

OSHA Minimum Guardrail Requirements

Table 1. Minimum Requirements for Standard Guardrails (Cal/OSHA)

Top Rail Height	Upper surface 42-45 in. above the platform height (1-in. tolerance).
Midrail Height	Upper surface halfway between the top rail and the platform.
Strength	Top rail: Capable of withstanding 200 lb. of horizontal or downward pressure. Midrail: Capable of withstanding 150 lb. of horizontal or downward pressure. See Tables 3 and 5.
Overhang of Rails	The ends of the rails must not overhang the terminal posts, except where such overhang does not constitute a projection hazard (see Figure 1).
Railing Surface	Railings must be smooth surfaced with corners rounded so that it will not cause injury (punctures or lacerations), or snag clothing.
Rail Attachment	Rails must be attached on the side of the post that will afford the greatest support and protection. For example, when using an L-shaped top rail or angle iron top rail, the vertical leg should be on the contact side (platform side) of the post.
Alternatives to Midrails	Screens, mesh, intermediate vertical members, solid panels, or equivalent members may be used in lieu of a midrail subject to the following: <ul style="list-style-type: none"> • When screens or mesh are used it must extend from the top rail to the platform along the entire opening between top rail supports. • Wire mesh should have no larger than 1-inch openings. • When intermediate members (balusters or solid panels) are used between posts they must be installed such that there is no opening greater than 19 in. wide.

Table 2. Minimum Requirements for Toeboards (Cal/OSHA)

Minimum Height	3 ½ in. (4-in. nominal is acceptable).
Clearance to Platform	Not more than ¼-in. clearance above platform level.
Toeboard Material	Wood, concrete, metal, or other substantial material. Where constructed of metal grille, mesh openings shall not be greater than 1 in.
Falling Object Protection	Where standard toeboard does not provide adequate protection. paneling or screening from platform to intermediate rail or top rail shall be provided. Material such as No. 18 gauge U.S. Standard wire 1-in. mesh complies with the requirement for filling the space between the toeboard and the intermediate rail.

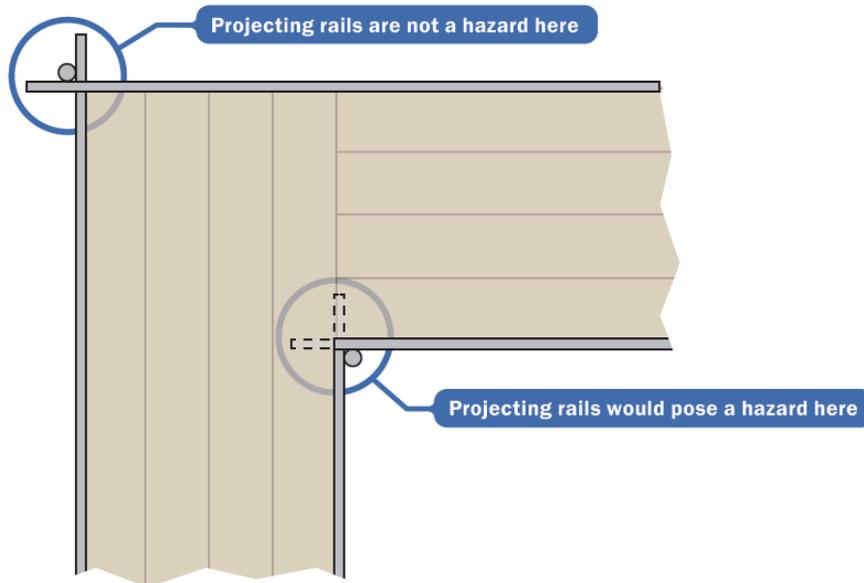


Figure 1. Ends of rails must not pose a projection hazard.

The materials given in Table 3 meet the strength requirements of Table 1. Various types and arrangements of guardrail are permissible as long as they provide equivalent protection. Per Cal/OSHA, guardrails must be made of “selected lumber”, which is defined as Douglas Fir with a bending stress of at least 1500 psi or other materials of equivalent strength. The other lumber species/grades shown in Table 3 can meet the requirement when doubled (back to back or constructed in an L-shape as shown in Figure 2). Table 3 shows the relative strength of different grades of Doug Fir lumber.

