U.S. Consumer Product Safety Commission

Log of Meeting

SUBJECT: Staff meeting with Mr. Russell Kendzior, of the National Floor Safety Institute (NFSI)

DATE OF MEETING: May 25, 2017

LOG ENTRY SOURCE: Mark Kumagai

DATE OF LOG ENTRY: July 13, 2017

LOCATION: US Consumer Product Safety Commission, 4330 East West Highway, Bethesda, MD 20814, Rm 714.

CPSC ATTENDEES: Mark Kumagai, Vincent Amodeo, Mary House, Samantha Li, Lawrence Mella, Wioletta Szeszel-Fedorowicz, Sharon White, Troy Whitfield,

NON-CPSC ATTENDEES: Mr. Russell Kendzior, of the National Floor Safety Institute (NFSI), Dr. Howard Harris, Committee Chairman, NFSIB101

SUMMARY OF MEETING: CPSC staff met with Mr. Russell Kendzior, of the National Floor Safety Institute (NFSI) and Dr. Howard Harris, Committee Chairman, NFSIB101 to discuss flooring safety research, standards and related topics. The meeting was requested by Mr. Russell Kendzior.

During this meeting Mr. Kendzior expressed his desire for a label on flooring to notify the consumer of the flooring's level of traction. Mr. Kendzior asked why the staff recommended denying his petition request to mandate that manufacturers of floor coverings and coatings to uniformly label their products' slip-resistance per the American National Standards Institute (ANSI) B101.5- 2014 Standard Guide for Uniform Labeling Method.

Staff acknowledged that slips and falls contribute to a large number of injuries especially among the elderly. Staff explained to Mr. Kendzior that they were unable to recommend accepting the petition because:

1. the staff did not find sufficient evidence or studies to support the assertion that a high coefficient of friction (COF) value leads to a decreased hazard of slips and falls.
2. the studies staff reviewed showed that the majority of test methods do not demonstrate a reliable correlation between COF values and the risk of falling.
3. staff's review of the scientific studies showed that COF values varied greatly among the test methods, depending on the environmental conditions and footwear or no footwear used.
4. staff is concerned that the proposed may have limited effectiveness because COF is likely only one of a number of factors involved in slip-and-fall incidents.

Mr. Kendzior presented several documents related to falls, measurement of COF and labeling (see attachments). Mr. Kendzior state that published scientific studies relating COF to slip/fall incidents are limited. He said that most of the work is done by the flooring manufacturers and the findings are not published. He recommended a German study for the staff to review. Mr. Kendzior said he planned on repetition the CPSC with additional information.

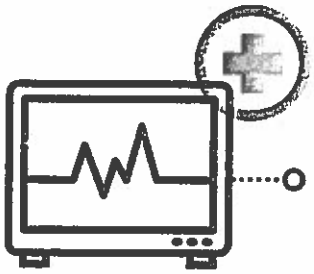
OLDER ADULT FALLS: A GROWING DANGER

The Concern:

Every second an older American falls. These falls threaten the health and independence of older adults and result in high medical costs across the U.S. healthcare system.

IN 2014:

1 in 4 older adults reported a fall.



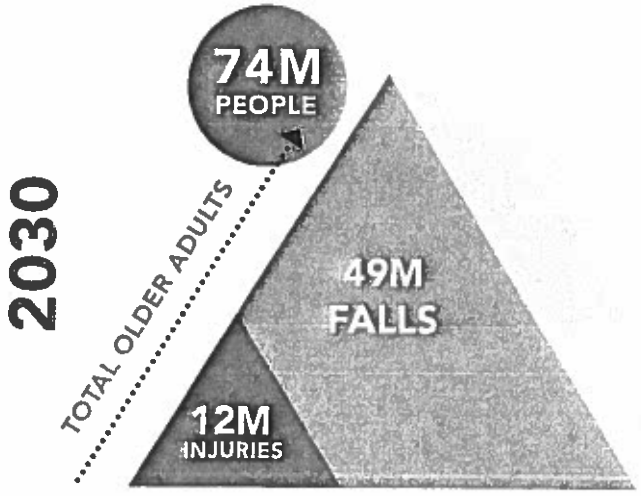
More than
7 MILLION
of those falls required medical treatment or restricted activity for at least a day.

More than
27,000
older adults died as a result of falls —that's 74 older adults every day.

A Growing Burden:

Over 10,000 people in the U.S. turn 65 every day and Americans are living longer than ever.

Falls and fall injuries are increasing in the U.S. Annual medical expenses for older adult falls cost over **$31 billion**, these costs will surge unless preventive measures are adopted.



STEADI Stopping Elderly Accidents, Deaths & Injuries

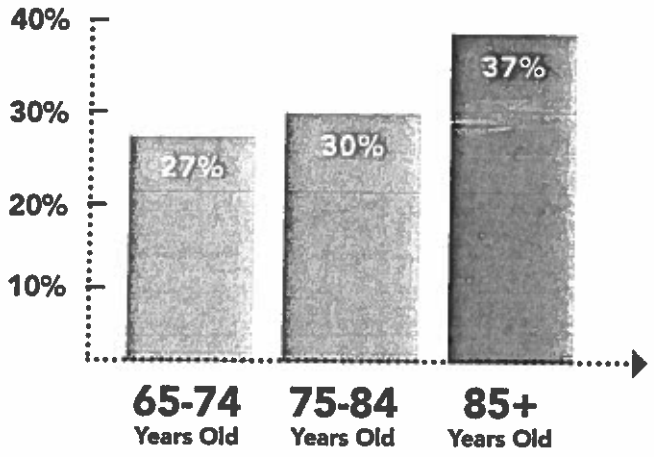
www.cdc.gov/steadi

OLDER ADULT FALLS: A GROWING DANGER

Who is at Risk?

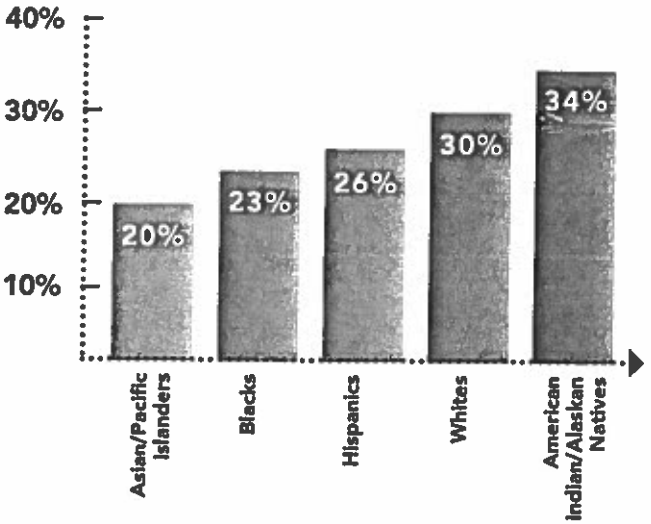
While the percent of older adults who fall varies by location and demographics, all older adults are at risk for a fall.

Falls Increase with Age:*

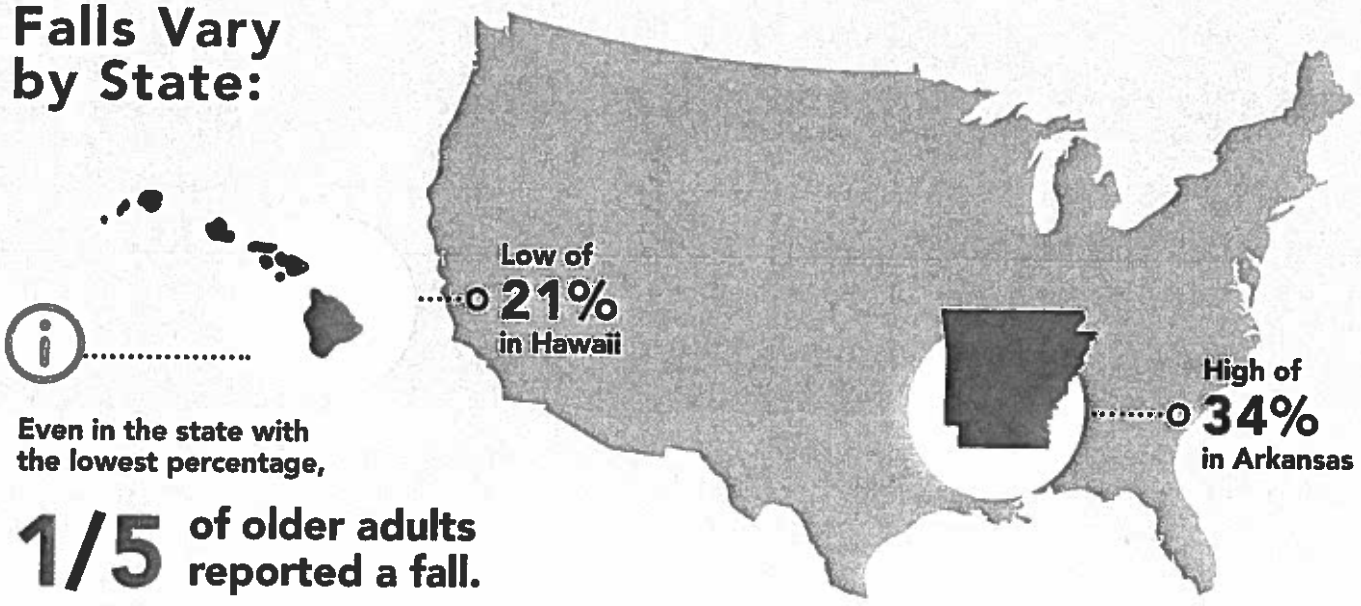


* Percent of older adults who reported a fall

Falls Vary by Race and Ethnicity:*



Falls Vary by State:



Even in the state with the lowest percentage,

1/5 of older adults reported a fall.

STEADI Stopping Elderly Accidents, Deaths & Injuries

www.cdc.gov/steadi

OLDER ADULT FALLS: A GROWING DANGER

What Can Be Done?

Falls aren't just a normal part of aging—they are preventable. Screening and effective strategies can save lives and money.

A Preventable Problem:

CDC, healthcare providers, and older adults and their caretakers can work together to reduce these devastating injuries.

1. CDC:

- Developed the STEADI (Stopping Elderly Accidents, Deaths & Injuries) initiative to help healthcare providers incorporate fall prevention into routine care for older adults. STEADI includes
  - screening tools,
  - educational materials and resources, and
  - online trainings.
- Worked with healthcare partners and electronic health record (EHR) vendors to integrate the STEADI materials and resources into EHR modules. The modules prompt clinicians to screen for falls risk, review medications, and recommend vitamin D.
- Continues to track the nation's progress in addressing older adult falls

Did You Know?

CDC funded health department and health system partnerships to implement STEADI into their primary care practices. For example, in Oregon and New York clinical practices:

- Before STEADI, clinicians rarely talked to their older adult patients about falls.
- After STEADI, clinicians screened and assessed 50-65% of their older patients for falls risks.

STEADI Stopping Elderly Accidents, Deaths & Injuries

www.cdc.gov/steadi

2. HEALTHCARE PROVIDERS:

- Identify patients who are at risk, identify modifiable risk factors, and offer effective fall strategies.
- Talk to older patients about falls using these three initial steps.
  1. **Screen for fall risk** using these three questions:
     - Have you fallen in the past year?
     - Do you feel unsteady when standing or walking?
     - Do you worry about falling?
  2. **Review and manage** medications linked to falls.
  3. **Recommend vitamin D** for improved bone, muscle, and nerve health.

3. OLDER ADULTS & CAREGIVERS:

Reduce the risk of falling and stay independent longer:

- **Speak up.** Talk to their doctor about fall risks and prevention. Tell their doctor right away if they have fallen, or if they're afraid they might fall, or if they feel unsteady.
- **Keep moving.** Activities that strengthen legs and help balance (like Tai Chi) can help prevent falls.
- **Check their eyes.** Have a vision screening once a year and update glasses as needed.
- **Check home safety.** Most falls happen at home.
  - Get rid of hazards. Keep floors clutter free.
  - Remove small rugs or tape down or secure them.
  - Add grab bars in the bathroom.
  - Have handrails and lights installed on all staircases.
  - Make sure there is plenty of light.

STEADI Material For Older Adults:

Stay Independent Brochure:
www.cdc.gov/steadi/pdf/stay_independent_brochure-a.pdf

What You Can Do To Prevent Falls Brochure:
cdc.gov/steadi/pdf/what_you_can_do_brochure-a.pdf

Check for Safety Brochure:
cdc.gov/steadi/pdf/check_for_safety_brochure-a.pdf

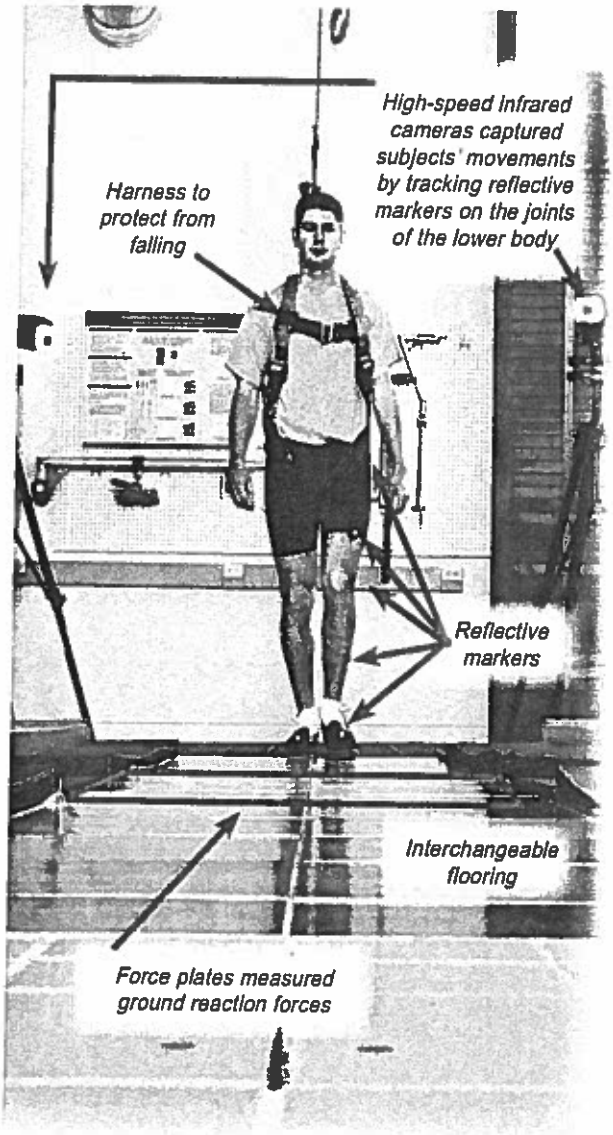
U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

RESOURCES

Older Adult Falls webpages:
cdc.gov/homeandrecreationalsafety/falls/adultfalls.html

STEADI Initiative:
cdc.gov/steadi

STEADI Patient Materials:
cdc.gov/steadi/patient.html



Beneath the Surface

Using Biomechanics to Study Same-Level Slips, Trips, and Falls

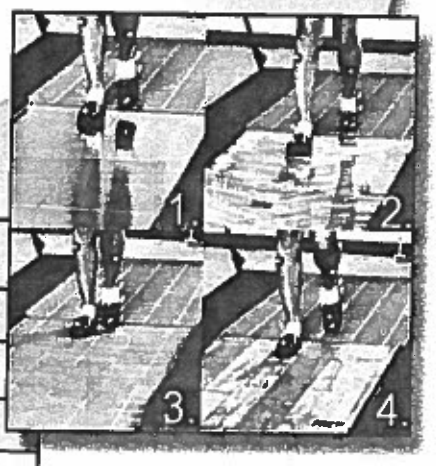
Part of understanding what can lead to a same-level slip and fall involves looking beneath the surface to examine the effects of internal and external forces on the joints, bones, and muscles during walking. By applying biomechanics, a branch of science dedicated to human movement, Liberty Mutual scientists study how various environmental and cognitive factors impact the body's response to potential slip and fall hazards.

