

Part 1: Overview & Gravity Loading

1. **Question:** Can the 200 pound load be shared by more than one post? Or, if it's a long stair, is every post loaded?

Adam Friedman: For your first question: Yes the concentrated load may be shared on the guard system. ASCE7-16 Section 4.5.1 states "Handrail and guardrail **systems** shall be designed to resist a **single** concentrated load of 200 lb..." However, you must also design for the uniform load per Section 4.5.1.1 of 50 lb/ft. Guard systems with posts spaced at 4' center to center or longer spacing will have to resist the imparted force at **each** post ($4' \times 50 \text{ lb/ft} = 200 \text{ lb}$ at 4' spacing).

For your second question: Every post will likely have some load but it will vary based on your post spacing. Refer to response to first question.

AISC Tip: Since these are ASCE 7 requirements, you might try directing further questions to ASCE. Note that the commentary to ASCE 7-16 Section C4.5 also states: "For cases in which extreme loads can be anticipated, such as long straight runs of guardrail systems against which crws can surge, appropriate increases in loading shall be considered."

2. **Q:** Does NFPA 101 have any bearing with respect to code compliance?

AF: Yes. NFPA 101 is typically enforced by the local Fire Marshal. Coordinate with the authority having jurisdiction and Fire Marshal to confirm what code requirements are to be enforced on a project (IBC, OSHA, NFPA, etc.)

3. **Q:** Please differentiate live load requirements for commercial versus residential.

AF: The webinar content provides loading for stairs that are covered by the International Building Code and OSHA including occupancies for commercial construction and residential construction (e.g. apartment buildings). Stair loading for one and two family dwellings is provided in ASCE7-16 Table 4.3-1. Please refer to the International Residential Code for requirements specific to one & two family dwellings.

4. **Q:** Does the 100 psf LL requirement account for any impact loading (i.e. people running up/down the stairs)? Should an extra load be considered if this type of load is anticipated on a regular basis?

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AF: Refer to ASCE7-16 Section 4.6.1 which indicates "The live loads specified in sections 4.3 through 4.5 shall be assumed to include adequate allowance for ordinary impact conditions. Provisions shall be made in the structural design for uses and loads that involve unusual vibration or impact forces." Additionally in the commentary C4.6 states "Grandstands, stadiums, and similar assembly structures may be subjected to loads caused by crowds swaying in unison, jumping to their feet, or stomping. Designers are cautioned that the possibility of such loads should be considered." Further, it would be worthwhile to review *AISC Design Guide 11, Vibrations of Steel-Framed Structural Systems Due to Human Activity* (2nd Edition) with regard to vibration.

5. **Q:** In your Example 2 you didn't include the rail live load into your loading...

AF: Occupant live load should only cause downward load on the stair or shared between the guard and stair. It should not double. In example 2, the stair was checked for the occupant live load. The guard should be independently checked for the live loads and transfer this load into the stair or main structure. Note that in some cases, project specifications specifically require that the stair stringer be checked for a combination of guard loads and stair loads acting concurrently. IBC 2015 commentary provides some additional information as well.

AISC Tip: Since these are ASCE 7 requirements, you might try directing further questions to ASCE.

Part 2: *Seismic Loads & Delegated Design*

6. **Q:** For industrial stairs (refineries), would you consider thermal expansion, especially when the project is in an environment that has significant temperature changes?

AF: Yes, thermal expansion should be considered where it can produce forces on the stair or support structure.

AISC Tip: While this presentation may not be specifically for stairs, it may still be of interest.
<https://www.aisc.org/education/continuingeducation/education-archives/insidious-thermal-forces-in-steel-structures-what-you-need-to-know-14/>

7. **Q:** Good luck in getting an OSHA-designed stair approved in California. I've never been able to. If you have, how were you able to?

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AF: Based on my clients and projects, more efforts are being made to be compliant with IBC to avoid code/inspection issues when an "OSHA" style stair is requested. In industrial settings, we typically provide stair designs that conform to the IBC layout requirements for 50 occupants or less.

8. **Q:** What is the relative cost difference between delegated approach versus conventional design?

AF: I don't have data for this comparison. In some cases cost may not be the driving factor.

Other factors to consider:

- designer lacks expertise and delegates to others
- budget/schedule issues
- contractual reasons (e.g. SER did not agree to provide this scope)

9. **Q:** Should serviceability (i.e. deflection) be checked when considering seismic loads?

AF: I am not aware of specific limits for stairs other than accommodating seismic displacement per ASCE7 section 13.3.2. Refer to ASCE7-16 commentary C13.3.2 and C13.5.10.

10. **Q:** For deferred approvals delegated design documents that go to the AHJ for review, our experience is that the AHJs required signed drawings and calcs. In your experience, are separate delegated design drawings ever provided?

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AISC Tip: Although note that stairs are not addressed in the AISC COSP (per Section 2.2), the commentary to Section 3.1.1 in the AISC COSP states: "The owner's designated representative for design may require that the substantiating connection information be signed and sealed for Option 3. The signing and sealing of the cover letter transmitting the approval documents and substantiating connection information may suffice. This signing and sealing indicates that a licensed engineer performed the work but does not replace the approval process provided in Section 4.4. A requirement to sign and seal each sheet of the shop and erection drawings is discouraged as it may serve to confuse the design responsibility between the owner's designated representative for design and the licensed engineer's work in performing the connection design. Such a requirement may not be possible when submitting fabrication and erection models."

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