

SUMMARY OF MEETING: See Attached ASTM Minutes



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Meeting Minutes

F15.03 on Safety Standards for Bathtub and Shower Structures

Sub Chairman: Leffler, John P

Date and Time: November 20, 2019, 1:30 PM - 3:00 PM EST

Place: Virtual

Attendees: John Leffler (sub Chair), David Fleisher (sub Vice Chair), Molly Lynyak (ASTM Staff Manager), Thomas Baker, Joseph Cohen, Peter De Marco, Ben Elkin, Juff George, Daniel Gleiberman, Brian Grieser, Don Huber, CJ Lagan, Wayne Maynard, Rick McCallion, Alison Novak, Jake Pauls, Shabbir Rawalpindiwala, Matt Sigler, Katelyn Simpson, Craig Stephenson, Kyle Thompson, Rachel Weintraub, Grant Davidson, Kevin Ernst, Ramiro Mata, Sean Oberle, Mark Gibeault, Peter Townsend, Bob Neff, Mark Malatesta

1. Call to order at 1:32pm
2. Approval of Agenda:
 - Motion by Shabbir Rawalpindiwala, seconded CJ Lagan. Unanimously approved.
3. Approval of Previous Meeting Minutes
 - Motion by Wayne Maynard, seconded by David Fleisher. Unanimously approved.
4. Membership Updates: John Leffler: For updates of members, refer to the roster of ASTM.
5. Review of status of standards
 - F444-88(2017) – no action planned
 - F445-88(2017) – no action planned
 - F446-85(2019)
 - i. A poll was taken regarding which entities cite this standard; other than the Uniform Plumbing Code, Moen (and possibly other manufacturers) tests to this standard.
 - ii. A problematic design feature of one brand was highlighted but the model has been discontinued and no meeting attendee stated that other manufacturers use that feature.
 - F462-79(2007) (withdrawn)
 - i. See the attached Powerpoint from this meeting.
 - ii. Leffler stated that his Powerpoint from the January 2017 F15.03 workshop regarding F462 and the Mark I tribometer was included in the posted agenda and that attendees might want to review it.
 - iii. CPSC commented on characteristics of NEISS data they had cited in their letter of July 30, 2019. No questions by attendees regarding the letter.
 - iv. CJ Lagan requested elaboration on utilized COF: this is measured by a force plate when a person steps on the force plate.
 - Proposed Replacement Standard for F462: John Leffler
 - i. Scope
 1. Discussion of whether replacement standard (F462+) should have scope that specifies what types of bathing surfaces it applies to. Current standard does not. Shabbir Rawalpindiwala

suggested an open standard non-specific to surface type. Leffler discussed that different surface types should perhaps be planned for when coming up with methodology. Surface types discussed:

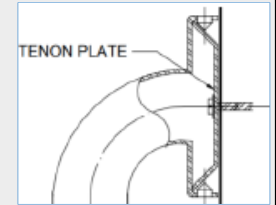
- Porcelain-enameled metal bathing surfaces
 - Polymer/composite bathing surfaces
 - Mosaic tiles
 - Some mechanical interlock with the foot at grout gaps in tile surfaces.
 - Not aware of research or testing method to quantify this friction.
 - Katelyn Simpson agreed that grout gaps contribute to higher friction. Not aware of test method to quantify the benefits of these grout gaps.
 - In-tub adhesive mats
2. Comment on durability discussion
 - Craig Stephenson stated that any time interval to inspect should be up to property manager to determine based on use/traffic, not written into standard
- ii. Proposed research methodologies
 1. Comments on human/tribometer slip research on bathing surface friction
 - Katelyn Simpson stated that TCNA may be able to provide testing facilities at their lab (in Clemson SC)
 - Testing should capture various ages (college students, elderly population)
 - Craig Stephenson asked about whether DCOF or SCOF would be tested. Leffler response: any competent tribometer method could potentially be used regardless of measurement system.
 - iii. Proposed task groups and call for participants. Anyone interested in joining a task group can sign up or if there are task groups listed below that are not necessary, please share thoughts on this.
 1. Research funding
 2. Reference surfaces: porcelain-enameled metal
 3. Reference surfaces: polymer/composite
 4. Reference surfaces: mosaics
 5. Human slip research experimental design
 6. Tribometry methods
 7. Contaminants
 8. In-tub bathmats
9. New Business: Shabbir Rawalpindiwalla commented that Kohler has done bathing surface testing with BOT-3000E and found it reliable. Leffler responded that BOT-3000E may prove useful in eventual tribometry method but that current methods are based on hard sole shoe-shod pedestrians and there's no correlation of the BOT to barefoot users on bathing surfaces.
 10. Old Business: none
 11. Administrative Deadlines: none
 12. Future Meetings
 - Doodle poll will be sent out the first week of January. (Chair update: Doodle poll will be sent sooner with proposed meeting dates in January)
 13. Adjourn 3:02pm

