

**WABO/SEAW
Liaison Committee**

Washington Association of
Building Officials &
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of Washington

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Title: Guards & Connections

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Abstract:

Guards and their connections to the primary structure as required by the code are to be designed for specific loads. This White Paper provides recommendations for the required design submittals for these structural elements.

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Committee Mission Statement:

- *Improve communications between the public jurisdictions that administer building codes and the engineering design community that prepares construction documents.*
- *Improve consistency and quality of engineering submittals and project reviews.*
- *Build consensus between the engineering design community and building officials with regard to code interpretation and submittal requirements.*

I. INTRODUCTION:

Guards and their connections have a relatively high rate of failure leading to injury or death due to inadequate design and construction.

For various reasons guards and their connections are often constructed with inadequate strength and not in compliance with the code. In particular, the code specified lateral load to be applied to the top rail of guards is often not adequately addressed. Guards are often inadequately attached to the main building structure for lateral loads or have an inadequate load path.

This White Paper addresses these lateral load and attachment issues but does not address the dimensional requirements in the code for guards or handrails which are also important but more often designed in compliance with the code. These recommendations apply to guards constructed with various materials such as metal and wood and their connection to deck framing of all types.

II. RECOMMENDATIONS/GUIDELINES:

1. Construction documents for guards should show structural details as required for the attachment to the primary structural elements of the building and full resolution of the lateral loads as specified in the code. These can be as part of the base permit package or submitted as a deferred submittal. If the guard construction includes vendor designed components, the extent of the vendor designed portion of the guard should be clearly indicated on the permit drawings, and the required deferred submittals clearly described.
2. Supporting documentation should be provided and reviewed by the building department prior to guard installation. Supporting documentation may include structural calculations and details

- prepared by a Professional Engineer, an approved Evaluation Report or an approved prescriptive design. Connection loads from the guardrail onto the primary structure should be reviewed by the Engineer of Record (EOR) for the building for all projects where an EOR is hired.
3. The design may be based on prescriptive structural details that have supporting documentation showing that they meet the code provisions. This could be using IRC prescriptive details, MyBuildingPermit.com, Simpson Strong-Tie publications, or the DCA-6 Prescriptive residential Deck Construction Guide published by American Wood Council, all as approved by the Building Official. Guard installations must not deviate from the details and limitations of approved prescriptive designs.
 4. Connection details of vendor designed components to the main structure should be provided by a Professional Engineer. This should include fastener sizes and locations as well as bracing for rotation of structural members.

III. COMMENTARY:

1. Per 2018 IBC, Section 1607.8 and ASCE 7-16, Section 4.5, Handrail and Guardrail systems shall be designed to resist a single concentrated load of 200 lb or 50 plf applied in any direction at any point. In addition, infill components shall be designed to resist a lateral load of 50 lbs applied on a 12 in by 12 in area. One and two-family dwellings do not have to be designed for the 50 plf load case. Wind loads for glass and similar railing types may exceed these loads. This load is typically taken by the top rail spanning to posts which cantilever up from the edge of the deck framing below. The bending moment applied at the base of the post is a challenging structural detail and is a common flaw in deck construction. This detail generally requires through-bolts that extend through the rim joists or beam and a hold-down type tension connection to deck joists or blocking in the deck framing.
2. As an alternative to the post cantilevered up from the deck framing, the load at the top rail of the guard can also be taken by spanning the top rail horizontally to an end connection made to a wall or braced side panel. If this method is used, it should be clearly shown in the construction documents and supporting documentation.
3. Vendor designed railings are often used. Submittals should be provided from the vendor showing the fully dimensioned plans for the components provided, including structural member sizes and connection details. The submittal should clearly indicate the limits of the vendor provided components and the structural loads that are to be transferred at the connection points to the building structure. The EOR should confirm the adequacy of the main structural elements to receive those forces. These connection forces should include vertical and lateral forces as well as bending moments at the transfer point.
4. Supporting documentation for vendor provided guards should be reviewed and approved by the EOR prior to submittal to the Building Department. This documentation should include engineered calculations showing the specific conditions for the project or an approved ICC Evaluation Report for specific railing components used on the project. If there is no ICC Evaluation report, test reports for various components can be submitted for reference, but an engineered calculation for the specific components used on a project should be required.
5. If the structural design of the guard is identified on the plans as a deferred submittal, then the procedure in chapter 1 of the IBC should be followed.

Original Committee: *Chris Ricketts (WABO), Mark D'Amato (SEAW), Lee Kranz (WABO, co-chair), Charlie Griffes (SEAW, co-chair), Jon Siu (WABO), Dan Sully (WABO), Rick Fine (SEAW), Larry Lindell (SEAW)*