



**Detectable warning Systems
Technical Committee Meeting Agenda
Working Session # 2
Tuesday, June 10th, 2019 1:00PM – 12:30PM**

- 1) **1:00AM-1:05PM: Call to Order and Introductions**
- 2) **1:05AM-1:10PM: Review of Current Technical Committee Members**
 - Looking for a Vice Chair. Encourage participation and TC membership
- 3) **1:10PM-1:15PM: Brief summary of the Technical Committee
(for those states not participating in quarterly calls or who are new to NTPEP)**
 - This program evaluates detectable warning systems for disability access. The program includes verification testing of geometry, physical testing, weathering, and adhesion. Products are affixed to a concrete slab and evaluated before and after weathering.
- 4) **1:15PM-1:25PM: Update - Program Status**
 - The work plan was balloted to the states and passed. It is hoped that testing can be started this summer. A “User’s Guide” needs to be developed. The TC needs to keep up with developments in AASHTO TP 103 as the work plan is based on that.
- 5) **1:25PM-1:50PM: Testing Presentation, Joel Sprague, TRI Environmental**

***Insert slide show from Joel Sprague - TRI**

Testing will be performed at the TRI facility in South Carolina.

A test slab is prepared with the sample panel in place. Visual and microscopic evaluations.



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It takes 1600 hours to do the cold exposure testing. It takes approximately 110 days to get through an evaluation. Industry stated that this will make for a big queue of products to be tested.

It is expected that product submissions will be accepted soon.

Question: Does the evaluation test shear?

Response: The evaluation does not include snowplow shear testing because many northern states are using cast iron. Also, states who want that testing are already set up to do it themselves. Wisconsin has done some snowplow testing several years ago.

Question: Is there any correlating data for these tests?

Response: Florida has been doing about half of these tests. Precision and bias will have to come in time. There is a need to correlate testing to product performance. That's where we need to work on user's guide.

Audience Poll: How many states are interested in adopting this plan? Small response. It is expected that survey results will be available by the time of the webinar (July 18th)

Discussion on alternative test methods for UV Resistance.

UV resistance

Sam Allen

*Slide show

Decided on accelerated UV testing to get it done quickly, also some states indicated they wanted the xenon arc UV method.

Question: Is time exposure the same with the xenon arc vs fluorescent?

Response: Time is a function of equipment and that will determine the turnaround time of the evaluation.

There was discussion regarding controlling variability of UV exposure in the testing apparatus. The effective life of bulbs and ability to control amount of radiation. Current state of the art testing apparatus allows for control of amount of radiation so as to keep exposure within tight limits.

Question: Are there any standard QC tests that manufacturers perform that can be part of this program, giving manufacturer an opportunity to stop testing before expensive testing is performed if they see that the sample is going to fall short?

Response: The standard NTPEP protocol will be followed.

6) 1:50PM-2:10PM: Industry Concerns



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Question: Industry is concerned with return on investment. They are concerned that there may not be enough states using the testing to justify the cost of testing.

Question: Industry wanted to know how much the evaluation would cost.

Response: An estimated cost is around low to mid \$20k per product plus additional cost for more colors of the same product. Reason for extensive testing: States using adhered products have concerns over loss of adhesion and that is why the weathering test is included. If a product is accepted for evaluation, submittals of the same panel in different colors can be evaluated for color only without going through the entire regimen, for a reduced cost.

Question: Can NTPEP state that a certain number of states will use these evaluations?

States make their own decisions on use and spec requirements.

Response: Each state establishes their specified limits for testing. There may be some national standards for some of the test methods included in the work plan. An example might be slip testing.

7) 2:10PM-2:25PM: Open Discussion

Directional bars were mentioned. These consist of raised bars rather than domes and provide directional guidance.

Vince provided information about the Data Mine module for this technical committee. It is ready and easy to understand.



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Session Name	Full Name	Registration Type	Check-In Date (GMT-05:00) Eastern [US & Canada]
WORKING SESSION #2 - Detectable Warning Systems	Allen, Sam	Sponsor/Exhibitor	6/10/2019 14:56
WORKING SESSION #2 - Detectable Warning Systems	Bandoh, Alexander	AASHTO Member	6/10/2019 14:58
WORKING SESSION #2 - Detectable Warning Systems	Barker, Susan	AASHTO Member	6/10/2019 15:02
WORKING SESSION #2 - Detectable Warning Systems	Blackburn, Andrew	AASHTO Member	6/10/2019 14:59
WORKING SESSION #2 - Detectable Warning Systems	Bonk, Aaron	AASHTO Member	6/10/2019 15:03
WORKING SESSION #2 - Detectable Warning Systems	Bradfield, Katherine	AASHTO Member	6/10/2019 14:58
WORKING SESSION #2 - Detectable Warning Systems	Brown, Sophie	AASHTO Member	6/10/2019 15:02
WORKING SESSION #2 - Detectable Warning Systems	Brydl, Michael	AASHTO Member	6/10/2019 15:00
WORKING SESSION #2 - Detectable Warning Systems	Byram, Karen	AASHTO Member	6/10/2019 14:57

WORKING SESSION #2 - Detectable Warning Systems	Dupler, Doug	AASHTO Member	6/10/2019 15:00
WORKING SESSION #2 - Detectable Warning Systems	Dusseault, Charles	AASHTO Member	6/10/2019 15:03
WORKING SESSION #2 - Detectable Warning Systems	Entrekin, David	AASHTO Non-Member (industry representative)	6/10/2019 15:02
WORKING SESSION #2 - Detectable Warning Systems	Frederick, Samuel	AASHTO Member	6/10/2019 14:58
WORKING SESSION #2 - Detectable Warning Systems	Furrer, Tom	AASHTO Member	6/10/2019 14:56
WORKING SESSION #2 - Detectable Warning Systems	Gentry, Paul	AASHTO Member	6/10/2019 15:02
WORKING SESSION #2 - Detectable Warning Systems	Glick, Vince	AASHTO Member	6/10/2019 15:16
WORKING SESSION #2 - Detectable Warning Systems	holzschuher, charles	AASHTO Member	6/10/2019 15:23
WORKING SESSION #2 - Detectable Warning Systems	John, Rublein	AASHTO Member	6/10/2019 15:04
WORKING SESSION #2 - Detectable Warning Systems	Keels, Mike	AASHTO Non-Member (industry representative)	6/10/2019 15:00