ASTM F15.03 Safety Standards for Bathtub and Shower Structures

Virtual meeting
November 20, 2019
Subcommittee Chair: John Leffler, PE

Agenda

- Review of status of standards
 - F444-88(2017) – no action planned
 - F445-88(2017) – no action planned
 - F446-85(2019)
 - Poll: where is this standard cited?
 - Next steps on pending Work Item for modification of handrail standard



ASTM F462-79(2007) (withdrawn 2016)

F462

- *Standard Consumer Safety Specification for Slip-Resistant Bathing Facilities*
- Unchanged between publication in 1979 and withdrawal in 2016, though ASTM has changed
- An ASTM **Specification** currently is:
 - “an explicit set of requirements to be satisfied by a material, product, system, or service”
- ASTM Specifications can contain a **Test Method**:
 - “a definitive procedure that produces a test result”

Brief history of F462

- ASTM F462 first released in May of 1979
- ASME A112.19 standards:
 - ASME A112.19.1 (enameled cast iron tubs) was first to reference F462 in September 1979
 - 1984 revision of ASME A112.19.4 (enameled formed sheetmetal tubs) referenced F462
 - A112.19.1 and A112.19.4 were merged in 2008
 - A112.19.x adopted by US government for Federal housing & ADA, and referenced in International Plumbing Code

Brief history of F462

- The tribometry method contained in ASTM F462 specifies a soap and a testfoot polymer that have not been available in decades
- In last ballot, 15-04 (June 2015), an alternate soap specification and testfoot polymer were balloted
 - Six negative voters questioned the lack of data supporting a switch to the alternate soap & polymer
 - F462 was withdrawn in July 2016 without negatives being resolved

Brief history of F462

- Following the withdrawal, a workshop was held in January 2017 at ASTM HQ
 - Issues with F462 reliability and relevance were discussed; excerpt from Leffler's workshop Powerpoint is included in this meeting's Agenda
- No F15.03 activity regarding F462 replacement since workshop
- July 2019: letter from CPSC to F15.03 requesting status on replacing F462

Questions or comments?

Bathing surface slip incident data

CPSC NEISS data (Leffler analysis)

- Incidents reported to 100 emergency rooms
 - Patient → doctor → NEISS coordinator
- 2017 data for product code 0610
 - “Non-glass bathtub or shower enclosures”
- 1,139 incidents for patients treated/released or admitted
 - Ages 20-69

CPSC NEISS data (Leffler analysis)

- | | |
|---|---|
| <ul style="list-style-type: none">• Search terms include<ul style="list-style-type: none">• Slip• Tub or Shower | <ul style="list-style-type: none">• Search terms exclude
(anywhere in record)<ul style="list-style-type: none">• “Hot tub”• Bathmat or “bath mat”• Chair, seat, bench• Bar, rail• ETOH, drunk, alcohol• Clean |
|---|---|

CPSC NEISS data (Leffler analysis)

- Limitations (unknowns)
 - Accuracy of incident reporting
 - Age and materials of bathing surface
 - Use of anti-scald or thermal shock devices
 - Contaminants
 - Use of in-tub bathmats, appliques, etc.
 - Patient intrinsic issues (if any)

Clinical Pediatrics bathtub injury study data

- Study at Children's Hospital in Columbus, Ohio*
 - Analysis of medical records and parent follow-up
 - Study evaluated adult supervision (84.8% of children < 5 y/o), use of bathmats and appliques (68.6%), use of anti-scald devices (12.5%)
- Over a 3 year period, 168 bathing surface slip/falls
 - Median age 2.8 y/o, mean age 3.1 y/o
 - 82.3% of incidents in study were slip/falls

* Spencer SP, Shields BJ, Smith GA. Childhood Bathtub-Related Injuries: Slip and Fall Prevalence and Prevention. *Clinical Pediatrics*. May 2005, 311-318

Clinical Pediatrics bathtub injury study

- Limitations (unknowns)
 - Accuracy of incident reporting
 - Age and materials of bathing surface
 - Minimal use of anti-scald or thermal shock devices
 - Less relevant with adult-supervised children
 - Contaminants
 - Patient intrinsic issues (if any)
 - As a study done by medical professionals, maybe less significant

Liberty Mutual Insurance data (Leffler analysis)

- Slips reported to 147 hotel entities insured by Liberty Mutual
 - Claimant → hotel → Liberty Mutual
- Cumulative claim data 2015-2018 involving a "bathtub" with claim value of \$100 or greater
- 504 claims with an average claim value of \$9,273

