



## Controlling Slips, Trips, and Falls on Same Level and Stairs

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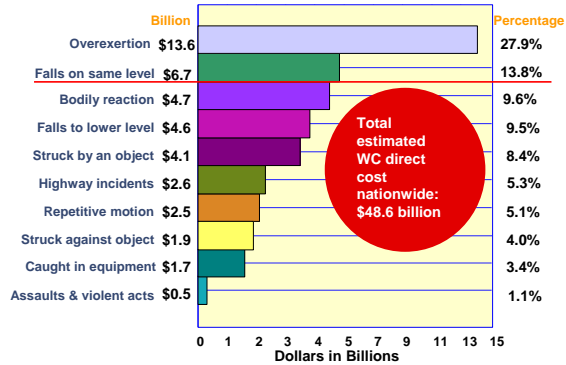
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### In this Session, You Will:

- Recognize the extent of same-level slips, trips and falls.
- Become familiar with 10 links in the chain of same-level falls prevention.
- See some of the tools and techniques to assessing slip and fall potential.
- Learn and be able to apply key improvements that significantly reduce the risk of slips, trips and falls.



### 2006 Liberty Mutual Workplace Safety Index



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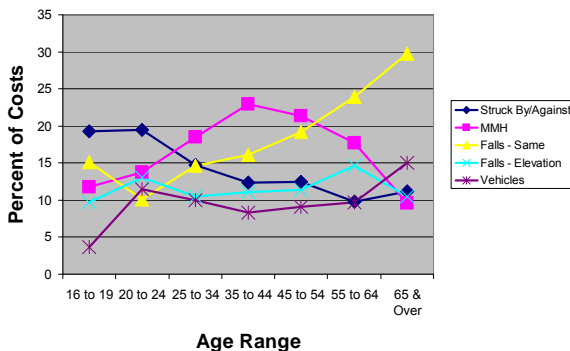
### Significance of Same-Level Slips and Falls

- Second-most costly occupational injury cause.
- Falls (combined with Elevated Falls) rivals Overexertion as the MOST costly injury cause.
- 11% of low back pain (LBP) claims frequency and 12% of LBP claims cost attributed to slips and falls-same level.
- Aging Workforce

From Liberty Mutual Research Center for Safety & Health



### Percent of Claims Cost by Type within Each Age Range (2008)



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### Falls Are Complicated....

- Tribology
  - Surface roughness (Chang, et al., 2004)
  - Slipperiness measurement (Chang, et al., 2001)
- Ergonomics
  - Aging - vision, strength, reaction time
- Biomechanics
- Psychology
  - Distractions/transitions
  - Perceptions of slipperiness (Chang, et al., 2004, DiDomenico, et al., 2006, Lesch et al., 2007)



### Falls are Simple... The 10 Aspects of Same-Level Falls Prevention:

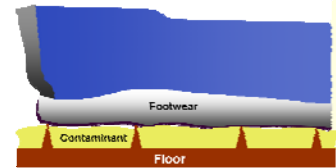
- Floor Materials/"Treatments"
- Contaminants
- Floor Cleaning Protocols
- Tripping Hazards
- Footwear
- Lighting
- Stairs and Ramps
- Mats
- Incident Reporting
- Training and Signage



### Definition of Tribology

The science of the mechanisms of friction, lubrication, and wear of interacting surfaces that are in relative motion.

- Friction between footwear and floor
- Lubrication at interface (contaminants)
- Wear of footwear and floor materials



**All these factors are interrelated!**

### How Do You Measure Slipperiness?



Brungraber Mark II (PIAST)



English XL (VIT)



Horizontal Pull Slip Meter (HPS) ASTM F609



### Slip Meter Benefits

- Great for comparative floor studies
  - Wet versus dry
  - Clean versus dirty
  - Worn surface versus new surface condition
  - Differences between flooring
  - Differences between floor treatments
  - Measure SCOF



### Floor Safety Facts

- Most dry surfaces are slip-resistant (0.5 SCOF or higher)
- Slips/falls occur when floor is wet and/or contaminated (dust, grease, oil etc.)
- Transitions from "non-slippery" to "slippery" floors are a problem (including spills)
- Slipperiness increases over time when floor is worn














### Floor Surface Selection

- When choosing materials
  - What kinds of spills are likely?
  - What are the sanitary requirements?
  - Will the area have heavy traffic?
  - Is it normally a wet environment?
  - How will the floor be cleaned?
  - Are aesthetic effects a concern?



