

18 GUARDRAILS

Falls are the number one cause of critical injuries and deaths of Ontario workers on construction sites. One of the most reliable and convenient ways to protect workers from a fall is by installing guardrails.

Section 26.3 of the Construction Projects regulation (213/91) requires a guardrail to be used if a worker is exposed to a fall of 2.4 metres or more and has access to the open side of a:

- Floor, including a mezzanine or balcony floor
- Bridge surface
- Roof while formwork is in place
- Scaffold platform or other work platform, runway or ramp.

In addition, the regulations require that workers be protected from a fall if they are exposed to any of the hazards listed below.

- Falling more than 3 m (10 ft)
- Falling more than 1.2 m (4 ft) if the work area is used as a path for a wheelbarrow or similar equipment
- Falling into operating machinery
- Falling into water or another liquid
- Falling into or onto a hazardous substance or object
- Falling through an opening on a work surface.
(O. Reg. 213/91, s. 26)

Guardrails are considered the preferred method of fall protection. However, if it is not practical to install them, workers must be protected by the highest-ranked method that is practicable. In order of preference, these are:

1. Travel restraint system
2. Fall restricting system
3. Fall arrest system
4. Safety net.

Specifications

Guardrails must be high enough and strong enough to resist the force of workers stumbling or backing up against them. The specifications for a typical wooden guardrail system are found in section 26.3 (4) of the Construction Projects regulation (Figure 18-1). They include:

- A top rail, mid-rail, and toeboard secured to vertical supports
- A top rail between 0.9 m (3 ft) and 1.1 m (3 ft 7 in) high
- A toeboard installed flush with the surface and at least 89 mm (3½ in) high (100 mm (4 in) high if made of a material other than wood)
- Posts at least 38 mm (1½ in) by 89 mm (3½ in) and no more than 2.4 m (8 ft) apart.
- Installed no more than 300 mm (1 ft) from an edge.

For maximum resistance to lateral force, the top rail of a wooden guardrail system should be laid flat (with the larger dimension horizontal). It must be

fastened securely to the top of each post so that the rails cannot be pulled off the posts.

To strengthen guardrails, reduce the spacing of posts to between 1 and 2 metres (3 feet 4 inches and 6 feet 8 inches) and double the 2 x 4 top rail. Posts on wooden guardrails must not be further apart than 2.4 metres (8 feet).

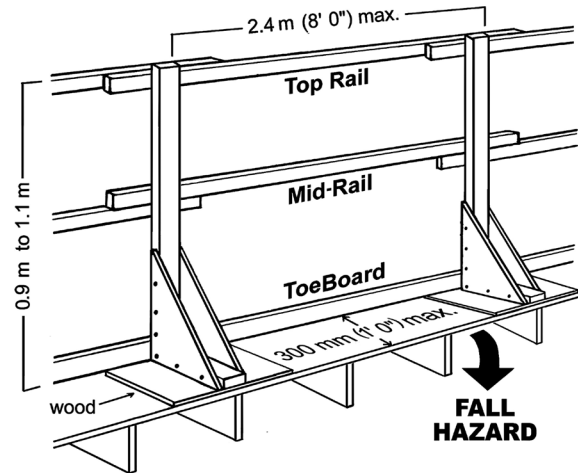


Figure 18-1: Typical Dimensions for Guardrails

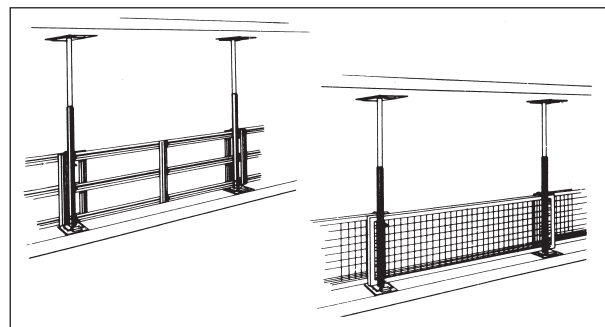
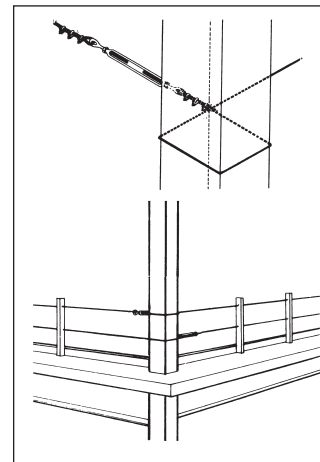


Figure 18-2: Wire Rope Guardrail System (top) and Manufactured Safety Fences

Wire rope and manufactured guardrail systems and fencing can also be used if they are as strong and durable as wooden guardrails with the same minimum dimensions (Figure 18-2). Ensure all manufactured guardrail systems meet the regulatory requirements and are installed according to the manufacturer's instructions. Specifications for wire rope guardrail systems can be found in section 26.3(8) of the construction regulations.

