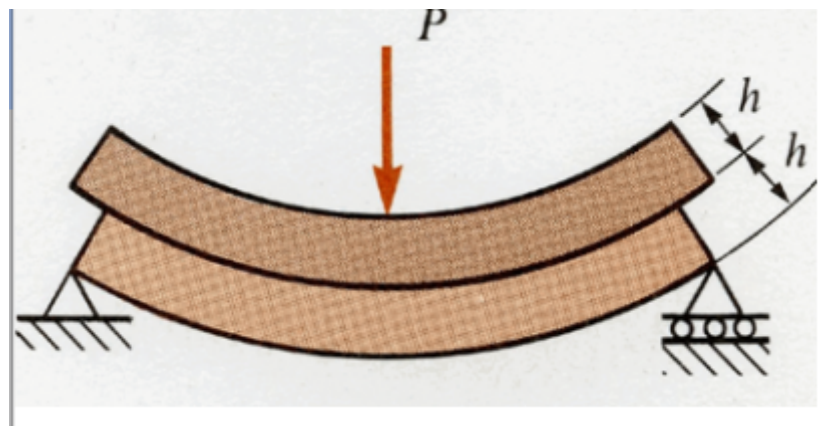
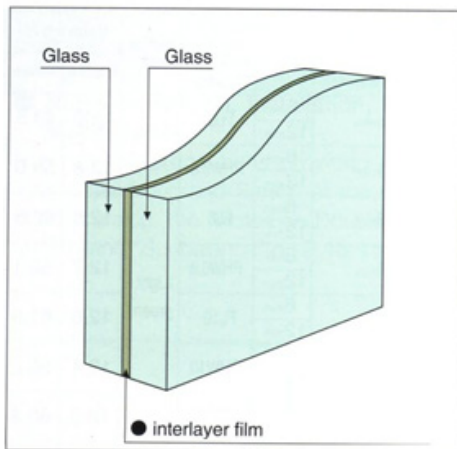
Challenge #2: laminated glass

Laminated glass also has to get past Challenge #1

Along with temperature effects.

As glass temperature increases, interlayer softens and stress increases.

MUST USE SGP ALL CASES



Solutions:

Interior Rails

All codes

- 1) Can get to work

Exterior Rails

2012 or older

- 1) Change to monolithic and solve Challenge #1
- 2) Increase glass Thickness

2015 or newer

- 1) Increase glass thickness



Summary:

2012 IBC or earlier

- Use monolithic rails with a cap
- Solve Challenge Number 1

2015 IBC or later

(must use laminated unless there is fall protection)

Interior

- Use SGP
- Solve Challenge Number 1

Exterior

- Use SGP
- Increase glass thickness
- Solve Challenge Number 1