

WHAT IS A SAFE FLOOR?



Of all the surfaces we come in contact with on a daily basis, the walkway surface is the most common. Adults in America walk on average between 3 and 4 miles per day requiring between 6-8,000 individual steps. In a year that's about 2,750,000 individual steps. Taking that many steps, it seems like most adults should be pretty good at walking, yet, on any given day hundreds of people slip, trip and fall and some are severely injured.

Much research has been done on walking and the research shows that our individual walking style is a function of early life learned behavior that relies heavily on our own "reflex activity"¹. The speed and length of our gait, the height of our step, heel and toe pressure, where we look etc.... are all individual traits that we develop over time and intuitively rely on as adults when we walk. Once we've mastered it, walking is an unconscious behavior and, spending so much of our time walking, it is a behavior that is not easily altered².

People don't plan to go out in public and slip or trip and fall down. Building owners don't plan on their patrons visiting their facility and slipping or tripping and falling down. Every slip trip and fall injury has a story and not surprisingly, there are often common factors.

The first factor is user expectation. What are the *user's expectations* of a walking surface? Likely these expectations include;

1. That the flooring surface is appropriate for its intended use and;
2. That it has been installed correctly and;
3. That it is maintained such that it is free from hazardous conditions.

In other words, the general public should expect a safe floor in the environments that they visit. The National Safety Council publication [Injury Facts, 2012](#), identified that falls in the workplace account for greater than 13.4 billion dollars a year in worker compensation

claims. These figures do not include slips, trips and falls which occur outside the workplace in such places as grocery stores, restaurants, retail environments, sidewalks, parking lots, your home and the like.

Including these injuries, the figures grow substantially. The most common causes of these incidents are listed by the National Safety Council as:

- Uneven walking surfaces (trip)
- Spills (slip)
- Loose matting (slip or trip)
- Weather related conditions such as snow and/or ice (slip)
- *Inappropriate footwear*³
- Disrepair of the walkway surface (slip or trip)
- Highly polished surfaces which do not allow for adequate footwear traction (slip)
- Low obstructions in the walkway (trip)
- Clutter (trip)

Any one of these hazards can cause a slip trip and fall incident

and the presence of these hazards can make the walking surface dangerous.

Codes and standards for providing safe walkways based upon the prevention or elimination of these hazards have been nationally recognized and adopted. It seems reasonable that a user should expect that the walkway surface complies with the published codes and standards and be free of hazardous conditions.

Let's look more closely at these common hazards and how they affect walkway safety.

First, trips. What do we mean by trip?

A trip is the sudden or momentary stopping of the foot that prevents it from normal and continued forward motion. A trip occurs when something interferes with or interrupts our normal walking behavior⁴. As we walk our foot is raised above the ground with a small clearance during its' forward swing. This clearance may be as low as about three eighths of an inch. An obstacle that interrupts the foot's forwards swing can cause a trip. Examples of these obstacles include mis-aligned sidewalk joints, a change of flooring materials, an inappropriate door threshold, foreign objects, or a parking lot speed bump.

A trip can also occur due to a surface defect of the walkway. A depression or hole in the walkway surface that when stepped in will cause the foot to catch its leading edge.

Another type of trip is often referred to as an air-step or stumble. A stumble can cause a sudden loss of balance. A stumble occurs due to the lack of foot support by the walkway surface. For example, stepping off a curb, or the edge of sidewalk, or stepping onto a sloped surface from a flat and planar surface, can all lead to a loss of balance and a fall.

A trip can also occur at the transition between two separate walkway surface materials, such as carpet and tile. If the surface characteristics between the two are substantially different, a persons' expectation of the walking surface may be violated and they can lose their footing.

In order to prevent trips through the maintenance of safe walkways then, the walkway should be flat and planar to provide support of the foot as people walk. It should gently transition from flat to sloped to prevent air steps and stumbles. It should be free of surface defects that people may step into. It should be free of low obstacles that can interrupt the normal walking gait and if conditions of the walkway are changing, it should be obvious

to the person walking on it.

Another injury event is a slip. A slip is very different than a trip.

A slip is the failure or lack of available traction between the footwear and the walking surface causing the foot to slide. The available traction of a walkway surface is often referred to as its slip resistance. As people walk, they are generally aware of the surface they are walking on, and the available traction. A slip most often occurs when there is a sudden, abrupt or unrecognized change in slip resistance (lower) between a persons' footwear and the walking surface. A slip may happen in either the forward or backward direction of the foot, depending upon how and where the foot strikes the walkway surface.

A change in slip resistance can occur for various reasons including a change in surface material, the presence of a contaminant, (spill) or a change in walkway slope, amongst others. When people encounter any one of these changes they may not recognize it. Once encountered, they may not be able to adjust their gait sufficiently or may not be able to react quickly enough to arrest the slip and prevent a fall. Sometimes the conditions are such that a reaction isn't possible at all.

