Rethinking Slip, Trip and Fall Prevention Through Tribology

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John Kovacs

Sonya Luisoni

Steve Simon,
MS, ARM, CPE

Course Objectives

01 Tribology Overview

02 Statistics and Claims

03 Root Causes

04 Premises Liability and Standards/Regulations

05 Leading Practices and Solutions

What is Tribology?

1

Tribology:
The science and engineering of understanding friction and wear phenomena for interacting surfaces in relative motion.

2

Origin of Tribology:
The word derives from the Greek root “ tribo ,” meaning “rub,” and the suffix, “ -logy” from "study of" or "knowledge of."

- 1493 – Leonardo da Vinci first noted the two fundamental 'laws' of friction.
- 1966 – Peter Jost first coined the word “Tribology,” which highlighted the cost of friction, wear, and corrosion to the UK economy.

Statistics and Claims

STF Statistics

65%	of slips and falls are caused by same-level walking surface	**30%**	of people who slip/fall suffer moderate/severe injuries
2nd	leading cause of injury are slips, trips, and falls	**46%**	of fatal fall injuries happen to older Americans*
1800	annual slips and fall deaths	**15%**	of all accidental deaths are from slips, trips, and falls*
$40K	average work comp payout on each slip/fall incident	**$70 Billion**	is paid toward medical costs and compensation associated with employee slip and fall accidents*

* Occupational Health and Safety Administration - Bureau of Labor Statistics - National Floor Safety Institute

U.S. BUREAU OF LABOR STATISTICS

Costly Consequences of Claims

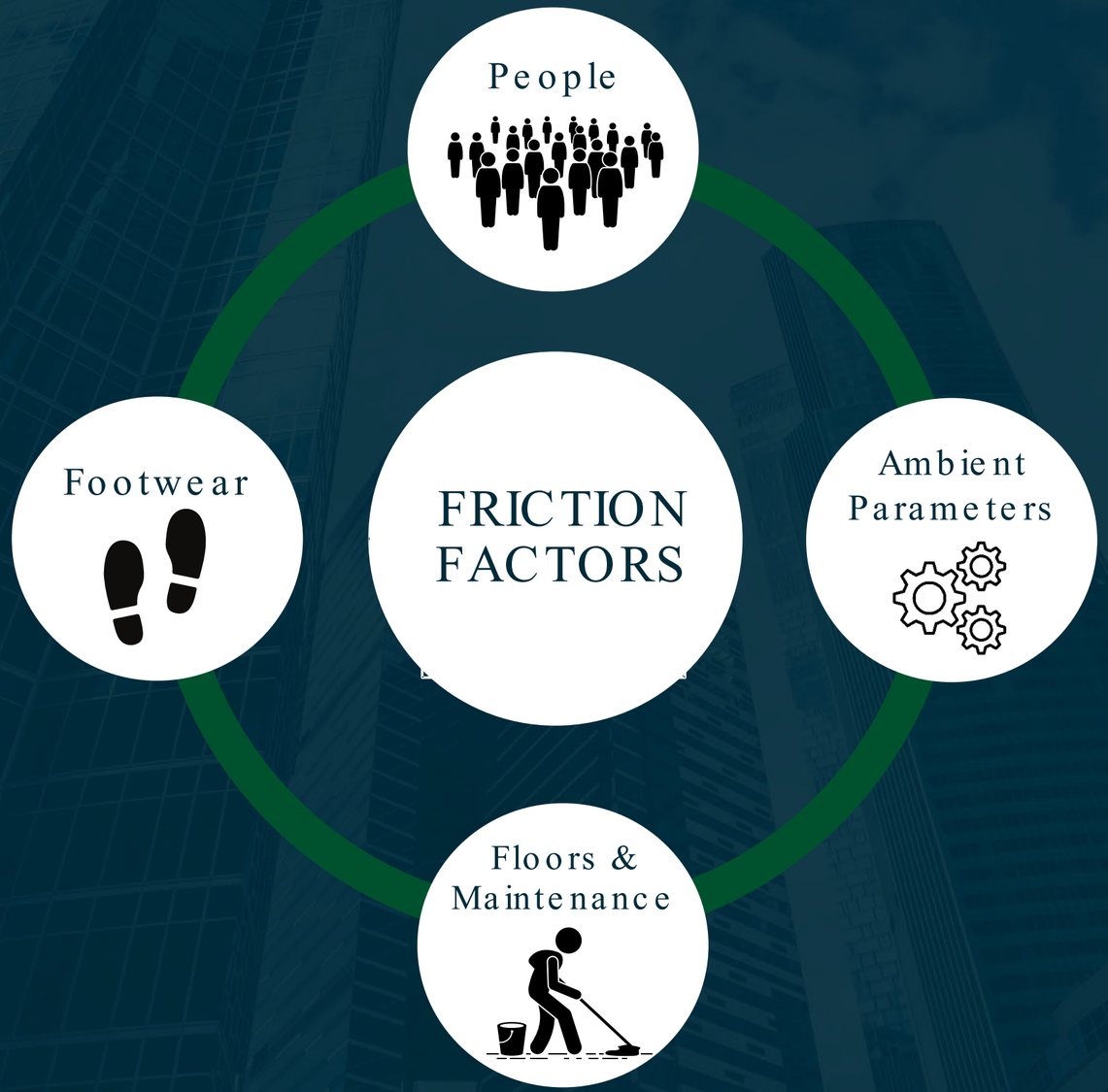
An Alabama man won $7.5 million in a Walmart slip-and-fall injury claim when his foot got lodged in a pallet used to display watermelons. Walmart surveillance caught this incident on camera and Walmart was found guilty of negligence and recklessness.

