

## **Avoiding 12 Common Mistakes in Slip, Trip, and Fall Prevention**

**David M. Natalizia  
Dynamic Safety, Inc.  
Castle Rock, CO**

### **Background**

Most industries, public spaces, institutions, and municipalities face continued issues with slips, trips, and falls year after year. Countless serious injuries, temporary and permanent disabilities, lost time cases, and minor injuries that lead to loss of productivity and morale occur due to slips, trips, and falls each year. In reality it is not strictly slips, trips, and falls that are the issue in injuries from walking. The category more accurately includes mis-steps, air steps, and upsets in gait that also lead to stumbles and body reaction injuries. For the purposes of clarity in this article, this category of injury will be referred to in traditional terms (i.e. slips, trips, and falls or simply slips and falls). It's also important to recognize that these prevention approaches focus on modes of injury from healthy unimpaired walkers on flat surfaces, though there may be significant applicability to other categories of walker.

This article looks at some of the more common mistakes made by those overseeing facilities or performing safety or loss control functions when it comes to slip, trip, and fall prevention. The following informal ranking presents some real-world examples of those areas and considerations where slip, trip, and fall prevention efforts tend to be less than completely effective. The reader will find that it is not the intense but brief application of one or two key points that will make the most difference in reducing slip and fall risk, but rather coordinated attention to a full range of factors over time.

### **Mistake #12: Starting From Scratch**

Slips, trips, and falls have been around ever since humans have been walking. A certain amount of information about how to control these risks has been around ever since safety has been practiced as a discipline. Not obtaining good reference materials in the early stages of prevention efforts is a notable problem to avoid. In the information age, it may be said that there is an overwhelming amount of information available, and that it is hard to sort out what is current, useful, and practical, especially with a proliferation of questionable and conflicting information available. Fortunately, there are several consensus standards that represent a great starting point for prevention efforts.

Neglecting the use of consensus standards might be called the mistake-within-a-mistake in this regard. Anyone looking to reduce the risks of falls on the same level will be well served to create a written fall prevention policy. A prudent way to begin crafting that policy is to obtain and review two key consensus standards related to this issue, namely;

ASTM F1637: *Practice for Safe Walking Surfaces*<sup>1</sup>

ANSI A1264.2: *Standard for the Provision of Slip Resistance on Walking/Working Surfaces*<sup>2</sup>

The two standards mentioned above cover both the provision for slip-resistance of surfaces, which is crucial for slip prevention, as well as other considerations for the design, construction, and maintenance of floors relating to both slip and trip hazards. There are a number of other useful standards as well, including model and local building codes, the ADA Accessibility Guidelines, and others. The first step in creating or revising your program is to gather and review these materials.

## **Mistake #11: Missing the opportunity to control walking style**

Gait is understood as the manner of walking, including the pace and pattern of footsteps and leg and body motion in walking. Walking style is more than gait, though, and refers to the choices a pedestrian makes while walking, including the speed of travel, directional changes, how they cross obstacles, and similar factors. There are even details of the walking motion that are normally left to reflex (such as tensing of the ankle joint and the angle at which the sole of the foot contacts the ground) that can be voluntarily controlled to reduced the likelihood of a fall. These factors require training and practice for workers to adopt, but they have a great deal of use in training workers to deal with difficult surfaces or obstacles.

There is a place for simple guidelines about walking style in most slip, trip, and fall prevention plans, though, with such simple guidelines as a prohibition on running and a reinforcement of the concept of keeping “eyes on path” while walking or carrying items. Such guidelines fit well into behavior-based safety implementations, and offer the opportunity for progressively more detailed task definitions for movement in the workplace to be instituted.

In the same way that the historically used “fire triangle” describes the risk components for fires (fuel, oxygen, and heat), it may be useful to think of a “slip and fall triangle” with floor factors, footwear factors, and walking style factors making up the three sides of the triangle. The concept is useful when thinking about how reducing any side of the triangle makes risks on the other two sides easier to face, and conversely, an extreme risk on one side of the triangle would require strong controls for the other sides.