**Performance**

				<p>Excellent to Good Slip Resistance, <b>BOTH Wet and Dry</b></p>
			<p>Good Slip Resistance Dry, Fair Wet</p>	
				
				

### Floor Treatments - Abrasive Floor Coatings

- Type of business-FDA or local sanitary standards might be difficult to meet with abrasive floors. Some epoxies can be damaged by extremely hot water
- Abrasive floors should be avoided where floors are likely to be subject to crushing and turning forces associated with platform trucks and forklifts especially with steel wheels

**Grit Size (Lower # = Larger Grit Size)**

8 - 16	Ramps
16 - 30	General purpose
36 - 60	Food processing plants
60 - 80	Restaurants



### Abrasive Floor Coatings

**Grit Type (and Hardness)**

Silicone Carbide 9.5	Aluminum Oxide 9.0	Quartz 7.0
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**Bonding Material**

Epoxy Resin	Adhesive Sheets	Paint
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**Cost/Durability**  
High-----Low


### Other Floor Treatments

- Chemical etching**
  - Ceramic tile, quarry tile, concrete
- Waxes, polishes**
  - Limitations of COF data offered by manufacturers
  - Durability an issue
- Mats**





## Contaminant Control - Three Key Strategies:

- Potential Contaminants are Controlled at the SOURCE (By Design).**
- Generous (adequately large, plentiful, and accessible) trash receptacles are emptied before they are full.**
- An effective spill clean-up program has been established, including a "clean-as-you-see" policy.**



### Additional Considerations

- Restrooms**
  - Soap dispensers by sink
  - Paper towel dispensers by sink; not behind
- Cafeteria**
  - Same as above
  - Housekeeping; spill control
  - Floor cleaning protocol



### Equipment in the right spots

Enough cleaning implements and supplies accessible near points where needed



### Specialty Cleaning Items Absorb, don't wet-mop spills!



What is the most important clean-up tool?



### What about Warning Signs for Cleaning and Spills?



### Spill Clean-Up Program

- Supervisors accountable
- Areas Audited
- Training of employees
  - Keep main aisles clear and clean
  - If you drop it, pick it up
  - If you spill it, wipe it up
  - If you SEE it, pick/wipe it up
  - Cordon off spill areas until clean.



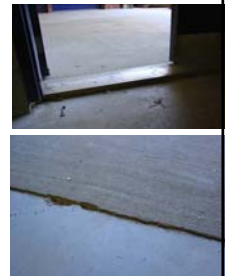
### Common Floor Cleaning "mistakes"

- Done "as needed" rather than on a schedule
- Frequency of cleaning NOT increased with increased contamination.
- No clean rinse used.
- No mechanical agitation used (stiff brush).
- Water not hot enough (Use 120°F Softened Water).
- Not properly cordoned off.



### Trips and Falls

- Changes less than ¼ inch (6mm) in height may be without edge treatment
- Changes ¼ inch to ½ inch (6mm-12mm) beveled with slop no greater than 1:12 (rise:run)
- Greater than ½ inch (6mm) ramp or stairway
- Next to the Floor itself, Boxes, Pallets, and Hoses are the most common tripping hazards



ASTM 1637 Standard Practice for Safe Walking Surfaces





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### Planter damage

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### Cracks in blacktop

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### Trips - Sidewalks

**Curbs - Trips/Falls**

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### Curbs - Visual Contrast

5 inches height min. and 8 inches max.  
(City Codes)

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### Cut Throughs Can Be a Problem

### Beware of Drainage Issues

**Before**

**After**

Photos courtesy of Jennifer Bell, NIOSH

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### Best Practice for Controlling Tripping Hazards

- Maintaining the quality and condition of the floor surface.
- Eliminating in-path fixed objects (hoses, phone cords, retaining berms, protruding machine parts, exterior planters, etc.)
- Eliminating in-path in-process goods and materials.
- Maintaining "perfectionist" housekeeping (mostly trash/debris elimination).

### Slip-Resistant Shoes

- No universal standard on what is slip-resistant
- Look for "slip resistant" (on the shoe itself or on the box/descriptive literature)
- Oil-resistant, non-marking, skid-resistant is not the same!
- Tread material
  - Softer rubber outsole conforms to floor surface
- Tread design
  - Large contact area (no large gaps between contact surfaces)
  - Lots of crisscrossing groves.

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### Overshoes and Shoe Covers

AlphaProtect AquaTraK  
www.ahsafety.com

SURE-TREAD  
www.ahsafety.com

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### Slip-Resistant Footwear Programs

- Mandatory with overshoes provided by employer
  - Full compliance
  - Provides option for employees who do own slip-resistant soles
  - Nominal cost
  - Often fits well with dress standards
  - Accommodates visitors, employees who leave their slip-resistant work shoes at home, employees with excessively worn shoes, and shoe sizes 5 to 17.