WORKING SESSION #2 - Detectable Warning Systems	Klopp, Rodney	AASHTO Member	6/10/2019 15:00
WORKING SESSION #2 - Detectable Warning Systems	Kuniega, David	AASHTO Member	6/10/2019 15:47
WORKING SESSION #2 - Detectable Warning Systems	McDonnell, Jim	AASHTO Member	6/10/2019 15:16
WORKING SESSION #2 - Detectable Warning Systems	Meggers, Dave	AASHTO Member	6/10/2019 14:57
WORKING SESSION #2 - Detectable Warning Systems	Merced, Awilda	AASHTO Member	6/10/2019 14:59
WORKING SESSION #2 - Detectable Warning Systems	Moffett, Anson	AASHTO Member	6/10/2019 14:56
WORKING SESSION #2 - Detectable Warning Systems	Morgan, Jeff	AASHTO Member	6/10/2019 14:59
WORKING SESSION #2 - Detectable Warning Systems	Mroczkowski, Andrew	AASHTO Member	6/10/2019 15:00
WORKING SESSION #2 - Detectable Warning Systems	Mulcahy, Richard	AASHTO Member	6/10/2019 16:28
WORKING SESSION #2 - Detectable Warning Systems	Nunez Olivieri, Jonathan	AASHTO Member	6/10/2019 15:01

WORKING SESSION #2 - Detectable Warning Systems	Pelham, Michael	AASHTO Member	6/10/2019 14:59
WORKING SESSION #2 - Detectable Warning Systems	Perry, Eric	AASHTO Non-Member (industry representative)	6/10/2019 14:59
WORKING SESSION #2 - Detectable Warning Systems	Rangel, Rosa	AASHTO Member	6/10/2019 15:00
WORKING SESSION #2 - Detectable Warning Systems	Rowden, Raymond	AASHTO Member	6/10/2019 14:55
WORKING SESSION #2 - Detectable Warning Systems	Sirianni, Jonathan	AASHTO Member	6/10/2019 14:58
WORKING SESSION #2 - Detectable Warning Systems	Smith, Buan	AASHTO Member	6/10/2019 15:05
WORKING SESSION #2 - Detectable Warning Systems	Sprague, Joel	AASHTO Non-Member (industry representative)	6/10/2019 14:57
WORKING SESSION #2 - Detectable Warning Systems	Stallard, Tim	AASHTO Member	6/10/2019 14:56
WORKING SESSION #2 - Detectable Warning Systems	Stelzer, Mike	AASHTO Member	6/10/2019 15:16
WORKING SESSION #2 - Detectable Warning Systems	Swickard, James	AASHTO Non-Member (industry representative)	6/10/2019 15:02

WORKING SESSION #2 - Detectable Warning Systems	Tobias, Daniel	AASHTO Member	6/10/2019 15:00
WORKING SESSION #2 - Detectable Warning Systems	Ulmer, Eli	AASHTO Member	6/10/2019 14:58
WORKING SESSION #2 - Detectable Warning Systems	Waldrop, Drew	AASHTO Member	6/10/2019 14:57
WORKING SESSION #2 - Detectable Warning Systems	Weber, Richard	AASHTO Member	6/10/2019 14:57
WORKING SESSION #2 - Detectable Warning Systems	Wheat, Michelle	AASHTO Member	6/10/2019 14:41
WORKING SESSION #2 - Detectable Warning Systems	Young, Brad	AASHTO Member	6/10/2019 14:56

NTPEP Laboratory Evaluation of Detectable Warning Systems

Testing Overview

Joel Sprague, Technical Director
TRI Environmental – South Carolina Labs
Greenville, SC



Governing Documents

- NTPEP Designation: DWS-18-01, NTPEP Committee Work Plan for Evaluation of Laboratory Evaluation of Detectable Warning Systems
- AASHTO TP 103 (2015) - Standard Method of Test for Detectable Warning Systems

Testing Criteria

5.3 *Fabrication of Test Specimens*

- 5.3.1 Prepare samples . . . in accordance with AASHTO TP 103 (2015) Section 5 and manufacturer/supplier's instructions. Provide and report photographs showing installed samples and the unique identifier in at least two views: a top view and side view.
- 5.3.2 and 5.3.3 cover brick paver type and color-only type submittals.

5.4 *Visual and Microscopic Evaluation*

Perform and report product description in accordance with AASHTO TP 103 (2015) Section 6. In addition, provide and report additional close-up photos of defects.

5.5 *Domes and Spacing Dimensional Testing*

Perform and report product dimensions in accordance with AASHTO TP 103 (2015) Section 7.

Testing Criteria (cont'd)

5.6 *Slip Resistance Testing*

Perform slip resistance testing in accordance with Work Plan Appendix C. Report each individual slip resistance measurement, as well as, the average of measurements for domes and field, respectively.

5.7 *Color Measurement Testing*

Perform and report measurements as defined and in accordance with AASHTO TP 103 (2015) Section 9. Perform and report additional colors samples using this section.

5.8 *Resistance to Impact from Falling Tup Testing*

Perform and report impact testing in accordance with AASHTO TP 103 (2015) Section 10 using both 27 J and 54 J. (omitting cold exposure category testing). Provide and report photographs of dome testing results.

Testing Criteria (cont'd)

5.9 *Wear Resistance Testing*

Perform and report measurements as defined and in accordance with AASHTO TP 103 (2015) Section 12. Provide and report photographs of dome wear testing results.

5.10 *Bond Strength Testing*

Perform and report measurements as defined in Appendix B including the following: sample identification, exposure history of samples at time of testing, report all values computed along with the nature and location of the failures. Perform and report measurements as defined in ASTM D4541, report surface preparation, the average strength to failure; and comments describing irregularities in the tested domes or system and any deviation from the test procedure. In addition, provide and report photographs of failure mode results.

Testing Criteria (cont'd)

5.11 *High-Temperature Thermal Cycling Testing*

Perform and report measurements as defined and in accordance with AASHTO TP 103 (2015) Section 14.

5.12 *Abrasion Exposure Testing*

Perform and report measurements as defined and in accordance with AASHTO TP 103 (2015) Section 15.

5.13 *Freeze-Thaw Durability Testing*

Perform and report measurements as defined and in accordance with AASHTO TP 103 (2015) Section 16.

5.14 *Ultraviolet Light Exposure Testing*

Perform and report measurements as defined and in accordance with AASHTO TP 103 (2015) Section 17 **except limiting the exposure in Sections 18 and 19, “Hot Exposure Category” to 1000 hours.**

Testing Criteria (cont'd)

Exposure Regimes per AASHTO TP 103 (2015) Sections 18 & 19

HOT EXPOSURE CATEGORY

- 19.1 Subject specimens to 15 thermal cycles according to Section 14, “High Temperature Thermal Cycling.”
- 19.2 Subject the specimens to four abrasion cycles according to Section 15, “Abrasion Exposure.”
- 19.3 Subject the specimens to ~~375~~ h (250 hrs per work plan) of ultraviolet radiation exposure according to Section 17, “Ultraviolet Light Exposure.”
- 19.4 Repeat the series of exposures, in the same order, three additional times for a total of four cycles. This will provide a total of 60 thermal cycles, 16 abrasion cycles, and ~~1500~~ h (1000 hrs per work plan) of ultraviolet radiation.

