

# Glass baluster guards still present code challenges

By Tony Leto

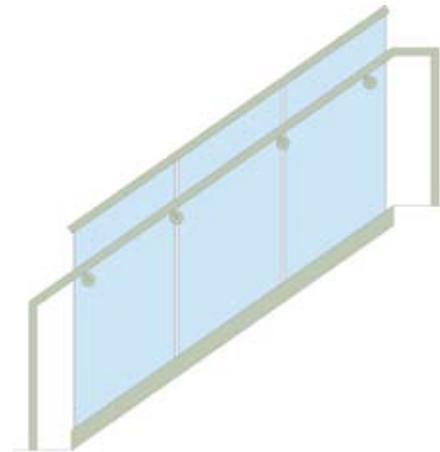
**D**espite the International Code Council's consistent assertion that top rails are required for monolithic glass baluster guards, we continue to see installations without the required top rail. Several factors contribute to this disconnect between the code requirement and actual installations.

The confusion begins with "IBC Section 2407.1.1.2 Support." There are two issues:

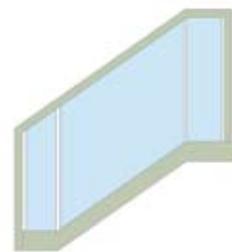
- 1. The term "guard" is used improperly.** The ICC defines "guard" as an element in place to stop accidental falls, and refers to the full assembly, not the guard top. The intention was to refer to a "top rail" as noted in the "Exception" text later in that section (see sidebar on Page 15).
- 2. Misinterpretation of the phrase, "Glass balusters shall not be installed without an attached handrail or guard."**

Handrail is required on stairs, and is located 34 inches to 38 inches above the stair nosing. A guard is required when there is a 30-inch drop. The International Building Code minimum for a guard is 42 inches above the walking surface. If a stair has a drop of more than 30 inches, it is required to have both a handrail and a guard. However, if the stair height does not exceed 30 inches, only a handrail is required. (See Fig. 1)

There are some who interpret Section 2407.1.1.2 as allowing a glass baluster guard to be installed with either a handrail or a guard (top rail). However, the section's intention is that a glass baluster handrail must have an attached handrail and that a glass baluster guard must have an attached guard (top rail). The presence of a handrail on a guard does not eliminate the need for a top rail. (See Fig. 2)

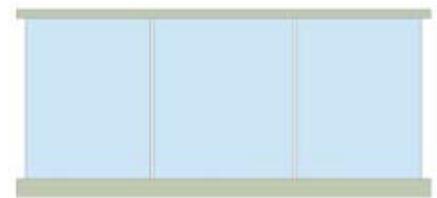


Stair with required guard and attached handrail.

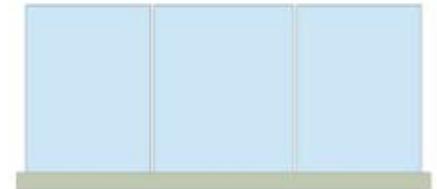


Required handrail for stair when a guard is not required.

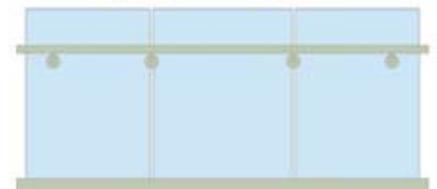
Fig. 1



Guard with top rail



Guard without top rail. Permitted only when used with laminated, tempered glass or if the glass balustrade meets the structural load requirements set out in IBC 1607.7



Guard with non-required handrail — handrail is in place in an attempt to meet the requirements of an attached handrail or guard.

Fig. 2

This interpretation is supported by:

### A. The ICC

In 2008, Todd Daniel of the National Ornamental and Miscellaneous Metals Association asked the following question of the ICC: "Can a glass rail system be installed without a guard on top of the glass if there is a handrail attached to the glass? In other words, no cap, exposed top edge of glass at 42-inch height with a handrail mounted on the side of the glass at handrail heights."

The ICC staff said no, because "the application you describe can only be allowed if the glass can withstand the loads for guards and handrails in Section 1607.7."

