

Preventing Slips, Trips and Falls



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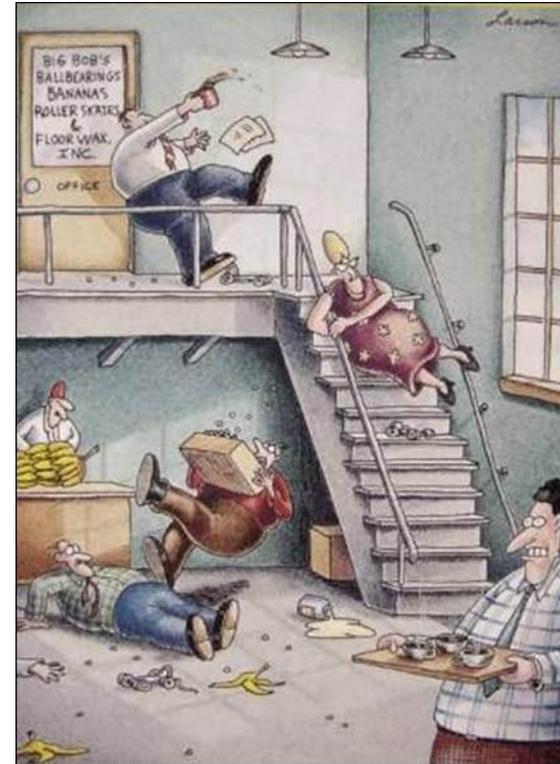
Responsibility. What's your policy?®

Session Agenda

- Causes of same-level slips, trips and falls (STF)
- Preventing slips, trips and falls: a continuum
 - STF Hazards: slipperiness, inside/outside
 - Flooring selection, treatments and coatings
 - Housekeeping and maintenance
 - Slip-resistant footwear
 - Mats and runners
 - Slipperiness assessment

Causes of Slips, Trips and Falls

- Tribology
- Ergonomics issues
 - Aging population
 - Vision
 - Reaction time
 - Strength
- Biomechanics
- Psychology
 - Transitions
 - Perceptions of slipperiness
- Others



Gary Larson's The Farside®

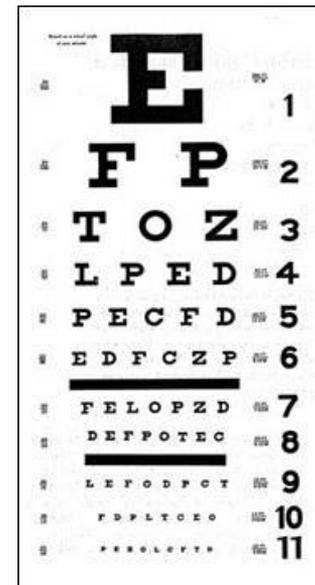
Tribology

- The study of the interaction of sliding surfaces
- It includes three subjects:
 - Friction
 - Lubrication
 - Wear



Age and Vision

- 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)



Perceptions of Slipperiness Research



Heel Slip (DiDomenico et al., 2007)

"Most people were not sensitive enough to detect small differences in slip distances and underestimated the slipperiness of the floor surface." Slips under 30 mm not perceived



Visual Cue (Lesch et al., 2007)

"A significant relationship was observed between visual cues to slipperiness [COF, reflectiveness]

Key to Prevention

- “Humans cannot be relied upon to detect slippery floors and take corrective action. Installing the best flooring and keeping it clean and as dry as possible is key to prevention”



Slip, Trip and Fall Prevention Continuum



Slip, Trip and Fall Prevention Continuum



Slip, Trip and Fall Prevention Continuum



Definitions*

- **Slip resistance, n** - the relative force that resists the tendency of the shoe or foot to slide along the walkway surface. Slip resistance is related to a combination of factors including the walkway surface, the footwear bottom, and the presence of foreign materials between them
- **DISCUSSION** - Slip resistance is dependent upon many factors, such as material and condition of the walkway surface, material and condition of the shoe sole or heel material, the physical abilities of the user, the attempted or proposed activities of the user, the presence of any contaminants on any or both of the surfaces, and other factors
 - *From ASTM F1646-2005e1, Standard Terminology Relating to Safety and Traction for Footwear

What Is “Slippery”?