The largest settlement ever awarded in a STF lawsuit was over $20 million. This was awarded to the plaintiff. The case went to trial, and the jury found that the hotel had failed to warn its guests of the hazardous condition and was liable for her injuries.

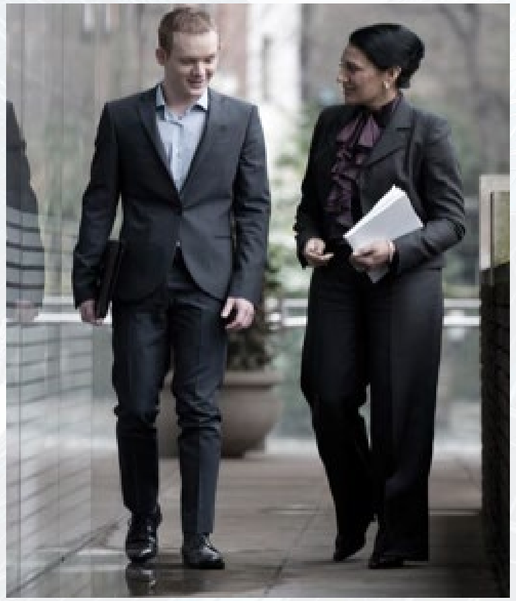
A woman slipped on a wet floor while shopping at a grocery store in Maryland. She suffered serious injuries, including broken bones and facial fractures. She sued the grocery store chain for negligence and was awarded $10 million as compensation for her medical expenses, lost wages, pain and suffering.