### B. The 2009 IBC Exception

The ICC approved an exception in 2009 that a top rail was not required if the laminated glass used meets the load re-

quirements and is approved by the building official. If this is the exception to the rule, then it should be understood that a top rail is required in all other situations.

### C. The load requirements

Section 2407.1.1 requires that glass baluster handrails and guards meet the load requirements of 1607.7 with a safety factor of four. In a required guard, the loads must be applied to the top of the guard — not the top of the handrail. Tempered glass edges are the most susceptible to rupture under load. Directing an 800-pound concentrated load (200 lbs. multiplied by a safety factor of four) to that bare edge will most likely result in failure.

### The question still remains

Given the clarity provided by the ICC, the question remains, "How is it that

glass rails using monolithic tempered glass are still commonly installed without a top rail?” The answer lies in the hands of the engineer of record for the project. While ICC staff says a top rail is required, it also notes that a top rail is not required if the “glass can withstand the loads for guards and handrails in 1607.7.”

An engineer reviewing a glass baluster guard uses “ASCE 7, Minimum Design Loads for Buildings and Other Structures” and various ASTM standards for metal and glass to determine safety factors for design.

Using their standard reference texts, engineers are able to provide calculations indicating the glass can withstand the loads set out in 1607.7. When presented with stamped, engineered support data, a local inspector has little choice but to approve the system as meeting the IBC’s structural requirements.

During the recently completed 2012 code cycle, NOMMA representative Tom Zuzik, vice president of sales and design for Artistic Railings Inc., Garfield, N.J., submitted changes to Section 2407 to eliminate some of the continuing confusion. In particular, his code change limited the four times safety factor to the glass and not the “support system,” which would eliminate the need to over-engineer the base and attachments. However, the IBC committee and membership were reluctant to make the change as they were unsure of the original basis for the requirement. The code therefore remains unchanged for the next scheduled publication in 2012. The next opportunity to submit another change will be in the 2015 code cycle.

In the meantime, varying levels of interpretation and enforcement are being applied across the country.

As always, it all comes down to the local Authority Having Jurisdiction. To alleviate issues, always consult with the AHJ regarding their position on applicable codes and standards; and have an engineer review and provide support information regarding the structural

## Section 2407 Glass in Handrails and Guards

### IBC 2407.1: Materials.

Glass used as a handrail or a guard section shall be constructed of either single fully tempered glass, laminated fully tempered glass or laminated heat-strengthened glass. Glazing in railing in-fill panels shall be of an approved safety glazing material that conforms to the provisions of Section 2406.1. For all glazing types, the minimum nominal thickness shall be ¼ inch (6.4 millimeters). Fully tempered glass and laminated glass shall comply with Category II CPSC 16 CFR 1201 of Class A of ANSI Z97.1, listed in Chapter 25.

### IBC 2407.1.1 Loads.

The panels and their support system shall be designed to withstand the loads specified in section 1607.7. A safety factor of 4 shall be used.

### IBC 2407.1.2: Support.

Each handrail or guard section shall be supported by a minimum of three glass balusters or shall be supported to remain in place should one baluster panel fail. Glass balusters shall not be installed without an attached handrail or guard.

integrity of any glass railing system.

If properly designed and engineered, a glass railing installation that meets a desire for a completely unobstructed view — while still providing a safe, code-compliant guard — is possible. 



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### Exception.

A top rail shall not be required where the glass balusters are laminated glass with two or more glass plies of equal thickness and the same glass type when approved by the building official. The panels shall be designed to withstand the load specified in Section 1607.7.

### Cross-referencing to section IBC 1607.7 regarding design loads:

#### IBC 1607.7.1 Handrails and guards.

Handrail assemblies and guards shall be designed to resist a load of 50 pounds per linear foot (pound per foot) (0.73 kN/m) applied in any direction at the top and to transfer this load through the supports to the structure.

#### IBC 1607.7.1.1 Concentrated load.

Handrail assemblies and guards shall be able to resist a single concentrated load of 200 pounds (0.89kN), applied in any direction at any point along the top, and have attachment devices and supporting structure to transfer this loading to appropriate structural elements of the building.