In 2006, Liberty Mutual researchers launched a study to examine how individual perceptions of risk can impact gait adjustment. The study hypothesizes that individual visual perceptions of slipperiness and other sensory feedback received while walking can influence gait. "We know that, under certain conditions, discrepancies between perceived and actual slipperiness can hinder proper gait adjustment and increase the risk of a slip and fall," notes Chien-Chi (Max) Chang, Ph.D., principal investigator for the study. "The more we can understand the psychological causes and biomechanical effects of such discrepancies, the better our research can provide strategies to identify potentially hazardous conditions."

In an earlier related study, cognitive psychologists asked study participants to rate 38 different floor surfaces based on visual appearances. Then they examined the relationship between individual ratings of perceived slipperiness and actual measured friction for the surfaces studied. "We knew that visual cues play a critical role in shaping individual perceptions of slipperiness," notes Mary Lesch, Ph.D., cognitive psychologist and the study's principal investigator. "With this study we wanted to find out what visual cues people use to judge surface slipperiness and how well they are able to use those cues." The study found that the participants were relatively consistent in their judgments of slipperiness, and reflectance provided the strongest visual cue to perceived slipperiness.

Is It Slippery – What's Your Perception?

How would you rate the four floors (F) in the photos at right on a scale of 0 (not slippery) to 100 (extremely slippery)? Compare your answer to the slipperiness ratings (R) of our study participants and the actual measured coefficient of friction (COF). A high COF = less slippery, a low COF = more slippery.



F	R	COF	Consistency
1.	73	.76	Inconsistent - looks very slippery, but high COF
2.	90	.21	Consistent – looks very slippery, low COF
3.	29	.87	Consistent – doesn't look slippery, low COF
4.	42	.5	Inconsistent – doesn't look slippery, but relatively, low COF

published

Research to Reality

Liberty Mutual Research Institute for Safety

Assessing Slipperiness in Fast-Food Restaurants in the USA using Friction Variation, Average Friction and Perception Rating

Wen-Ruey Chang
Yueng-Hsiang Huang
Kai Way Li
Fred Filiaggi
Theodore Courtney

Research to Reality

Friction and Slipperiness

- Friction is widely used to assess slipperiness.
- Level of friction is used to identify dangerous spots for potential interventions.

  low COF → slippery

  high COF → not slippery

Friction Variation

- People manipulate gait when aware of walking on slippery surfaces.
- The potential of slip and fall incidents could be increased due to local friction variation (Strandberg, 1985).
- However, actual friction variation measurements have not been reported in the literature to assess slipperiness.

Research to Reality

Study Purpose

- Explore the relationships among multiple friction variations, friction levels and perception ratings of slipperiness in 6 major working areas of 10 fast-food restaurants.

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Methodology

- Quantify average friction and friction variation in major working areas of fast-food restaurants using the PIAST right after the lunch period
- Assess employee perceptions of floor slipperiness via survey in the same selected areas concurrently
- Correlate the measured friction coefficients with the subjective slipperiness ratings

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Major Working Areas

- Back vat (fried chicken)
- Front counter
- Fryer (French fries)
- Grill (beef patties)
- Sink
- Walk through

Research to Reality™

Research to Reality

Floor Slipperiness Survey

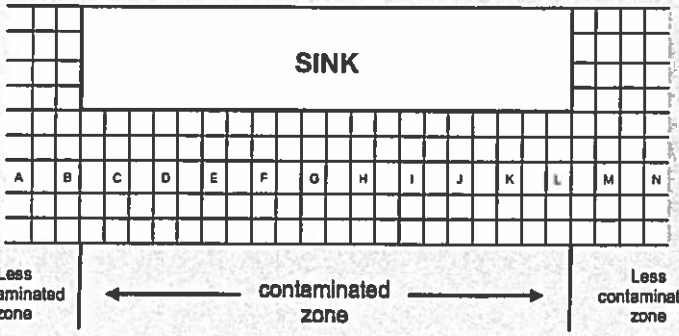
- Participants: all employees working during the lunch period
- Rated the floor conditions during the lunch period on the day of the visit using a four point Likert scale

4 not slippery
3 a little slippery
2 more slippery
1 very slippery

Research to Reality

Tile Selection for Friction Measurement

- Selected a line of measurement in each area to represent a typical walking path
- Critical areas: measured a tile every 30 cm on the line (back vat, fryer, grill, sink and walk through)
- Non-critical areas: measured a tile every 60 cm (front counter)



Friction Measurement

- Two measurements were taken on each selected tile, one is each direction.
- Wet measurement was conducted on the tiles within the contaminated zone of the sink.
- Surface conditions were not altered on any other tiles.

Friction Variation Calculations

- Friction variations were calculated from COF pairs measured in the same direction at 60 cm intervals.

Two Types of Friction Variation

- Absolute friction variation

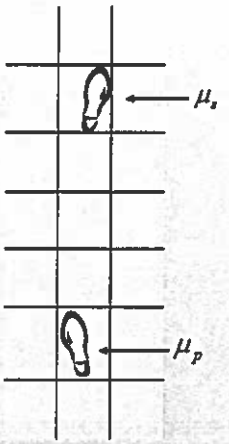
$$\Delta\mu_a = \mu_s - \mu_p$$

- Relative friction variation

$$\Delta\mu_r = \Delta\mu_a / \mu_p$$

μ_s: friction coefficient of subsequent tile

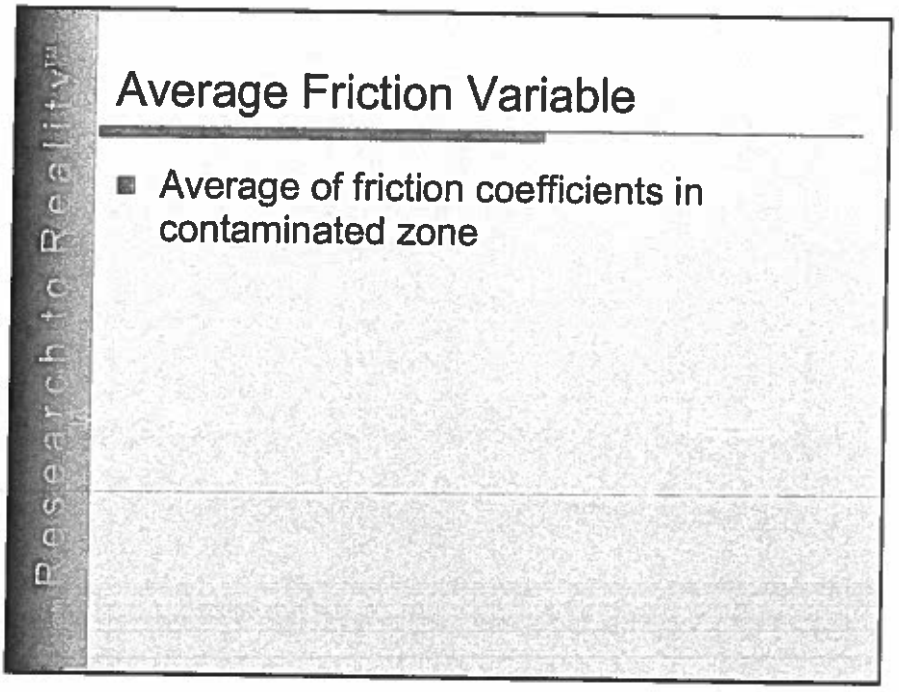
μ_p: friction coefficient of preceding tile



Friction Variation Variables

- Average and maximum friction reductions (absolute and relative)
  - within the contaminated zone
  - at the transition between contaminated and less contaminated zones
  - over the entire working area

There were a total of 12 friction variation variables.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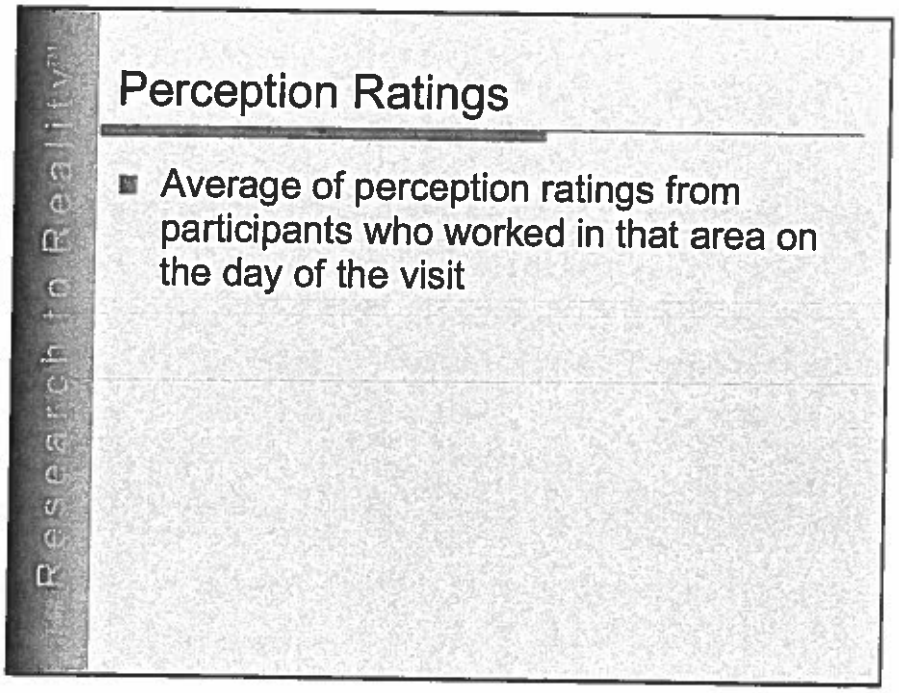
Average Friction Variable
Average of friction coefficients in contaminated zone


Research to Reality™
Perception Ratings
Average of perception ratings from participants who worked in that area on the day of the visit

Statistical Analyses

- Calculated the Pearson correlation:
  - perception vs. average friction
  - perception vs. friction variations
  - average friction vs. friction variations

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Participants

- Visited 10 fast-food restaurants in USA
- 126 employees interviewed
  - 87.5% response rate

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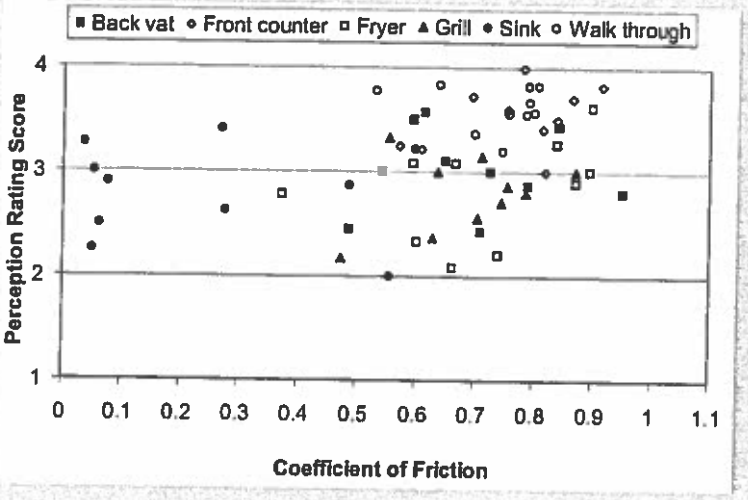
Friction and Perception Correlation

- The Pearson correlation for average friction: 0.33 (p=0.01)
- Friction variation variable that had a higher correlation coefficient than average friction:
  - Maximum absolute friction reduction over the whole working area: 0.34 (p=0.008)
  - Maximum relative friction reduction over the whole working area: 0.37 (p=0.004)

Average Friction Coefficient versus Subjective Score Across 60 working Areas



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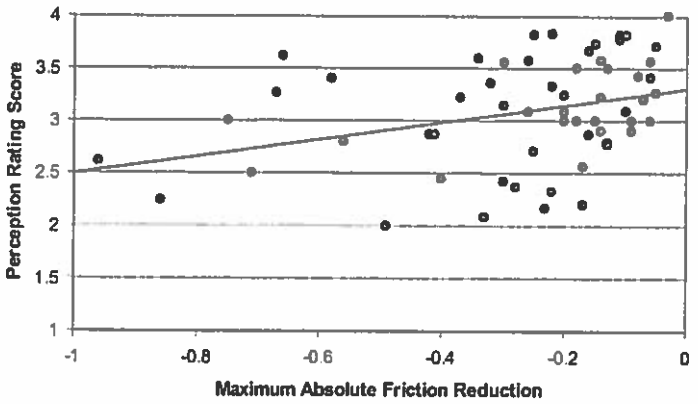
Maximum Absolute Friction Reduction vs. Subjective Score



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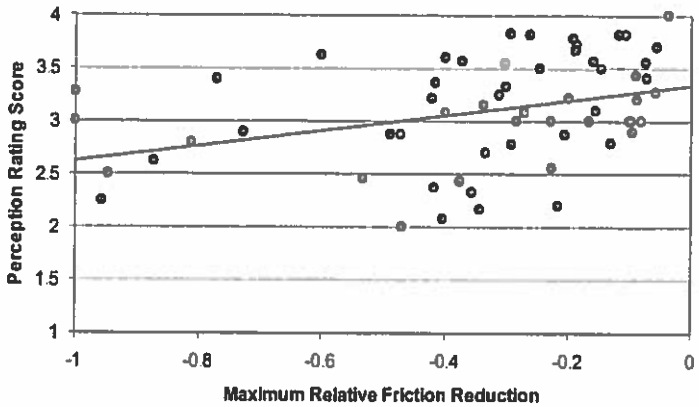
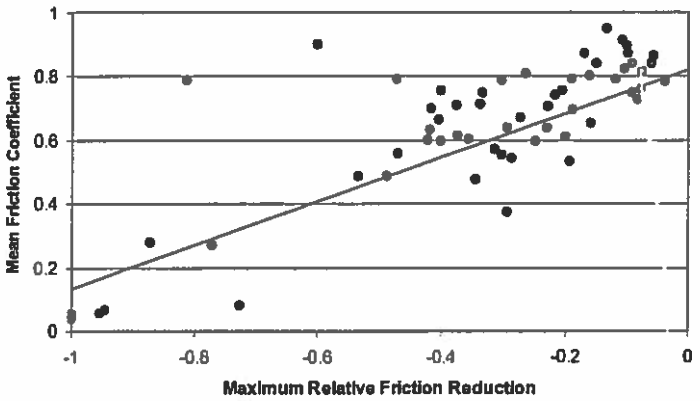
Maximum Relative Friction Reduction vs. Subjective Score



Correlation between Friction Reduction and Average Friction

- The correlation between average friction and some friction reduction variables was found to be as high as 0.85 ($p<0.001$).
- The correlation between the maximum absolute friction reduction over the whole working area and average friction: 0.64 ($p=0.001$)
- The correlation between the maximum relative friction reduction over the whole working area and average friction: 0.80 ($p=0.001$)

Maximum Relative Friction Reduction vs. Average Friction Coefficient



Friction Variation or Average Friction?

