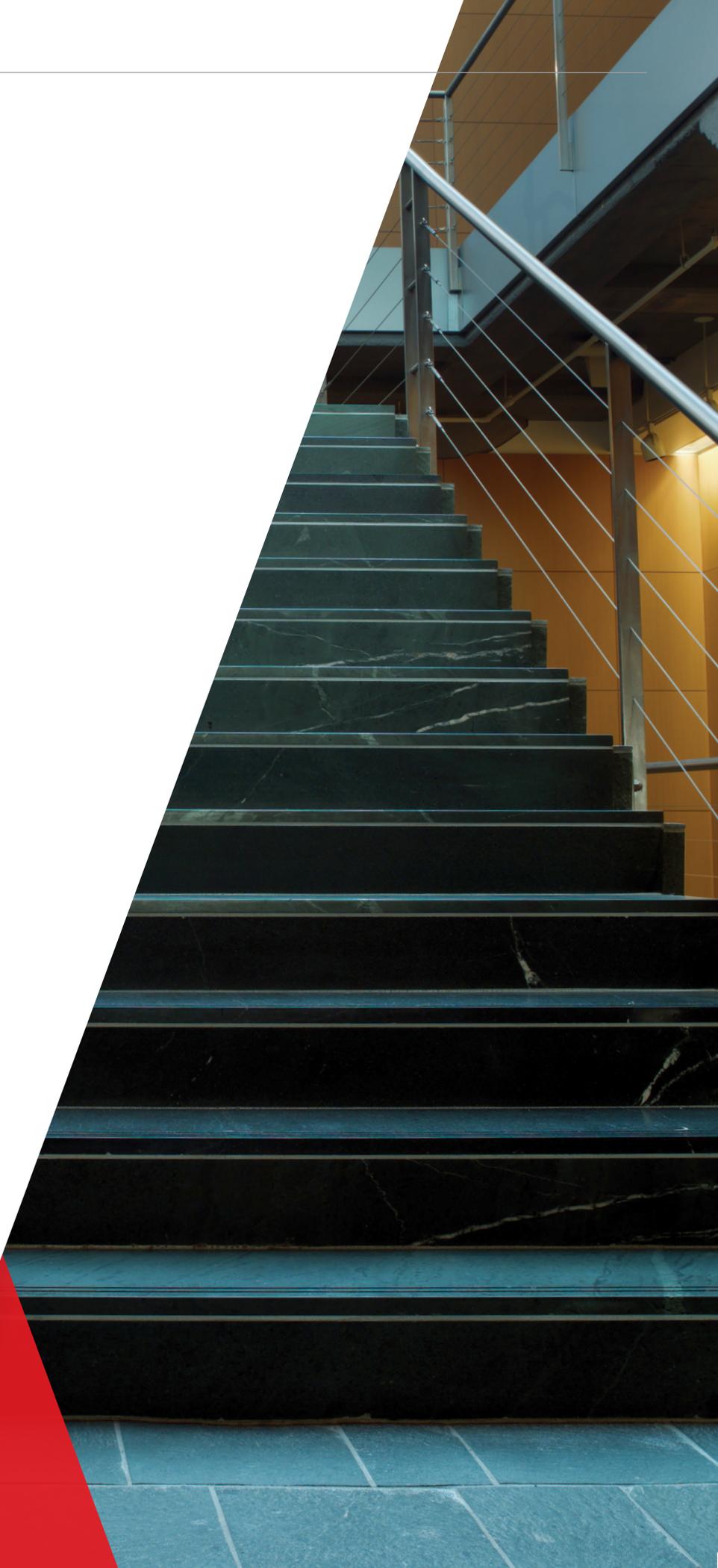


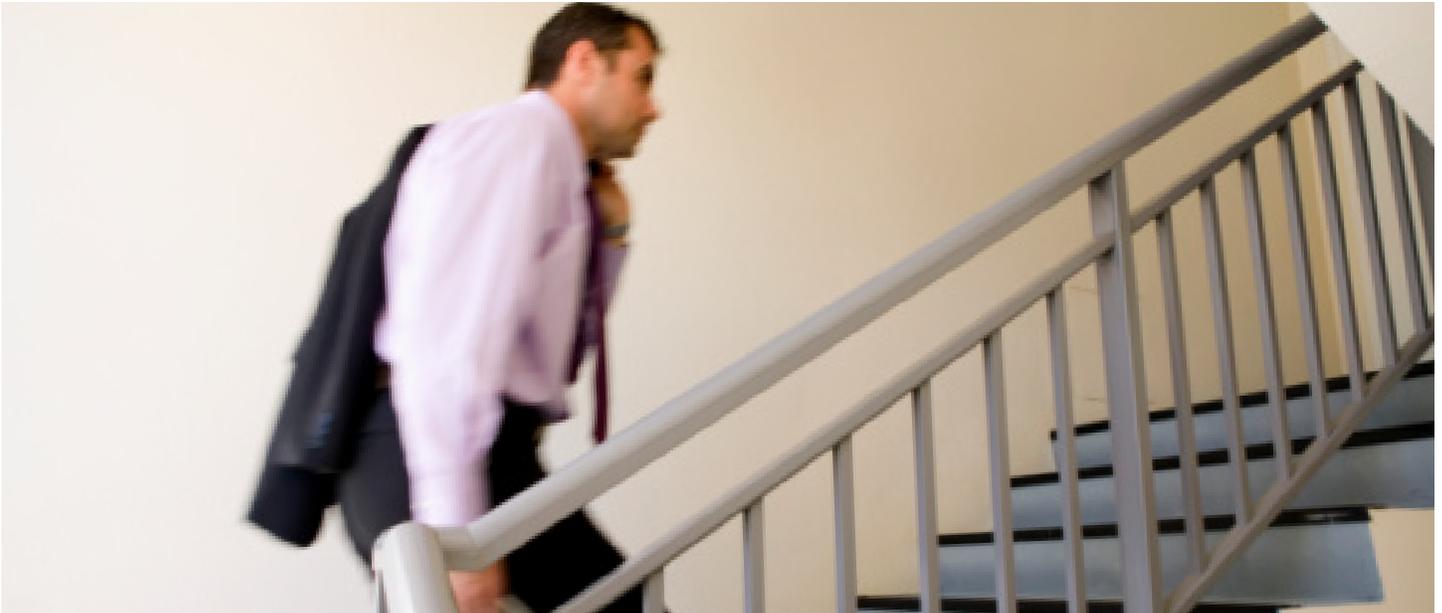


Indoor Stairs and Ramps

Slip and Fall Prevention



Slips, trips and falls can occur as pedestrians maneuver stairs and ramps inside of buildings. Many premises liability laws hold property owners, managers and business operators liable for injuries resulting from slips and falls if the walking surfaces do not meet uniform building codes and industry standards. Therefore, proper design and maintenance are key to prevention.



The controls outlined in this document are applicable to not only public commercial buildings but also to industrial settings, where stairs and ramps tend to deteriorate faster.

Stairs

Factors associated with high incident rates include:

- Riser and tread dimensions, such as steep or inadequate uniformity of rise and tread measures
- Inadequate slip-resistance features
- Dimensional irregularities
- Low head room
- Low contrast, which makes visibility of edges and rise difficult
- Poor lighting or excessive shadows
- Physical dexterity of pedestrian
- Careless or distracted use of stairs
- Lack of handrails to sustain balance
- Tripping over materials stored in the stairway
- Accumulation of snow, ice and debris

Key Takeaways

- Stairs, steps and ramps should be free of defects, storage and contamination
- Steps should have uniform rise and run dimensions
- Sturdy handrails should be made available
- Use traction devices to increase slip resistance
- Schedule a regular inspection

Riser and Tread

Design requirements vary upon jurisdiction building codes. The following points are basic principles of design:

- The most critical steps for pedestrians are the top three and lowest three.
