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The Problem **Preventing Injuries from Slips, Trips and Falls**

In 1999, over one million people suffered a slip, trip or falling injury, and over 17,000 Americans died as a result. Of the estimated 3.8 million disabling injuries each year in the work force, 15 percent are due to slips, trips, or falls, which account for 12 to 15 percent of all Workers' Compensation costs. About 5,100 workers died from a fall in 1999.

The average direct cost for one disabling injury now approaches \$28,000. Conservative estimates of indirect costs are significantly higher at \$46,000. In the case of a death on the job, the average cost has recently been estimated at \$940,000. Add to these the personal and family costs and trauma, and it is evident that slips, trips and falls should be avoided.

A thorough analysis of falls in Florida agriculture was conducted in 1991, based on an analysis of Workers' Compensation records. Falls accounted for nearly 25 percent of all serious disabling work injuries: 17 percent were elevated falls, 8 percent were same-level falls. Elevated falls accounted for 26 percent of the injuries in fruit and vegetable production occupations. Same-level falls accounted for 12 percent in both livestock and horticultural production occupations.

Same-level falls were on walking or working surfaces in 76 percent of the incidents.

The back was the most frequently injured part of the body in falls: 37 percent of the injuries were from elevated falls, while 29 percent were from same-level falls. The joints -- wrist, elbow and shoulder, or the ankle, knee and hip -- accounted for 32 percent of elevated falls and 47 percent of same-level falls.

Most injuries are sprains and strains: 52 percent from elevated falls, 46 percent from same-level falls. Fractures are the result of 19

percent of elevated falls and 10 percent of same-level falls. Bruises and contusions account for most of the remaining injuries.

Types of Falls

Falls are of two basic types: elevated falls and same-level falls. Same-level falls are most frequent, but elevated falls are more severe.

- Same-Level Falls: high frequency--low severity
- Elevated Falls: lower frequency--high severity

Same-level falls are generally slips or trips. Injury results when the individual hits a walking or working surface or strikes some other object during the fall. Over 60 percent of elevated falls are from less than 10 feet.

Same-Level Falls

Examples of same-level falls are described below.

Slip and Fall

Slips are primarily caused by a slippery surface and compounded by wearing the wrong footwear. In normal walking, two types of slips occur. The first of these occurs as the heel of the forward foot contacts the walking surface. Then, the front foot slips forward, and the person falls backward.

The second type of fall occurs when the rear foot slips backward. The force to move forward is on the sole of the rear foot. As the rear heel is lifted and the force moves forward to the front of the sole, the foot slips back and the person falls.

The force that allows you to walk without slipping is commonly referred to as "traction." Common experience shows that dry concrete sidewalks have good traction, while icy surfaces or freshly waxed floors can have low traction. Technically, traction is measured as the "coefficient of friction." A higher coefficient of friction means more friction, and therefore more traction. The coefficient of friction depends on two things: the quality of both the walking surface and the soles of your shoes.

To prevent slips and falls, a high coefficient of friction (COF) between the shoe and walking surface is needed ([Figure 1](#)). On icy, wet, and

oily surfaces, the COF can be as low as 0.10 with shoes that are not slip resistant. A COF of 0.40 to 0.50 or more is needed for excellent traction. To put these figures in perspective, a brushed concrete surface and a rubber heel will often show a COF greater than 1.0. Leather soles on a wet smooth surface, such as ceramic tile or ice, may have a COF as low as 0.10.

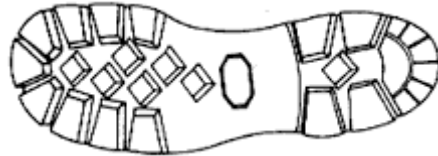


Figure 1. Shoes with soft rubber soles and heels with rubber cleats provide a high coefficient of friction (COF).

Providing dry walking and working surfaces and slip-resistant footwear is the answer to slips and their resultant falls and injuries. Obviously, high heels, with minimal heel-to-surface contact, taps on heels, and shoes with leather or other hard, smooth-surfaced soles lead to slips, falls, and injuries. Shoes with rubber-cleated, soft soles and heels provide a high COF and are recommended for most agricultural work.

In work areas where the walking and working surface is likely to be slippery, non-skid strips or floor coatings should be used. Since a COF of 0.40 to 0.50 is preferred for walking and working surfaces, we should strive for a surface which provides a minimum of 50 percent of this friction. If the working surface is very slippery, no footwear will provide a safe COF.

Trip and Fall Trips occur when the front foot strikes an object and is suddenly stopped. The upper body is then thrown forward, and a fall occurs.

As little as a 3/8" rise in a walkway can cause a person to "stub" his toe resulting in a trip and fall. The same thing can happen going up a flight of stairs: only a slight difference in the height of subsequent steps and a person can trip and fall.

Step and Fall Another type of working and walking surface fall is the "step and fall." This occurs when the front foot lands on a surface lower than expected, such as when unexpectedly stepping off a curb in the dark. In this type of fall, the person normally falls forward. A second type of step and fall occurs when one steps forward or down, and either the inside or outside of the foot lands on an object higher

than the other side. The ankle turns, and one tends to fall forward and sideways.

Contributing Factors

Proper housekeeping in work and walking areas can contribute to safety and the prevention of falls. Not only is it important to maintain a safe working environment and walking surface, these areas must also be kept free of obstacles which can cause slips and trips. One method which promotes good housekeeping in work environments is the painting of yellow lines to identify working and walking areas. These areas should never be obstructed by objects of any kind. Adequate lighting to ensure proper vision is also important in the prevention of slips and falls. Moving from light to dark areas, or vice versa, can cause temporary vision problems that might be just enough to cause a person to slip on an oil spill or trip over a misplaced object.