- Some friction variation variables had only slightly higher correlations with perception ratings than the average friction coefficient.
- A high correlation was found between average friction and most friction variation variables.
- The time and effort required for quantifying friction variation were much greater than for quantifying average friction.

Conclusions

- Friction and slipperiness

  low COF → slippery

  high COF → not slippery

Average friction is an adequate indicator of slipperiness in practice.

Research to Reality™

Publication

- WR Chang, YH Huang, KW Li, A Filiaggi, TK Courtney, 2008, Assessing Slipperiness in Fast-Food Restaurants in the USA using Friction Variation, Friction Level and Perception Rating, *Applied Ergonomics*, 39 (3), 359-367.

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August 22, 2008

Mr. Thomas Bresnahan
8078 Garfield Avenue, #9-3
Burr Ridge, Illinois 60527-7914

Re: Summary of user testing for traction/slip symbols

Dear Tom:

As we discussed, I have prepared a summary of user testing activities for the traction/slip symbols.

OVERVIEW OF ASSIGNMENT

On February 20, 2008, ASE was provided with potential candidate symbols for communicating the level of traction provided by floor covering products (see Attachment A). With feedback from Tom Bresnahan and Terry Grisim, ASE edited and modified the symbols. From April 5 through April 15, 2008, ASE conducted two phases of symbols testing based on the recommendations in ANSI Z535.3 (2007) "Criteria for Safety Symbols." Phase 1 consisted of a judged comprehension test (ANSI Z535.3 Annex B2.4), in which four variants of the traction/slip symbol were tested with 50 participants. Phase 2 consisted of an open-ended comprehension test, in which the modified symbols from Phase 2 were tested with another 50 participants. The following sections describe the activities, findings, and recommendations from this testing. Supporting attachments A, B, and C are also included.

PHASE 1: JUDGED COMPREHENSION TESTING

The initial test phase consisted of a judged comprehension test as recommended in ANSI Z535.3 (2007) "Criteria for Safety Symbols." The purpose of this testing was to identify symbol variants that were most likely to be well comprehended by asking participants to estimate the percentage of the population that would comprehend the meaning of each of several symbols representing the same concept. The following section describes participant recruitment and demographics, questionnaire design, and results of this phase. The selection of the symbols for Phase 2 open-ended comprehension testing is also discussed.

Participant Recruitment and Demographics

From April 4 through April 9, 50 participants were recruited in southeastern Michigan and Arlington, Virginia at flooring and hardware stores, a Home and Garden show, and

contacts of ASE employees who are "do-it-yourselfers". Thirty-two were male and 18 were female. The average age was 43.5 years (range: 21-68 years). Thirty participants had at least a four-year college degree. Twenty-nine participants had business or sales-related occupations (e.g., manager, customer service), 13 had professional-related occupations (e.g., doctor, accountant), 5 participants had trade-related occupations (e.g., construction, electrician), 2 participants were retired, and 1 had other type of employment (i.e., "PSA"). All participants were offered $5 for their participation.

Questionnaire Design

The questionnaire used in this phase is shown in Attachment B. The first page consisted of the following script for the interviewer to read:

> "We are developing symbols that would appear on packaging for floor coverings (tile, vinyl, etc.). Here is a photo of potential products that may have these symbols. And, here are several symbols that are all intended to convey how slippery the floor might be. What I would like for you to do is compare each of the symbols with the meaning in the center and tell me how many people out of 100 would understand the symbol. If no one would understand the symbol, please tell me 0. If you believe everyone would understand the symbol tell me 100. Feel free to use any numbers in between 0 and 100. You may use any number as often as you like."

The interviewer showed four symbol variants to the participant and wrote down the participant's responses. The interviewer also asked participants if they had any suggestions for improvements to the symbols and wrote these suggestions on the response form.

Results

The results of the judged comprehension testing are shown in Figure 1.

Symbol Selected for Modification and Further Testing

ANSI Z535.3 suggests that a variant receiving a score below 65% (mean or median) is unlikely to meet the 85% criterion on final open-ended testing (ANSI Z535.3, Annex B2.4). Given this, ASE selected the highest mean value percentage (60.9%)[1] and modified the symbol based on feedback received from participants. Suggestions included the addition of descriptive text (i.e., traction) and adjusting the location of the person to the horizontal rather than along the gauge. The modified symbols are shown in Figure 2.

[1] We used the mean scores to select the symbol for open-ended comprehension. The median score for the selected variant was 68.5%. All other variants had 50% as a median.

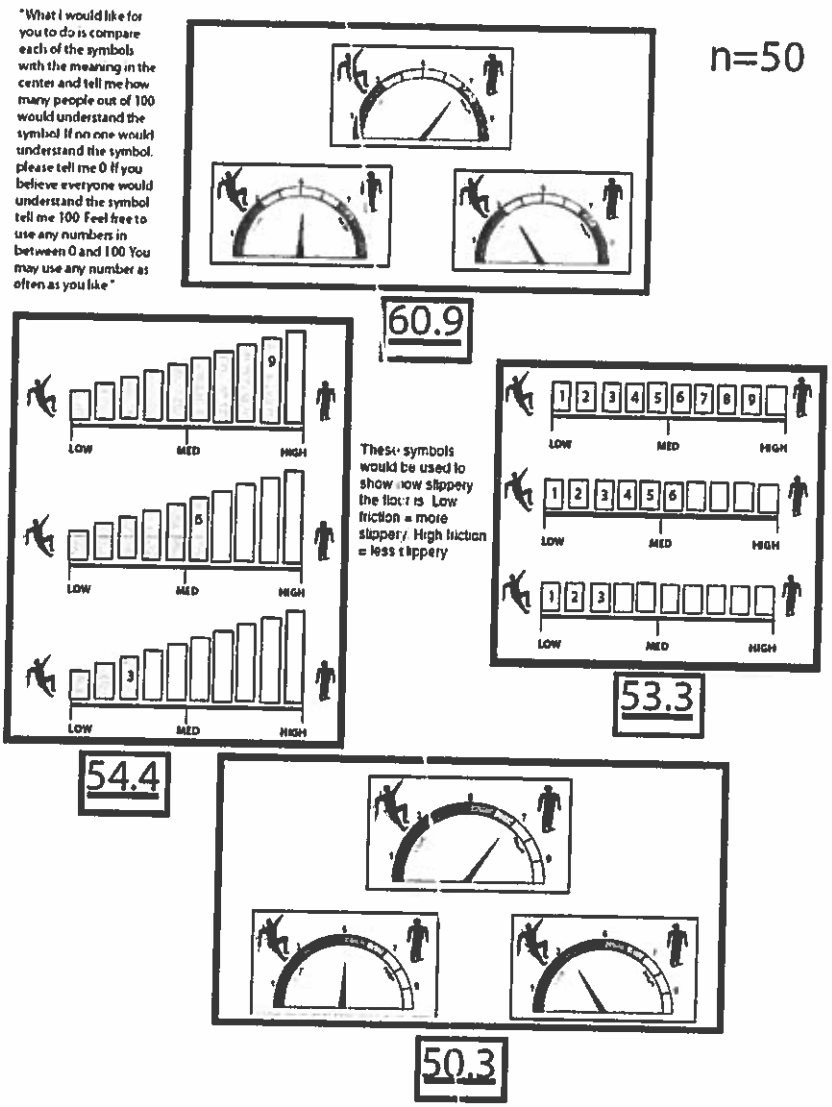


Figure 1. Results from judged comprehension testing (shows mean values)

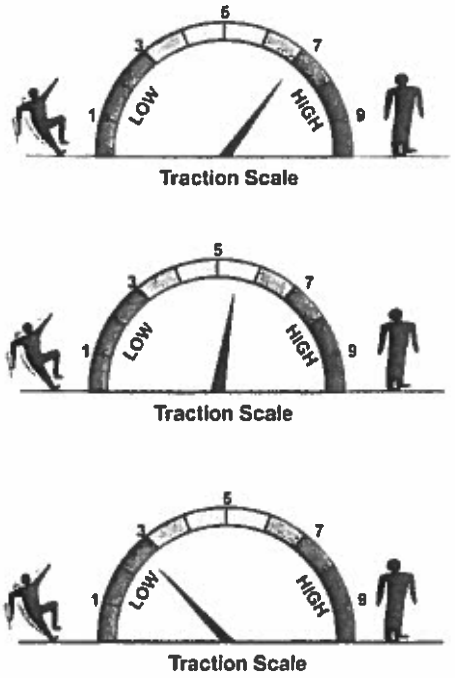


Figure 2. Modified symbols for Phase 2 comprehension testing.

PHASE 2: OPEN-ENDED COMPREHENSION TESTING

The second phase of testing consisted of an open-ended comprehension test as recommended in ANSI Z535.3. The purpose of an open-ended comprehension evaluation is to identify how well symbols are actually comprehended and, if comprehension difficulties occur, to develop improvements to symbol features to increase comprehension. The following sections describe participant recruitment and demographics, questionnaire design, and results for this phase.

Participant Recruitment and Demographics

From April 11 through April 15, 50 participants were recruited in southeastern Michigan at a Home and Garden show, a Habitat for Humanity build, and flooring and hardware stores. Twenty-nine were male and 21 were female. The average age was 37 years (range: 18-85). Thirty-three participants had less than a four-year college degree. Twelve participants had business or sales-related occupations (e.g., manager, customer service), 7 had professional-related occupations (e.g., doctor, accountant), 3 participants had trade-related occupations (e.g., construction, electrician), 6 participants were retired, 16 were students, 4 were unemployed, and 2 had other types of employment (e.g., mail clerk, automotive worker). All participants were offered $5 for their participation.

Questionnaire Design

The questionnaire used in this phase is shown in Attachment C. The first page consisted of the following script for the interviewer to read:

> "We are developing symbols that would appear on packaging for floor coverings (tile, vinyl, etc.). Here is a photo of several boxes of floor covering. And, here is a symbol set that might appear on the package. I would like to ask you a few questions about these. Just do the best that you can, and take an "educated guess" if you are not sure of the meaning. Remember, it is the symbols that are being tested, not you."

The interviewer showed the symbol set to the participant and asked the participant to assume that they were shopping for floor coverings at a store and noticed the symbol set on packaging for different products. The interviewer asked, "What do you think these symbols mean?" (and asked "is there anything else?" until the participant said no). The interviewer wrote down their responses. The interviewer also asked participants if they had any suggestions for improvements to the symbols.

Results

Forty-four participants (88%) correctly reported the meaning of the symbol set. Of the six participants that incorrectly reported its meaning, four (8% of total participants) reversed the meaning of the symbol (i.e., the "low traction" was thought to mean "low slipperiness" or "high traction"). In an Annex to ANSI Z535.3, these responses are referred to as critical confusions in that the acceptance criterion is no more than 5% of this type of responses. The two participants that reported incorrect responses correctly identified that there was a low to high measure, but did not equate it with traction. One thought it was "quality" of the product and the other thought it was related to product use (but could not articulate what kind). Based on ANSI Z535.3, the symbol exceeds the comprehension criteria (85%) for correct responses, but also exceeds that of the "critical confusions". Therefore, it meets one, but not both criteria according that particular protocol.

RECOMMENDATIONS

To accept a symbol, ANSI Z535.3 recommends a criterion of 85% correct responses with a maximum of 5% critical confusions (assuming a sample of 50 participants). If a symbol does not meet this criteria, ANSI recommends rejecting, modifying and retesting, using a supplementary word message, or having specialized training to supplement the symbol. For this particular situation, 88% of the participants were able to correctly comprehend the meaning of the symbols. This is actually an encouraging result because many symbols used in the marketplace are not tested or, if they are tested, do not pass the ANSI Z535.3 criteria. There are many possibilities to explain why a symbol might not pass the criteria, including symbol factors and person factors. However, the number of participants who gave incorrect responses (6 total, 4 with critical confusions) is not large enough to draw any conclusions regarding possible person factors, and no trends were evident in the demographic information that we collected (age, gender, education, occupation).

Because the current symbols did not meet the ANSI Z535.3 comprehension criteria, we

recommend modifying the symbols to include additional text. This approach is consistent with ANSI Z535.3 and **additional testing is not required.** Therefore, considering the responses received by the participants with critical confusions, we recommend adding the supplemental word "Traction" to the "LOW" and "HIGH" text to clarify that it is traction rather than "slipperiness" being indicated.

It is important to note that the protocol within ANSI Z535.3 is intended for testing the comprehension of symbol elements, not words. The confusion seen in the 4 responses in this study seems to be related to the clarity of the existing words and not the symbol elements. Therefore, strictly applying the ANSI Z535.3 critical confusion criteria to these symbols seems to be outside the range of the standard. Furthermore, even the ANSI Z535 standard that addresses warning labels with words, ANSI Z535.4, does not require testing when wording changes are made to labels.

In addition, to enhance the readability of this additional text and the existing text, we also recommend orienting the text "LOW" and "HIGH" on the horizontal plane rather than angled and on top of the horizontal traction line. Figure 3 (on the following page) shows an example of these modifications.

Please let me know if you have any questions regarding this report.

Sincerely,

Elaine Wisniewski

Elaine Wisniewski, MSE, MA, CPE, CPSM

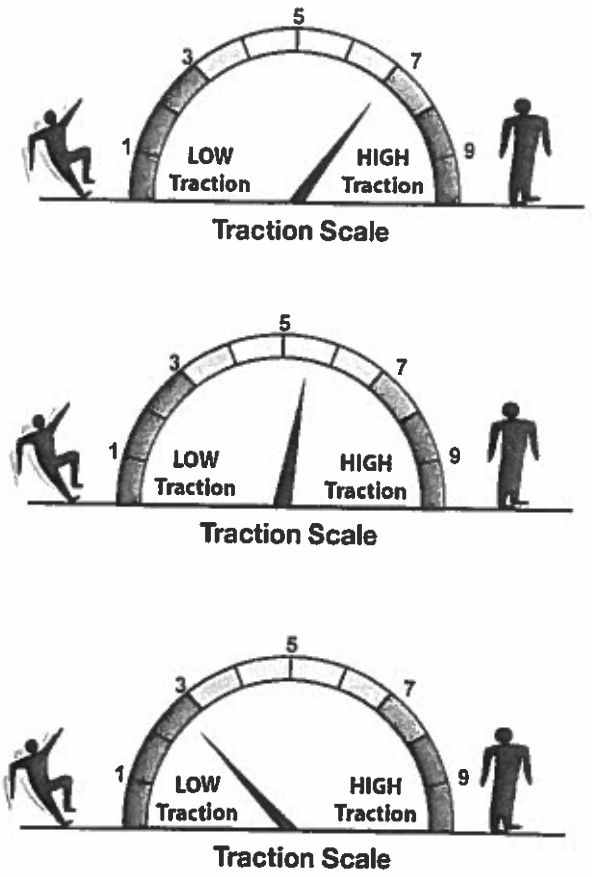
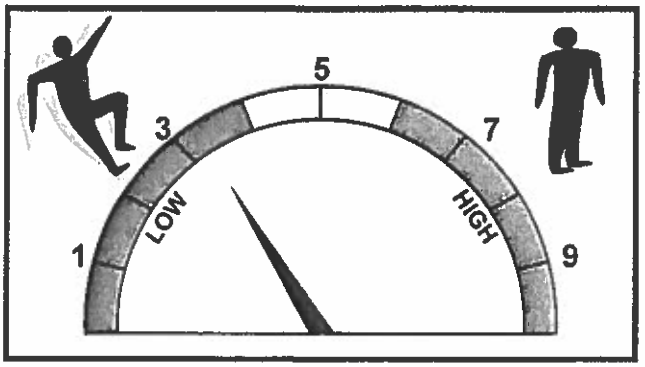


Figure 3. Modifications to symbols.