## **Mistake #10: Relying on ineffective measurements**

---

<sup>1</sup> ASTM F 1637-95 *Practice for Safe Walking Surfaces*, American Society for Testing and Materials, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959.

<sup>2</sup> ANSI/ASSE A1264.2-2006: *Standard for the Provision of Slip Resistance on Walking/Working Surfaces*, 1819 L Street, NW Washington, DC

The first point to consider under measurement mistakes is the difficulty in evaluating flooring under other than installed conditions. The process used to install and finish a floor, the relationship of a floor to the substrate, and the effect of edges of individual floor elements (such as in tile systems with many small tiles) can all change the slip resistant properties of a floor. There is no substitute for preparing a sample area of the flooring as it will be used, or even better, finding an example of the flooring in installed use to evaluate.

It may also be a mistake to employ the measurement methods employed by flooring manufacturers in their own testing. Some test methods may be well suited for quality control during manufacturing, but not appropriate for evaluation of the potential safety of a walking surface.<sup>3</sup>

A very common issue in the area of measurement of slip resistance is that of wet versus dry testing. Using test methods that cannot provide accurate wet readings to attempt to test a wet surface, or attempting to use dry readings to attempt to predict wet performance are both hindrances to an accurate understanding the performance of a floor. Though it may be tempting to take manufacturers' specifications at face value and dispense with testing altogether, major prevention opportunities will be missed.

Ideally, testing will be done on flooring as it will be installed and used, under expected conditions, with a tester that has been shown to produce valid results when testing wet or contaminated surfaces in the field.<sup>4</sup>

## **Mistake #9: Short flight stairs and other obstacles**

Short flight stairs, with three fewer steps, can be built-in trouble for a pedestrian. In one sense, any change in elevation is a potential hazard which is why falls in high-risk groups such as the elderly are much more prominent at places where there are stairs, thresholds, curbs, or other changes in level. One of the key issues with short flight stairs is that they can be difficult to see and do not always provide the pedestrian the opportunity to prepare for and adapt to the steps that they must take. There are many examples of single riser falls attributed to the pedestrian misperceiving that there is no stair at all.<sup>5</sup>

When used, short flight stairs require prominent visual cues, including marking of the edges of each nosing, appropriate contrast in the color or the flooring and the stairs, and good illumination from both directions of approach. Visual cues alone will not make short flight stairs safe, as there are often situations where a pedestrian is not actively looking at their path, particularly where an area is perceived as low-risk, such as restaurants and entertainment venues.

Good handrails are also very beneficial for short-flight stairs, not just for the walkers to have a place to hang on, but also as an extension of visual cues above the floor. The presence of

---

<sup>3</sup> ASTM C 1028-06 *Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method*, ASTM International, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959.

<sup>4</sup> *State of the art in slip-resistance measurement*, Professional Safety, June 2002, American Society of Safety Engineers, Des Plaines, IL.

<sup>5</sup> *Castro falls, breaks knee and arm*, CNN.com, Atlanta, GA, October 2004.

handrails that are easy-to-see and spaced evenly across a short-flight stair can help with the visual acquisition of the elevation change.

This discussion of elevation changes also applies to other types of changes in level. It is generally required that changes in level of ¼" inch or greater be controlled or removed.<sup>6</sup> Tire stops in parking lots can create a trip hazard, and have the additional issue of often being difficult for pedestrians to see in the midst of a parking lot. There are many other potential surface issues to consider, including thresholds, speed bumps and humps, and gratings and other surface hardware.

Handicap access ramps and other ramps present their own challenges. The slope of these ramps must be maintained at not greater than 1:12, and they are required to feature tapered edges so that there is not as great a risk for pedestrians walking perpendicular to the ramp.<sup>7</sup>

## **Mistake #8: Footwear Issues**

Footwear should be selected for the task at hand. The first considerations are the surfaces that will be encountered, and what contaminants are expected on those surfaces. A mistake often made involves the selection of footwear without regard to these factors. A shoe that would function well in an outdoor environment, traversing loose soil and branches, is not the same shoe that would be preferred for the tile flooring of a restaurant environment.

