

Preventing Outdoor Same-Level Slips, Trips, and Falls

Risk Control from Liberty Mutual Insurance



Highlights:

- Trip hazards
- Sidewalks, curbs, parking lots
- Curb ramps and handicap ramps
- Ice, snow, water
- Selection of ice melting chemicals
- Outdoor lighting

Slips, trips, and falls in outdoor environments can be caused by undetected changes in level; rain, sleet, ice, and snow; and particulate soil that causes surfaces to become slippery or produce poor traction.

This reference note addresses slip, trip, and fall hazards, and describes interventions. Stairway design is not addressed in this reference note; see reference note *Controlling Falls on Stairways*, RC 5158, for guidelines on stairway fall prevention.

While we cannot control environmental conditions that increase slipperiness of outdoor walkway surfaces, we can certainly reduce the likelihood of falls through improved design of exterior sidewalks, curbs, parking areas, improved lighting, and improved maintenance to increase awareness and eliminate hazards.

Trip and Fall Risk

A trip occurs when the toe or the foot strikes a near-ground obstacle or change in elevation that abruptly halts the foot when the body's center of gravity is in motion. A trip most often results in the person falling forward, and can occur if an elevation transition is unseen or gait behavior is such that minimum foot or toe clearance does not clear the obstacle.

Changes in Level

Most design standards for ground and floor surfaces (see References section) define a change in level as exceeding one-half inch (13 mm) in height, whereas abrupt changes in level not exceeding one-quarter inch (6 mm) may be vertical without edge treatment. The NFPA 101 — Life Safety Code (see Resources) for walking surfaces in means of egress defines a change of level as a change in elevation greater than one-half inch (13 mm), whereby “a ramp or stairway may be installed that complies with applicable building codes, regulations, standards, or ordinances.” When a ramp cannot be designed to slope requirements, a one-, two-, or three-step riser system is often the resulting solution. See reference note *Controlling Falls on Stairways*, RC 5158, for details on step/stair design and safety.

Note that for elderly populations or those with walking disabilities, the one-fourth inch (6 mm) vertical change in level guideline may not be sufficient to prevent a trip and fall. It is always good business practice to reduce or eliminate as many obstacles and changes of level along the main pedestrian travel course as possible.

However, if elimination is impossible, design standards offer the following options:

- For changes in level exceeding one-quarter inch (6 mm) but not exceeding half an inch (13 mm), bevel the edge with a slope no greater than 1:2.
- For level changes greater than half an inch (13 mm), install a ramp with maximum slope 1:12.
- A less desirable option is to make such transition hazards visually noticeable through appropriate detectable warnings. See Color, Contrast, and Visible (Detectable) Warnings section below.
- Avoid one-step stair systems if at all possible as they are not easily detectable.

Sidewalks, Curbs, and Parking Lots

A business owner may not be responsible for injuries resulting from a fall on a public sidewalk located outside his or her property. However, some courts may impose liability for injuries on a sidewalk used exclusively by customers coming to and from the business. Consult with your legal counsel if you have questions on liability.

A parking lot owner can be responsible for maintaining the parking lot in a manner such that it is reasonably safe for people using it.

This includes:

- Filling and patching cracks and holes.
- Repairing and eliminating raised areas due to tree roots, settling, cold weather (frost heaves), and ordinary wear and tear.
- Reducing surface water by directing roof drainage away from sidewalks and parking areas.
- Clearing sidewalks/parking areas of snow/ice before employees and guests arrive.
- Centering and securing parking stoppers.
- Near entrances, painting or staining parking stoppers Safety Yellow to improve visibility.

Curb Ramps and Handicap Ramps

State, local, and national codes specify guidelines/requirements for curb ramps and handicap ramp design. For example, “ramp slopes 1:15 minimum to 1:12 maximum with slip-resistant surfaces” is often cited. There are no specific guidelines as to what “slip-resistant” means, but some codes specify grooving or other alterations of the curb ramp to improve slip resistance. Check with your state and local codes for requirements on ramp slip-resistance guidelines. Handicap ramps and curbs are colored Safety Yellow (see section on Color, Contrast, and Visible Warnings).

Entrances

Entrances represent unique slip and fall issues and are addressed in reference note *Preventing Slips and Falls: Selecting the Right Matting System*, RC 5408. For outdoor walkways at entrances exposed to the elements, consider installing a canopy to reduce snow, ice, and water from being tracked into the building.