- <0.5 (relatively slippery), $0.5 - 0.6$ (generally acceptable), >0.6 (relatively not slippery)
- Most studies show that people can walk comfortably and safely on surfaces with a coefficient of friction greater than 0.4, but 0.5 offers an additional safety factor*. This is called a Slip-Resistant surface
- Wet or dry
 - * Miller, J. M. (1983). Slippery work surfaces: Towards a performance definition and quantitative coefficient of friction criteria. *Journal of Safety Research*, 14, 145–158

Tripping Hazards

- Changes less than $\frac{1}{4}$ inch (6mm) in height may be without edge treatment
- Changes $\frac{1}{4}$ inch to $\frac{1}{2}$ inch (6mm-12mm) beveled with slope no greater than 1:2 (rise:run)
- Greater than $\frac{1}{2}$ inch (12mm) ramp or stairway
 - ASTM F1637, Standard Practice for Safe Walking Surfaces
 - US Access Board Technical Bulletin: Ground and Floor Surfaces



Color and Visual Contrast

- 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)
- Contrast on curbs, step risers, stair nosing and landings
- Edge transitions?



Safety Yellow



Parking Lots and Sidewalks



Parking Lot



Sidewalk



Sidewalk



Sidewalk / Parking Lot



Rubber Flooring and Stair Treads



Nora Flooring: Norament® 925
Neutral cleaner
Do not polish or wax

Polished and waxed:
Potential problem wet



One and Two Step Entrances

- Avoid if you can
- Risers follow guidelines for stairs
- Possibly install hand rail
- Not ADA compliant- might need ramp
- Use safety yellow on step edges



Slip, Trip and Fall Prevention Continuum



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



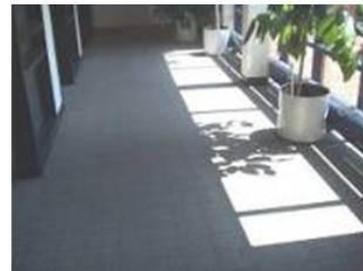
Flooring Selection

- 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?
- Inside or outside?



Flooring

- Lobbies
- Restrooms
- Kitchens
- Cafeteria
- Stairs/steps
- General office
- Manufacturing



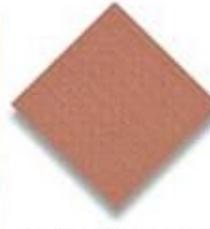
Flooring Selection



Unsealed Brushed Concrete



Quarry Tile with Embedded Grit



Textured Glazed Ceramic Tile with Raised Points



Carpeting



Textured Porcelain Pavers



Quarry Tile without Embedded Grit



Textured Rubber Tiles or Sheets



Terrazzo



Diamond Plate



Hardwood Floors



Vinyl Composition Tile (also Glazed ceramic or porcelain)