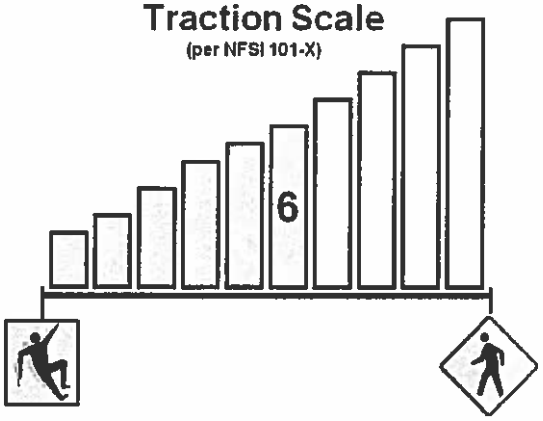
Attachment A: Example Symbols Received



Traction Scale
(per NFSI 101-A)

0	0.5	1.0
LOW	MEDIUM	HIGH

Traction Scale
(per NFSI 101-X)



Date: _____ Attachment B. Phase 1 Questionnaire Participant #____
Interviewer Initials _____

Introduction

"Hello, I am conducting a brief study regarding symbols that might appear on the packaging of flooring materials such as tile or vinyl. I will pay you $5 for 5 minutes of your time. Would you be interested in participating?"

If no, "thank you for your time."

If yes, "thank you, I appreciate it (hand money to participant)"

Instructions

"We are developing symbols that would appear on packaging for floor coverings (tile, vinyl, etc.). Here is a photo of potential products that may have these symbols."

(Show photo pages to participant)

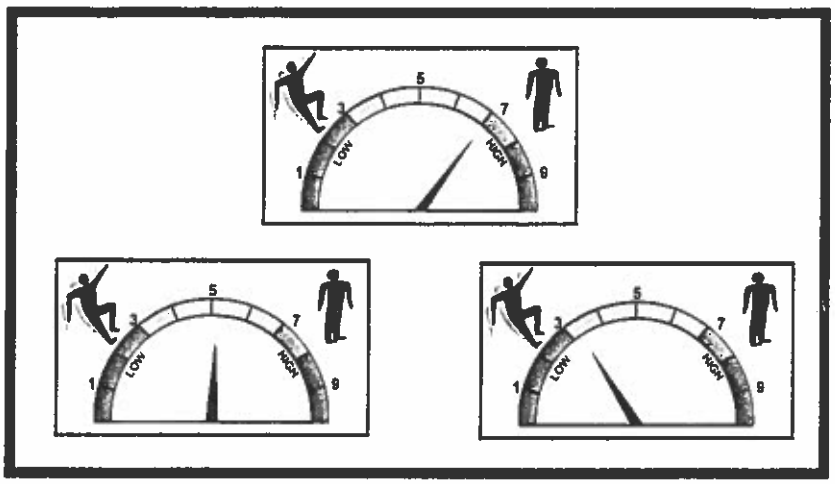
"And, here are several symbols that are all intended to convey how slippery the floor might be."

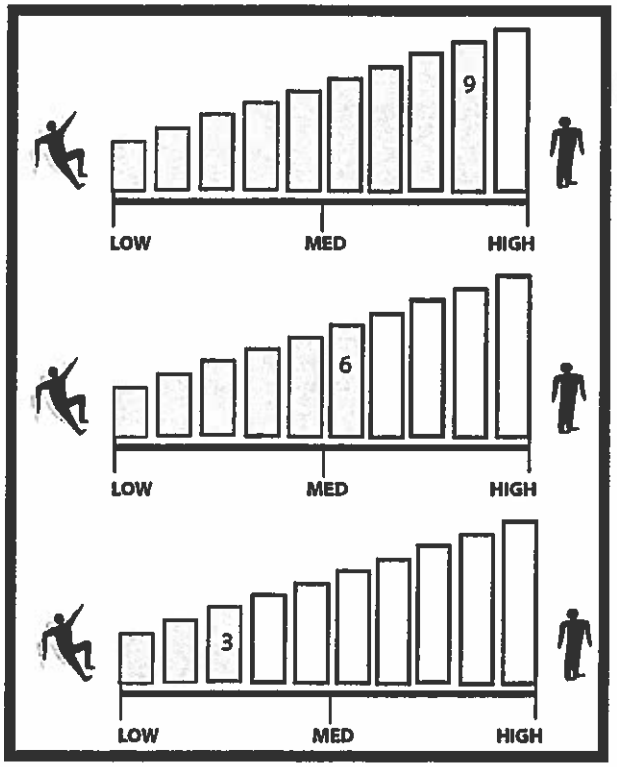
(Hand sheet of symbols to participant)

"What I would like for you to do is compare each of the symbols with the meaning in the center and tell me how many people out of 100 would understand the symbol. If no one would understand the symbol, please tell me 0. If you believe everyone would understand the symbol tell me 100. Feel free to use any numbers in between 0 and 100. You may use any number as often as you like."

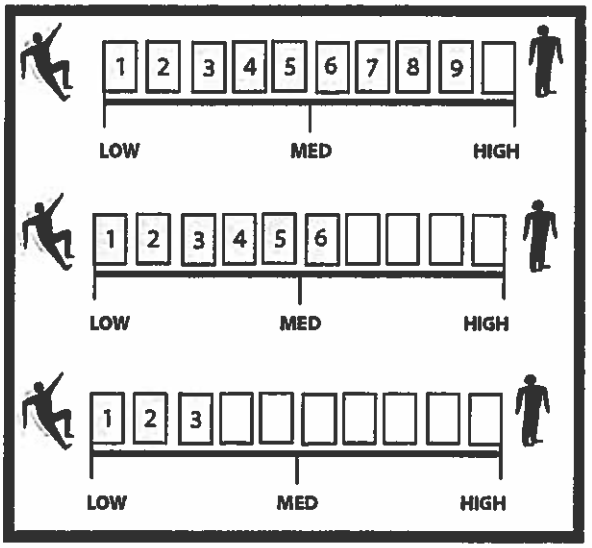
Date _____

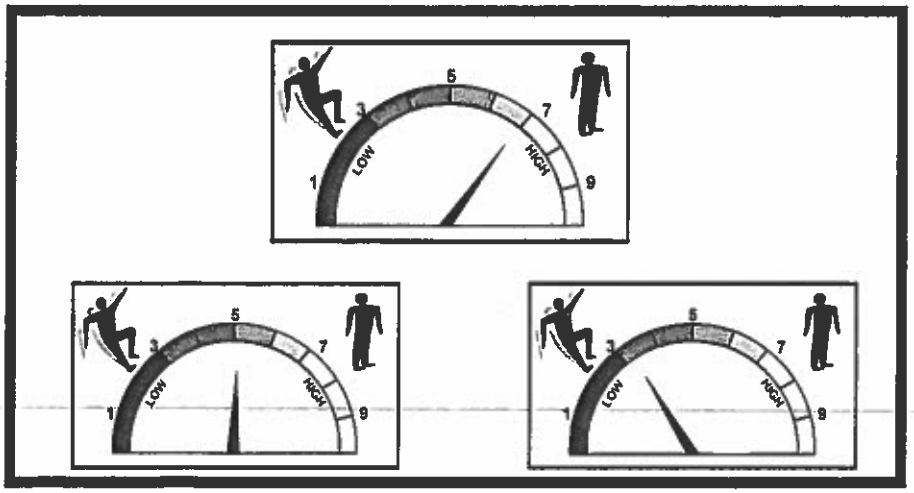
Participant # _____
Interviewer Initials_____





These symbols would be used to show how slippery the floor is. Low friction = more slippery. High friction = less slippery.



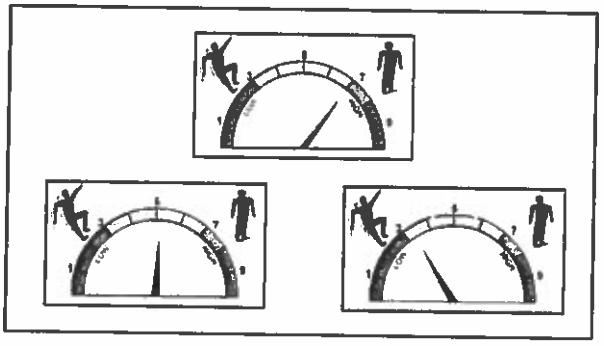


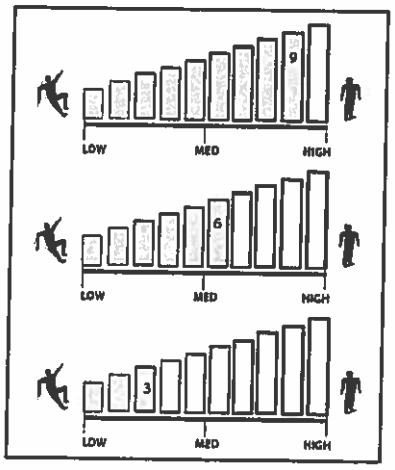
Date: _____

Participant #____
Interviewer Initials _____

Questions

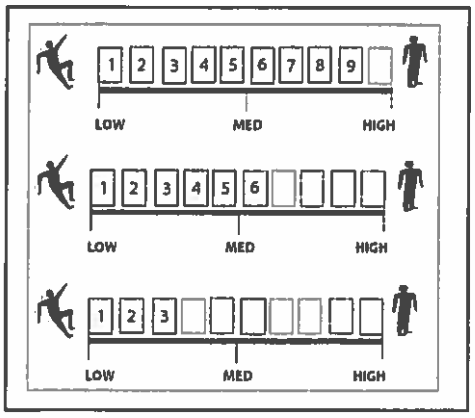
Do you have any suggestions for improvements to these symbols?

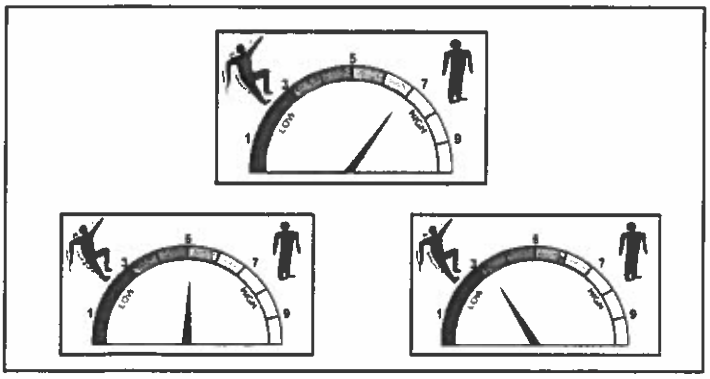




Date: _____

Participant #____
Interviewer Initials _____





Date: _____

Participant #____
Interviewer Initials _____

Participant Background Information

Age: _____

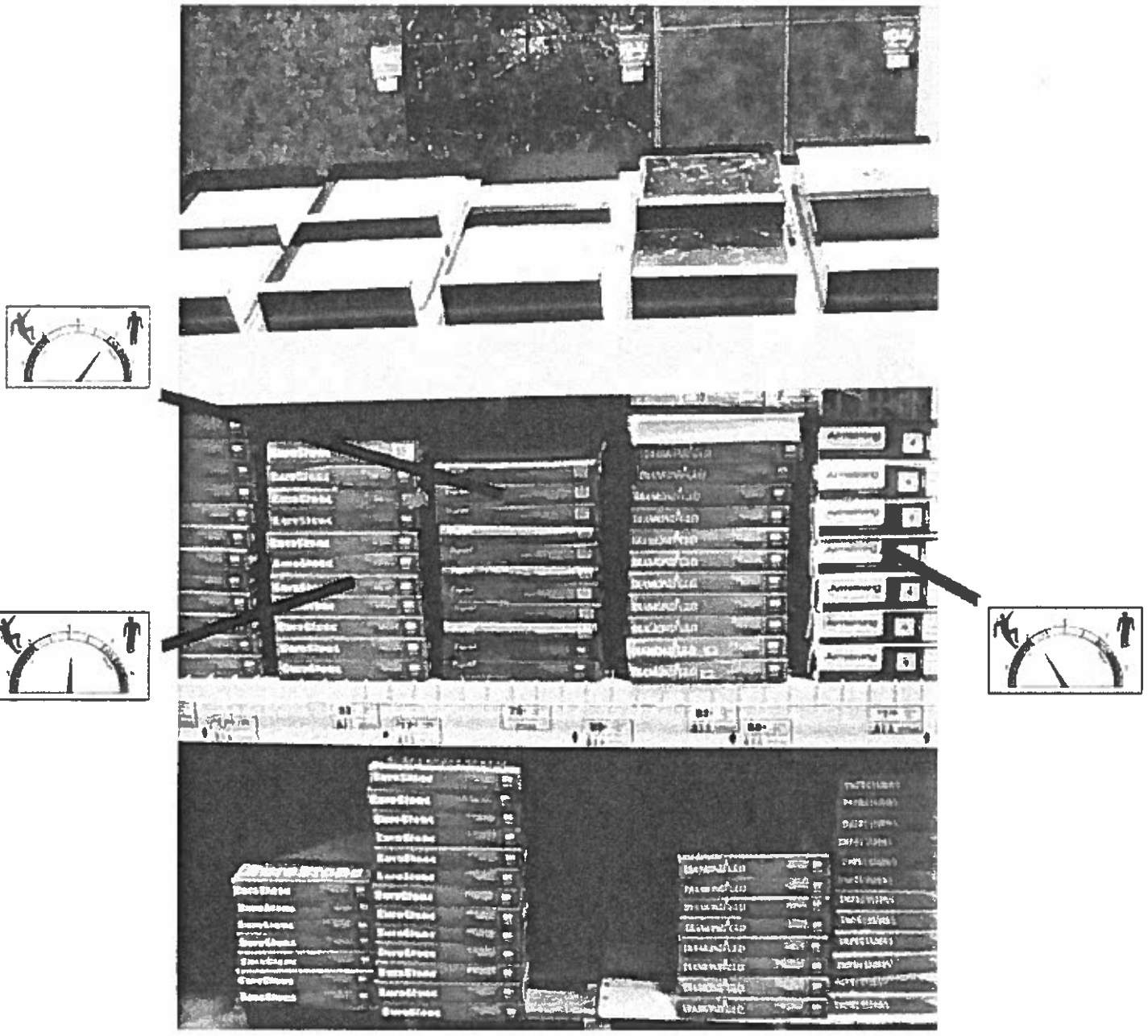
Gender (please circle) Male Female

Education (please circle)

Less than high school
High school
2-year college
Trade school
4-year college
More than 4-year college

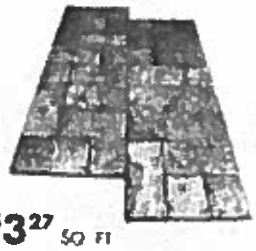
Occupation: _____

Thank you for your time today!