Loads

Guardrails must be capable of resisting the following loads.

- A point load of 675 newtons (150 lb) applied laterally to the top rail
- A point load of 450 newtons (100 lb) applied to the top rail in a vertical downward direction
- A point load of 450 newtons (100 lb) applied to the mid-rail in a lateral or vertical downward direction
- A point load of 225 newtons (50 lb) applied laterally to the toeboard.

These loads are applied separately, anywhere along the length, and must not exceed the allowable unit stress for each material used.

Note: If a guardrail system that is made of wood is constructed and installed so that it is capable of resisting all loads that it may be subjected to by a worker, the requirements above do not apply.

Wooden guardrails must be made of spruce, pine, or fir (S-P-F) timber of construction grade quality or better with no visible defects affecting its load-bearing capacity.

Supports

Typical methods of supporting wooden guardrails are shown in Figure 18-3. Posts extending to top rail height must be braced and solidly fastened to the floor or slab.

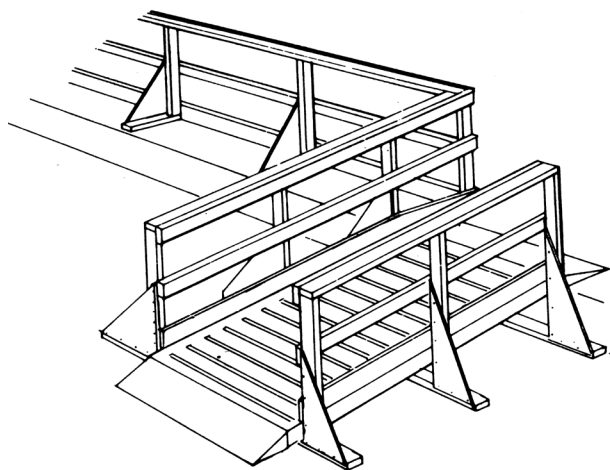


Figure 18-3: Supports for Wooden Guardrails

Shoring jacks used as posts should be fitted with plywood softener plates at the top and bottom. Snug up and check the posts regularly for tightness.

For slabs and the end of flying slab forms, manufactured posts can be attached to the concrete with either clamps or inset anchors (Figure 18-4).

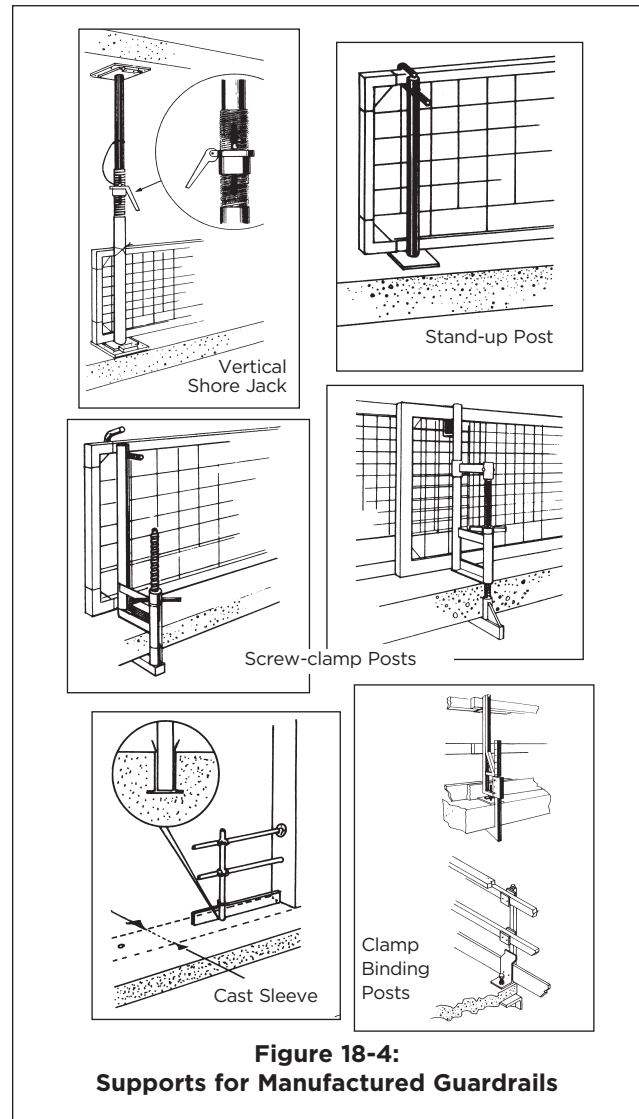


Figure 18-4: Supports for Manufactured Guardrails

Temporary Removal

It's often necessary to remove a section of guardrail in order to land and unload material or equipment. Before removing the guardrail, workers in the unprotected area must tie off using a travel restraint or fall arrest system. Travel restraint is preferred, but fall arrest may be required.