Note that grades like construction grade light framing lumber does not meet the 1500 psi minimum bending strength to be used for guardrails.

Table 3. Minimum Specifications for Wooden Guardrail			
	Douglas Fir	Hem-Fir	Southern Pine
Posts spaced 6 ft. or less	2 × 4: #1 or better	3 × 4: Select Structural or Double 2 × 4: Select Structural	3 × 4: Select Structural or Double 2 × 4: Select Structural
Top Rails	2 × 4: #1 or better or (2) 2 × 4 L-shape: #2 or better	(2) 2 × 4 L-shape: Stud, #2 or better	(2) 2 × 4 L-shape: #1 or better
Midrails	2 × 4: #1 or better or (2) 2 × 4 back-to-back or L-shape: #2 or better	(2) 2 × 4 back-to-back or L-shape: #1 or better	(2) 2 × 4 back-to-back or L-shape, #1 or better
All lumber must be free of defects that affect its strength.			

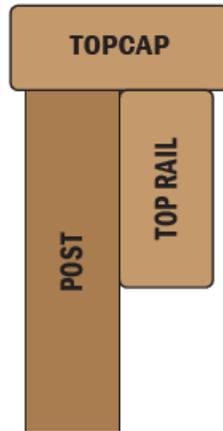


Figure 2. L-shape (hog trough).

Table 4. Lumber Grade Example: Douglas Fir 2"× 4"

Grade	Bending Stress (psi)
Select structural	2250
#1 and better (structural)	1800
#1 (structural)	1500
#2 (structural)	1350
Construction (light framing)	1000
#3 (structural)	790
Stud	770
Standard (light framing)	575
Utility (light framing)	275

Notes: The grades refer to strength characteristics. Grading terms like “clear” and “prime” refer only to appearance.

Table 5. Minimum Metal Pipe Guardrail Specifications

Posts At least 1 ½-in. OD, spaced 8 ft. max

Rails At least 1 ½-in. OD

OD. Outside dimension.

Fasteners and Construction

Practical tests of guardrails¹ have established that three or four adequately long common nails or all-purpose screws meet the strength requirements (Figure 4). Using too many fasteners can weaken the joint by increasing the chance of splitting the wood.

¹

Pull-to-failure strength testing reported by the Division of Safety Research, National Institute for Occupational Safety and Health.

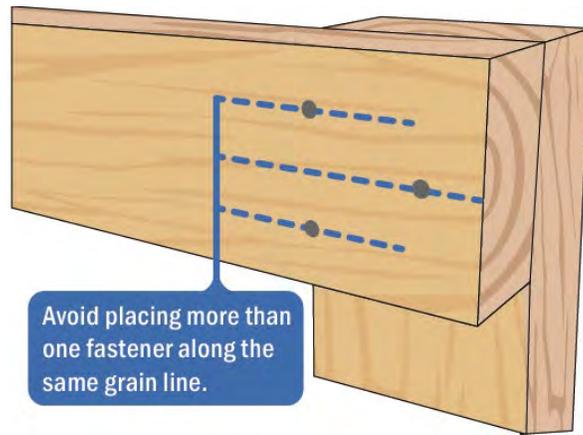


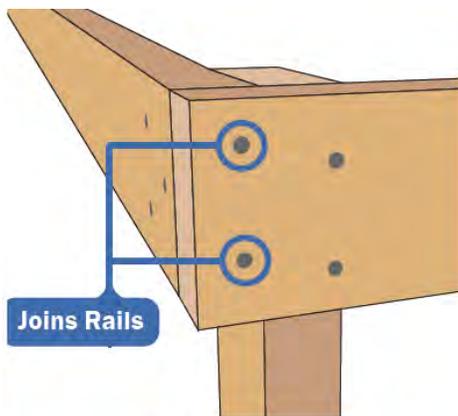
Figure 3. Plan the nailing pattern to avoid weakening or splitting the wood.