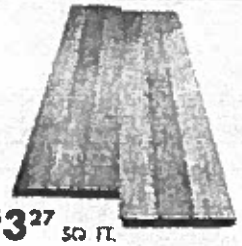


Floor Coverings

LAMINATE



$3.27 SQ FT
DUPONT™ REALTOUCH™ ELITE TUSCAN STONE LAMINATE
Case covers 20.02 sq ft. 30-year limited warranty. 10mm thickness.



$3.27 SQ FT
DUPONT™ REALTOUCH™ ELITE CHERRY LAMINATE FLOORING
Case covers 18.49 sq ft. The look and feel of a custom installed real-wood floor. 10mm thickness.

CERAMIC

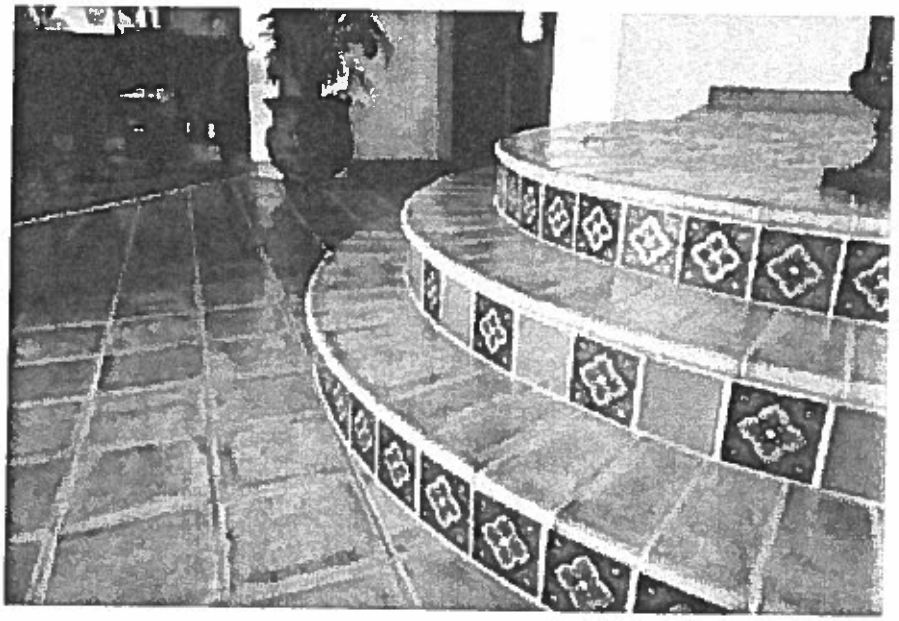
SPECIAL BUY
77¢ SQ FT
12"x12" SONORA TAUPE CERAMIC TILE
Case covers 15 sq ft.

99¢ SQ FT
16"x16" ISLAND SAND CERAMIC TILE
Case covers 15.50 sq ft.

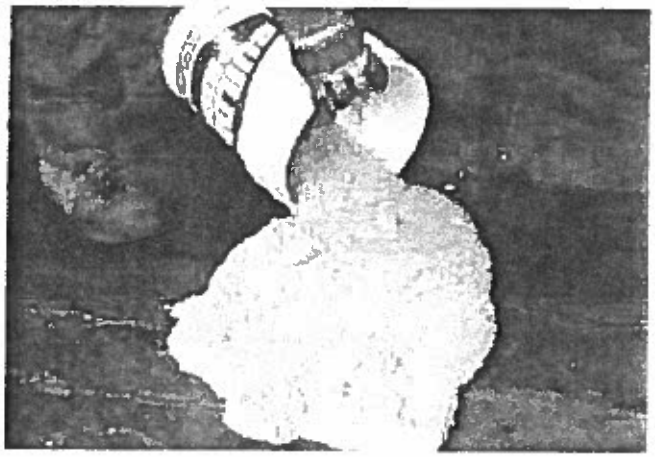
VINYL

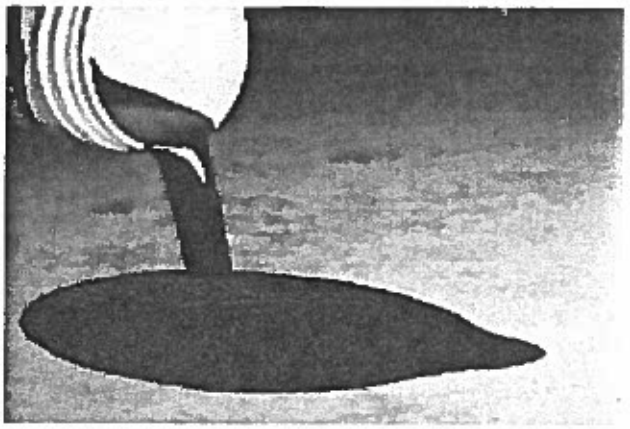
$1.69 SQ FT
ALLURE RESILIENT OAK PLANK FLOORING
Case covers 24 sq ft. A true wood look you can install yourself.

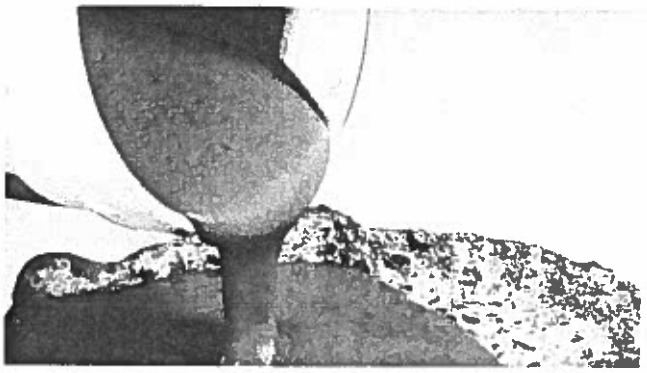
$1.69 SQ FT
TRAFFICMASTER™ ALLURE RESILIENT PLANK FLOORING IN HICKORY
Case covers 24 sq ft. Installs over your existing floor.



Floor Covering Materials







Date: _____ Attachment C: Phase 2 Questionnaire Participant #____
Interviewer Initials _____

Introduction

"Hello, I am conducting a brief study regarding symbols that might appear on the packaging of flooring materials such as tile or vinyl. I will pay you $5 for 5 minutes of your time. Would you be interested in participating?

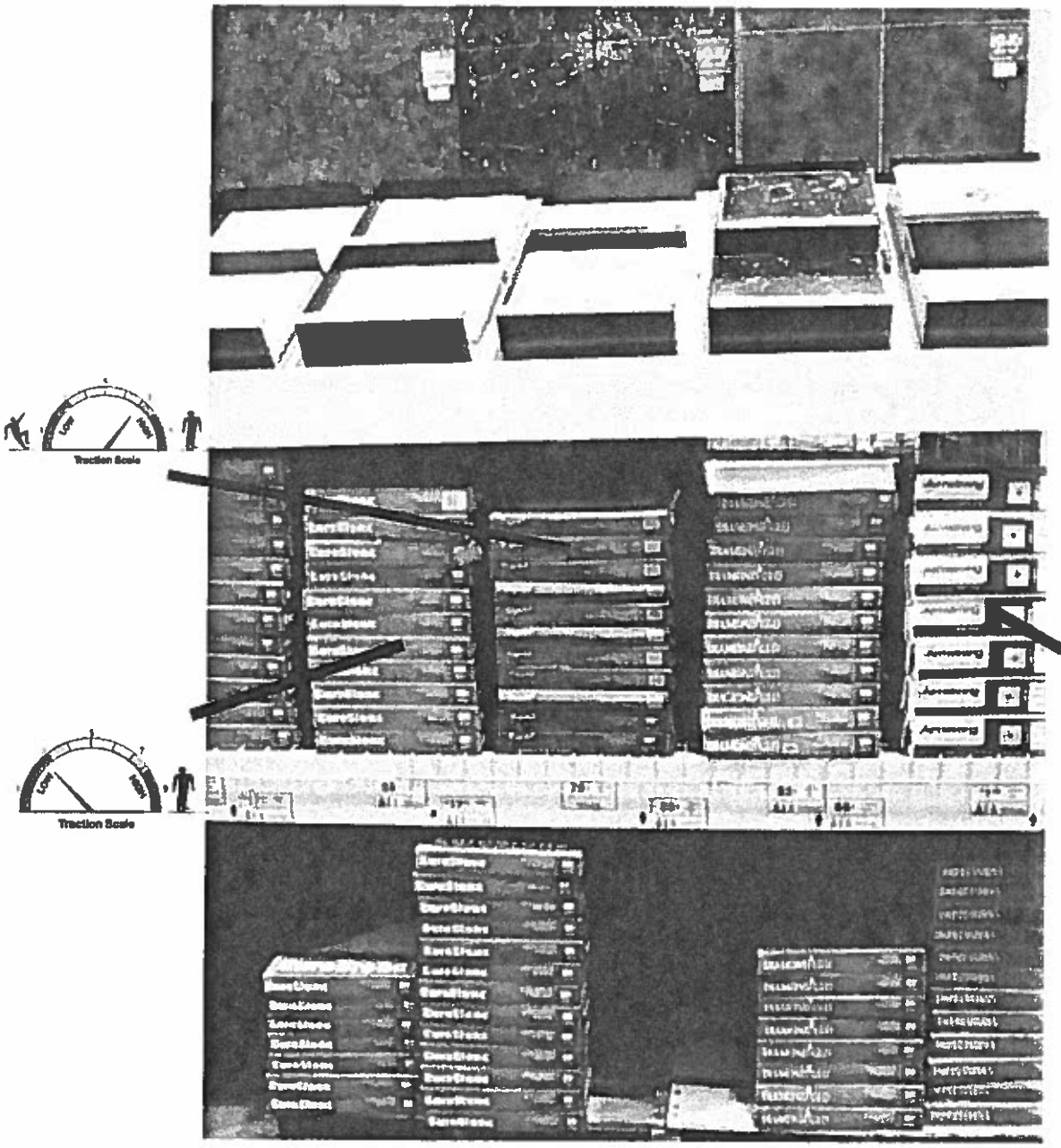
If no, "thank you for your time."

If yes, "thank you, I appreciate it (hand money to participant)"

Instructions

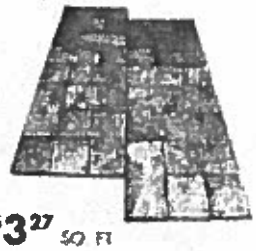
"We are developing symbols that would appear on packaging for floor coverings (tile, vinyl, etc.). Here is a photo of several boxes of floor covering. (Show photo page to participant)."

"And, here is a symbol set that might appear on the package." (give sheet of symbols to participant) I would like to ask you a few questions about these. Just do the best that you can, and take on "educated guess" if you are not sure of the meaning. Remember, it is the symbols that are being tested, not you."

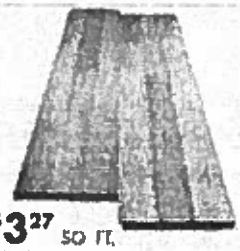

Traction Scale
Traction Scale
Traction Scale

Floor Coverings

LAMINATE



$3.27 SQ. FT.
DUPONT™ REALTOUCH™ ELITE TUSCAN STONE LAMINATE
Case covers 20.02 sq. ft. 30-year limited warranty. 10mm thickness.



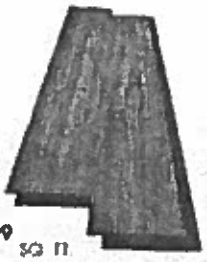
$3.27 SQ. FT.
DUPONT™ REALTOUCH™ ELITE CHERRY LAMINATE FLOORING
Case covers 18.49 sq. ft. The look and feel of a custom-matched real-wood floor. 8mm thickness.

CERAMIC

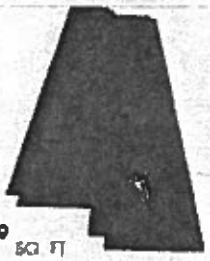
77¢ SQ. FT.
12"x12" SONORA TAUPE CERAMIC TILE
Case covers 15 sq. ft.

99¢ SQ. FT.
16"x16" ISLAND SAND CERAMIC TILE
Case covers 15.50 sq. ft.

VINYL

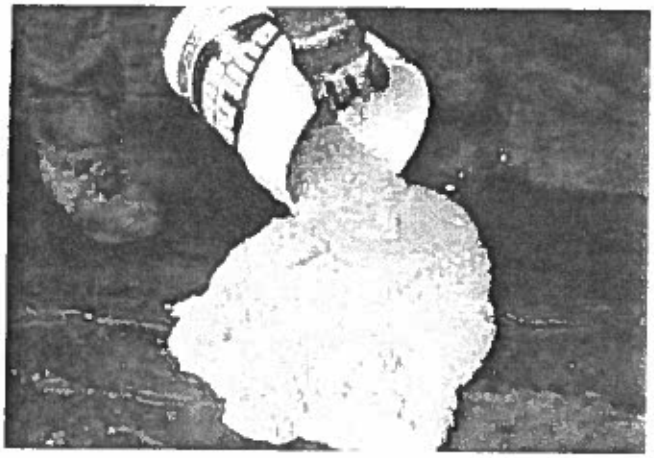


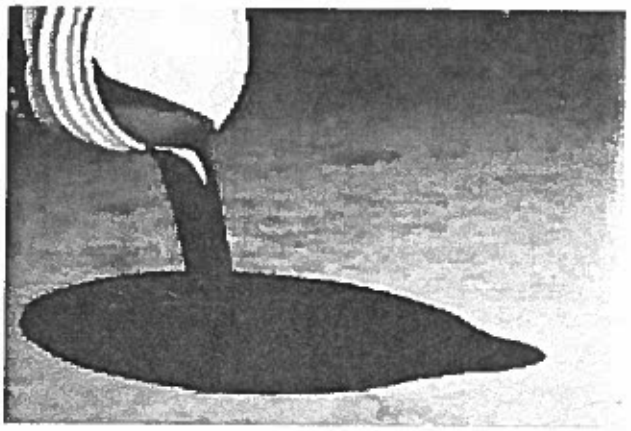
$1.69 SQ. FT.
ALLURE RESILIENT OAK PLANK FLOORING
Case covers 24 sq. ft. A true wood look you can install yourself.

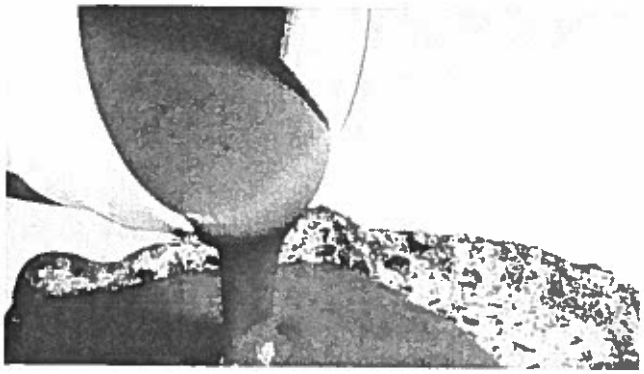


$1.69 SQ. FT.
TRAFFICMASTER™ ALLURE RESILIENT PLANK FLOORING IN HICKORY
Case covers 24 sq. ft. Installs over your existing floor.