Performance

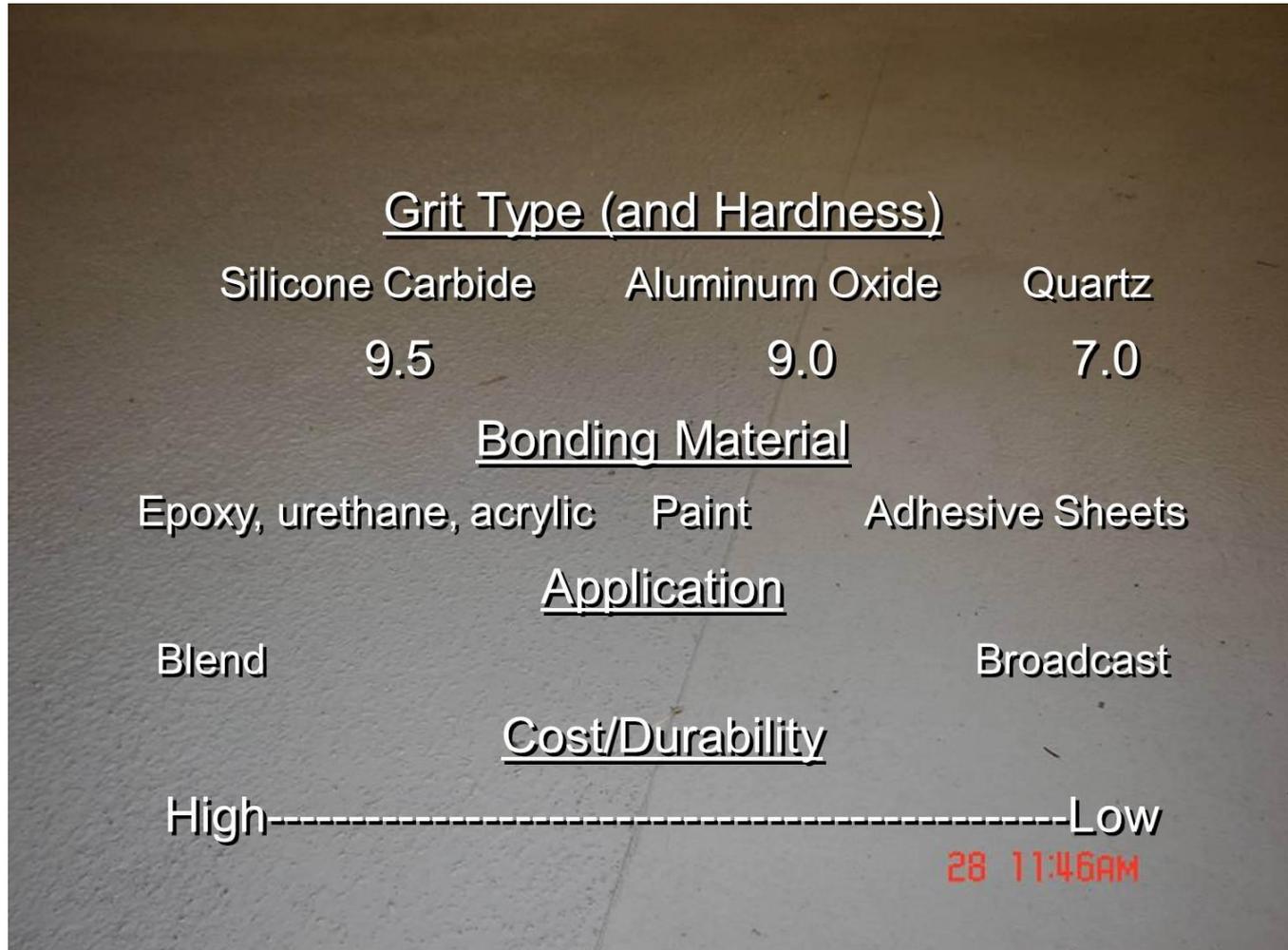
- Excellent to Good slip-resistance, BOTH wet and dry.
- Good slip resistance dry, Fair wet.
- Good to Fair slip resistance dry, Poor wet.