Testing Criteria (cont'd)

Exposure Regimes per AASHTO TP 103 (2015) Sections 18 & 19

COLD EXPOSURE CATEGORY

- 20.1 Subject specimens to 15 thermal cycles according to Section 14, “High Temperature Thermal Cycling.”
- 20.2 Subject the specimens to four abrasion cycles according to Section 15, “Abrasion Exposure.”
- 20.3 Subject the specimens to 15 freeze–thaw cycles according to Section 16, “Freeze–Thaw Durability.”
- 20.4 Subject the specimens to 250 h of ultraviolet radiation exposure according to Section 17, “Ultraviolet Light Exposure.”
- 20.5 Repeat the series of exposures, in the same order, three additional times for a total of four cycles. This will provide a total of 60 thermal cycles, 16 abrasion cycles, 60 freeze–thaw cycles and 1000 h of ultraviolet radiation.

Testing Criteria (cont'd)

5.15 *Exposed Specimen Testing*

Repeat tests 5.4 through 5.10 after exposure to 5.11 through 5.14 and report final results and calculated change in accordance with AASHTO TP 103 (2015) and as modified herein.

5.4 *Visual and Microscopic Evaluation*

5.5 *Domes and Spacing Dimensional Testing*

5.6 *Slip Resistance Testing*

5.7 *Color Measurement Testing*

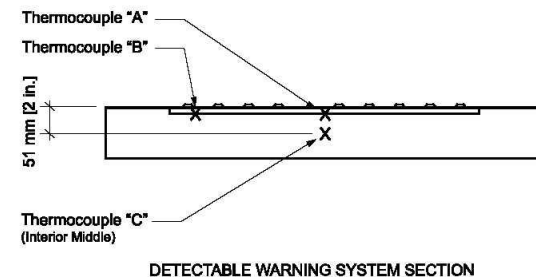
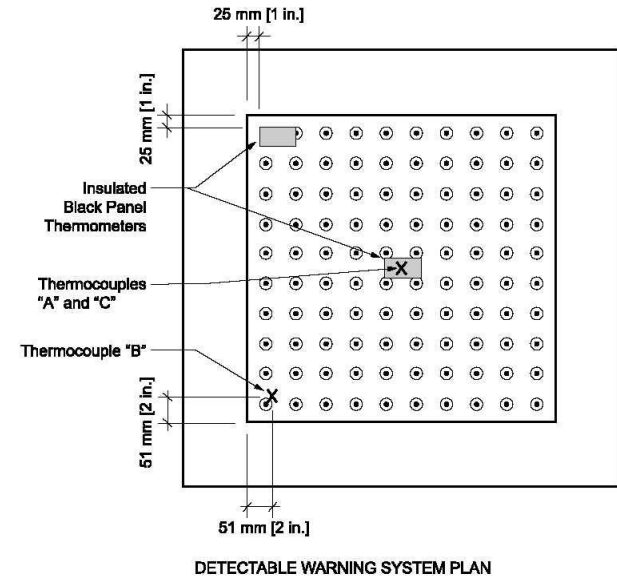
5.8 *Resistance to Impact from Falling Tup Testing*

5.9 *Wear Resistance Testing*

5.10 *Bond Strength Testing*

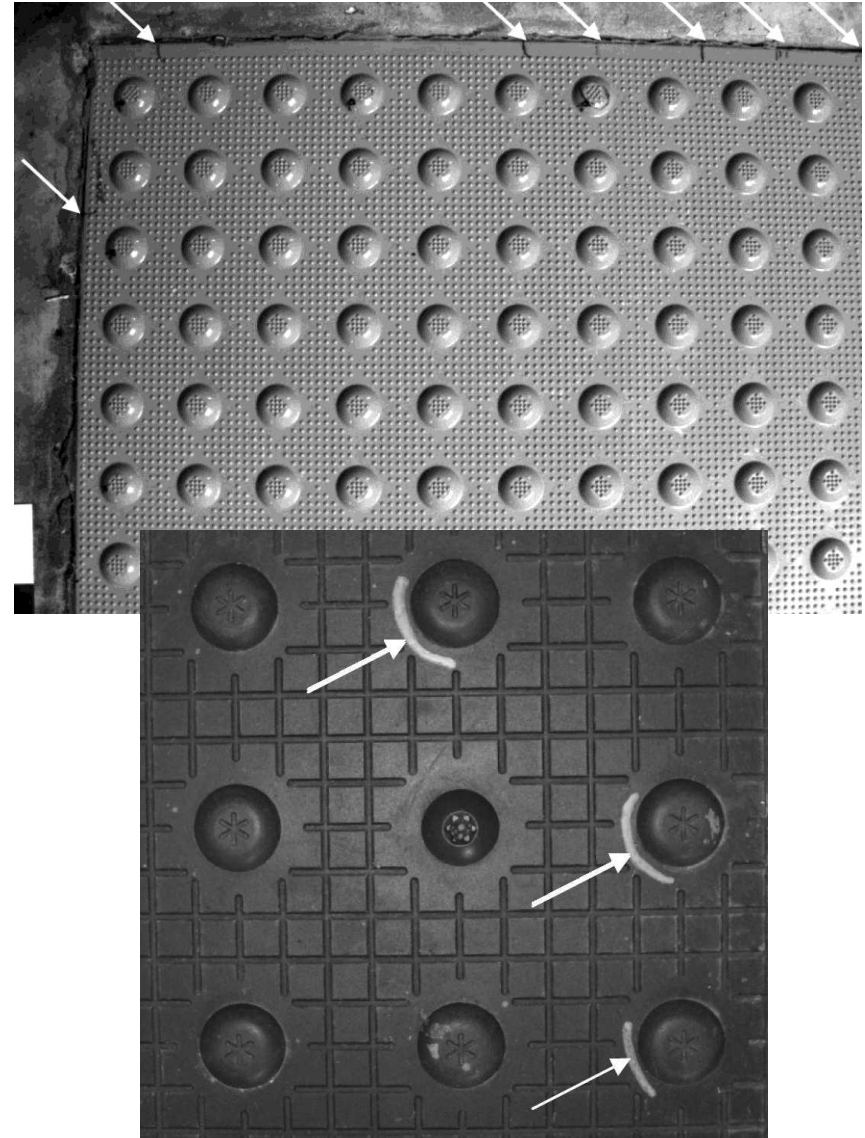
5.3 *Fabrication of Test Specimens*

- AASHTO TP 103 (2015)
Section 5
 - 3 concrete “slabs” w/
6x6 WWF and #4 rebar
measuring 34” x 34” x 4”
with 24” x 24” DWS
centered.
 - Cure for 14 days



