SLIPS, TRIPS AND FALLS: A PRIMER

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Abstract: *This article presents basic issues to be considered by attorneys, insurance professionals, and accident experts when analyzing many types of pedestrian falls. The following information is intended as a "primer" and does not purport to represent a detailed treatise on the subject of pedestrian accidents beyond the intended scope of this article.*

The Americans with Disabilities Act (ADA) has created a greater sense of awareness for attorneys and engineers when analyzing slip/fall and trip/fall cases. The purpose of this article is to (1) briefly explain the physical dynamics in both slip/fall and trip/fall case and (2) to suggest current standards governing these conditions.

Although elementary, let's first consider the basic differences between slips and trips since, as an engineer analyzing both type accidents, I'm constantly amazed that many victims of these events are confused, calling a "trip" a "slip" and vice versa. The disparity between these two events require totally different analysis techniques which can be costly if not defined at the onset.

A "slip" simply occurs when one surface slides across another and is analyzed by evaluating the static coefficient of friction (SCOF). It's generally accepted that a SCOF of 0.5 or greater indicates a "safe" walking surface. Alternatively, a "trip" most often occurs when the foot's forward motion is suddenly stopped by a protrusion above the walking surface. Of course, trips also occur when the walking surface unexpectedly changes in elevation or "falls away" resulting in a "missed step."

Trip/falls are the more basic type accident and will be discussed first. A trip often occurs when a "change in level" of 1/2" or more occurs within a walkway (although most experts would agree that a 1/4" difference in level is sufficient to cause a person to trip. For example, the 1991 Uniform Building Code (UBC) states in Section 3304 (i):

Floor Level at Doors. Regardless of the occupant load, there shall be a floor or landing on each side of a door. When access for persons with disabilities is required by Chapter 31, the floor or landing shall not be more than 1/2 inch lower than the threshold of the doorway. Although the UBC references doorways and not other walking surfaces, this 1/2" mandate is reinforced in the landmark 1990 Americans with Disabilities Act (ADA). The ADA utilizes two design standards, those being *The Code of Federal Regulation, 24 CFR, Part 40, Accessibility Standards for Design, Construction, and Alteration of Publicly Owned Residential Structures* and essentially, The American National Standard Institute (ANSI) A117.1-1986, titled, *Providing Accessibility and Usability for Physically Handicapped People*. This latter standard was revised and reissued as an appendix to Title III of the ADA and is titled *Americans with Disabilities Act Accessibility Guidelines* (ADAAG).

The ANSI 117.1-1986 Standard, Section 4.3.8 Changes in Levels, states:

If an accessible route has changes in level greater than 1/2 in (13mm), then a curb ramp, ramp, elevator, or platform lift shall be provided....
The "bottom line" is that changes in elevation of 1/2" or more are inherently dangerous and should be avoided.

Slippery surfaces present a greater degree of complexity and is analyzed by assessing the coefficient of friction (COF) or simply, the degree of slipperiness. It's extremely important to understand that "static" friction is the force present when the slip begins whereas, "dynamic" friction occurs during sliding. Attorneys and experts alike should be most concerned with static COF, that being the overwhelming standard utilized in the United States. It's crucial to know if your expert supports static or dynamic COF since the latter is approximately 75% less, indicating a potentially misleading and more slippery condition!

To compute the COF, the expert basically measures the force required to pull a known weight (properly supported on a "standard grade" shoe leather). The COF is then calculated by dividing the pulling force by this predetermined test weight. As an example, if a 5 pound pulling force was required to move a 10 pound weight across a concrete sidewalk, the COF is 0.5 (5 lbs. divided by 10 lbs.). In the case of non-level surfaces such as ramps, a mathematical adjustment must also be made to correct for the angle involved. Although the procedure to calculate COF is relatively simple, most test apparatus, such as the Horizontal Pull Slipmeter (HPS), simplify this procedure and allow the user to read the COF direct.

A COF of 0.5 is generally accepted as the minimum threshold for a safe walking surface. In other words, a COF lower than 0.5 represents an unsafe condition whereas, a COF of 0.5 or greater is acknowledged as safe. Although the UBC and ADA fail to specify an acceptable value, a minimum acceptable COF of 0.5 has been recognized by Underwriters' Laboratories, Liberty Mutual, National Bureau of Standards, Occupational Safety and Health Administration (OSHA),

and the American Society of Testing and Materials (ASTM). The ADA however, recommends a higher minimum SCOF value of 0.6 for flat surfaces and 0.8 for ramps. In essence, a COF of 0.5 should be considered the **minimum** value for a safe wet or dry walkway surface.

Wet surfaces can present a unique problem since the SCOF of wet surfaces often cannot be measured directly with standard protocol due to the effects of "adhesion" present in some test procedures. The best any expert can do under these conditions is to measure the "dry" SCOF and adjust it to those representative of "dynamic" conditions (approx. 75% of dry, static COF, for water saturated surfaces). As a forensic engineer, I support this method since most wet surfaces provide a lubricating effect, thereby simulating conditions similar to dynamic (sliding) friction.

From the victim's vantage point, he/she experienced an embarrassing accident which likely culminated in varying degrees of discomfort represented by a range of physical trauma from skin scrapes to broken bones. From an engineering expert's perspective, a slip or trip and fall accident can be explained by the appropriate principles of engineering and physics. From an attorney's point of view, these issues must be clearly understood, hopefully void of complexity, and easy to covey to insurance companies, judges, juries, and arbitrators. Hopefully, this article has provided an acceptable (albeit brief) explanation of the standards and technical issues of slip/fall and trip/fall accidents.

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