Liberty Mutual Insurance data (Leffler analysis)

- | | |
|-------------------------------|---|
| • Search terms include | • Search terms exclude
(anywhere in record) |
| • Slip | • "Hot tub" |
| • Tub or Shower | • Bathmat or "bath mat" |
| | • Chair, seat, bench |
| | • Bar, rail |
| | • Floor |

Liberty Mutual Insurance data (Leffler analysis)

- Limitations (unknowns)
 - Accuracy of incident reporting
 - Age and materials of bathing surface
 - Likely met F462 when new, if porcelain-enamel
 - Use of anti-scald or thermal shock devices
 - Hotels likely have these devices
 - Contaminants
 - Use of in-tub bathmats
 - Use of refinishing or friction treatment products
 - Claimant intrinsic issues (if any)

Questions or comments?

Human subject research

Human subject research

- Siegmund et al* studied utilized COF (uCOF) for 60 humans entering & exiting a bathtub
 - 20-30, 40-50, 60-70 y/o, 30 women
 - Porcelain-enamel tub with plain water flowing across
 - Grippy “floor” outside tub
 - No handrail use, no fall protection harness, no slips
- Forceplates used in & out for uCOF evaluation
 - Tub entry mean(SD) for uCOF was 0.179(0.035)

* Siegmund GP et al (2010). Utilized friction when entering and exiting a dry and wet bathtub. *Gait & Posture* 31, 473–478

Human subject research

- King & Novak* studied Center Of Pressure (COP) movement for humans entering & exiting a bathtub
 - 14 older adults (10 women) mean age 71 y/o, 12 younger adults (6 women) mean age 26 y/o
 - Subjects used for assistance a wall, vertical handrail, horizontal handrail, in-tub suction-cup mat, or nothing
 - Porcelain-enamel tub with 0.05% SLS (in water) applied
 - Fall protection harness used, some slips occurred

* King EC, Novak AC. (2017). Centennial Topics—Effect of bathroom aids and age on balance control during bathing transfers. *American Journal of Occupational Therapy* 71, 1–9.

Human subject research

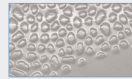
- King & Novak: selected findings
 - Vertical handrail most effective for managing COP dynamics
 - Tub rim obstacle negotiation a significant issue
 - In-tub mat helped with medial/lateral (not anterior/posterior) stability entering tub; mat described by researchers as analogous to increased friction

Questions or comments?

Replacing F462 with “F462+”
Scope

Scope

- Specification for porcelain-enameled metal bathtubs and shower bases (ASME A112.19.1/CSA 45)
 - Cited by IPC, Federal regulations
- Specification for plastic bathtubs and shower bases?
 - IAPMO has not previously cited F462
 - At least two main types of plastic bathing surfaces
 - Sheet-formed polymer products
 - Typically use “profiled” features to facilitate friction
 - Molded gelcoat/fiberglass composite products
 - Typically use profiled features or roughness to facilitate friction



Scope (continued)

- Specification for mosaic tiles used as bathing surfaces?
 - Often used for shower stall floors
 - No human slip research (?) on friction benefit of grout gaps
 - Not a “finished” bathing surface product
 - As-built installation details may affect available friction



Scope (continued)

- Specification for remedial products?
 - F462 did not address bathing surface friction beyond the period of the surface’s “guarantee”
 - Frictional surfaces wear smoother with use
 - ...particularly non-profiled surfaces in commercial usage
 - Bathing surface replacement may be burdensome
 - Options: remediation products or inspect-reject criteria
 - Currently-common remedial products
 - Refinishing products (coatings or porcelain etchants)
 - In-tub bathmats (suction cup- or adhesive-backed)

Scope (continued)

- Remedial products?
 - Refinishing products
 - The friction benefit of porcelain etchants will depend upon the base surface being treated – not practicable for F462+
 - Coatings replace the original base surface but the application process would need to be highly refined for consistency – not practicable for F462+

Scope (continued)

• Remedial products?

• In-tub bathmats

- Suction cup-backed mats vary in rigidity, size, and # of cups
 - May not stick reliably to existing friction features on surface
 - May slide in use
 - Hypothetically, King/Novak test subjects may have been tentative in stepping on the study's suction cup-backed mat because of prior experience with such mats slipping
- Adhesive-backed mats are “permanent”, fixed in place, replace the original base surface, and may be testable in human slip research

Scope (continued)

• Human slip research correlation

- F462+ must contain (or cite) a way to qualify bathing surfaces as having adequate friction for humans
 - F462+ could rely on external human slip research without providing guidance on how it is conducted
 - F462+ could establish consensus-approved guidance on how to conduct the research
- F462+ must contain (or cite) a consensus-approved tribometry method correlated to the human research
 - So manufacturers and others don't have to do human tests

Scope (continued)

• Tribometry method? Choices include:

• “Single tribometer” based (after Sebald*):

- Data from human testing of numerous surfaces results in target uCOF value, tribometer sought to “match” this value to some defensible extent
- Passing tribometer value for friction a numerical value to be achieved using one tribometer model and method
 - Favors one supplier; ASTM would likely prohibit mention of a proprietary tribometer brand in F462+

* Sebald J. (2009). System oriented concept for testing and assessment of the slip resistance of safety, protective and occupational footwear. Berlin: Pro BUSINESS GmbH.