Root Causes of STF

Primary Root Causes



People



Employees

General Public

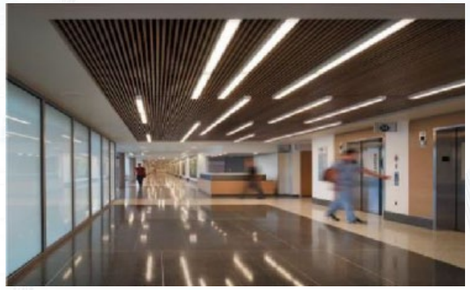
Elderly and
Disabled Persons

Children and
Young Adults

Ambient Parameters

Handrails and Warning Postings

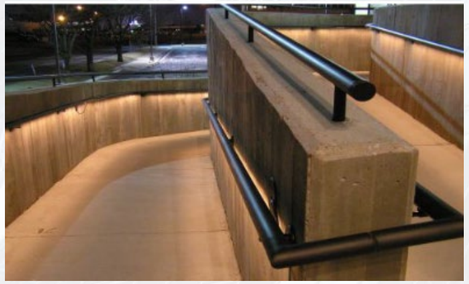
Walking and Working Floor Surfaces

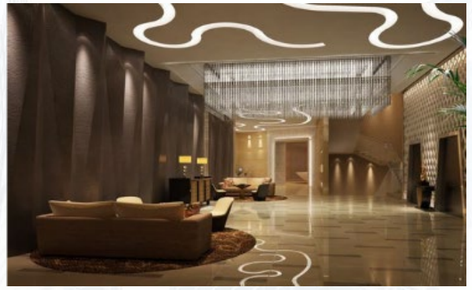


Lighting

Environmental Exposures

Uneven Surfaces

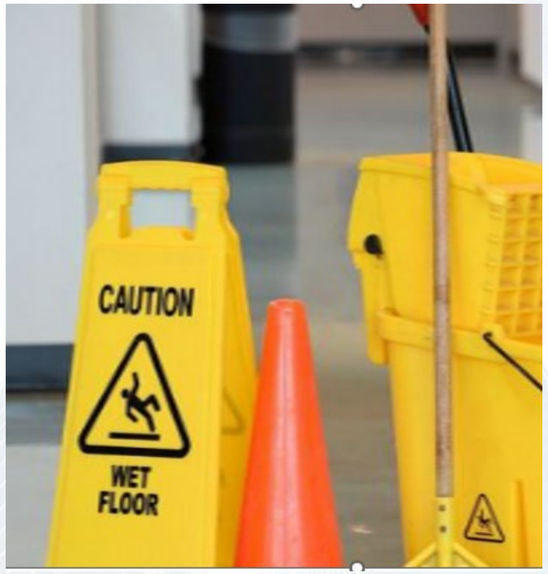




Floors and Maintenance

Floor Porosity

Floor Restoration



Daily Cleaning Program

Flooring Chemicals

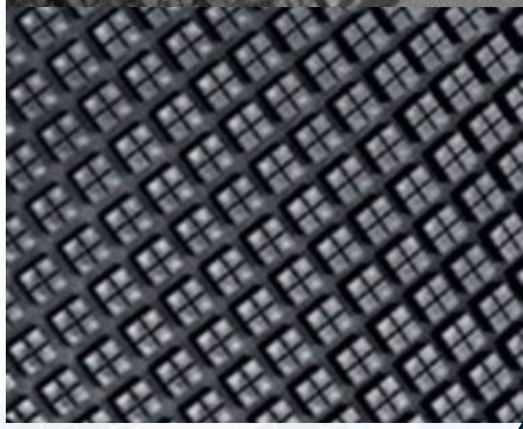
Footwear

Dress Shoes

Athletic Shoes

Work Boots

Casual Shoes



Slip-Resistant Shoes

Premises Liability and Standards/Regulations

Premises Liability & Tort Law

Failure to comply with precedence or code (CAUSATION)

- CACI 430 – Causation: Substantial Factor

Failure to correct (DUTY)

- CACI 1001 – Basic Duty of Care

Failure to warn (NOTICE)

- CACI 1011 – Constructive Notice

Failure to inspect & maintain (BREACH)

- CACI 1003 – Unsafe Conditions

Failure to act reasonably under the circumstance (NEGLIGENCE)

- CACI 1000 – Premises Liability: Essential Factual Elements

Industry Based Associations

- American National Standards Institute (ANSI- A326.3)
- American Society for Testing and Materials (ASTM-E303:2022)
- International Swimming Pool and Spa Code (ISPSC-306.2)
- Occupational Safety and Health Administration (OSHA-1910.22(d)(1))
- Americans with Disabilities Act (ADA- 4.5.1)
- International Building Code (IBC-1003.4)
- American Society for Testing and Materials (ASTM-F1637:2021)