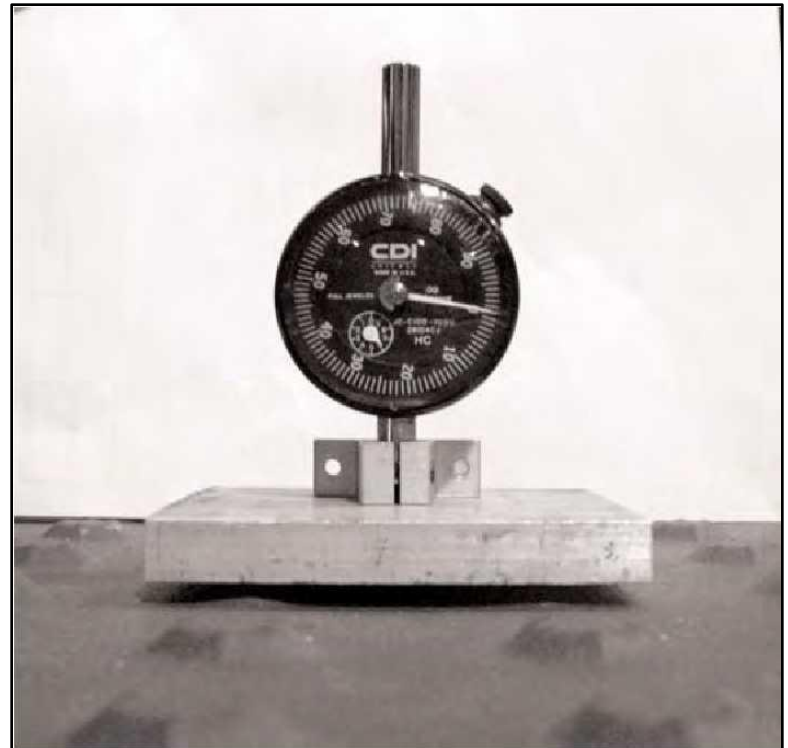
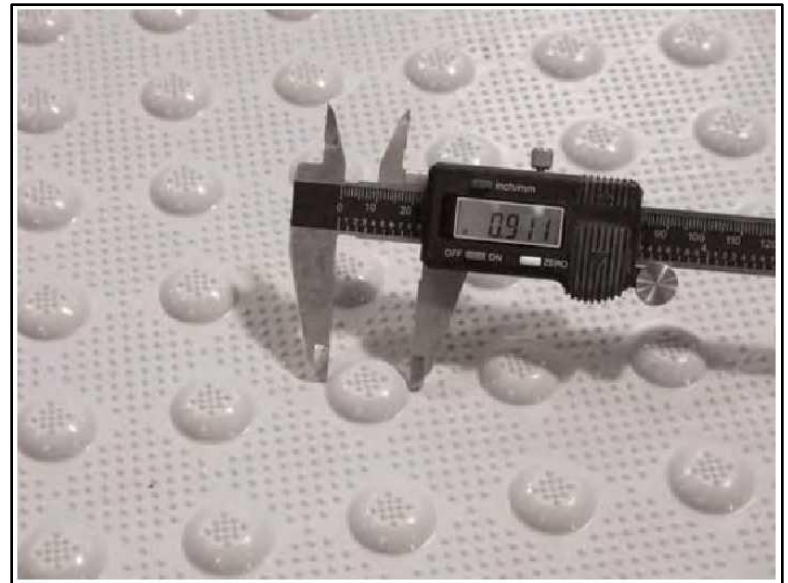
5.4 *Visual and Microscopic Evaluation*

- AASHTO TP 103 (2015)
Section 6
 - Portable microscope (10X to 30X) / observe from 6" to 18" and multiple angles / photomicrographs
 - Contrasting markers to identify features to re-examine "after".



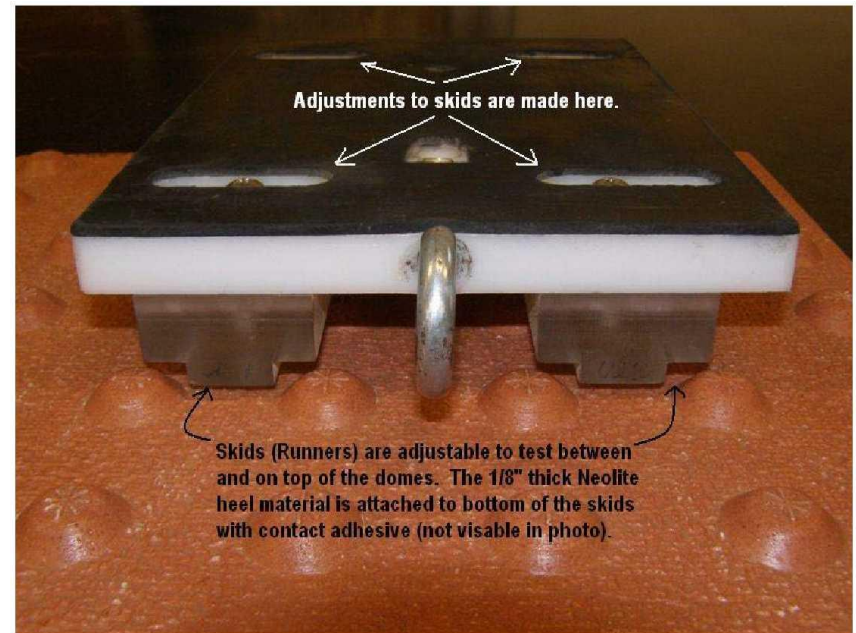
5.5 *Domes and Spacing Dimensions*

- AASHTO TP 103 (2015) Section 7
 - Digital calipers with 6-inch span
 - Depth gauge with dial, and
 - Tapered point, and
 - 0.5" travel, and
 - 3" x 3" (min.) plate with center hole.

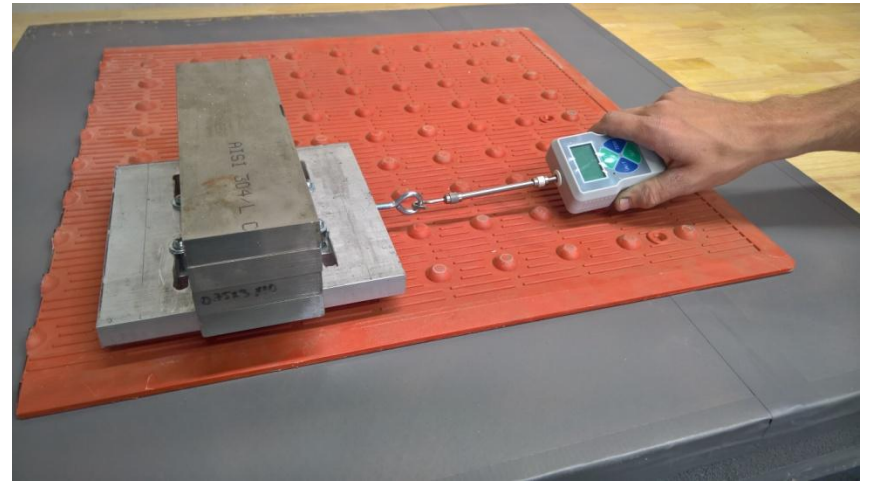
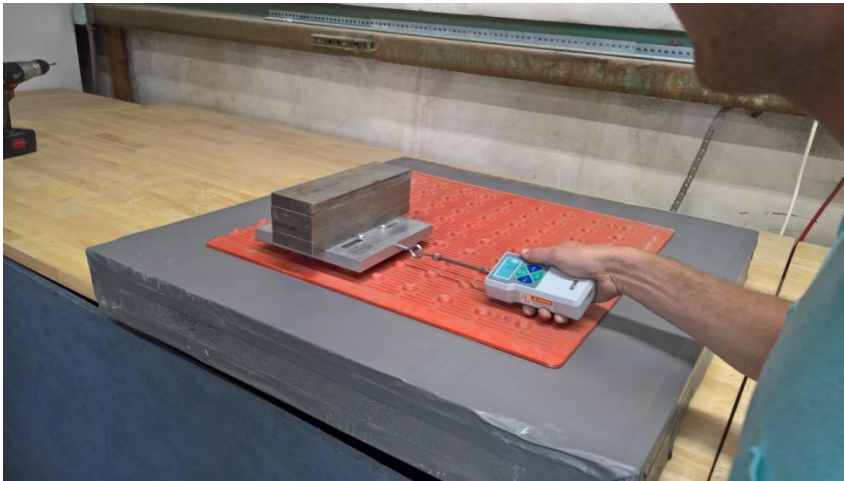