Scope (continued)

• Tribometry method? Choices include:

• “Threshold surface” based:

- Humans determine one surface that represents just-adequate (“threshold”) friction
 - Duplicates are produced/sold as reference surfaces
- Different tribometer brands/models will likely measure this “threshold” surface in different ways (different values)
- Any appropriately qualified tribometer can be used to test for the “threshold” value
 - Despite different values, OK per Brand X = OK per Brand Y
 - Does not favor one model; some models may be more reliable

Scope (continued)

- Durability
 - Requirement for friction to drop no more than <??> percent over <??> duration?
- Periodic inspection of friction? With reject criteria?
- Grandfathering
 - Existing bathing surfaces could be addressed in F462+, **or** in regulations/standards that adopt it
 - Effectivity date and transition period appropriate

Questions or comments?

Replacing F462 with “F462+”

**Proposed human slip research
methodology**

Existing human slip methodologies

- There are no current consensus-approved standards in the US, Europe, or Australia for barefoot friction on bathing surfaces
 - Existing standards are either:
 - Barefoot subjects on ordinary walkway materials (e.g. DIN 51097)
 - Subjects wearing footwear on bathing surface materials (e.g. AS 4586/HB 198)

Proposed human slip methodology

- Based on elements of Siegmund and King/Novak research, one possible methodology is:
 - A variety of representative bathing surface samples would be tested (interchangeable panels)
 - Water with soap (or a soap analog) would be present on the sample surface
 - Subject is supported by fall protection harness
 - Multiple human subjects would evaluate each sample
 - No upper body assistance (handrail, wall) during entry

Proposed human slip methodology

- Based on elements of Siegmund and King/Novak research, one possible methodology is:
 - Subject starts 1.5m from bathing surface, steps to and onto bathing surface in two scenarios:
 - Steps over an 8cm “shower pan rim” onto test surface with both feet, and stops; test is over
 - Steps over a 38cm “bathtub rim” onto test surface with both feet, and stops; test is over
 - Number of slips for each sample would be recorded
 - Shower/tub “rims” will be soft mockups, in case of a slip

Proposed human slip methodology

- Considerations with this methodology
 - Only entry onto surfaces is tested
 - Not testing bathroom floor friction (on exit)
 - Test subjects likely will test with dry feet
 - Using a single representative elevation distance (e.g. 5cm) between “floor” and bathtub bathing surface
 - Single representative distance between “floor” and shower bathing surface, if different
 - Necessary to capture forceplate data (uCOF)?

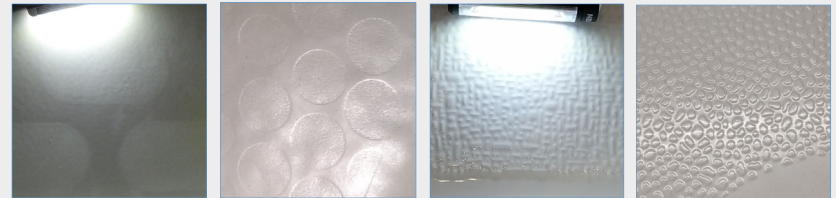
Questions or comments?

General considerations

**...independent of
methodological details**

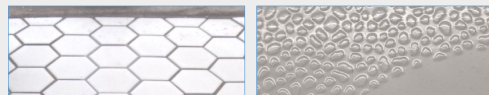
General considerations

- The current lack of “standardization” of bathing surface friction feature configurations will likely affect research reliability and usability



General considerations

- Different tribometers are affected by “profiled” surfaces in different ways
 - Planar surfaces are most reliable for testing
- Bathtubs tend to have a slightly concave friction surface; the degree of concavity differs
 - Tribometer readings may be affected by differing concavity between bathtub brands



Questions or comments?

Proposed task groups and call for participants

Proposed task groups

- Research funding
- Reference surfaces: porcelain-enameled metal
- (Reference surfaces: polymer/composite)
- (In-tub bathmats)
- Human slip research experimental design
- Tribometry methods
- Contaminants

Agenda

- Old business
- New business
- Administrative deadlines – no relevant ones at this time
- Future meetings: Doodle poll will be sent in January
- Adjourn