Drywall screws are never acceptable as a structural fastener. Use steel screws designed for wood-to-wood applications.

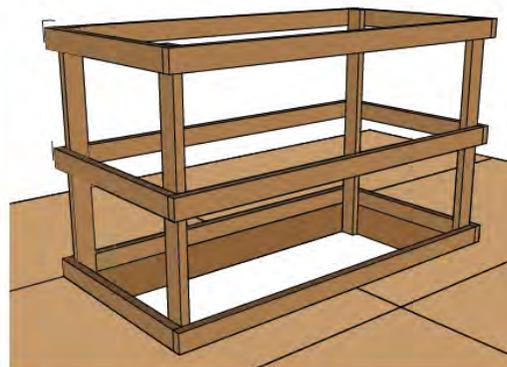
Double-headed nails should not be used for guardrails where they might catch on the clothing or create similar hazards.

The following construction techniques increase strength in critical places:

- Overlap and fasten the guardrail ends to one another at the corners, rather than only driving fasteners into the posts (Figure 4A).
- Where possible, orient corner posts at right angles to the others as shown (Figure 4B).



A One rail extends past the post so that the two rails can be nailed to one another as well as to the post



B Having posts anchored at right angles to one another (where possible) gives the structure shear strength in two directions

Figure 4. Construction techniques that improve strength.

Stair Railing Specifications

Stairways having four or more risers must have a *stair railing* on open sides. Stair railings must:

- Have a top rail 34–38 in. above the nose of the stair treads (Figure 5)
- Be constructed similar to guardrails with regard to post spacing and other details
- Be continuous along the full length of the stairs
- Withstand a load of 200 lb. applied in any direction
- Have a midrail where any open stair is 30 in. or more above the surface below

Guardrail vs. Stair Railing vs. Handrail

- A guardrail is a physical barrier installed to prevent falls (top rail 42-45 in.). Open sides of stairway landings must have guardrails.
- A stair railing is a physical barrier constructed along the open sides of a stairway to prevent falls. It may be constructed similar to a guardrail, but with the top rail height 34-38 in. The top rail of a stair railing may serve as a handrail.
- A handrail is a grasping surface—a handhold for support (34-38 in.). It is mounted so there are no obstructions to a smooth grasping surface on the top and sides (e.g., using brackets) and is spaced away from the wall or stair railing.

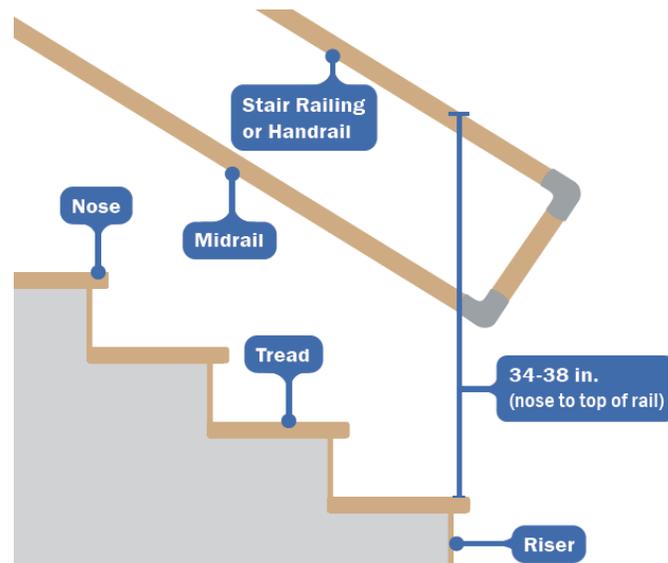


Figure 5. Specifications for stair railing

Fed OSHA Requirement (29 CFR 1910.29(f)): Guardrails for Floor Openings. Stair Railing For systems installed after Jan 2017, the employer must ensure:

- Handrails are installed 30–38 in. above the leading edge of the stair tread.
- Stair rail systems are installed at least 42 in. above the leading edge of the stair tread.