5.6 Slip Resistance Testing

- Work Plan, Appendix C
 - 2 directions / wet & dry – 3 areas (min.)
 - Dynamometer (100 lb) – hold peak value
 - Skid:
 - 8" x 8" x $\frac{3}{4}$ " aluminum with two adjustable 6" x $\frac{3}{4}$ " x $\frac{3}{4}$ " skids;
 - 1/8" x $\frac{3}{4}$ " wide Neolite heel on skids
 - 25 lb weight



5.6 *Slip Resistance Testing*



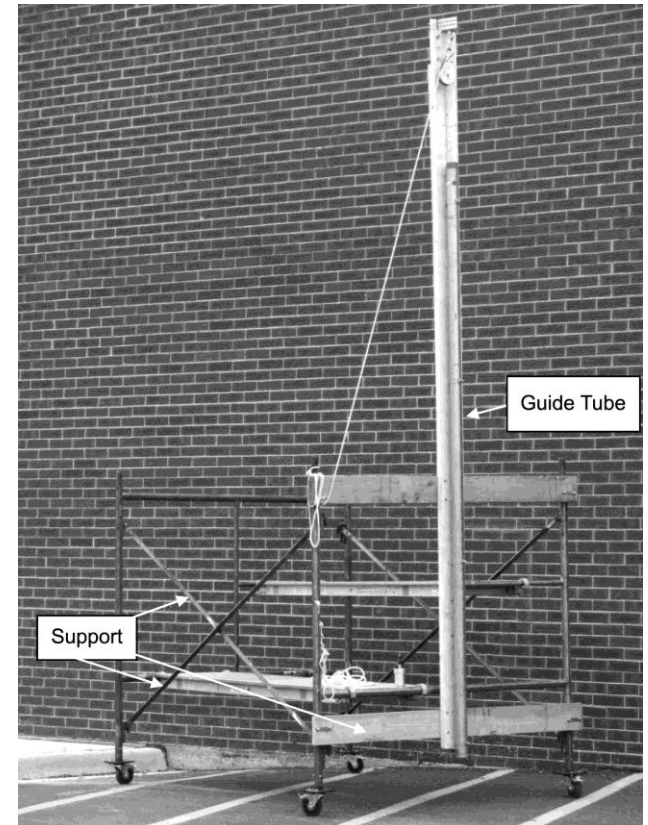
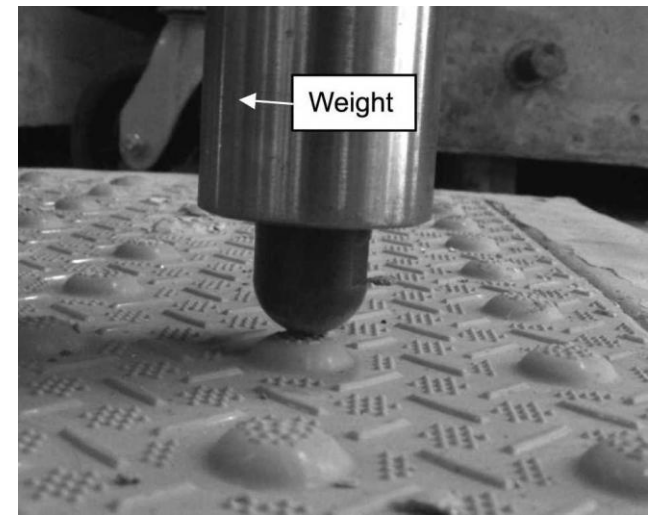
5.7 *Color Measurement Testing*

- AASHTO TP 103 (2015) Section 9
 - CIELAB Capable Device
 - 10 dome & 10 field locations (random)

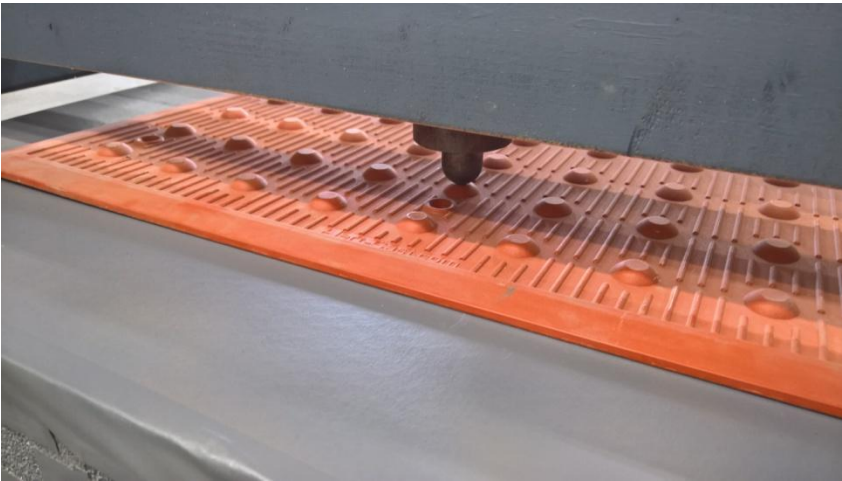


5.8 *Resistance to Impact from Falling Tup Testing*

- AASHTO TP 103 (2015)
Section 10
 - Tup has 1-inch hemispherical tip (≥ 54 HRC steel)
 - Guide tube, rope, pulley
 - 2 impact levels: 20 ft-lb, 40 ft-lb
 - 3 domes per impact level
 - Room temperature only

