

**EVALUATION OF  
DETECTABLE WARNINGS/DIRECTIONAL SURFACES  
ADVISORY COMMITTEE (EDWAC)**

**Meeting Attendance on Friday, April 29, 2005**

**Committee Members Present**

H. David Cordova  
Doug Hensel  
Jeff Holm  
Arfaraz Khambatta  
Eugene (Gene) Lozano, Jr.  
Minh Nguyen  
Michael Paravagna  
Paula Anne Reyes-Garcia  
Richard Skaff  
Jane R. Vogel

**Committee Members Absent**

None

**DSA Staff Present**

Derek M. Shaw

**UL Staff Present**

Jeffrey Barnes  
Billie Louise Bentzen via Teleconference (UL  
Consultant – from Accessible Design for  
the Blind)  
Esther Espinoza  
Andre Miron

**Others Present**

Regina Baak, TG Lining BV  
Ron Baak, TG Lining BV  
Martin Bearden, Safety Step TD  
Lisa Berry, Wausau Tile  
Paul Hantz, Wausau Tile  
Mark Heimlich, Armor-Tile  
Jon Julnes, Vanguard ADA Systems  
Of America  
Russ Klug, ADA Concrete Domes  
Jeff Koenig, Detectable Warning Systems Inc.  
Fred Meise, Norsestar Construction  
Phil Montgomery Sr., Disability Devices, Inc.  
Bill Naugle, N-Direct, Inc.  
Michael Stenko, Transpo Industries, Inc.  
Dustin Upgren, Cold Spring Granite  
Chip Van Abel, Naviplate  
Ed Vodegel, Flint Trading, Inc.

April 29, 2005

***General*** – A meeting of the Evaluation of the Detectable Warnings/Directional Surfaces Advisory Committee (EDWAC) was held on April 28 and 29, 2005 at the California Community Colleges Building in Sacramento, California. The purpose of the meeting was to introduce and discuss known technologies, testing programs, and to discuss other issues related to the evaluation of detectable warnings and directional surfaces.

***The following minutes/meeting report is not intended to be a verbatim transcript of the discussions at the meeting, but is intended to record the significant features of those discussions.***

1 **1. Call to Order (Jeffrey Barnes/UL)**

2 Jeffrey Barnes called the third meeting of the advisory committee for detectable warnings  
3 and directional surfaces to order at 10:00 a.m.

4

5 **2/3. Testing for Acoustic Quality, Exhibit B, Section 18; and Manufacturer/Public**

6 **Comments (Andre Miron/UL)**

7 Andre Miron reported that the purpose of the Acoustic Quality Test is to approximate the  
8 sound-on-cane acoustic quality of a detectable warning. Basically, the test is described as  
9 dropping an object on a test panel, recording the sound, and analyzing of the data. A  
10 quantitative or qualitative value is applied to the sound, and compared to other data. Andre  
11 selected among the numerous available software that analyzes sound, software that  
12 produces a sound spectrogram that examines a number of different characteristics of the  
13 sound, and which generates distinctive data (a fingerprint) on the sound for the committee  
14 to review. The recorded data will be saved for comparison to other recorded data.

15

16 The test apparatus consisted of:

17 a) A striker (a nylon ball);

18 b) A microphone, with a sensitivity/frequency response that still needs to be determined,

- 1 c) A computer, equipped with audio hardware capable of recording digital audio at a
- 2 sample rate of 44.1 KHz (CD quality) and 16-bit resolution;
- 3 d) Software, capable of rendering a sound spectrograph in the audio frequency range;
- 4 and
- 5 e) Test specimens, measuring 12 by 12 inches, on 2 inches of substrate.

6

7 Testing will be conducted on as-received and conditioned test specimens placed on a hard

8 surface, with a microphone situated to capture and record sound. A nylon ball will be used

9 as a striker, which represents nylon cane tips, although other canes have steel tips, so the

10 committee may wish to consider using a metal ball instead of the nylon ball, or both, or

11 consider having one striker represent both.

12

13 When asked if the proposed test represented an ASTM test, Andre responded that it did not

14 since his research found that none of the ASTM tests differentiated sound. The ASTM tests

15 dealt with determining the loudness of sound, or the transmission of sound through a certain

16 medium, or determined if one sound was louder than another, however it did not determine

17 if a sound was different from another sound, or whether two sounds were the same.