Additional Considerations

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



Coatings



Paints and Coatings - Grits

Grits: aluminum oxide, sand, others

Grit Diameter (inches)	Grit Diameter (microns)	Mesh Size (smaller is bigger)	Examples
.008 - .006	254-145	60-80	Restaurants and food preparation
.014 - .008	356-254	40-60	Food processing
.027	686	20	Manufacturing workstations
.073 - .053	2210-1346	8-12	Vehicle Ramps

Slip, Trip and Fall Prevention Continuum



Treatments

- Chemical etching
 - Ceramic tile, quarry tile, natural stone, porcelain (including bathtubs), concrete
- Waxes, polishes
 - Limitations of COF data offered by manufacturers
 - Durability an issue
- Coatings (acrylic, urethane)
 - Grit issues similar to epoxy discussion
 - Self adhesive mats (plastic, fiberglass bathtubs)



Slip, Trip and Fall Prevention Continuum



Housekeeping: Floor Cleaning



Slip, Trip and Fall Prevention Continuum



OSHA PPE payment ruling for “specialty non-slip soles”

U.S. Department of Labor

Occupational Safety and Health Administration
Washington, D.C. 20210

Reply to the attention of:

JUN 3 0 2008

DEP/GIE/PJK-13042

Ms. Donna M. Garren, PhD
Vice President, Health and Safety
Regulatory Affairs
National Restaurant Association
1200 Seventeenth Street, NW
Washington, DC 20036-3097

Dear Ms. Garren:

Thank you for your February 27 letter to the Occupational Safety and Health Administration's (OSHA's) Directorate of Enforcement Programs (DEP). Your letter has been referred to DEP's Office of General Industry Enforcement (GIE) for an answer regarding OSHA's recent Personal Protective Equipment (PPE) payment standard, 29 CFR 1910.132(h). Your question has been restated below.

Scenario: There is an array of shoe types worn throughout the restaurant industry. Employees are required to wear shoes that are uniform in color and offer slip resistant soles. The employees wear the shoes to and from work and in other places outside of the work environment. The shoes are what the restaurant considers a standard work shoe and are basically indistinguishable from ordinary street shoes.

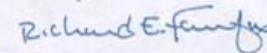
Question: Do employers have to pay for these types of non-slip shoes that offer some slip resistance but are basically standard work shoes?

Response: No, the employer is not required to pay for non-specialty shoes that offer some slip resistant characteristics but are otherwise ordinary clothing in nature.

Thank you for your interest in occupational safety and health. We hope you find this information helpful. OSHA requirements are set by statute, standards, and regulations. Our interpretation letters explain the requirements, and how they apply to particular circumstances, but they cannot create additional employer obligations. This letter constitutes OSHA's interpretation of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules. In addition, from time to time we update our guidance in response

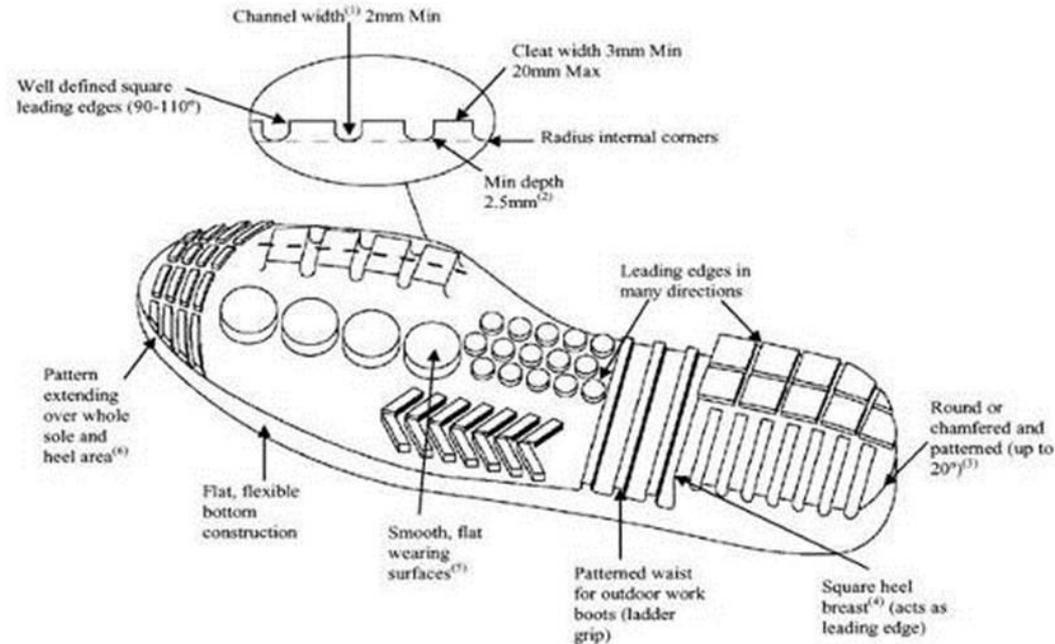
to new information. To keep apprised of such developments, you can consult OSHA's website at <http://www.osha.gov>. If you have any further questions, please feel free to contact the Office of General Industry Enforcement at (202) 693-1850.