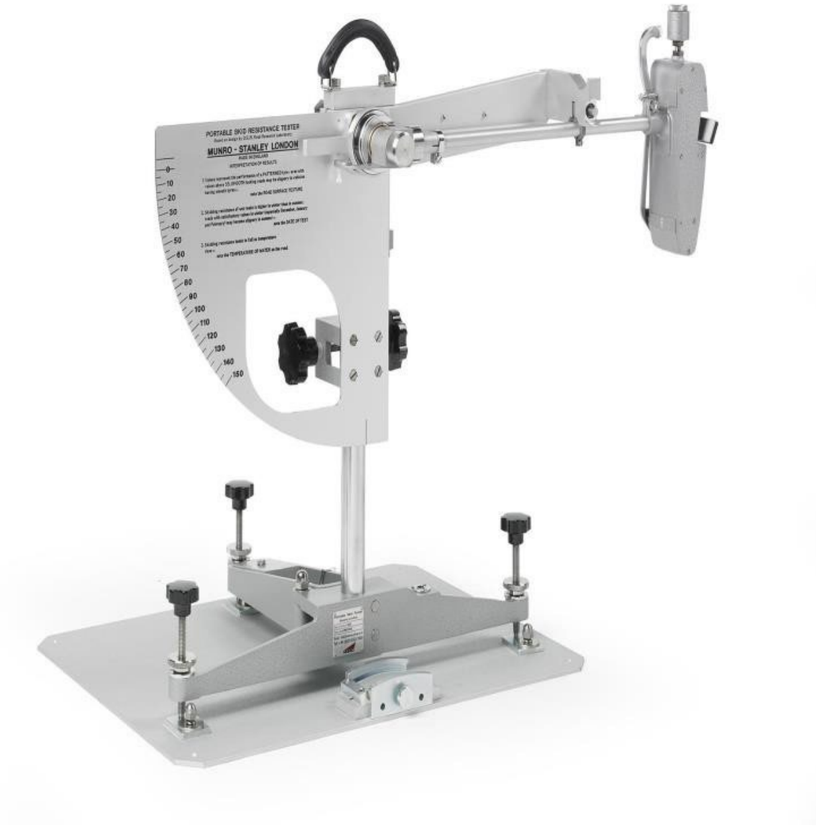
Slip Testing

BOT 3000-E Tribometer

- The BOT is an electronic device that provides precise, digital measurements of DCOF. Its advanced technology ensures high accuracy and repeatability, making it a reliable tool for assessing legal and safety evaluations.

- This device uses a motor to move a standardized rubber slider with consistent speed and pressure across a hard surface to determine ACOF.

Pendulum Tester



- Used in over 50 Nations, the Portable Skid Resistance Tester (also referred to as the British Pendulum) is the most used test method worldwide.
- This device mimics the dynamics of a slipping foot by simulating a heel strike motion.
- Its consistent and reproducible results are crucial for legal and safety assessments.

ACOF > RCOF

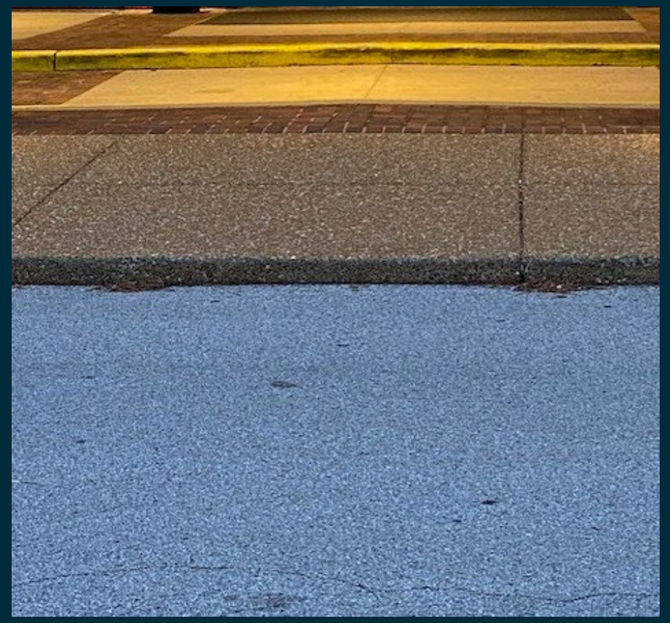
- Available coefficient of friction (ACOF) is the friction provided when the sole of the shoe meets the surface.
- Required coefficient of friction (RCOF) is the friction required by the pedestrian for the maneuver being attempted, such as walking, turning, stopping, etc.
- If ACOF exceeds RCOF, the pedestrian should not slip.

