Preventing Slips and Trips at Work
# Preventing Slips and Trips at Work

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1 Introduction

Accidents in workplace not only cause injuries and sufferings of the worker and their families, but also affect the business on the employer’s side, for examples: loss of manpower, sick pay, loss of production, loss of time, increase in insurance premiums, potential legal costs and damage of company’s reputation. Organizations should establish a safe system of work and working environment in order to prevent the occurrence of accidents at workplaces.

Occupational Injuries in All Workplaces analysed by Type of Accident

![Pie chart showing the distribution of occupational injuries]

In order to prevent accidents effectively, it is necessary to identify all the possible causes and impose proper control measures. Review of the accident statistics in recent years shows that slip, trip or fall on same level is the most frequently recorded type of accident which accounts for about 20% of the reported occupational injuries in all workplaces. If risk of slip and trip can be effectively controlled through good health and safety arrangements, it can help to reduce the number of accident.
2 Slip and Trip Accidents

Slips and trips are often regarded as non-fatal injuries. Actually, slips and trips may not only lead to bruises and sprains, but more serious injuries may also be resulted. For example:

- Collision with hard objects
- Collision with fine-pointed or sharp-edged objects
- Collision with moving parts of dangerous machineries
- Falling onto the hot surfaces of machineries or flame
- Falling into corrosive substances
- Falling from a height
- Falling into a hole or ditch
- Falling into river or water bodies and get drowned
3 Identification of Slipping and Tripping Hazards

3.1 Slipping Hazards

Good friction between our shoes and the floor is essential for walking in a controlled manner. Friction when walking is particularly important immediately after the heel of the leading foot strikes the ground, when the toe of the trailing foot is pushing off for the next stride, and when making a sudden change of direction. Without sufficient friction at these critical phases of walking, a slip is most likely to occur.

3.2 Causes of Slipping Hazards

Environmental factors:

- Spillages of liquid or solid materials
- Wet cleaning methods
- Wind-driven rain and snow through doorways
- Sudden change in floor surface, say from carpet to polished timber
- Change from wet to dry surface
- Dusty and sandy surfaces
- On a ramp where the floor begins to slope downwards
- Loose or bumpy carpets and mats
- Low light levels

Individual factors:

- Use unsuitable footwear
- Low awareness of occupational safety and health at work
- Failure to follow safety rules and regulations
3.3 Tripping Hazards

A trip happens when the pedestrian fails to notice a low obstacle in the path leading to loss of balance and fall. Obstacles, whether permanently or temporarily placed, may be the objects left lying around after work can easily go unnoticed and cause a trip.

3.4 Causes of Tripping Hazards

- Ridges in floors or carpets
- Holes worn in floors or tiles
- Potholes and cracks in floors
- Changes in floor level
- Thresholds and doorstops
- Floor sockets and phone jacks
- Cables from power extension units
- Temporarily stored stocks or miscellaneous items
- Opened drawers or cabinet doors
- Untidy tools and miscellaneous items left unattended after work
4 Control of Slipping and Tripping Hazards

In order to effectively control slipping and tripping hazards, it should be targeted to control the causes of the hazards. Prevention of slips and trips starts with good design of the workplace, follows by good housekeeping and cleaning practice, provision of staff training and use of appropriate footwear.

**Design**
- Design of facilities
- Modification of work process

**Housekeeping**
- Eliminate slipping hazards
- Eliminate tripping hazards
- Improve floor conditions and slip-resistance

**Safety Training**

**Personal Protective Equipment**

Prevention of slips and trips should be considered at the design stage.
5 Control Measures

5.1 Design

The best way to eliminate the problems of slips, trips and falls is to build and design workplaces with safety and comfort in mind. There is no universal set of specifications which can cover all industries, but some basic matters are common to most. Before drawing up a set of specifications for workplace design, be clear about the potential hazards through analysis of work tasks and the circumstances in which they will be carried out. The following are some general matters which can be specified in the design of workplace.

5.1.1 Design of Facilities

- Minimize changes in the floor level. If levels must change, pedestrian connections are preferably by ramp rather than steps. The maximum ramp slope should be 1 in 12.
- Use slip-resistant floor tiles
  - The Coefficient of Friction should not be less than 0.5 (ANSI A1264.2).
- Avoid sudden transitions in floor surface texture if possible. Where such transitions do occur, ensure good lighting and visual cues highlight the change.

Stair Design

- All risers and treads must be uniform throughout a flight of stairs.
- Variations in the ‘riser’ and ‘tread’ should be reasonable: the riser ranges from 150-175mm and the tread ranges from 225-320mm; trips can be easily induced for riser less than 75mm.
- The elevation of any flight of stairs should be designed between 15° and 55°.
- A landing should be introduced for every 16 steps in a flight of stairs
- Handrails are required for staircase higher than 600mm.

Lighting

- Ensure both internal and external stairways are well lit.
- To give an illuminance of at least 100 lux at general areas like corridors, walkways, staircases and lifts.

Drainage

- Provide means of containing and draining water or other fluids at machines or processes as required
- Provide drainage locations as close as possible to any source of water or liquid frequently generated.
- Use gratings in the flooring if the work task is very wet. Wherever people may have to walk on gratings, their surfaces should be slip resistant.
Preventing Slips and Trips at Work

Storage:

- Provide ample storage space to avoid materials being placed in aisles.
- Ensure returns of tools to designated places are in place.

5.1.2 Modification of work process

- Modify work processes and avoid build-up of rubbish in the production processes.
- Minimize build-up of rubbish by using pre-cast units instead of the formwork and barbending construction methods in construction works.
- Replace machinery that frequently generates noise, dust, fumes or smoke.