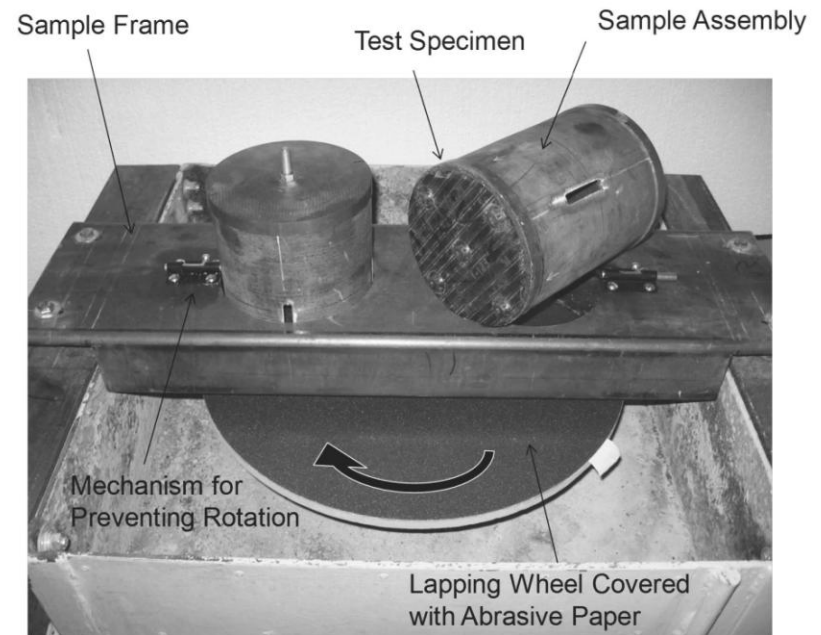


5.8 *Resistance to Impact from Falling Tup Testing*



5.9 *Wear Resistance Testing*

- AASHTO TP 103 (2015)
Section 12
 - 45 rpm turntable
 - 18" diameter abrader wheel (self-adhesive sand paper)
 - 2 – 6" diameter cores of DWS
 - 4 – 90 degree positions
 - 60 seconds at each position
 - Measure dome height

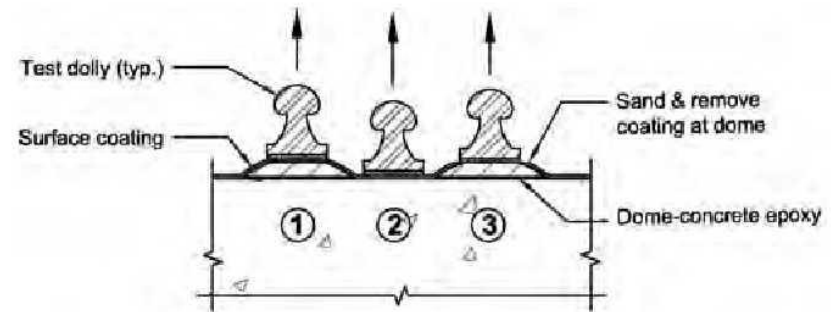


5.9 *Wear Resistance Testing*



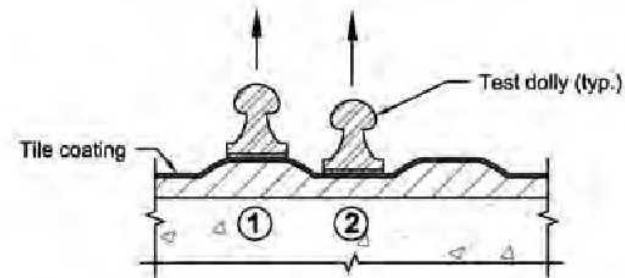
5.10 Bond Strength Testing

- Work Plan, Appendix B / ASTM D D4541
 - Adhesive bonded systems only
 - Dollies epoxy-adhered to surface
 - Core-drill around dolly
 - Attach bond tester and pull
 - 5 test results from each of 3 sample areas



For systems with discrete domes, pulloff adhesion tests on

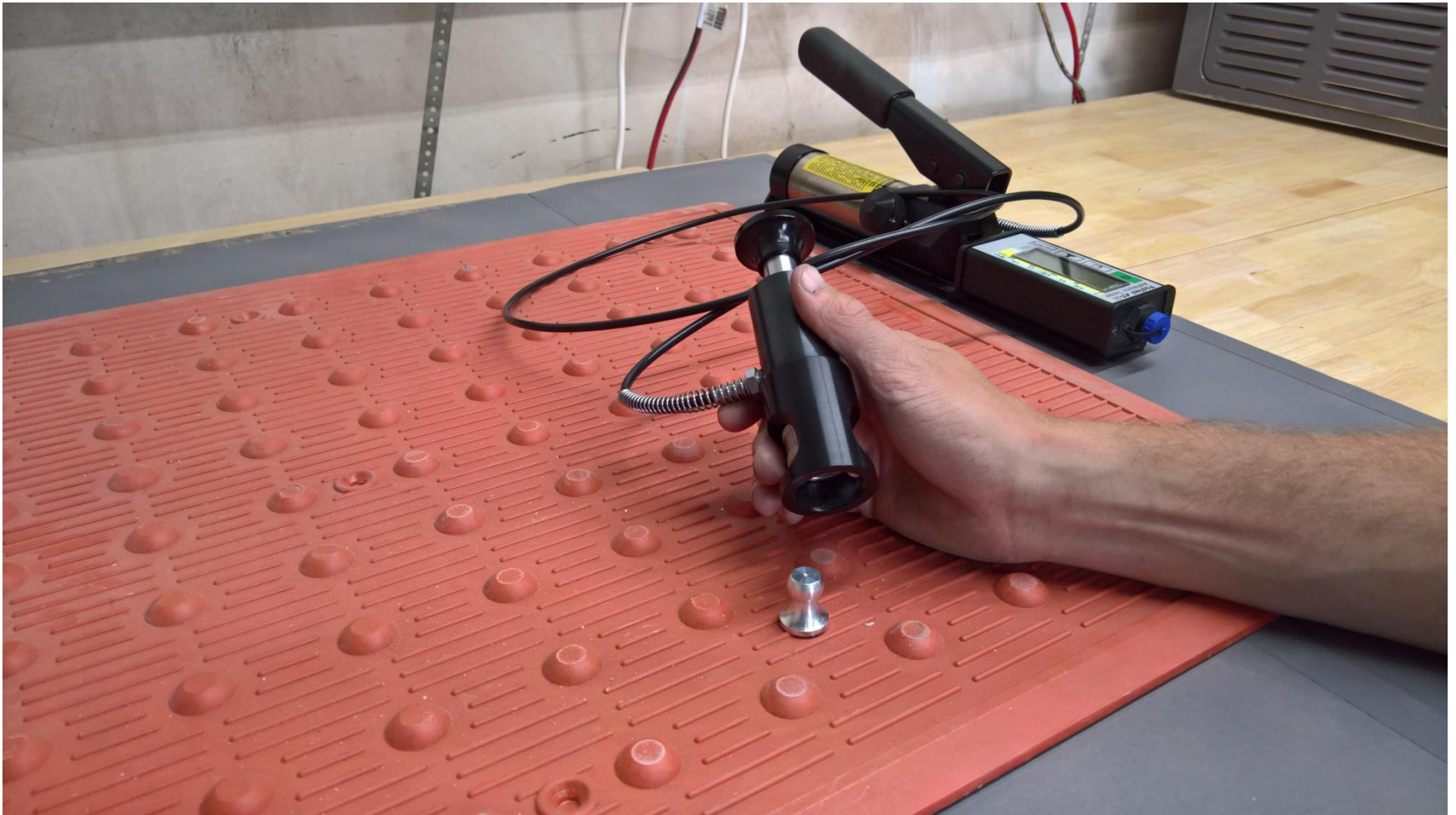
1. Coating on dome
2. Coating on field
3. Dome-concrete interface