18

19 David Cordova questioned the need to compare recorded data, since according to the

20 definition for acoustic quality; data comparison was not part of the definition.

21

22 Andre Miron replied that the comparison was necessary, and would be conducted on as-

23 received and conditioned samples, to determine if there has been significant degradation in

24 the test samples as a result of environmental and performance testing. In addition, the

25 committee may want to consider comparing the data to a standard spectrograph, such as

26 concrete, if most concretes are found to have a similar sound spectrum. A sound spectrum

1 could be set up, and used to determine if there is a difference between a given medium and  
2 concrete or asphalt.

3  
4 Andre agreed with a comment from Mark Heimlich, that the sound contrast could be a key  
5 method of detecting detectable warning products. This test is still under development and  
6 additional research will be needed to finalize the test procedure, and to verify if the test will  
7 provide the information needed for determining sound differences. Presently the draft  
8 standard specifies that the test method is differentiating from a standard concrete and  
9 asphalt standard. This hasn't been set yet; so for now Andre wants to make certain that the  
10 technology will operate properly.

11  
12 Gene Lozano mentioned that he considers the nylon striker a better choice than a metal  
13 striker since nylon cane tips represent worse case scenarios over steel cane tips for sound  
14 acoustics. Although, Gene suggested that using a test setup using a cane with a nylon tip  
15 mounted on a hinge to swing, might best duplicate the sound of a cane on detectable  
16 warning surfaces.

17  
18 Andre Miron agreed that this use of a cane on a hinge would be a good idea to consider and  
19 will conduct further research.

20  
21 Andre Miron demonstrated the proposed test method by dropping a nylon ball in a tube  
22 device, and used a sound system to demonstrate a sound spectrograph. The spectrograph  
23 plots sound, and has Y-axis indicating a frequency up to 20, 000 hertz. The second item  
24 plotted is intensity, and the duration is noted based on time. The test was demonstrated  
25 first on fiberboard, followed by test on a concrete paver. On the paver, the graph showed a

1 nice long peak at 6000 hertz, although there was evidence of some ambient sound. Andre  
2 mentioned that this test would normally be conducted in a sound proof room.

3

4 Gene Lozano suggested that the testing of the samples should be as they are normally  
5 imbedded in concrete. The reason is that some ceramic tiles have an zing sound, which  
6 changes when installed in concrete material to a very muted sound.

7

8 Andre Miron replied that testing would be conducted with test specimens imbedded in  
9 concrete, since there appears to be a large difference in sound quality when test samples  
10 are not installed in concrete prior to testing.

11

12 Richard Skaff recommended that testing be conducted on both domes and field areas,  
13 because the sound may vary based on the coating used, spaces between domes, on dome/  
14 field size differences, and for other reasons.

15

16 Andre Miron replied that he had conducted multiple testing on both dome and field and  
17 found that the frequency sound was similar. Additional research and testing will be  
18 necessary to verify if domes and field areas always have a similar sound frequency,  
19 although this may not be the case when domes are not integral to the field surface.

20

21 Andre Miron used a sophisticated software program, which permits numbers to be applied  
22 on the sound data, and which will be suitable for use in the demonstration of the test. The  
23 program resulted in a spectrograph, which permits the collection of actual sound data.  
24 However, there is still a need to determine a proper striker (nylon or metal, ball or cane tip),  
25 to develop a striker release mechanism, and UL still needs to select a suitable microphone  
26 and other equipment, for conducting the Acoustic Quality Test. This test is still under

1 development, and Andre continues to look for the best available software that can handle  
2 this type of test.

3

4 Manufacturer/Public Comments

5 Several manufacturers asked if testing based on sound taps, would be better or worse than  
6 testing based on simulated cane sweeps? Is there evidence that more persons use tap  
7 movements with a cane or is a sweep technique more common?