Cordon off the area with caution tape or a warning barrier at least 2 metres (6 feet, 6 inches) from either side of the opening and at least 2 metres back from the open edge of the work surface. Post warning signs (Figure 18-5).

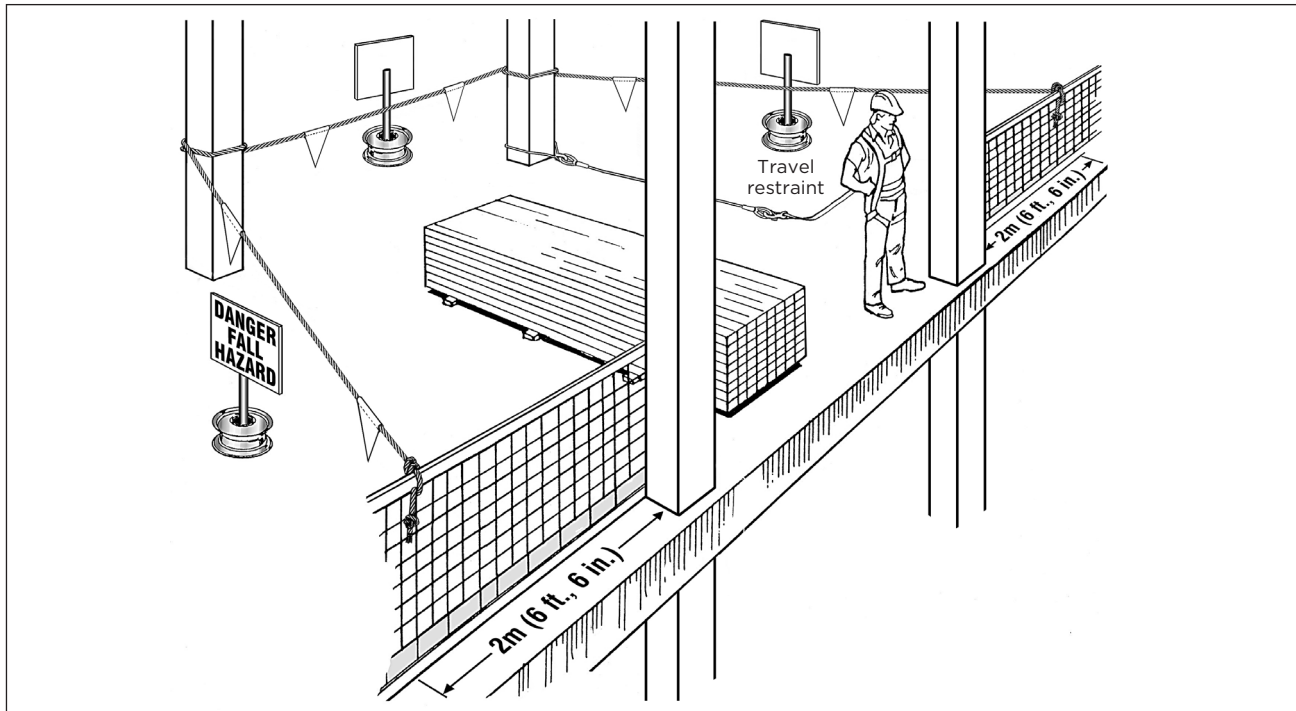


Figure 18-5: Proper Set-up for Temporary Removal of Guardrails

When removing guardrail posts temporarily, unfasten them from the deck using proper tools—don't pry or pull them off—and place them safely out of the way.

When it's time to replace the guardrail section, a competent worker using the specified type and number of fasteners and the proper tools must install the posts according to the original design requirements.

Floor Openings

Guardrails are the preferred method for protecting workers near floor and roof openings that do not have permanent or temporary coverings. However, they may not always be practical. In narrow access routes, for example, the best alternative may be to use securely fastened covers made of planks, plywood, or steel plates (Figure 18-6).

According to section 26.3 (2) of the construction regulation, a protective cover must:

- Cover the opening completely
- Be securely fastened
- Be labelled as a covering for an opening
- Be made of material that can support all loads that may be placed on it
- Be able to support a live load of at least 2.4 kilonewtons per square metre without exceeding the allowable unit stresses for the material used.