For systems with tiles having integral domes, pulloff adhesion tests on

1. Coating on dome
2. Coating on field

5.10 *Bond Strength Testing*



5.11 *High-Temperature Thermal Cycling Testing*

- AASHTO TP 103 (2015)
Section 14
 - Water spray at 25°C (77°F) for 15 minutes
 - Heat* to 93°C (200°F) in 15 minutes
 - Hold at 93°C (200°F) for 2 hours
 - Water spray to lower temp to 25°C (77°F)
 - Repeat 15 cycles
 - When running in combination with cold exposure (freeze-thaw) heat only to 77°C (170°F)

* Infrared system.



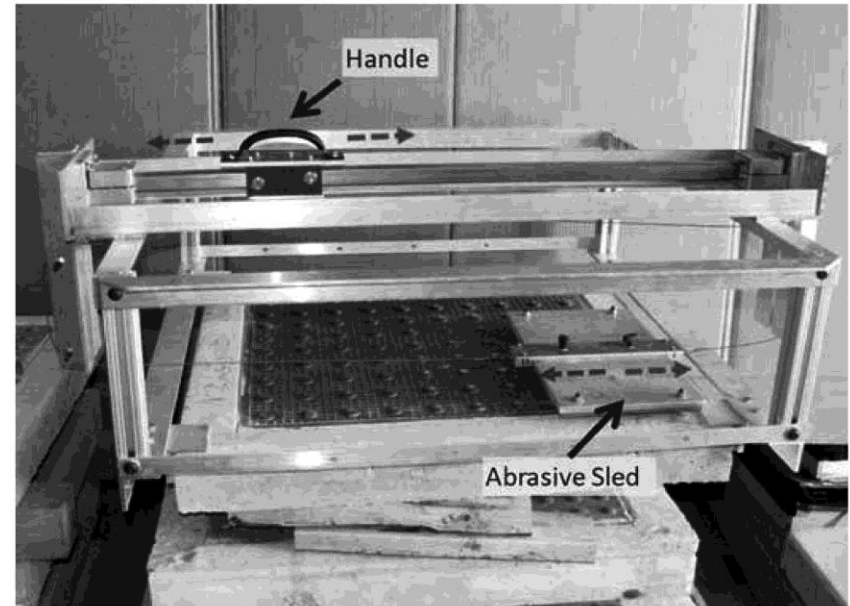
Note: A sheet of water draining to the left on the sample surface.

5.11 *High-Temperature Thermal Cycling Testing*

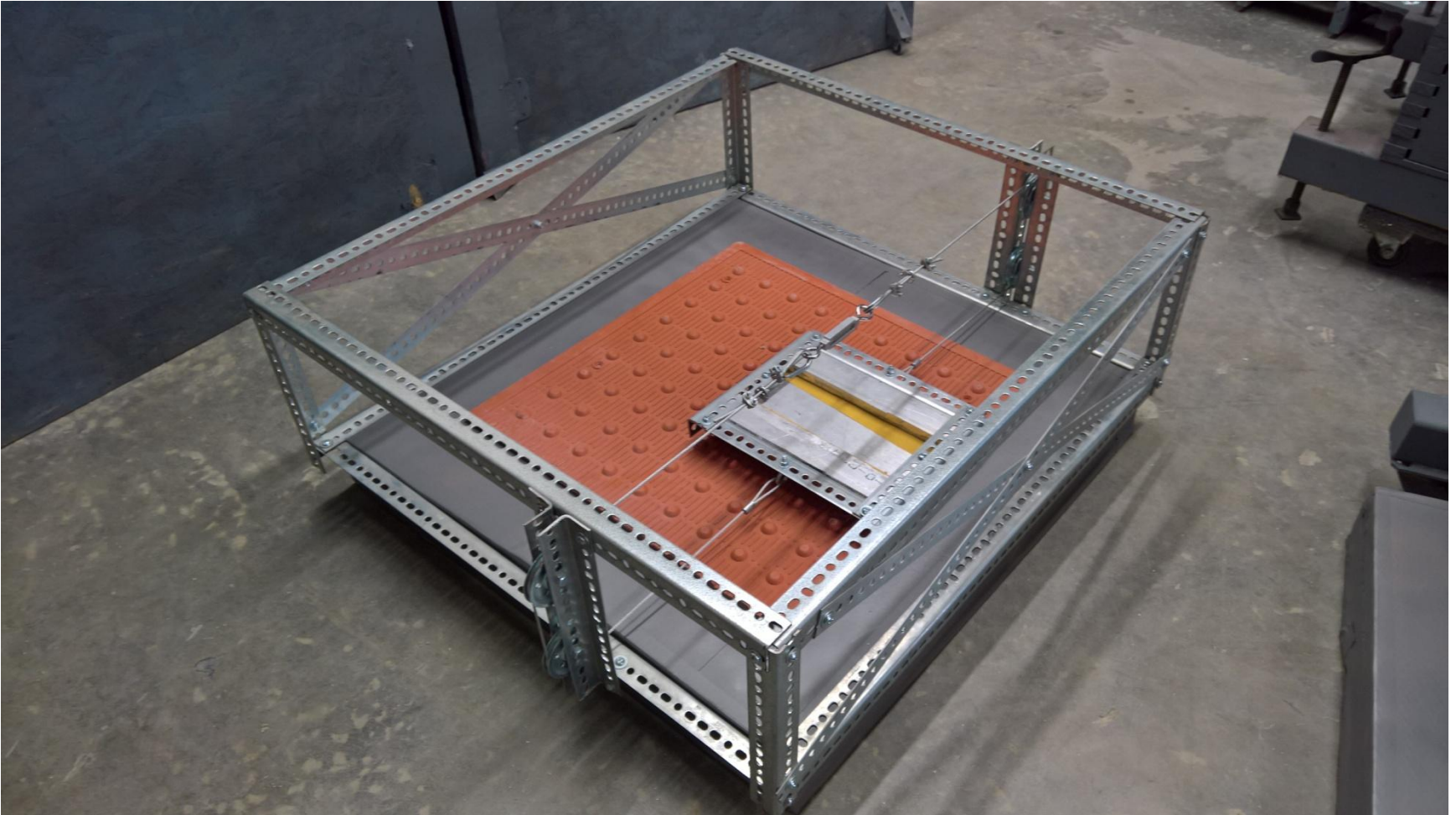


5.12 *Abrasion Exposure Testing*

- AASHTO TP 103 (2015)
Section 15
 - Abrasive sled – 8" x 12" wide
 - Abrade half of DWS at a time
 - 4 cycles each area then switch (forth + back = 1 cycle)
 - Measure change in dome height