8

9 The several committee members replied that the tap vs. sweep techniques varies from  
10 person to person, and from situation to situation. Persons with multiple disabilities will  
11 modify their movements, are less precise, and may drag or push, rather than using the  
12 usual tap or sweep technique. Depending on the pressure applied, users with multiple  
13 disabilities will have jerky cane movements, which results in erratic sounds. In addition, the  
14 weight and length of a cane can vary, and may result in a lighter or heavier cane, and in  
15 smaller or bigger swings of the cane.

16

17 Andre Miron adds that testing for acoustic quality is easier when using a tapping-based test,  
18 and conducting tests using a sweeping method will have other factors come into play.

19 There are too many variables when multiples sounds are collected from a sweep technique,  
20 and using this process would be more costly and take longer to analyze. In addition,  
21 testing should use worst-case scenarios to represent all products, which is probably the  
22 tapping motion.

23

24 Jon Julnes Comments:

25 The demonstration of the sound test really clarified things for Jon. Is it possible that a  
26 sweep gives more sound, more data, and would therefore be more useful?

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Andre Miron replies that for testing purposes, it would be necessary to develop a “standard” sweep, and to discount the domes. Overlapping sounds becomes more difficult to distinguish, although this could be looked at further. Having more available data, would be useful if it is carefully researched, and if we are capable of analyzing the data properly. The intent of the Acoustic Quality Test is to verify that the material doesn’t degrade, however we need to answer to the spirit of the scope, to determine where the resiliency is different. It’s important to determine how to detect sound differences, and how to analyze the information. Additional research on all this is planned.

Jeff Barnes announced that the committee should discuss stamped concrete. The issue to address is the apparent inconsistency of this material in the field. There are too many variables in creating samples. Standard quality control measures are missing, and the committee needs to consider this issue.

Jon Julnes Comments:

Many companies do not care for this product. The manufacturers of stamped concrete should follow all the proposed tests, and if they do, they are likely to fail at least some of the tests.

Another committee member agreed that stamped concrete would not likely pass all of the specified tests.

Jeff Barnes requested additional input and suggestions from the EDWAC and the public on the use and testing of stamped concrete. Jeff notes that it is not the committee’s intent to disallow any products, without further testing.

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**4/5. Testing for Attachment Exhibit B, Sections 15 – 16; and Manufacturer/Public Comments (Andre Miron/UL)**

*Topics:*

- a) Bond Strength, Section 15 – Update*
- b) 60-Degree Load Test, Section 16 – New Test*

**a) Bond Strength, Section 15:**

Andre Miron reported that a clarification was made to the draft standard to account for perimeter-attached materials. A clause was put into the standard, Section 15, that allows testing at the seam in the case of perimeter-attached material. When the product being testing is intended for perimeter installation, the test specimen should be prepared such that the junction of two units is in the center of specimen of the test area. The 2-inch diameter steel disk should be attached and centered on the junction of the two units. Two perimeter-attached systems should be placed side by side, and then tested at the junction between the two. This will alleviate problems with testing perimeter-attached systems by testing in the center where there will be no adhesive.

Andre Miron states that the other item to consider is whether an elevated temperature bond strength test, should be done, in a warm or hot condition. As mentioned on Thursday, April 28, 2005, asphalt temperatures can become very hot, and conducting deformation tests of the materials may be necessary. A similar kind of test with a hot bond strength test may be needed in order to test certain adhesives that might break down or soften at higher temperatures. As far as high temperatures cycling, that will be covered by the UV exposure, because there are elevated temperatures in the UV chamber during exposure. Therefore, there is heating and cooling of the specimens as the lamp is turned on and off.

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Andre added that at times adhesives might become sticky or lose strength as they heat up, or when hot they may start to peel, so we may wish to conduct an elevated temperature bond strength test, very similar to the tests that are being prepared for the Ball Pressure Test. The test samples would be heated to 75°F, and then a method would need to be found to conduct the Bond Strength Test in a warm condition. The problem at present is that the Bond Strength Test is written to require that epoxy be added to the steel disk and then the entire assembly would be heated. A method must be found to get to the pole machine and test it in a hot condition. That could be a difficult problem to accomplish, and further research is being done. There is a need to consider if an elevated temperature test is even necessary, and input so far at the meeting indicate yes, although the adhesive materials information submitted by the manufacturers so far indicate that all the materials could very easily handle these elevated temperatures.