A shoe needs to serve mobility and support needs, and workers who spend long periods of time on their feet may be sensitive to how a shoe affects their standing comfort. In shoe selection, versatility may bring compromises, meaning that shoes intended to work acceptably for all surfaces might not provide optimum performance on any one surface.

For example a shoe that is meant for use on indoor and outdoor surfaces may need to have sole channels wide enough to not get clogged with organic matter from the ground. Such a wide tread pattern would not be ideal for the wet and oily environment in a production manufacturing setting, where a finer tread pattern might be ideal.

There are other considerations for shoe selection than the tread pattern, including tread composition (hardness and chemical-resistance properties), sole height, support, lacing and adjustment method to touch on a few.

## **Mistake #7: Ignoring pre-loss indicators**

The typical slippery floor will lead to a lot of near-accidents and incidents without injury, sometimes many of these before an injury occurs<sup>8</sup>. It is a profound mistake to assume that just because there have been few or no injuries reported that there is no issue.

---

<sup>6</sup> *Americans With Disabilities Act, Standards for Accessible Design; Section 36.201* , Order No. 1513 - 91, 56 FR 35592, July 26, 1991

<sup>7</sup> ANSI A117.1-1992, *Accessible and Usable Buildings and Facilities*, Council of American Building Officials, 5203 Leesburg Pike, #708, Falls Church, VA 22041.

Consider the example of a large area of smooth, polished floor in a retail environment. Such a floor may be slip-resistant in a dry condition, which is the normal state of the floor, but slippery when it is contaminated with water or other liquids. On this large expanse of floor, identifying the risky condition would typically involve a contaminant ending up on the floor, and someone walking through the contaminant, and that leading to a slip that gets reported either as an area of concern (not following a particular injury) or a report following an injury. The question a safety professional must ask is “Are we capturing information about incidents without injury, or does it take an injury for important information to be communicated?” It has been shown that there is typically progressively smaller number experiences of unsteady steps, slips without falls, and minor falls, leading to an even smaller number of falls with significant injury, which are often the only incidents reported.<sup>9</sup>

Compounding the issue of valuable pre-loss information that may not be captured, some injuries from slips, trips, and falls may be categorized as different injury types, such as when an employee falls and grasps at a piece of equipment to steady themselves but ends up with a lacerated hand which is put in another injury classification category.

Individuals at all levels of an organization need to share an understanding of the importance of this important information that precedes losses. When a customer remarks to a retail clerk that they “almost fell on that slippery spot over there” the clerk needs to be more than empathetic – they need to communicate that information to their management, who in turn need to understand how important it is both for immediate intervention and to communicate that to those who are looking at risks and controls in a broad sense in the organization. Managers should also all understand how the knowledge gained from an incident is typically disseminated.

## **Mistake #6: Less than adequate housekeeping**

Each organization should have a written fall prevention program, including a clear statement of commitment to keeping the work area clean. Sometimes housekeeping is treated as a tired concept and receives cursory mention in training and management. Housekeeping overall is actually one of the most reliable indicators of the safety of an operation, and has been shown to impact the frequency of injuries on a jobsite.<sup>10</sup>

Good housekeeping has several direct benefits to the safety of an operation, including fewer trip hazards, more predictable paths for employees to move throughout the work area, and the ability for problem areas to be seen in contrast from the outside area and noticed more quickly.