Where temporary covers are used, they should extend enough past the opening that they provide sufficient strength (e.g., 15 cm (6 in)). If permanent covers or hatches are installed, they should be kept closed except when workers are using them for access.

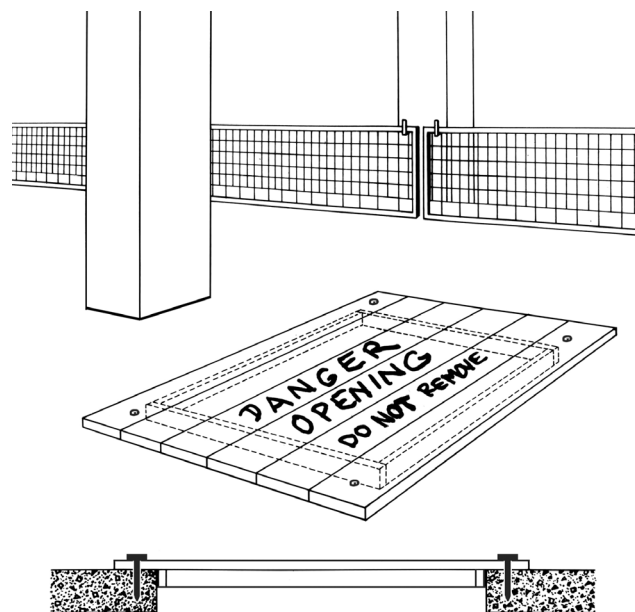


Figure 18-6: Protective Cover

Skylights must be treated like other roof openings. While it may seem like the opening is covered, a skylight has very little strength. If a worker were to step on it or fall into it, it could break and the worker could fall to the level below.

To protect against this, install temporary guarding around or over each skylight near the work area (Figure 18-7). It's also a good idea to barricade the skylights on other areas of the roof to keep workers away from them.

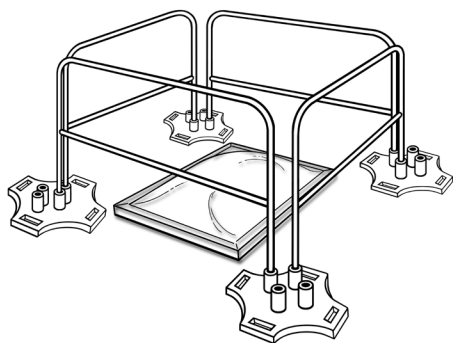


Figure 18-7: Guardrails around Skylight

Safe Work Practices

Here are some safe work practices when working around floor and roof openings:

- If making a cover out of wood, use full-sized No. 1 spruce planks 48 mm x 248 mm (1 7/8 in x 9 3/4 in).
- Make opening covers stand out with bright paint. Mark it clearly with a warning - DANGER! OPENING - DO NOT REMOVE! DO NOT LOAD!
- Fasten the cover securely to the floor to prevent workers from removing it and falling through the opening.
- Never stand or walk on a protective cover.
- Never store materials on a protective cover.
- Never drive over a protective cover.
- Always fasten the cover securely to prevent workers from removing it and falling through.
- Where permanent covers or hatches are installed, they should be kept closed at all times except when they are being used for access.
- Tell the supervisor if a protective cover is loose, not fastened, not properly identified, or in poor condition.
- If an opening is not covered, always use another means of fall protection when working around it.

Stairs

The open edges of stairs require guardrail protection. Specifications for a wooden arrangement are shown in Figure 18-8.

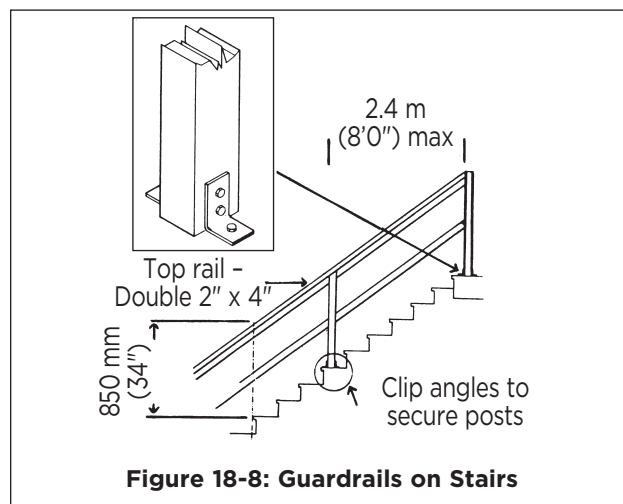


Figure 18-8: Guardrails on Stairs