Carrying an oversized object can also obstruct one's vision and result in a slip or a trip. This is a particularly serious problem on stairs.

Behaviors that Lead to Falls

In addition to wearing the wrong footwear, there are specific behaviors which can lead to slips, trips, and falls. Walking too fast or running can cause major problems. In normal walking, the most force is exerted when the heel strikes the ground, but in fast walking or running, one lands harder on the heel of the front foot and pushes harder off the sole of the rear foot; thus, a greater COF is required to prevent slips and falls. Rapid changes in direction create a similar problem.

Other problems that can lead to slips, trips and falls are: distractions; not watching where one is going; carrying materials which obstruct view; wearing sunglasses in low-light areas; and failure to use handrails. These and other behaviors, caused by lack of knowledge, impatience, or bad habits developed from past experiences, can lead to falls, injuries, or even death.

Slip-Resistant Materials

Abrasive coatings can be applied to concrete, metal and wood surfaces to increase the COF and reduce the risks of slips and falls. Many of these products can be applied like paint; others can be troweled on in a thin coat. These coatings are formulated to resist

grease, oil, water and a wide range of chemicals. Most paint and building supply companies handle these materials. It is important, however, to purchase the correct product for your particular problem, since some are enamels or epoxies which contain a rough, hard, gritty material with a high COF.

There are also a number of skid-resistant products that can be purchased in strips or rolls. These may have a pressure-sensitive backing or be applied with a special glue. They are designed for easy application to stair treads, ramps and other hazardous walking and working surfaces.

Another effective skid-resistant material is rubber or rubber-like mats. This material is long-wearing and skid-resistant on both the top and bottom sides. Hard rubber or hard rubber-like mats are ineffective because they have a low COF when wet.

Signs and Stripping

Safety signs to remind people of slip, trip and fall hazards are certainly always helpful, particularly where hazards cannot be removed or corrected. Such signs should be changed frequently. Recent evidence indicates that "humorous" warnings are more effective than simple warning signs. "CAUTION-WET FLOOR" is less effective than "WET FLOOR--SKATE, DON'T SLIP".

Yellow stripping to identify walking and working areas are most effective if their meaning is enforced. Striped areas should mean that no object should be placed in these areas. Dropped and spilled materials should be removed immediately.

Learning How to Fall

Naturally, the goal is not to slip, trip and fall; however, the possibility of a fall still exists. There are correct ways to fall, however, the recommended procedures are:

- **Tuck your chin in, turn your head, and throw an arm up. It is better-to land on your arm than on your head.**

- **While falling, twist or roll your body to the side. It is better to land on your buttocks and side than on your back.**
- **Keep your wrists, elbows and knees bent. Do not try to break the fall with your hands or elbows. When falling, the objective is to have as many square inches of your body contact the surface as possible, thus, spreading out the impact of the fall.**

More about Shoes and Boots

According to the National Safety Council (NSC), there are 110,000 injuries each year to the feet and toes of United States workers, representing 19 percent of all disabling work injuries.

The most important protection is to wear the proper footwear for your work and environment. In most agricultural occupations the shoes or boots should provide three major types of protection.

- The soles and heels should be slip-resistant
- The toe of the shoe should resist crushing injuries
- The shoe should support the ankle.

ANSI sets standards for shoes and boots. Never purchase work shoes that do not meet these standards. A typical ANSI rating could be 1-75 C-25. This means the toe will withstand 75 foot pounds of impact and 2,500 pounds of compression.

Chevron or cleat-designed soles are definitely the best for slippery situations because of the suction or squeezing action they provide. The softer soles are better for slippery indoor conditions; the harder, more rugged cleat-type sole is preferred for tough outdoor use.

Leather covering the foot and ankle portion of the foot is preferred in most work environments. However, when working in wet environments or around chemicals, oils, greases or pesticides, boots made of polyvinyl chloride (PVC), a blend of PVC and polyurethane, or neoprene should be used. Rubber is satisfactory for wet conditions, but not with pesticides or petroleum products.

When purchasing work shoes or boots, it is best to purchase them from a reputable dealer who handles quality footwear. A dealer who is informed of your work and work environment will be able to provide

the correct footwear for you. Quality footwear for work is expensive; but not nearly as expensive or painful as broken foot bones or other injuries from a slip, trip or fall.

Recommendations

Established policies and practices can be implemented to significantly reduce the number of injuries and deaths due to slips, trips and falls.

The following recommendations are provided for your consideration:

Owners, managers and supervisors must make a commitment to prevent accidental slips, trips and falls.

Regular frequent inspections of working and walking areas should be conducted to identify environmental and equipment hazards which could cause slips, trips and falls. Special attention should be given to the working and walking surfaces, housekeeping, lighting, vision, stairways and ladders. Immediate corrective action should be taken. Extensive safety training on the prevention of slips, trips and falls should be provided for all new employees. Regular retraining should be provided for all employees. Special attention should be given to proper walking, carrying, climbing and descending stairways, ladders, vehicles and equipment. Unsafe practices should be corrected immediately.

All workers should wear proper footwear for their work and environment whether in the office, shop, plant, feedlot or field.

No riders should be permitted on tractors, trucks or other self-powered or towed equipment unless a safe seat or workstation is provided.

All slips, trips and falls, with or without injury, should be reported, recorded and thoroughly investigated. Corrective action to prevent such a repeat occurrence should be taken immediately.

Slips, trips and falls whether on or off the job are expensive, disruptive, painful, and may be tragic.