---

<sup>8</sup> Chang, W.R., Li, K.W., Huang, Y.H., Filiaggi, A., and Courtney, T.K., “Objective and Subjective Measurements of Slipperiness in Fast-Food Restaurants in the USA and Their Comparison With the Previous Results Obtained in Taiwan,” *Safety Science*, Orlando, FL, Vol. 44, No. 10, 2006

<sup>9</sup> DiDomenico, A. and McGorry, R.W., “The Relationship Between Slip Distance and Perceptions of Slipperiness and Stability,” *Proceedings of the Human Factors and Ergonomics Society 48th Annual Meeting*, New Orleans, LA, pp. 1449-1453, 2004

<sup>10</sup> *Electrical Contractors Industry Focus Group Report*, SHARP Program  
Washington Department of Labor and Industries, Olympia, WA December, 2004

Indirect benefits to a housekeeping program include an increase of the general sense of safety of an operation, managers being able to build a foundation of control in the work environment (as opposed to disorder), a greater sense of pride and ownership amongst employees, and lastly, fewer questionable claims arising out of possible hazards in a workplace in disarray.

## **Mistake #5: Relying on single-factor solutions**

There are many solutions readily suggested to slip, trip, and fall issues, including floor finishes and treatments, footwear, warnings, and spill response protocols. Though one approach might well be identified as the top priority to impact the issue, a solution that addresses one area introduces challenges to the ultimate goal of risk reduction. One of the prime challenges is that even the best single-factor solutions leave areas of risk that may then be peripheral enough that an employer may overlook them until an incident occurs.

Some examples of this type of situation include:

Example 1: A written policy put in place, but training is not arranged to reach all levels, or necessary equipment and physical modifications are not made. A written policy may be an ideal first step, but the written program must be supported by action.

Example 2: A footwear program is put in place; but visitors, vendors, customers are not factored into the program and are left unprotected. Guest shoe covers and footwear policies are important, as are efforts to ensure that good floors are present and contaminants are controlled.

Example 3: A floor finish is applied to a problem floor, but neighboring areas may still have slip and fall risks. In some situations it may be necessary for a chemical treatment may be best applied to one area, a coating to a second, and a third area may need to be replaced altogether.

The challenge in the face of single factors is this: Can you focus on the area that can make the largest impact the soonest while not forgetting the other issues that are not solved by the key solution?

## **Mistake #4: Unresponsive contaminant control**

The contaminants expected on a given floor could be primarily weather-related in certain public spaces, they might be food debris in a kitchen, where in industrial operations, contaminants might include substances such as lubricants, cooling water, antifreeze, or process solutions. Knowing what contaminants to expect, and under what circumstances to expect them is a key for slip, trip, and fall prevention. In public operations, this usually means an inclement weather policy, and in industrial operations this usually means a systematic approach to contaminant control that takes into account substances, control measures, and physical and administrative control elements.

Ongoing control of contaminants is different than spill response, especially in the sense that contaminants can be foreseen relatively accurately most of the time, whereas spills may be expected, but the frequency, timing, nature, and extent of spills is usually highly variable. A

written fall prevention and safety policy should include a specifically customized section on contaminant control.

Approaches to dealing with contaminants follow a standard hierarchy of risk controls for the most part.<sup>11</sup> The approach begins with the elimination of contaminants where possible; continues with the reduction of the amounts experienced; the reduction of the hazardous nature of the contaminants (for example, using a less slippery coolant in an industrial process environment) and then proceeds to controlling the spread of the contaminants; making the surface more able to maintain traction while contaminated; removal of the contaminant; warnings; work rules designed to minimize exposure to the contaminants; and finally includes slip-resistant footwear.

There are many other possible measures that were not mentioned in the preceding list, such as the addition of mats or altering ventilation to help in the evaporation of water-based contaminants. Even from the limited examples given, though, it is easy to see how real-world considerations might change what makes sense for a given operation. The question to return to is what contaminants are expected, under what circumstances, and what the overall options are for control of those contaminants. Any approach to contaminant control must be responsive to these conditions.