- Tread depth (flat surface) must adequately allow for the ball of the foot to make contact with the surface, without extending over the edge, when descending the stairs. If only the heel makes contact, a misstep can result in a forward fall.
- Stairways with more than 12 steps must have a landing for patrons to rest, if needed. Check local or applicable provincial building codes.

- Surfaces should be slip resistant.
- Minimum tread depth should be 11 inches (28cm).
- Riser height should be four to seven inches (10 cm to 18 cm).
- Uniform riser and tread dimensions cannot vary more than $\frac{3}{8}$ inch (9.5 mm).¹
- Where moisture can accumulate, the maximum outward slope for optimal drainage is $\frac{1}{4}$ inch per foot (1 cm per .5 m).
- Choose safety over aesthetics. Avoid glass/transparent stairs with surface changes that have no contrast and are not visible (2%).

Controls

- Provide contrasting surfaces to make changes in steps visible. (See Figure 1.) The most important area is the edge of the landing before the first step, where shadows may affect the visibility of the steps.
- Highlight edges of walking surfaces that lead to the first downward step to help pedestrians avoid stepping out without seeing the steps. (See Figure 1.)
- Use carpeted stairs when possible.
- In low-light areas, use step lighting or install additional lighting of at least 20 foot-candles (200 lux) or glow-in-the-dark treads.
- Install handrails when there are three or more steps.
 - **Enclosed stairs less than 44 inches** (112 cm) – a handrail is required on one side.
 - **Open-sided stairs less than 44 inches** (112 cm) – If one side is open, a handrail is required on the open side. If both have open sides, install handrails on both.
 - **Stairways between 44 and 88 inches wide** (112 cm and 224 cm) – handrails are required on both sides.