Like trips, there are nationally



recognized standards related to the prevention of hazards that cause slips on walkway surfaces. A primary factor in the slip resistance of a walkway surface is the available traction, or coefficient of friction (CoF). For normal walking environments, on a flat and planar surface for people of normal physical ability⁵, a CoF of 0.50 has been recognized as safe. This is a relative value between a surface that provides no slip resistance (0.0) and a rough surface that effectively allows no slip (1.0).

To provide a point of reference, in our own experiences we know that people can walk on ice and we've likely seen people slip on a bathroom floor. Ice has a CoF of about 0.20 while an average concrete floor with no surface treatment has a CoF of about 0.80. The CoF value is not usually enough to define a floor as a safe walking surface. There are many factors that should be considered in the determination of a slip resistant walkway. These factors include:

- Contaminated surfaces
- Wet or dry conditions
- Foreseeable activities
- Foreign objects

In public environments, the walkway surface is subjected to various contaminants. Soap, water, soup, salad dressing, oil, fruit, any substance that is on the walkway surface that is not intended to be there

is a contaminant. And all of them will have an effect on the available traction of the walkway.

For expected activities a floor should have characteristics that make it slip resistant. A sense of the potential contaminants that could affect its slip resistance should be considered. For example, a High school gymnasium has different foreseeable activities than the ladies department at a department store. The likely contaminants are also different. The location, environment and expected activities should provide guidance on flooring selection and the methods of keeping the floor contaminant free, or slip resistant, is important to the safety of the walking surface.

Another type of slip that occurs is where a third material exists between the footwear and the flooring surface such as a carpet runner, walk off mat or a paper floor protector. In these situations the third material is often the cause of the slip and careful consideration to the type of runner or floor protection needs to be made before its use.

In order to prevent slips through the maintenance of safe walkways then, the walkway should be free of un-intended contaminants. The flooring should be selected based upon foreseeable uses and activities. The use of mats, runners or other such flooring protective

devices should be selected to maintain the CoF of the flooring that exists without the protective covering.

The relationship between the walkway surface material, its condition, the activities occurring and the participants involved provides a broad range of variables that can all affect an opinion of whether a floor is reasonably safe.

Hence, there are four primary factors that should be considered in determining whether or not the flooring in any given environment is "safe".

The first is **flooring selection**. Does the flooring material and its' characteristics match the intended use of the floor?

The owner of a facility is in the best position to establish what activities are expected in any given environment, and therefore what floorings are appropriate for that use. Owners are expected to have firsthand experience and knowledge of their business and facility and the expected activities to be engaged in by both their staff and patrons.

Whether the owner makes the flooring selection themselves or works with an architect, manufacturer representative or contractor, the selection of the appropriate flooring is the first step in ensuring a safe floor.

SOURCES:

1. Hyde, Accidental Falls 1996
2. Ibid
3. Inappropriate footwear is highlighted because it is not a factor that can be controlled by the walking surface.
4. Hyde , Accidental Falls, Their causes and their injuries, 1996
5. Assessment of walkway tribometer readings in evaluating slip resistance Journal of Forensic Science, March 2007
6. ACI 302.1R Guide for Concrete Floor construction

Just behind flooring selection is **proper installation**. Once a floor is selected, it must be installed correctly. The right flooring installed in the wrong manner is the same as having the wrong flooring. Any number of installation problems can lead directly to continued maintenance and repair issues, and worse yet, injury. All flooring manufacturers including concrete⁶ provide written instruction on the proper installation and tolerances that must be maintained during installation to ensure a safe floor. A key component of ensuring a safe floor is a warranted and certified floor installation by those with the experience and knowledge to install it properly.

The third component is **flooring maintenance and repair**. Is the floor surface kept in an appropri-

ate state of repair for the intended uses?

Proper maintenance and repair techniques are the responsibility of the owner. Whether it's a grocery store or a Gymnastics studio, virtually all flooring manufacturers provide written instruction on the maintenance and repair of their products. Following the manufacturers' instructions for maintenance and repair is essential to maintaining a safe floor.

Finally there is **Floor management**. Any floor can be deemed unsafe when it is used in an un-intended way. The owner must provide clear and sensible rules and regulations regarding the activities permitted in any environment. They must manage their facility to permit only those activities for which the en-

vironment is suitable. Many injury incidents have occurred because what a participant thought was an acceptable activity in an environment, was not.

A safe floor then, is a floor that meets or exceeds the users' expectation for its foreseeable use. A failure of the flooring to meet those expectations is likely to result in injury.

Building owners who prescribe to these four basic guidelines are more likely to meet or exceed the patrons' expectations of the flooring and less likely to find themselves in a costly slip trip and fall lawsuit.

SLIP TRIP & FALL INVESTIGATIONS

The Premises Safety team at Robson Forensic is trained to investigate cases involving the design, construction, operation, and maintenance of residential, institutional, and commercial premises. We conduct site inspections, perform tests, and review applicable standards to learn facts and form opinions about how and why individuals were injured within the built environment.



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