Color, Contrast, and Visible (Detectable) Warnings

Recent U.S. Access Board Research recommends Safety Yellow as the preferred color for persons having limited vision. Safety Yellow, therefore, is a color standardized for use as a warning in the pedestrian/highway environment, as well as for improving visual detection of elevation hazards on walkway surfaces. The U.S. Access Board also specifies that visible warnings “shall contrast visually with adjoining surfaces, either light-on-dark, or dark-on-light,” (70 percent contrast in light reflectance value LRV) therefore, allowing brightness contrast as further options for improving visual detection of transition hazards.

Ice, Snow, Water

Slips and falls from ice, snow, and water are common in northern climates. Falls can be caused by inadvertent accumulation of ice and snow due to misapplication. Misapplication can be caused by selecting less efficient deicing chemical(s) and friction additives (sand), and inadequately managing application schedules.

Effective ice removal often occurs during the day with full sun. But, full sun will melt adjacent snow or ice, placing water on the de-iced walking surface. This will dilute the solution and tend to refreeze at night. With dropping temperatures, ice can re-form, with falls occurring first thing in the morning.

Selection of Ice Melting Chemicals

- Rock Salt (Sodium Chloride) is the least expensive but is somewhat corrosive and can damage concrete, interior surfaces, and vegetation. It may need a wetting agent for application at low temperatures.
- Calcium Chloride and Magnesium Chloride are more effective than rock salt, and most effective at lower temperatures. Magnesium Chloride is somewhat less corrosive than Calcium Chloride, which is about as corrosive as rock salt.
- Calcium Magnesium Acetate is the most environmentally friendly, but is more expensive and is least effective at lower temperatures.

De-Icing Chemicals	Use	Advantages	Disadvantages
Sodium Chloride (rock salt) NaCl	Plain or wetted with CaCl ₂	Cost	Corrosive, damages vegetation, environment issues
Calcium Magnesium Acetate (CMA)	Liquid mixed with salt or sand	Less corrosive than salt	Wet pavement, need twice as much as salt
Magnesium Chloride, MgCl₂	Sprayed on, mixed with sand and other de-icing chemicals	Attracts moisture, dissolves and melts snow as it hits pavement	Road stays wet
Calcium Chloride, CaCl₂	Mix with salt, pre-wets salt	Releases heat, helps snow melt, saves on salt	Cost

Adapted from US Consumer Reports 2014 <http://www.consumerreports.org/cro/2014/02/best-ice-melts/index.htm>

The following are guidelines for managing slips and falls from ice, snow, and water:

- Plow, shovel, and use de-icing, salting, or ice-melting chemicals to remove ice and snow.
- Pre-apply de-icing chemicals before a storm, followed by snow/ice removal during and after the storm. Use plenty of de-icing materials, as using “barely enough” will leave patches of ice.
- Check the surface regularly. For parking areas, this can be time consuming, but it is well worth the effort.
- Aim for evaporation. If the water can drain (e.g. drains aren’t blocked) and there is full sun, or even reasonable wind, the water and ice will evaporate. Dry pavement is a clear indication there is no ice.
- Use a friction additive. Sand is the most popular because it is cheap; use a lot of it. Make certain that anyone walking on the surface has a lot of traction. You can clean up the mess once the bad weather is over.
- Check and treat surfaces every morning, especially around snow piles, where melting may have created new problem areas. Re-evaluate during the day and re-treat as needed.
- Remember that a clean-looking surface is only “safe” if it is dry. A wet surface can contain ice and can also turn to ice in the shade or overnight.

- Hold facility managers, custodians, grounds maintenance staff, and contracted snow removal personnel responsible for snow and ice removal.
- Train those responsible in procedures for safely maintaining walkway surfaces, including the location of equipment and supplies.

Outdoor Lighting

Inadequate lighting may also lead to accidents involving falls in parking lots; trips over curbing; falls on a step or stairs from a parking lot to a store; and trips and falls due to holes, cracks, and uneven surfaces.

Recommended outdoor lighting levels for general parking, ramps, and corners, pedestrian areas and entrances are given in reference note *Lighting for Safety and Performance*, RC 628.

Resources

Liberty Mutual Reference Notes

- *Controlling falls on stairways*, RC 5158
- *Lighting for safety and performance*, RC 628

External Resources

- ANSI/ICC A117.1-2009. *Accessible and Usable Buildings and Facilities*, 303 Changes in Level.
- ANSI/ASSE A1264.2 -2012. *Provision of Slip Resistance of Walking/Working Surfaces*.
- ANSI/NEMA Z535.1 – 2006. (R2011). *Safety Color Code*.
- ASTM F1637-13. *Standard Practice for Safe Walking Surfaces*, 5.2 Walkway Changes in Level.
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- NFPA 101, Life Safety Code – 2015 Edition. 7.1.6.2, *Changes in Elevation*.
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