5.12 *Abrasion Exposure Testing*



5.13 *Freeze-Thaw Durability Testing*

- AASHTO TP 103 (2015)
Section 16
 - Enclosed container with 3% sodium chloride solution
 - Cool to freeze but not below -23°C (-10°F)
 - Hold in frozen state for at least 30 minutes
 - Thaw, but do not heat air above 29°C (85°F)
 - Hold in thawed state for at least 30 minutes
 - Complete 1 cycle in no less than 6 hours
 - Repeat 15 cycles



5.14 *Ultraviolet Light Exposure Testing*

- AASHTO TP 103 (2015) Section 17
 - UVA 340 lamps & air temp of $30\pm 3^{\circ}\text{C}$ ($86\pm 5^{\circ}\text{F}$)
 - Continuous exposure for 250 hours



5.14 *Ultraviolet Light Exposure Testing*



Testing Matrix

Task Description	Test Time - All Cycles, All Specimens (hrs)	# of Specimen
Task #1		
Receive and Categorize DWS, and Fabrication of Test Specimens in accordance with AASHTO TP 103 (2015) Section 5	350	3
Task #2		
Visual and Microscopic Evaluation in accordance with AASHTO TP 103 (2015) Section 6	4	2
Domes and Spacing Dimensional Testing in accordance with AASHTO TP 103 (2015) Section 7		2
Slip Resistance Testing in accordance with Work Plan, Appendix C		2
Color Measurement Testing in accordance with AASHTO TP 103 (2015) Section 9		2

Testing Matrix

Task Description	Test Time - All Cycles, All Specimens (hrs)	# of Specimen
Task #3a - High Temp Thermal Cycling - Hot Exposure		
High-Temperature Thermal Cycling Testing in accordance with AASHTO TP 103 (2015) Section 14	1200	1
Abrasion Exposure Testing in accordance with AASHTO TP 103 (2015) Section 15		1
Ultraviolet Light Exposure Testing in accordance with AASHTO TP 103 (2015) Section 17 as modified herein		1
Task #3b - High Temp Thermal Cycling - Cold Exposure		
High-Temperature Thermal Cycling Testing in accordance with AASHTO TP 103 (2015) Section 14	1600	1
Abrasion Exposure Testing in accordance with AASHTO TP 103 (2015) Section 15		1
Freeze-Thaw Durability Testing in accordance with AASHTO TP 103 (2015) Section 16		1
Ultraviolet Light Exposure Testing in accordance with AASHTO TP 103 (2015) Section 17 as modified herein		1

Testing Matrix

Task Description	Test Time - All Cycles, All Specimens (hrs)	# of Specimen
Task #4		
Exposed Specimen Testing: Visual and Microscopic Evaluation in accordance with AASHTO TP 103 (2015) Section 6	4	2
Exposed Specimen Testing: Domes and Spacing Dimensional Testing in accordance with AASHTO TP 103 (2015) Section 7		2
Exposed Specimen Testing: Slip Resistance Testing in accordance with Work Plan, Appendix C		2
Exposed Specimen Testing: Color Measurement Testing in accordance with AASHTO TP 103 (2015) Section 9		2
Task #5		
Unexposed (Specimen #3) and Exposed Specimen Testing: Resistance to Impact from Falling Tup Testing in accordance with AASHTO TP 103 (2015) Section 10	3	3
Unexposed (Specimen #3) and Exposed Specimen Testing: Wear Resistance Testing in accordance with AASHTO TP 103 (2015) Section 12	6	3
Unexposed (Specimen #3) and Exposed Specimen Testing: Adhesive, Coating and Single Dome Bond Strength Testing in accordance with Work Plan, Appendix B	16	3

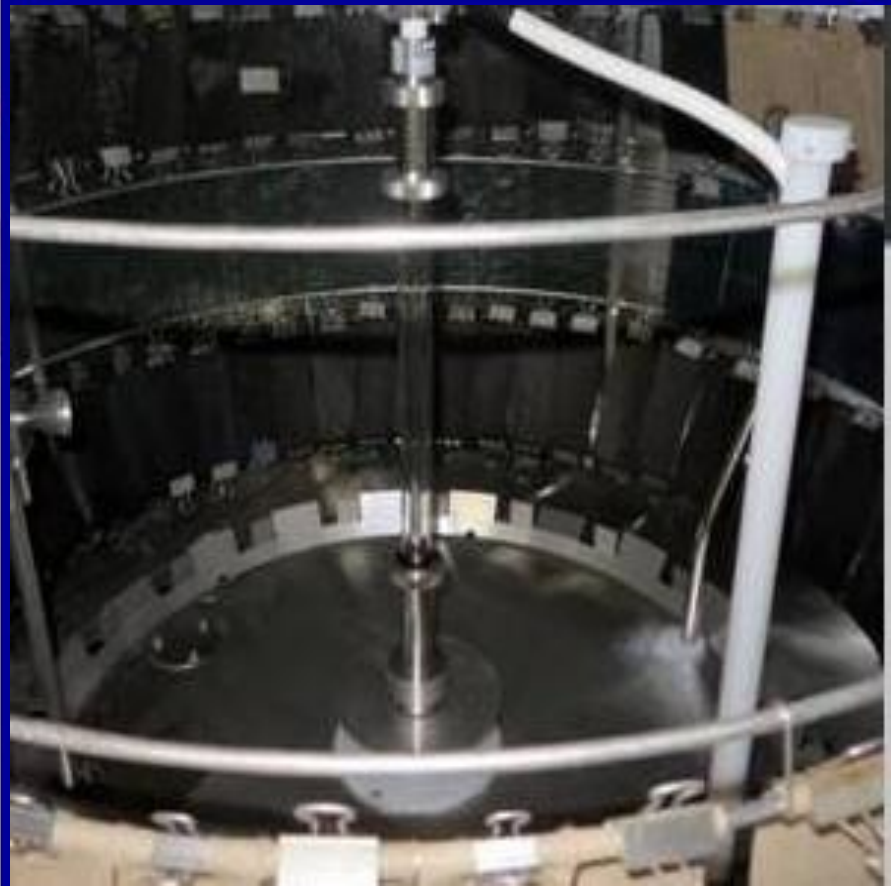
THANKS!

Q and A

About UV Resistance



EMMAQUA (Equatorial Mount with Mirrors for Acceleration)



ASTM D 4355

Typical
Xenon Arc
Weatherometer





Typical ultraviolet fluorescent weatherometer and
closeup of UV-A bulbs

Fluorescent UV vs Xenon Arc