Sincerely,



Richard E. Fairfax, Director
Directorate of Enforcement Programs

SATRA Tread Pattern Guidelines



- (1) Narrower channels are suitable for boat shoes for water dispersal.
- (2) 4mm Min is recommended for rugged outdoor boots.
- (3) Except hill walking boots.
- (4) For indoor occupational footwear, catering, hospitals, wedge/flat soles should be considered.
- (5) Avoid textured wearing surfaces, sawtooth and sucker shapes.
- (6) Avoid an unbroken border around the sole edge.

From *Development of SATRA Slip Test Tread Pattern Design Guidelines*, Wilson, M.P., 1990, ASTM STP 1103

SATRA Tread Pattern Guidelines



Converse™



Safe T Step™



Shoes For Crews™



Skechers WORK™

Overshoes



Slip-Resistant Footwear Policy

- Should be in writing
- Specify selection, purchase, reimbursement and replacement
- Specify purchase/reimbursement
 - Company purchase
 - Employee purchase
 - Payroll deduction plans

Slip, Trip and Fall Prevention Continuum



Benefits of Mats

- Prevent slips and falls
 - Absorb water/contaminants, remove soils
 - Provide slip-resistant surface
 - Elevate above standing water
- Reduce floor maintenance
 - Keep floors clean
 - Reduce wear, protect finishes
- Reduce standing fatigue