Floor Covering Materials



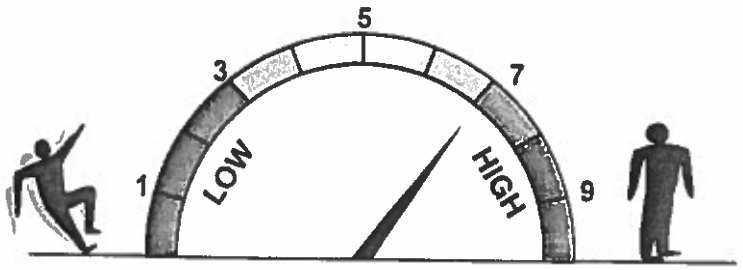




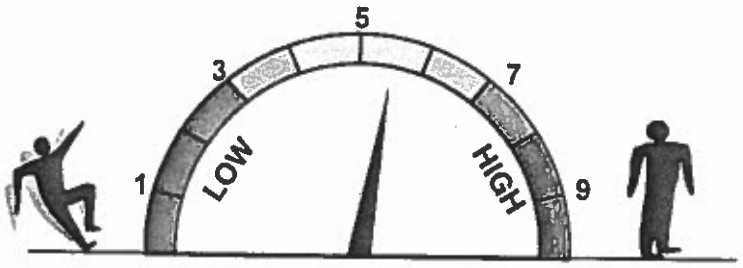
Questions Regarding Symbols

Assume that you are shopping for floor coverings at a store. You notice the following symbols on the packaging for different products.

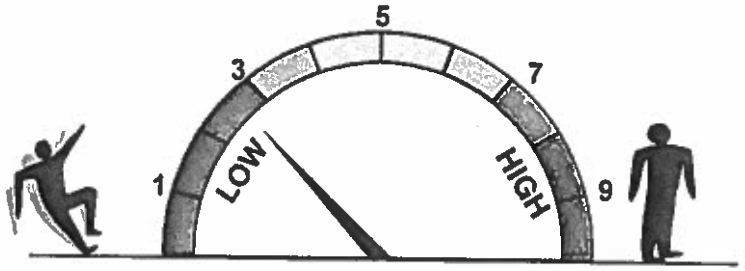
What do you think these symbols mean? (ask "Is there anything else?" until participant says "no")



Traction Scale



Traction Scale



Traction Scale

Do you have any suggestions for improvement?

Date: _____

Participant #____
Interviewer Initials _____

Participant Background Information

Age: _____

Gender (please circle) Male Female

Education (please circle)

Less than high school
High school
Some college
2-year college
Trade school
4-year college
More than 4-year college

Occupation: _____

Thank you for your time today!

Measuring the Risk of Slips and Falls: An Injury Reduction Study Using Tribometry

CNA

Shari Falkenburg
Assistant Vice President
CNA

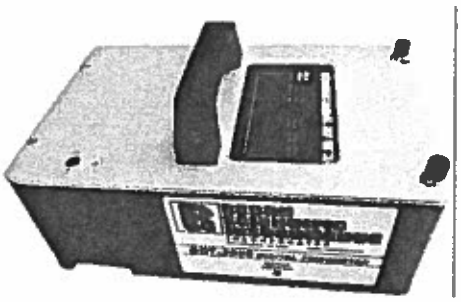
NFSI

NATIONAL FLOOR SAFETY INSTITUTE

Objectives

- Learn how to use a walkway standard and co-efficient of friction results as a risk management tool for reducing slips and falls.

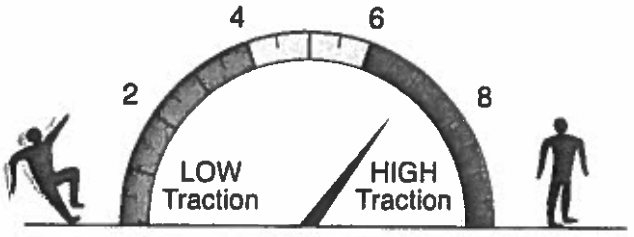
- Aid in the prevention of slips and falls through research and education



CNA

Understanding...

- **Tribometry**
  - Measures the SCOF (Static Coefficient of Friction) or DCOF (Dynamic Coefficient of Friction) of a flat surface area
- **COEF**
  - The COEF is determined by the BOT that physically senses the slip resistance of a surface.
- **Slips and Falls**
  - Occurs when there is too little friction or traction between footwear and the floor surface



Traction Scale

CNA

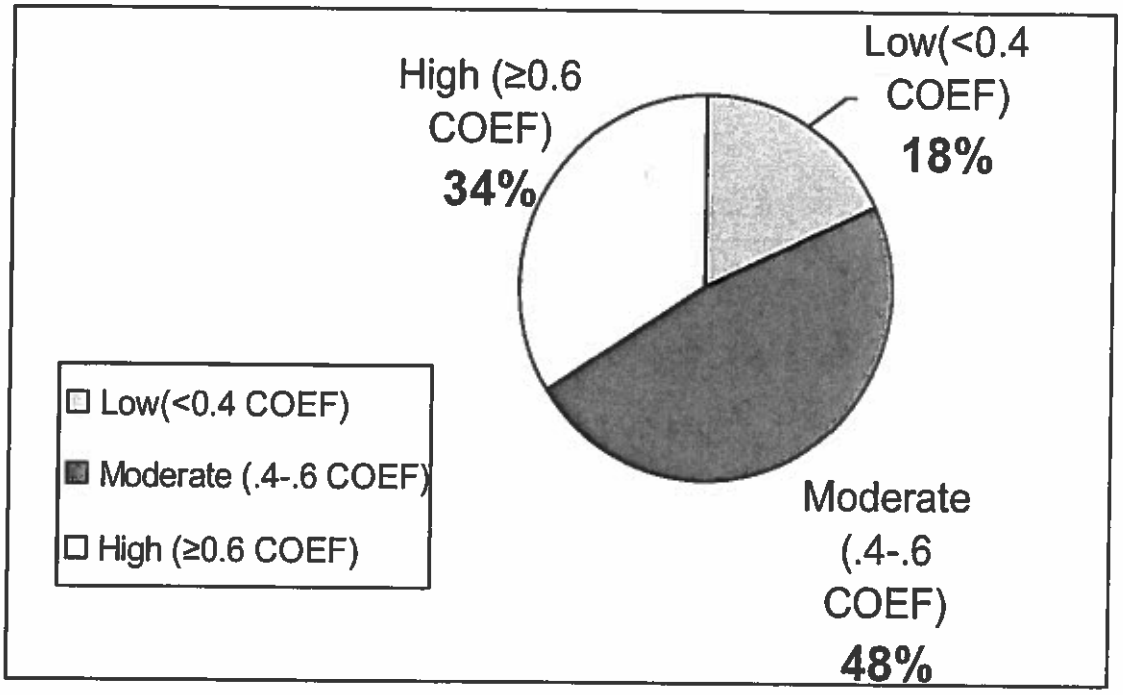
Customers with Tribometry Use

- **Top 5 Industries w/ slip/fall claims (CNA Claims data)**
  - Eating and Drinking Places
  - Real Estate
  - Apparel Stores
  - Food Stores
  - Hotels

- **Top Industries Risk Control used tribometry**
  - Restaurants
  - Real Estate
  - Retail

CNA

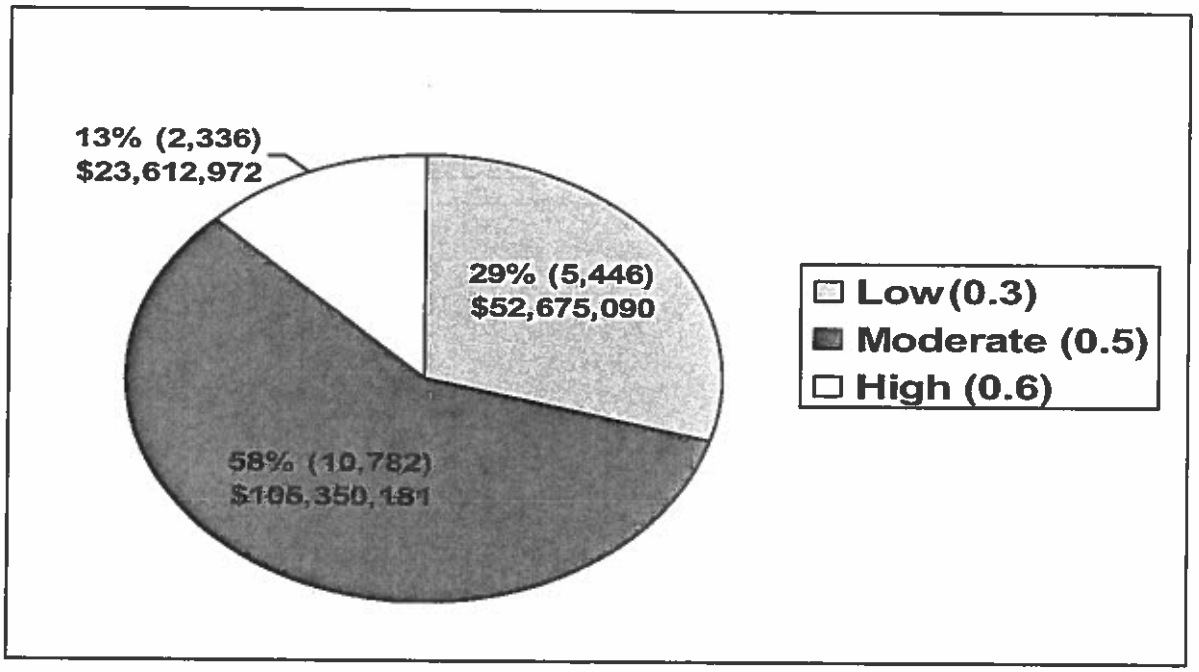
Profiling Customers using Tribometry



Out of 362 **accounts** visited....112 have had tribometry service over a 3-year period.

CNA

Analysis of Claims by COEF



CNA

Results...

3 Year Financial Impact with tribometry

Customer COEF	Current Losses	Improvement in Loss	Savings (Range)
Low	$ 52,675 ,000	10% - 25%	$ 790,125- $ 1,975,313
Moderate	$ 105 ,350,000	5% - 15 %	$ 790,125- $ 2,370,375
High	$ 24,000,000	0	$ -
Total			**$1,580,250 - $4,345,688**

CNA

Improvements using tribometry

If we improve the customers COEF of low friction by .05 to.125 we should expect to see a 10% to 25% reduction in claim costs. With these results we would achieve a savings greater than $ 1M.

Same applies to the customers with moderate friction. If we achieve a .025 -.075 COEF improvement we would reduce claims by 5-15% or a savings of $ 1M.

Further investigation was needed with the customers with high friction.

CNA

Applied to a Customer

- Franchise retail
  - Number of stores owned/managed
  - Number of slip and fall events
  - Frequency of slip and fall
- Classified each store and set a target
  - .8 frequency = 2 stores
  - .4 frequency = 1 store
- Determined if they were in the low or high friction group
- Results, when customer properly cleaned and maintained floors showed reduction of 1 - 2 slips and falls per each store they owned/managed

CNA

Recommendations

- Risk Control continue to use tribometry with customers.
- Tribometry appears to have a positive return on its aid in preventing slip/trip/fall.
- Customers will continue to find a savings when maintaining their walkway surfaces.

CNA

Disclaimer

The information, examples and suggestions presented in this material have been developed from sources believed to be reliable, but they should not be construed as legal or other professional advice. CNA accepts no responsibility for the accuracy or completeness of this material and recommends the consultation with competent legal counsel and/or other professional advisors before applying this material in any particular factual situations. This material is for illustrative purposes and is not intended to constitute a contract. Please remember that only the relevant insurance policy can provide the actual terms, coverages, amounts, conditions and exclusions for an insured. All products and services may not be available in all states and may be subject to change without notice. CNA is a registered trademark of CNA Financial Corporation.

CNA

Q&A

CNA

Standard Method for Conducting an Interlaboratory Study (ILS) to Establish Repeatability and Reproducibility of a Walkway Tribometer Measuring Wet Dynamic Coefficient of Friction (DCOF) for a Common Hard-Surface Walkway

Section 1: Scope/Purpose/Application/Exceptions

1.1 Scope

This method specifies the procedure for conducting an inter-laboratory study (ILS) for a walkway tribometer used to measure the wet dynamic coefficient of friction (DCOF) of common hard-surface floor materials.

1.2. Purpose

This test method evaluates the validity, repeatability and reproducibility of instruments and methods employed to evaluate the wet DCOF of common hard-surface floor materials across a typical traction range.

1.3 Application

This ILS for evaluating test methods used to evaluate walkway traction does not apply to carpeting of any type or mechanically polished tile such as polished porcelain, marble, etc., but does address common hard-surface flooring materials such as ceramic tile, vinyl floor coverings, and wood laminates, as well as coatings, polishes, etc.

Note: The ILS for evaluating test methods used to evaluate walkway traction does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. No express or implied representation or warranty is made regarding the accuracy or significance of any test results, for which instrument performance is evaluated by this ILS methodology set forth herein, in terms of slip resistance.

1.4 Exceptions

The ILS set forth herein does not pertain to methods employed for dry-surface testing.

Section 2: Reference to other Standards and Publications

ANSI/NFSI B101.1-2009 – Test Method for Measuring the Wet DCOF of Common Hard-Surface Floor Materials.

ANSI/NFSI B101.3-2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials (Including Action and Limit Thresholds for the Suitable Assessment of the Measured Values)

ASTM D297-93(2006) Standard Test Method for Rubber Products – Chemical Analysis

ASTM D2240-05 Standard Test Method for Rubber Property – Durometer Hardness

ASTME691-92 Standard Practice for Conducting and Interlaboratory Study to Determine the Precision of a Test Method

ASTM F1646-03 Standard Terminology Relating to Safety and Traction of Footwear

Section 3: Definitions

3.1 Analysis of Variance (ANOVA). A statistical technique that separates systematic variation that is attributable to the operator and/or testing instrument from random variation.

3.2 Friction. Resistance to the relative motion of two solid objects in contact. This force is parallel to the plane of contact and is perpendicular to the normal force.

3.3 High Traction. The physical property of a floor or walkway that is designed to mitigate slipping during normal human ambulation by providing a reasonably sufficient level of available contact friction.

3.4 Interlaboratory Study (ILS). A controlled study designed to evaluate the consistency of two or more laboratories purporting to measure the same object or phenomenon.

3.5 Laboratory. A combination of instrument, method and person or persons used to evaluate the wet DCOF of a flooring material.

3.6 Low Traction. The physical property of a floor or walkway that provides a comparatively low level of available friction, thus increase the risk of slipping during normal human ambulation.

3.7 Moderate Traction. The physical property of a floor or walkway that provides a moderate level of available friction, thus creating a moderate risk of slipping during normal human ambulation.

3.8 Normally Trained Operator. A tribometer operator who has received normal training on the operation of the walkway tribometer under review, but who does not possess expert-level knowledge on tribology and/or the specific tribometer being evaluated by the ILS.

3.9 P-Value. A statistical term that, for the purpose of this standard, quantifies the likelihood that variability in DCOF readings can be attributed to the use of different examples of the same tribometer instruments and/or different normally trained operators. For this ILS, a p-value < 0.1. constitutes an unacceptable degree of user and/or instrument-related variation.