### **Mistake #3: Lack of proper cleaning procedures**

Cleaning procedures is another area where a written fall prevention and safety policy comes into play. Establishing what is expected for cleaning procedures is the foundation for all maintenance and upkeep of walking surfaces. Problems with cleaning procedures range from poor spill response, to improper daily cleaning, to insufficient or nonexistent deep cleaning.

Spill response is one of the most important aspects of cleaning. An understanding of the importance of proper spill response among all employees will enable fast, consistent, and thorough response. A clear protocol for spill cleanup would include how spills are detected and communicated, how they are secured until cleanup, who performs cleanup, what equipment the use and where it is kept, the actual steps for the cleanup, and how the cleanup is verified and checked.

The other prominent areas of cleaning procedure that require attention are daily cleaning procedures and deep cleaning. Important considerations for these are the selection of tools, chemicals, and methods that will remove the expected soil and residue from the surface. Daily cleaning often needs to be supplemented with periodic deep cleaning which serves both to prevent build-up on the floor and keep the edges and detail areas in appropriate condition over time. Cleaning schedules need to be adjusted based on the environment and conditions, the appropriate level and frequency of cleaning cannot be determined without knowing those specifics.

### **Mistake #2: Selecting flooring material that is inappropriate for the application**

---

<sup>11</sup> *NIOSH Program Portfolio – “Engineering Controls,”* National Institute of Occupational Safety and Health, Washington D.C. 2006

There are no floors that are safe under every condition, just as there are few floors that are unsafe for every condition and usage pattern. When a flooring material is selected without regard to where it will be installed, how it will be used, what contaminants are expected, a gamble on safety is being made. A polished marble floor may be safe and appropriate for installation in a viewing area of an art gallery that does not allow food or beverages indoors and monitors that policy with docents, while a brushed concrete floor with significant texture may not provide an adequate level of traction for a petroleum processing environment where oil is frequently present on the ground.

Manufacturers of flooring products may refer to “excellent slip resistance” in their product materials, but that often is a relative description. Knowing that a flooring sample was tested in an installed condition, with the expected contaminants, by a reliable test method goes a long way towards gaining confidence about a material selection. Manufacturers’ information can be a helpful guide, but it is seldom possible to determine all those factors without performing some specific evaluation for the application in question.<sup>12</sup> One particular issue with test specifications is the use of test methods that are not reliable in wet conditions to predict the wet or contaminated performance of a flooring material.

If a flooring sample can be installed to test under actual conditions, that is ideal. If this is not possible, finding other examples of similar installations in other facilities is the next best thing, and if the building owners have information about performance over time that they are willing to share, it can be even better than a limited trial.

## **Mistake #1: Lack of proper follow-up**

For any of the items previously discussed, there are often issues with some initial attention to a prevention factor, but a larger and more common issue is the lack of follow-up over time. The author has observed many operations where key prevention elements were begun or in regular use at one time, but were not sustained. Written policies need to be revised and updated often and based upon experience and data.

Follow-up begins with an understanding of the goals of the risk controls that have been put in place and what the crucial elements for success of the given control are. For engineering and physical controls, there are issues to be considered with performance related to specifications, maintenance and repair over time, and the degradation of performance over time. For administrative controls, there are issues with the definition, application, and oversight of procedures. For all controls the larger concern is always the effectiveness of the measures that have been taken.

Potential problem areas need to be identified as they arise, and fixes implemented in a timely manner when hazards are identified. Post-incident information needs to be put to good use, as well as information gained from incidents without injury. Interventions and prevention efforts need to be tracked to evaluate effectiveness. Previous efforts that did not take hold or continue

---

<sup>12</sup> Li, K.W., Chang, W.R., Leamon, T.B., and Chen, C.J., “Floor Slipperiness Measurement: Friction Coefficient, Roughness of Floors, and Subjective Perception Under Spillage Conditions,” *Safety Science*, Vol. 42, No. 6, Orlando, FL 2004

over time might be still be the right solution. The solution in such situations is often not coming up with a new approach; it is revisiting a previous approach with focus and consistency.