5.2 Housekeeping

Housekeeping has a vital influence on minimizing slips and trips. To ensure housekeeping is performed to an appropriate standard, controls to reduce slipping and tripping hazards include:

- Arrange adequate manpower to promote housekeeping;
- Train staff to recognize slipping and tripping hazards and the importance of housekeeping;
- Set up standards and procedures as for normal production processes, e.g. storage and cleaning standards;
- Check and store usable inventories, discard any unwanted items;
- Instruct employees, who are unable to clean up the spillages on their own, to inform their supervisor, to enclose the spillages, and to erect warning signs;
- Provide sufficient rubbish or recycling bins at locations that often produce garbage;
- Line rubbish or recycling bins with impermeable plastic bags where possible to avoid leakage of waste water. If the rubbish is likely to contain sharp objects, using thicker and more resilient plastic bags will be better.
Assign employees to take charge of cleaning workplaces.

Develop a cleaning schedule. Encourage employees to clean their workplaces daily 15 minutes before they leave.

5.2.1 Eliminating Slipping Hazards

Liquid and waste from machinery:
- Using a metal tray to collect the liquid and waste.
- Examining the production process to eliminate any leaks.
- Use absorbent paper or powder for cleaning up any oily residue.
- Adjusting the machinery to prevent leakage
- Installing exhaust systems to remove dusts or vapours which would otherwise settle on floors.

Rainy days
- Have absorbent flooring materials at entrances
- Provide facilities for leaving umbrellas at entrances
- Ensure easy access to equipment and materials for cleaning up water on the floor

Accidental spills:
- Ensure immediate clearing up of water or oily spills.
- Thoroughly dry the wet floor after cleaning.
- Post warning signs at areas with high risk of spillage.
5.2.2 Eliminating Tripping Hazards

- Demarcate storage areas to limit storage.
- Provide sufficient storage systems to keep materials out of aisles.
- Provide sufficient power sockets and computer service jacks without requiring cords on the floor.
- Remove or cover protruding sockets on the floor. For example, in department stores, goods for display in the hallway should be securely stacked at least 600mm above floor level and avoid single towering stacks.
- Place prominent plants next to individual benches along passageways to alert pedestrians.
- Hang power cords over work areas.
- Clean up workplaces and remove refuse or obstructions regularly.
- Ensure visual cues, such as warning strips, and display of warning signs to highlight the change of uneven surface as well as provide good lighting to alert the pedestrians.
5.2.3 Improving Floor Conditions and Slip-resistance

Successful floor treatments that enhance slip resistance are those which substantially increase the surface roughness of the flooring. The main floor treatments are listed below:

- Sand blasting / Grinding
- Chemical etching
- Coating with resins
- Laying floor mat
- Applying adhesive anti-slip strips

Examples of Slip-resistant Mat Constructions

<table>
<thead>
<tr>
<th>Type</th>
<th>Construction</th>
<th>Material</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cushion</td>
<td>Coiled spring design</td>
<td>Vinyl</td>
<td>• Dirt and sand are trapped and fall below the matting surface.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Moisture is held and collected below the matting surface.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• The mat surface is kept clean and dry.</td>
</tr>
<tr>
<td>Open</td>
<td>Open “Z” vinyl construction</td>
<td>Vinyl</td>
<td>• Provide scraping action for excellent dirt and water removal in all direction and fall below the matting surface.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• The unbacked design allows water to drain out.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Low profile surface allows cart traffic to move easily over mat.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Dense construction allows water to drain out and sparse construction for greasy ground surfaces.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Thick cushion design is recommended for areas with high traffic.</td>
</tr>
<tr>
<td>Absorbent</td>
<td>Small and large diameter fibers</td>
<td>Polypropylene</td>
<td>• Large polypropylene fibers provide excellent removal and hiding of dirt.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Small fibers provide excellent removal of water.</td>
</tr>
<tr>
<td>Steel grit mat mat</td>
<td>Mineral coated top surface</td>
<td>Vinyl</td>
<td>• Vinyl construction will not deform after absorbing water.</td>
</tr>
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Application of floor mats and adhesive anti-slip strips

<table>
<thead>
<tr>
<th>Type</th>
<th>Outdoor</th>
<th>Entrance</th>
<th>Indoor</th>
<th>Corridor and Walkway</th>
<th>Kitchen</th>
<th>Workshop</th>
<th>Poolside and Changing Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cushion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crossed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorbent</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel grit mat</td>
<td></td>
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5.3 Safety Training

All employees share the responsibilities in achieving the target of good housekeeping and cleanliness. Therefore, provision of safety training to staff not only helps to equip employees with awareness of slipping and tripping hazards and the relevant control measures, but also helps to prevent accident.

The training should include:

- Awareness of slipping and tripping hazards
- Identification of effective control measures
- Duties of the employees

5.4 Personal Protective Equipment

Personal protection equipment should always be regarded as the last resort for control measures. Good working shoes may be considered as personal protective equipment in the case of slip resistance. The main characteristic of safety shoes is protection of the toes from falling and sharp objects but it does not warrant the slip resistance property. If possible, it is best to test the footwear for selecting and purchase of footwear with good slip resistance properties.

General characteristics:

- In wet conditions, the shoe sole tread pattern should be deep enough which helps to penetrate the water and make direct contact with the floor.
- In dry conditions, the shoe sole tread pattern should be flat bottom construction which grips the floor with maximum contact area.
- Urethane and rubber soles are generally more desirable than vinyl and leather soles in slip resistance. If the sole materials exhibit tiny cell-like feature, it provides the added benefit of slip resistance.