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## Best Practices for Lighting

- All floor surfaces (including outdoors and closets) have generous, even lighting.
- Light sources are arranged and diffused so there is adequate contrast to detect contaminants, transitions, and any tripping hazards.
- Glare is not to a distracting level.
- Contrasting colors are used at transitions/thresholds.
- Lighting systems are backed up with uninterruptible power supply equipment rather than just emergency lighting.
- Motion-activated and or infrared-activated lights preferred over switches; timed light circuits should have motion/infrared override during "off" cycle.



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## Exterior Lighting






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## Falls from Stairs

Slips and falls from stairs can be caused by:

- Faulty Housekeeping
  - Objects, water, or grease on stairs or landings
- Defects
  - No handrail
  - Handrail at improper height
  - Handrail not graspable
  - Improper tread or riser dimensions
  - Tread surface material
- Aging Workers?
  - Range of visual accommodation; visual detection of hazards
  - Loss of contrast sensitivity (diabetes, other illnesses)
  - Poor dark adaptation (slow/incomplete)
  - Less color sensitivity
  - Glare sensitivity (cataracts, reduced glare recovery >age 50)

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## Falls From Stairs



Riser heights, damaged risers      Trip hazards at landings



## Stair Tread Visibility - Visual Contrast





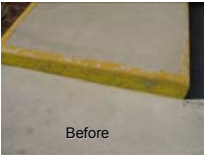
- Contrast on curbs, step risers, stair nosing and landings
- Use contrasting nosing color on first and last steps.
- ADAAG\* specifies that detectable warnings "shall contrast visually with adjoining surfaces, either light-on-dark, or dark-on-light."
- Surfaces colored safety yellow (ISO 3864, ANSI Z535.1) "most visually detectable" (US Access Board Research).

A step here somewhere?


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## One and Two Step "Stairs"


- Most Dangerous - Avoid if possible (air steps, tripping common)
- Risers follow guidelines for stairs
- Possibly install hand rail
- Not ADA compliant-might need ramp
- Use safety yellow on step edges



Before



After



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### Handrails ANSI A1264.1, NFPA 101



- Both sides of stairs, full length of stairway. If  $\leq 44"$  wide, one on right side descending, otherwise within 30" reach
- Install a two-rail system; a top rail at 42 inches and a second handrail at 34" high min. and 38" high max.
- Extend 12" at top of stair, one tread depth from bottom step at bottom.
- Hand rail 2 1/4" diameter
- Clearance 1 1/2 " away from wall
- Fixed barriers preferred to balustrades.





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### Lighting for stairs

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### Treads and Risers

- **Most Critical:** Consistent Dimensions – 7" riser, 11" tread (ANSI A117.1, International Building Code, ADA-ABA\*, NFPA 101 )
- "Steps and treads shall be of slip-resistant material" (NFPA 101, ASTM F802 revision draft)
  - Extend whole tread
  - Nosing strips okay
- Nosings shall extend not more than 1.5" (ADA-ABA)

\* Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines

### Summary Best Practices for Stairs/Ramps

**Stairs:**

- Consistent riser heights and runs near 7" high and 11" deep.
- Tread edges have adequate visual contrast.
- Stairs should have slip resistant treads or nosings extending at least 1 inch from front edge of nosing and the full width of the tread to within 4 in. of each side.
- Special visual cues for stairs with less than 4 steps.
- >12 steps should have a landing.



**Handrails**

- At 34-38" allow continuous grasping and extend one foot beyond top and bottom of stairs/ramp.
- If wider than 60-75 inches, should have a center handrail.



**Ramps**

- Should have a slope below 4.75 degrees (1:12 grade)

### Entrance Floor Mats

- Sufficient running length and width
  - Snow: 10 - 12 walking steps
  - Rain: 8 - 10 walking steps
  - Dry: 6 - 8 walking steps
- Contrasting color to floor
- 80% of soil entering a building can be trapped within the first 15' on a carpeted surface (ANSI A1264.2)
- Designed and placed so as not to create additional fall hazard
- Rule of thumb: should not be able to see footprints after stepping off mat (wet)



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### Summary

- Slips and falls are a big problem
- Slip and fall accidents attributed to:
  - Inappropriate Floor Surface Selection or Condition
  - Inadequate Contaminant Control
  - Flawed Floor Cleaning Protocols
  - Poor Housekeeping and "Order"
  - Inadequate Footwear Policy
  - Poor Lighting
  - Flawed Stair or Ramp design
  - Inadequate or Inappropriate Mat Use
  - Ineffective Incident Reporting
  - Lack Of Overall Program and Accountability
  - Insufficient Training
  - Ineffective Signage