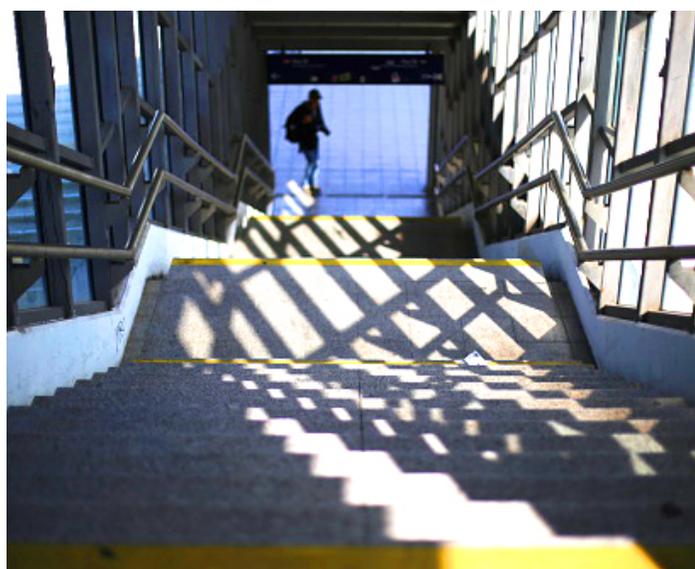


Figure 1 – Landing edges highlighted yellow. Excessive shadows distort perception of steps.

- If any side is elevated greater than 24 inches (61 cm) from a lower level, the handrails should have a mid-rail.
- If wider than 88 inches (224 cm), there must be a handrail in the center of the stair width.
- Handrails should extend 12 inches (30.5 cm) beyond the top and bottom of the staircase, parallel to the floor.
- Handrails should have rounded ends turned into the wall to prevent snagging of items such as purses or clothing.
- Use traction-enhancement devices or coatings to increase slip resistance.
 - Tread nose covering and inserts
 - Adhered non-slip tapes
 - Serrated surfaces on metal stairs
 - Rubber or vinyl step coverings
- Prohibit any cords, materials or other storage on the stairs.
- Use glow-in-the-dark nose tread covers for stairwells and other areas with potential deficient lighting. (See Figure 2.)

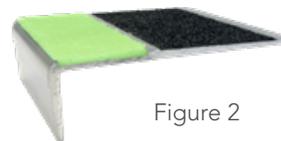


Figure 2

Ramps

Building access can be provided by ramps or sloped walking surfaces to bypass the use of steps and accommodate patrons with disabilities and wheelchairs. Ramps, like stairs, require pedestrians to change their gait or walking style and center of gravity. Because of the slope, the coefficient of friction is critical.

Controls

- Do not use any floor decals on sloped flooring. These can be very slippery. If a decal is needed, ensure it has a slip resistance of .50 dynamic coefficient of friction (DCOF).
- Design and construct ramps in accordance with applicable jurisdictional building codes, disability or access legislation, and occupational health and safety requirements.
- Ramps used for exit ways or handicap access should not exceed a slope of 1:12 (one foot (30.5 cm) of rise per 12 feet (3.7 m) of horizontal run).
- Ramps should have landings at turning points, entrances and exits.

¹ <https://www.ehstoday.com/ppe/fall-protection/article/21908140/reducing-slips-trips-and-falls-in-stairway>

- Ramps with any elevation greater than 30 inches (76 cm) above another level should be provided with guardrails to prevent falls to lower level.
- Handrails for ramps with a slope of greater than 1:15 (rise:run).
 - Ramps wider than 44 inches (112 cm) should have handrails on both sides.
 - If wider than 88 inches (224 cm), handrails should be in the center and on both sides.
- Walking surface should be level and free of bumps, holes, heaves or other elevations exceeding ¼ inch.
- Surfaces should be slip resistant. While there are no standards for slip resistance for ramps, a static COF of .80 is recommended.
- Interior ramp designs should avoid polished marble or granite, unless the static COF of .80 can be attained.
- Use traction-enhancing materials such as:
 - Carpeting
 - Non-slip rubber mats
 - Adhering non-slip tapes or mats
 - Abrasive embedded coatings
 - Grooved, rough or etched surfaces
 - If industrial metal ramp, serrated traction is suggested.
- Highlight the top descending edge and lower ascending edge



Figure 3 – Needs entry edge contrast.

Learn more about [managing slip and fall risks](https://cna.com/riskcontrol) at cna.com/riskcontrol (US) or cnacanada.ca (Canada).