3.10 Repeatability. Or, test-re-test reliability, is the variation in measurements taken by a single person or instrument on the same item and under the same conditions. Repeatability conditions include the same measurement procedure, the same observer, the same measuring instrument, used under the same conditions, the same location and repetition over a short period of time.

3.11 Reproducibility. Refers to the ability of a test or experiment to be accurately reproduced, or replicated, by independent parties evaluating the same material(s) under the same conditions.

3.12 Slip Resistance. The property of a floor or walkway surface that acts in sufficient opposition to those forces and movements exerted by a pedestrian under normal conditions of human ambulation.

3.13 Dynamic Coefficient of Friction (DCOF). The ratio of the horizontal component of force applied to a body required to overcome resistance to movement when the body is already in motion divided by the vertical component of the weight of the body or force applied to the surface where movement occurs.

3.14 Dynamic Friction. The resistance opposing the force required to perpetuate the movement of one surface over another.

3.15 Traction. The friction between the sole material of a shoe and the fixed surface it moves upon.

3.16 Walkway Tribometer. An instrument or device specifically designed to measure the available level of traction upon a floor or walkway.

Section 4: Procedure for the Inter-laboratory Study of a Walkway Tribometer Method

This method for conducting an inter-laboratory study may be utilized to evaluate the performance of any tribometer designed to measure the wet dynamic coefficient of friction (DCOF) of a floor or walkway surface under the conditions specified herein.

4.1 Laboratory. A laboratory shall be defined as the combination of one instrument and one user. ILS participants shall create six (06) unique laboratories by combining three (03) different measurement instruments and two (02) normally trained operators. For the purpose of this ILS, data shall be collected from each instrument/user combination.

4.2 Data Collection. Each method seeking ILS validation shall collect data from each laboratory according to the following guidelines.

4.2.1 Designate a Qualified Observer. A qualified observer is a supplier neutral, third-party observer who is a licensed Professional Engineer (PE) and has knowledge in the area of Tribology and or techniques of measurement for quality assurance - ideally as a quality engineer (CQE), reliability engineer (CRE) or quality auditor (CQA) from the American Society for Quality (ASQ). Observer candidates must be approved by the NFSI and shall be required to sign an affidavit as an attest to their neutrality.

4.2.2 Generate and Record Data. Data shall be generated, recorded and submitted to NFSI to the following guidelines:

4.2.2.1 Each of the six laboratories shall collect 64 observations on each of the three (03) standard materials utilizing standard wet DCOF measurement techniques set forth in the walkway tribometer supplier's operating manual. One material shall be designated "low traction", one material shall be designated "moderate traction" and one material shall be designated "high traction." All standardized walkway surface materials shall be provided by the NFSI. All testing shall be conducted in conformance

with ANSI/NFSI B101.3-2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials (Including Action and Limit Thresholds for the Suitable Assessment of the Measured Values).

4.2.2.2 The neutral third-party observer shall confirm that each laboratory is conducting measurements in accordance with the methodologies set forth in the walkway tribometer supplier's operating manual and in compliance with ANSI/NFSI B101.3-2012 Standard.

4.2.2.3 The neutral third-party observer shall record all data on standard data collection forms provided by the NFSI.

4.2.2.4 The NFSI recognizes that mistakes can be made in measuring walkway traction. As such, the user may elect to exclude an observation prior to receiving visual or other sensory feedback about the measurement. Once the value from the observation is known to the user, the value may not be excluded from the data set. It is the responsibility of the third-party observer to decide when an observation may or may not be excluded.

4.2.2.5 The neutral third-party observer shall sign each data collection sheet as an attest to the data collection process, package the twelve (12) sheets into the pre-addressed, pre-paid shipping envelope provided by the NFSI and drop the envelope at an official station designated by the carrier.

Section 5: Method for Analyzing the Data Collected During a Walkway Tribometer Inter-laboratory Study

Upon receipt of data collection forms signed by the neutral third-party observer, NFSI's designated analyst shall evaluate the submitted data and render an official statement about the instrument/method's performance on the ILS.

5.1 Data Editing. For each data set of 64 observations from each of the six (06) laboratories employed to test each of the three (03) materials provided by the NFSI, the two (02) highest readings and the two (02) lowest readings shall be excluded from the data set, leaving a net total 60 observations.

5.2 Data Analysis. To qualify for NFSI recognition as a walkway tribometer, the instrument and method shall perform satisfactorily both on the Pass/Fail Evaluation and the Analysis of Variance (ANOVA) Evaluation.

5.2.1 Pass/Fail Evaluation. The NFSI has set-forth a methodology by which the walkway tribometer's performance in testing standard materials is evaluated using a Pass/Fail test.

5.2.1.1 Pass/Fail Criteria. Pass/fail criteria have been set forth by the NFSI that are approximately +/- 10% of the known value for the tested material. For example, if the wet DCOF for a material is known to be 0.60, any reading that is between 0.54 and 0.66 shall be designated a "Pass." Any reading that falls outside of these bounds shall be designated a "Fail."

5.2.1.2 Required Confidence Level. The NFSI requires that the pass/fail test shall allow for a five percent (5%) likelihood of a false reading and be statistically accurate at the 95% confidence level.

5.2.1.3 Pass/Fail Judgment for a Material. A laboratory shall be deemed to "Pass" in its ability to test a particular flooring material if all 60 observations of the wet DCOF for that material fall within the Pass/Fail criteria bounds set forth by the NFSI. The presence of any outlying observations in the edited data shall constitute a "Fail" for the laboratory/material combination.

5.2.1.4 Pass/Fail Judgment for a Laboratory. A laboratory shall be deemed to "Pass" if all 60 observations of the wet DCOF for each of the three (03) standard designated flooring materials fall within "Pass" category of the Pass/Fail criteria bounds set forth by the NFSI. The presence of any outlying observations in the edited data set shall constitute a "Fail" for the laboratory for the Pass/Fail evaluation.

5.2.1.5 Pass/Fail Judgment for a Walkway Tribometer Methodology. A walkway tribometer method shall be deemed to "Pass" if all observations made by each of the six (06) laboratories on each of the three (03) standard designated flooring materials fall within the pass/fail criteria set forth by the NFSI. The presence of any outlying observations in the edited data set shall constitute a "Fail" for the tribometer methodology for the Pass/Fail evaluation.

5.2.2 Analysis of Variance (ANOVA) Evaluation.

5.2.2.1 Methodology. NFSI shall employ a three-factor ANOVA process to evaluate the performance of each walkway tribometer instrument and method combination in testing materials with high, moderate and low traction. The analysis shall be conducted according to standard and customary statistical techniques. The following table summarizes the experimental design employed for the ANOVA.

		Instrument 1	Instrument 2	Instrument 3
User 1	NFSI Low Traction Material	60 Observations	60 Observations	60 Observations
	NFSI Moderate Traction Material	60 Observations	60 Observations	60 Observations
	NFSI High Traction Material	60 Observations	60 Observations	60 Observations
User 2	NFSI Low Traction Material	60 Observations	60 Observations	60 Observations
	NFSI Moderate Traction Material	60 Observations	60 Observations	60 Observations
	NFSI High Traction Material	60 Observations	60 Observations	60 Observations

5.2.2.2 Evaluation. The walkway tribometer method shall pass the ANOVA evaluation if the p-value is greater than 0.10, meaning that the likelihood of instrument and/or user interference is less than 10% when testing high or low COF material. A reported p-value of less than 0.10 constitutes a failure.

5.3 Overall Pass/Fail Criteria. The instrument/method shall be deemed to have passed the NFSI inter-laboratory study for a walkway tribometer only if it successfully succeeds in both the Pass/Fail and ANOVA evaluations.

5.4 Waiting Period for Reassessment. In the event that an instrument/method is unsuccessful in its attempt to achieve ILS validation from the NFSI, the supplier may attempt validation after a mandatory waiting period of six (06) months. There is no limit to the number of times ILS validation may be attempted.

Section 6: Report Generated Following Data Analysis for a Walkway Tribometer Inter-laboratory Study

For each instrument/method's submission, a confidential report shall be submitted to the sponsoring organization. The report shall serve to state whether or not the instrument/method passed or failed the NFSI ILS for a Walkway Tribometer. The report shall contain the following details and analysis.

1. A clear statement of overall Pass/Fail status.
    a. If the instrument method/passed, a certificate of confirmation shall accompany the report.
    b. If the instrument/method failed, a concise statement of weaknesses shall be provided so as to enable the supplier to modify the instrument and/or method.
2. Details about the Pass/Fail evaluation data for each instrument/user/material combination.
3. Details about the ANOVA evaluation to test for instrument/method and or user bias in the measurement.

Section 7: Term of Validation

7.1 Standard Term of Certification. If successfully validated by the NFSI inter-laboratory study method, the instrument/method's certification of ILS validation shall be valid for a period of five (05) years, after which to retain its certificate of validation, the instrument must be revalidated according to the then current methodology set forth by the NFSI.

7.2. Provision for Design Change. Any change in the design of a walkway tribometer instrument and/or method that materially alters the core method for measuring the wet DCOF of a walkway material invalidates the certification of ILS validation and the new instrument/method shall require revalidation.

Appendix 1 – Logic for Pass/Fail Analysis for Establishing Repeatability of a Walkway Tribometer

The NFSI opted to use a pass/fail test to establish repeatability of a walkway tribometer. To pass, each laboratory must produce 60 reading that fall within the range specified by the NFSI for a given tile. The logic for requiring 60 observations that fall within the specified range is based upon the following standard equation for determining the sample size of a pass/fail test.

$$n = \frac{\ln\left(1 - \frac{c\%}{100\%}\right)}{\ln\left(1 - p\right)}$$

Where:

n = The required number of observations without a "failure," which is an observation that falls outside of the specified parameters

ln = log normal

c% = The required confidence level, in our case 95%

p = Specified p-value – in our case, 0.05

For the pass/fail portion of the ILS for walkway tribometers, the equation is as follows:

$$n = \frac{\ln\left(1 - \frac{95\%}{100\%}\right)}{\ln\left(1 - 0.05\right)} = 58.40$$

The resultant value of 58.40 was rounded to 60 – a slightly more conservative requirement than that produced by the standard equation. To circumvent complications associated with data editing, it was decided to require a total number of 64 observations per laboratory per tile type. The highest two and lowest two readings are automatically excluded by the data analyst. If the remaining 60 observations fall within the parameters set forth by NFSI for the pass/fail test, the specified laboratory passes for the specified tile. If all laboratory/tile combinations pass, the walkway tribometer passes the pass/fail portion of the ILS to establish repeatability.

Appendix 2 – Analysis of Variance (ANOVA) to Establish Reproducibility for a Walkway Tribometer

Overview

Analysis of Variance, or ANOVA, is a statistical technique employed to differentiate and analyze the significance of systematic variation relative to random variation observed in a sample data set. For the purposes of validating a walkway tribometer under the NFSI Interlaboratory Study (ILS) method, our objective is to differentiate variation specifically related to different tribometer instruments provided by a single supplier and/or different tribometer operators associated with each laboratory. The ANOVA is employed to establish the reproducibility of a walkway tribometer.

Significance to Walkway Tribometer Measurement

A valid walkway tribometer must produce repeatable and accurate results with no significant interference induced by the user or serial number on an instrument provided by a particular supplier. If an unacceptable level of user or instrument interference exists, it could result in false positive (measurements identify a problem when one doesn't actually exist) or false negative (measurements fail to identify a problem when one does actually exist) readings in the field.

Method

For the walkway tribometer ILS study, the ANOVA will compare the variation within the following "treatment" groups to the total amount of variation observed for all observations.

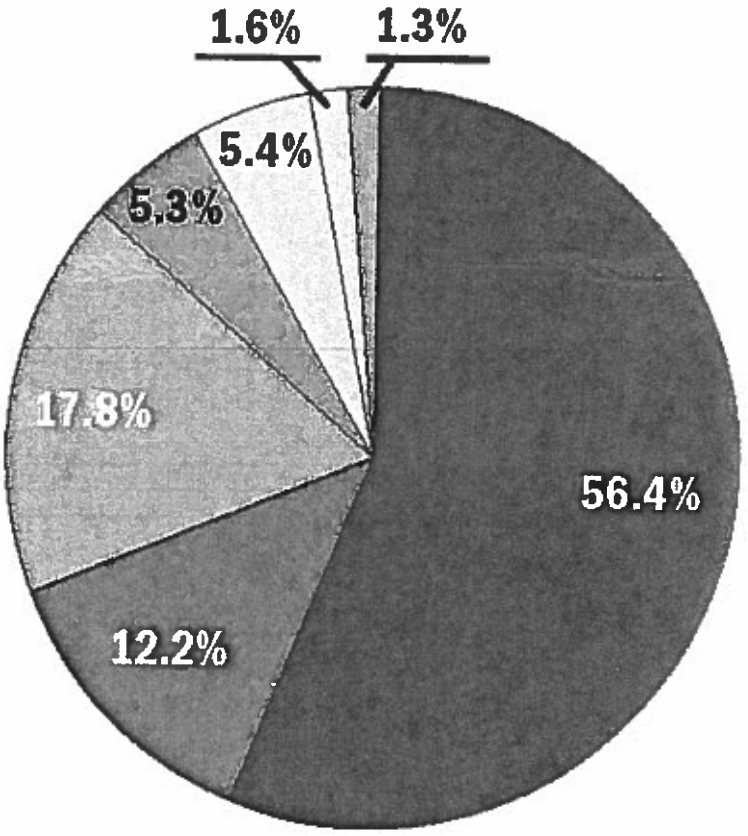
- Operator to Operator Variation
- Instrument to Instrument Variation
- Combined Operator/Instrument to Operator/Instrument Variation

ANOVA employs the Fisher Test, more commonly called the F-Test, which is based upon the Fisher Distribution first developed in the 1920s by Sir Ronald A. Fisher. The F-Test is the ratio of systematic variation to total variation. The result is reported as the p-value, which denotes the probability that the group responsible for systematic variation is the same as the larger sample population. As with most statistical techniques, the p-value penalized when the study includes a small number of observations. A larger sample size affords more "degrees of freedom" to the analysis. For the purpose of the walkway tribometer ILS, a p-value < 0.10 on any of the three treatment groups shall be deemed significant, causing the instrument seeking validation to fail.

Chart 2

2012 Floor Coverings Square Foot Sales

Total: 18.079 billion square feet



- Carpet & area rugs 10.2 billion
- Ceramic floor & wall tile 2.21 billion
- Vinyl sheet & floor tile 3.21 billion
- Laminate flooring 0.96 billion
- Hardwood flooring 0.98 billion
- Stone flooring 0.28 billion
- Other resilient* 0.24 billion

Source: Catalina Research

**Cork, other plastics, rubber and linoleum.*

American National Standard Specifications for Ceramic Tile
ANSI A137.1 – 2012 [Revised]

1.0 Purpose

These specifications serve as a reference standard for buyers and specifiers of Standard Grade and Second Grade ceramic tile, Decorative Tile, and Specialty Tile. These specifications are also a guide to producers in maintaining quality control of the manufacture of such ceramic tile.

2.0 Scope

These Specifications describe the normally available sizes and shapes of ceramic tile: the physical properties of Standard Grade and Second Grade Ceramic Tile, Decorative Tile and Specialty Tile; the basis for acceptance and methods of testing prior to installation; the marking and certification of ceramic tile; and the definitions of terms employed in these specifications.