Leading Practices and Solutions

Floor Designs

Three Level Changes

Effective designs of the walking path (from the parking lot to the entrance)



- Consider slip resistance characteristics and surface roughness
- Evaluate floor materials under different conditions (wet, dry, cleaning process, traffic conditions, etc.)

Floor Mats that Absorb and Abrade

- Mats at the entrances should have adequate length.
- Rain: 8 - 10 walking steps (12-15 feet)
- May need more than one on a rainy day. Prepare to exchange mats if they are saturated.

- Walk-off mats that abrade well.
- Dry: 6 - 8 walking steps

- Mats with absorbent material are recommended in front of water fountains, ice machines and restrooms.

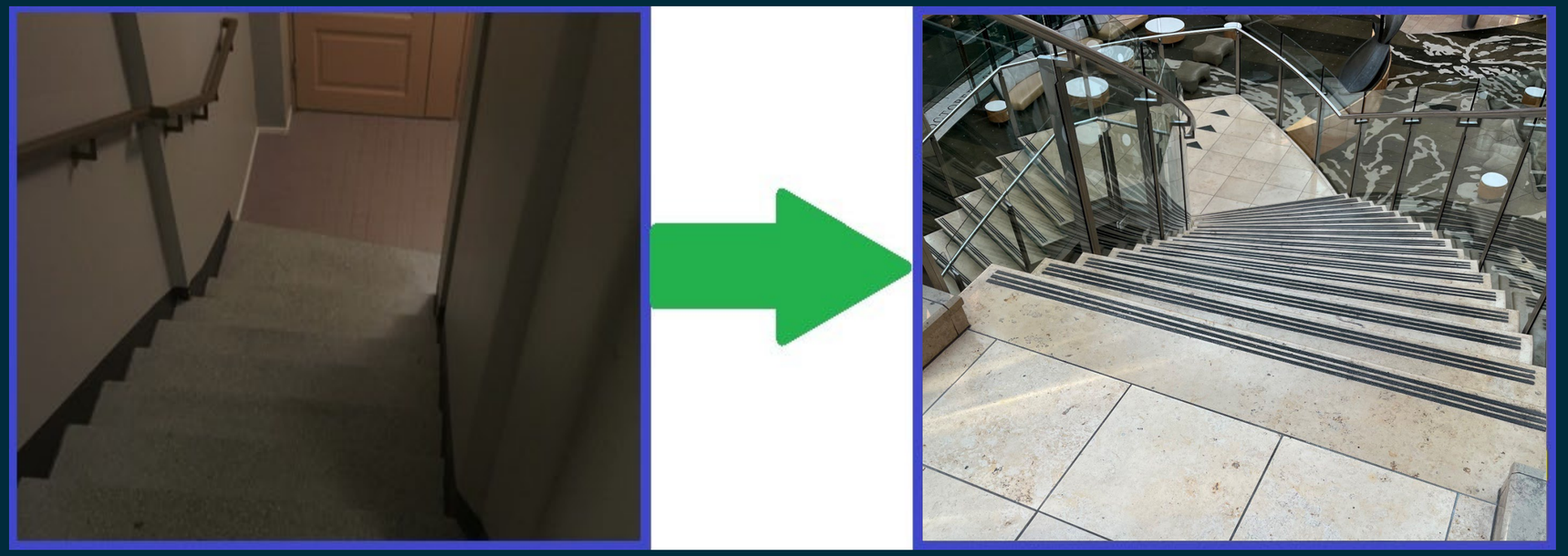
Innovative STF Prevention Strategies

COF Boosters

Spill Detection Cameras

Liquefied Floor Treatments

Best Strategies for Stairs



- Tread/riser dimensions or variation
- Installation of handrail (color design)
- Lighting (leading practice: 12–15 lumens per square foot)
- Stair nosing, edges, surfaces, etc.
- Wet Steps
- Signage (if needed)

Conclusions

Recommended Leading Practices

- Formal STF Program
- Specific STF Checklist
- Formal Plan for Matting
- Formal Cleaning Process
- Slip Testing

Thank You