Entrance Mat Types

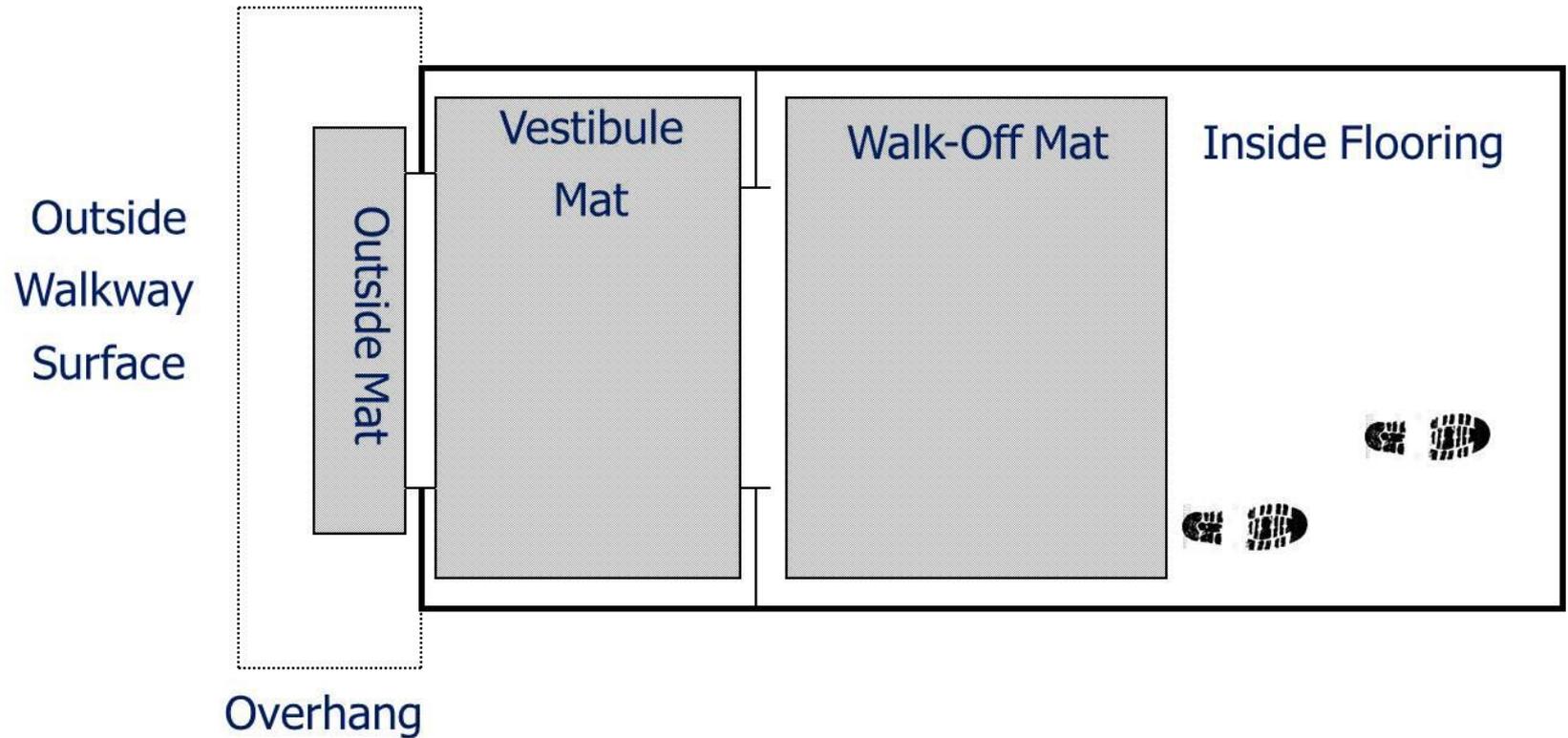
- Well and grate system
 - Funnels and drains moisture down and away from floors. Permanent fixture at entrances
- Recessed
 - Permanent mat installed in a well or recessed surface flush with floor
- Loose-Lay
 - Stays in place without adhesives



Entrance Mat Criteria

- Sufficient running length and width (unpublished manufacturer's study)
 - Snow: 10 - 12 walking steps
 - Rain: 8 - 10 walking steps
 - Dry: 6 - 8 walking steps
- 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)

Mat Selection



Mat Surfaces



Foot Grills www.matsinc.com



Sbemco Ultra Dry™
www.sbemco.com



Mats Inc. Soft
Grid™
www.matsinc.com



Mats Inc. Aqua Block™
www.matsinc.com

Entrance Risk Assessment

- Walkway surface material can be slippery when wet e.g. VCT, terrazzo, polished granite/marble, glazed smooth ceramic tiles etc
- There are no interior mats or
- There are mats but by design and installation they do not
 - Adequately absorb moisture from footwear
 - Adequately remove soils from footwear
 - Perform well because they are dirty

Entrance Strategy: Slip and Fall Prevention



Slip, Trip and Fall Prevention Continuum



Slipmeters or Tribometers



Brungraber Mark II (PIAST)



English XL (VIT)



American Slip Meter, Inc



Horizontal Pull
Slip Meter (HPS)
ASTM F609

Slip, Trip and Fall Prevention Continuum



Who Needs Training?

- Architects, Design and Construction Engineers
- Facilities Management
- Corporate Risk Management & Safety
- Occupational Health
- Human Resources
- Managers and line supervisors
- Employees

Questions and Comments



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Industrial Hygiene Services

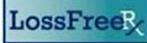
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