3.0 Definition of Terms

Aesthetic Class: A value assigned by the producer to a tile series (V0, V1, V2, V3, or V4). The letter 'V' indicates "variation," with the numbers quantifying the degree of variation of overall color and/or texture. The color can vary in intensity, brightness, hue, and saturation, or by pattern variation. This value is intended to give an indication of what a consumer can visually expect for a specific product. See Table 3.

Basis for Acceptance: The method of determining whether a lot of ceramic tile is acceptable under these specifications.

Caliber Range: An acceptable size range for tiles to be used in the same installation.

Calibrated Tile: Tiles that have been sorted to meet a manufacturer's stated caliber range.

Ceramic Mosaic Tile: Tile, usually ¼ inch (6.35 mm) to 3/8 inch thick (9.53 mm), and having a facial area of less than 9 inch^2 (5806 mm^2). Such tiles are typically mounted in sheets or strips with other mosaic tiles.

Ceramic Tile: See definition for Tile.

Commercial: Flooring areas that are subjected to considerable traffic and abrasive soil. Some examples of these would be: entrances, workrooms, inns, exhibition halls, and salesrooms.

Decorative Tile: A tile that is suitable for decorative use where the aesthetic value may outweigh one or more physical properties including, but not limited to: breaking strength, chemical resistance, or crazing resistance. Such a tile is generally used for interior decorative wall applications.

Dynamic Coefficient of Friction (DCOF): Sometimes called kinetic coefficient of friction. This is the ratio of the force necessary to keep a surface already in motion sliding over another divided by the weight (or normal force) of an object. This force is a materials property of the two surfaces. DCOF is usually less than SCOF for the same materials. Contaminants such as dirt, water, soap, oil, or grease can change this value.

Edge-bonded Tile: See definition for Pre-grouted Tile.

Facial Defect: The portion of the facial surface of the tile which is readily observed to be nonconforming and which will detract from the appearance or serviceability of the installed tile. Examples of such defects include, but are not limited to: pinholes, contaminants, chips, cracks, scratches, and glaze application errors.

Field Tile: A general term for the tile used in the majority of an installation.

Floor Tile: A manufacturer specified ceramic tile primarily for use on floors, but also suitable for use on walls and countertops, and having a facial area of 9 inch^2 (5806 mm^2) or more.

Floor-Wall Coordinating Tile: Wall tile designed to the same basic visual characteristics as corresponding floor tile, intended for use in the same installation.

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NOTICE OF DISCLAIMER AND LIMITATION OF LIABILITY

Armstrong

July 17, 1995

FAX

Secretary, Board of Standards Review
American National Standards Institute
11 West 42nd Street
New York, NY 10036

Dear Secretary:

Subject: UL Canvass of the Standard for Safety for Slip Resistance of Floor Surface Materials, UL 410 as an ANSI Standard

Armstrong World Industries, Inc., a manufacturer of resilient sheet and tile flooring, continues to object to the issue of Subject 410 "Standard for Slip Resistance of Floor Surface Materials" as an ANSI Standard, based on the following reasons.

1) The UL Canvass of interested parties for this activity does not include one resilient floor manufacturer or the Resilient Flooring Institute industry organization. The flooring industry voiced objection to the establishment of UL 410 for flooring products based on a polish industry standard. Underwriters Laboratories completely ignored the objections of this industry and established the UL program, despite several comments from the resilient industry.

2) UL's responses to all objections raised by the resilient flooring industry have been unsatisfactory, as they have been based on the polish industry assessments related to smooth surface materials.

3) Slip resistance has been an extremely controversial issue with regard to regulatory issues and building code references. It is not in ANSI's best interest to adopt a standard that does not represent resilient flooring industry consensus. Additionally, no data has been presented to demonstrate that this UL 410 label service program contributes to providing safer, more slip resistant walking surfaces.

4) CABO/ANSI A117.1 Accessible and Usable Buildings and Facilities has not recognized this test method for ground and floor surfaces. If UL 410 becomes an ANSI standard, is there an obligation to use it in ANSI A117.1?

Armstrong World Industries, Inc. P.O. Box 3001 Lancaster Pennsylvania 17604 717-397-0611

For your convenience, a copy of the Underwriters Laboratories canvass list, showing that no resilient floor manufacturers or the industry organization was contacted, is included for your review. Thank you for your attention and consideration.

Sincerely,

Peggy W. Rosol
Manager, Product Compliance
and Corporate Stewardship
Corporate Quality

SDT

Enclosure

34

CI/SfB
(43) (L7)

March 1971

Bulletin No.43
(2nd Series)

Item No.5

SLIP RESISTANCE OF FLOORS, STAIRS & PAVINGS

Purpose of this item

When selecting finishes for floors, stair treads and external pavings, the architect has to consider a number of factors applicable to each particular situation including:- resistance to the anticipated wear, appearance and durability of that appearance, noise production, initial cost, ease of maintenance and safety. The object of this item is to look at various aspects of the last of these - safety, or resistance to slip, in respect of pedestrian use.

Slip, its cause and consequences

When walking normally, the individual exerts various horizontal forces, backwards, forwards and sideways, on the surface traversed. These forces, which will vary in accordance with weight, speed, agility and changes of direction or momentum, are usually resisted by resolved reaction forces, made possible by minute deformations of the contacting surfaces, and by friction. When the resistence, or grip, is insufficient to contain the horizontal force, slip commences. Once commenced, slip usually results in a very rapid loss of equilibrium, a resulting increase in the horizontal force and a fall, the consequences of which may vary from an amusing incident to a fatal injury. The agile person can sometimes take instinctive action to arrest initial slip and most people can adjust their walk to cross ice in safety.

Measurement of slip resistance

The method employed by the Council's Scientific Adviser, is the use of the Road Research Laboratory skid resistance tester, shod with rubber. Results of this test are quoted in figures, high values indicating good slip resistance and low values poor resistance. Tests are made under wet and dry conditions and both values are normally quoted.

Assessment of slip resistance values

The Council's Scientific Adviser's definitions, which are in line with other opinions, are as follows:-

(a) 'Dangerous' - 19 or below. This condition is quite unsafe and, where it exits immediate action should be taken to replace or treat the surface to an acceptable standard.

(b) 'Marginal' - 20 to 39. The surface is below the recommended safe level and methods of improving the condition should be considered and carried out as soon as reasonably possible. Some remedial treatments have only temporary effect and will need to be repeated at regular intervals; in the long term, the substitution of an alternative finish may be more economic. In the mean time, warnings should be given to all using the building that care must be observed.

(c) 'Satisfactory' - 40 to 74.

(d) 'Excellent' - 75 and above. This condition, though desirable in many situations, is required in certain special cases, such as railway platform edges and crowded public stairs.

As the consequences of a fall by the elderly age generally serious and frequently fatal, the slip resistance of floors, stairs and pavings, designed for their use, should be well within the 'Satisfactory' range.

Factors effecting the slip resistance of a material

(a) Surface texture

With some exceptions, the rougher the texture, the better the slip resistance, and the smoother, the worse. However, some of the remaining factors can upset this general rule and rough surfaces can be difficult to clean and may be unacceptable in certain situations on hygienic grounds.

(b) Composition and method of manufacture

The materials employed and methods of use and manufacture can frequently have a considerable bearing on slip resistance. For example, the tile described in item 5 of bulletin No.40 (2nd Series), dated December 1970, has very good resistance in both dry and wet situations, yet is sufficiently smooth as to present no serious cleaning problems. The addition of 'non slip' agents, such as silicon carbide or aluminium oxide, incorporated into the surface during making or laying of finishes can produce an initial improvement of resistance, but this seldom lasts under moderate use.

(c) Wet and dry conditions

Nearly all surfaces have a considerably poorer resistance when wet and materials which may be quite safe in a dry situation, may be downright dangerous when wet. While it is obvious that materials with adequate wet slip resistance must be used in public entrance halls and lavatories and similar 'wet' situations, the architect must also consider to what extent this wetness may be foot carried onto adjacent 'dry' areas and their resistance under temporary wet conditions. One obvious precaution is the provision of an adequate matted area in entrance halls.

Surfaces which are subject to spillages other than water, such as oils and fats, need special consideration, exceptional wet slip resistance and frequent effective cleaning. Council staff dealing with such a problem should consult Materials Information Group.

(d) Surface treatments

It should be appreciated that later treatments over which the architect may have no control, may worsen the resistance of an otherwise satisfactory surface, to a quite unacceptable level. Such treatments may be roughly divided into sealers and polishes:-

(i) Sealers The most common types are oleo-resinous and polyurethane materials and the slip resistance characteristics will vary from brand to

brand, but it is good practice to use as thin a film as practicable and to remove surplus built up material before coating. Council staff should consult Materials Information Group as to slip resistance before selecting any particular brand of sealer. A number of such sealers have been reported in earlier issues of the bulletin.

(ii) Polishes These may be of the solvent based or emulsion type. The disadvantage of the former is that there is a greater risk that wax may be traffic transferred to adjacent surfaces, with highly dangerous results. The slip resistance of any brand of polish on any particular surface should always be investigated before general use. Again the obtaining of the minimum film thickness compatible with appearance and protection is of importance. The selection of a water plastics emulsion type polish is to be preferred.

(e) Wear

Some surfaces with good slip resistance can become dangerous after heavy wear over a long time and periodical inspection of finishes subject to such wear is desirable.

(f) Cleaning

The use of soaps for washing down surfaces should be discouraged, as a residual film can give rise to a condition akin to the traditional schoolboy slide.

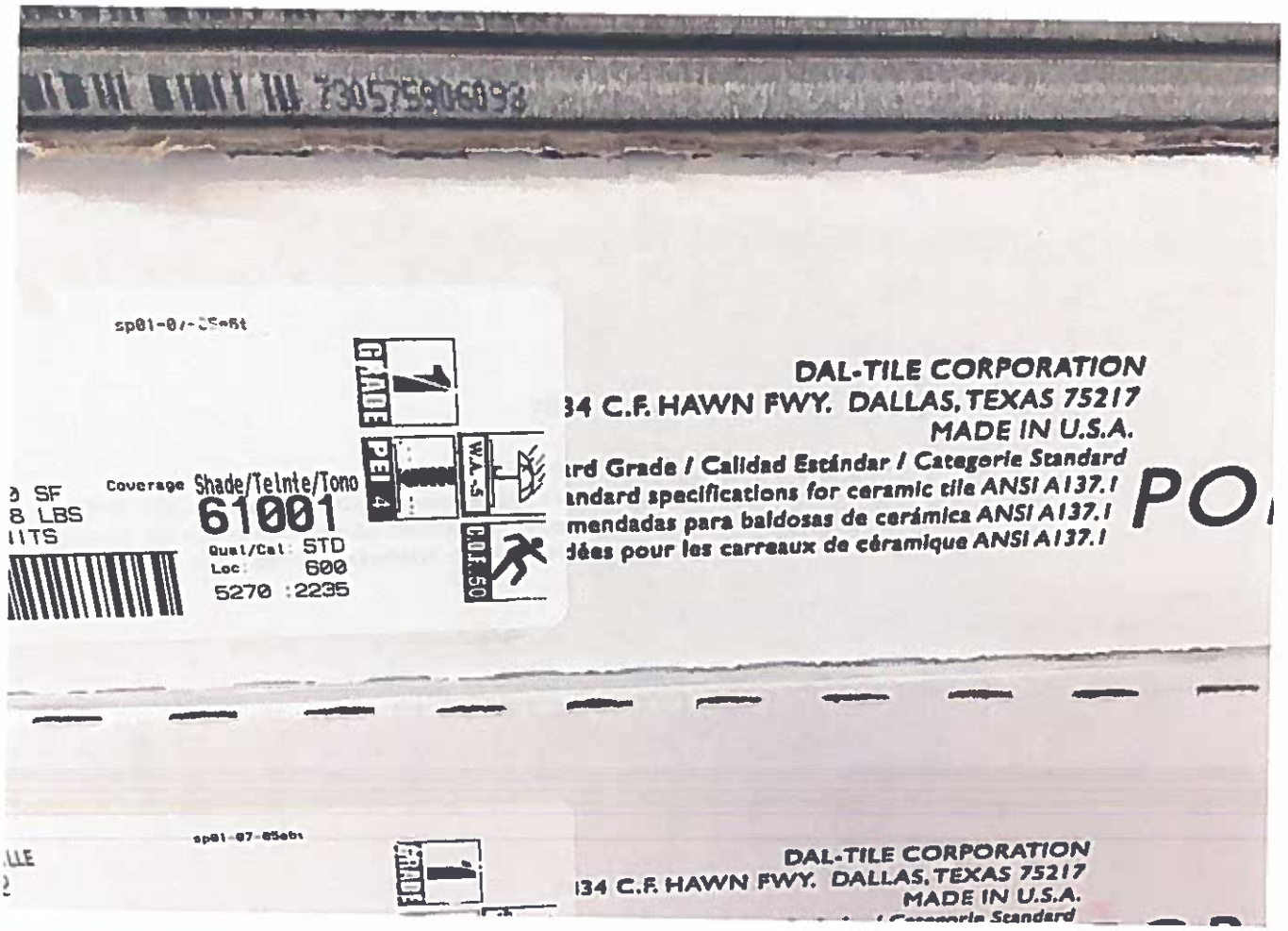
Typical slip resistance values for various flooring and paving materials

As the Council's experience from testing, although growing, is at present somewhat limited, the following list is far from comprehensive.

The values quoted must be treated as a guide only, since many factors, including workmanship and differences between one part of a floor and another, one makers product and another, one species of timber and another and between ambient conditions in various buildings, will all tend to diversify such values.

Material	Dry resistance	Wet resistance
Sheet PVC and embossed felt backed PVC	80 to 90	20 to 30
Altro 'Safety' (carborundum in PVC)	110 to 120	20 to 25
Oleo-resinous sealed wood blocks	85 to 95	30 to 40
Terrazzo	50 to 70	20 to 30
*Vitrified tiles, when new	100 to 110	40 to 50
*Quarry tiles, when new	80 to 90	20 to 30
**'Torginol' (polyurethane bound vitrified fine aggregate)	104	70
Linoleum, with water plastics emulsion polish	60 to 70	20 to 30
Thermoplastic tiles, with water plastics emulsion polish	60 to 80	30 to 40

*The resistance will reduce considerably with wear.
**A very effective remedial treatment for 'dangerous' stable substrates.


DAL-TILE CORPORATION
34 C.F. HAWN FWY. DALLAS, TEXAS 75217
MADE IN U.S.A.
ird Grade / Calidad Estándar / Categorie Standard
andard specifications for ceramic tile ANSI A137.1
mendadas para baldosas de cerámica ANSI A137.1
dées pour les carreaux de céramique ANSI A137.1
Coverage Shade/Telnte/Tono
61001
Qual/Cal: STD
Loc: 600
5270 :2235
GRADE 1
PEI 4
W.A. 3
C.O.F. .50
DAL-TILE CORPORATION
134 C.F. HAWN FWY. DALLAS, TEXAS 75217
MADE IN U.S.A.


dos. Antes de la colocación de las losas, verifica el tono y el calibre.
p01-15-grp_3
Coverage Shade/Telnte/Tono
56009
Qual/Cal: STD
Loc: 660
5291 :1837
GRADE 1
TONE
PEI 3
W.A. 3.0
C.O.F. .42
Tono