Richard Skaff asked if the test specimens would be tested with other bonding equipment attached? For example contractors may add a screw system to the corners, or midway, to plastic materials, to ensure that they don't have a pull up problem. This is added in the field, and may not be part of original sample or instructions submitted for testing. So environment wear may cause adhesive failure on some materials and on bolts or screws, which were added for extra securement security. How do we test for the type of systems being added in the field?

Arfaraz Khambatta replies the test specimens should not be tested with additional parts and materials, if the manufacturer does not specify that these additional parts are to be added to the product, in their installation instructions.

1 Richard Skaff suggested that manufacturers specially state in their written instructions, that  
2 additional screws or fastening systems should not be added to a product during installation  
3 in the field, unless authorized to do so by the manufacturer. What happens is that there is a  
4 deterioration of fastening devices over a period of time because of environmental damage.  
5 A metal part may deteriorate and fail, or the glue used for the adhesion may fail.

6

7 Jeff Barnes notes that there are products that rely specifically on anchors (screws) installed  
8 in the field. We need to address two issues, which is to provide a test program that  
9 addresses improper installation, and to make certain to test products with anchors.

10

11 Michael Paravagna asked if there are there plans to test or fasten products on concrete  
12 only?

13

14 Andre Miron replied that as mentioned on Thursday, April 28, 2005, UL may need to  
15 consider testing on asphalt, if requested by manufacturers to do so. Some products are  
16 only attached to asphalt, or both concrete and asphalt, and this kind of flexibility can be later  
17 added to the tests. For now Andre will focus on developing test methods, and will expand  
18 the test methods later if needed to include other material.

19

20 Richard has seen detectable warnings used occasionally on asphalt, such as at shopping  
21 malls, and therefore recommends testing be required on both concrete and asphalt.

22

23 Jeff Barnes replied that the requirements could require that all manufacturers be tested on  
24 both concrete and asphalt if manufacturers plan to install on asphalts too. Jeff  
25 recommended that testing on asphalt be optional, based on requests by the manufacturer,  
26 when the product is intended to be used on asphalt. The product would be so marked.

1

2 Richard Skaff agreed with Jeff's recommendation, if DSA verifies this information, by adding  
3 a statement onto their list of products, noting if the product is suitable for concrete, or  
4 asphalt, or both.

5

6 Jeff Holm asked if the test adhesive attached to the disk, fails before the manufacturer's  
7 bonding material, does the test specimen fail?

8

9 Andre Miron explained that a high strength epoxy would be used, and if it breaks before the  
10 sample bonding breaks, then that would be acceptable since the sample withstood a  
11 sufficiently large pull.

12

13 Jeff Barnes added that research testing is still being conducted on the samples sent in by  
14 vendors. The challenge with doing a full test is you don't want to change the properties of  
15 the product, like adding a bolt, because we want a surface pull.

16

17 David Cordova notes that there may be some complications with conducting this test on  
18 surface-painted domes. What about using unpainted samples, since the paint might be  
19 removed by the epoxy before the bonding material does, and this would indicate failure of  
20 the paint, not the dome.

21

22 Andre Miron replied that unpainted samples could be requested for conducting attachment  
23 tests only. Although using unpainted samples might change the product unless the sample  
24 is used only for a particular test. The EDWAC needs to look at all the ramifications for doing  
25 this because this may influence other test results. For example, if paint is provided on  
26 samples in order to protect the product from UV radiation.

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Richard Skaff was concerned because unpainted samples may change the product, and removal of the paint in the pull test may indicate a problem too, if not an integral color.

Andre Miron agreed, and explained that was the reason that he was leaning towards removing the paint immediately after conditioning. The idea is if you're only looking at attachment, then this would be sufficient. Adherence of the paint can be tested by the abrasion test.

David Cordova pointed out that there might not be a problem with testing painted products for some of the products. Eventually, experience will show which epoxy materials and bolts in certain sizes will work despite the paint coating, and so some testing could be waived based on that information. For example, Caltran requires that every product on the freeways be subjected to a crash test, however over time, experience has shown which materials are suitable for having the expensive tests waived.

David wondered how binding was this requirement? Because if not part of the binding revisions, than it would not be binding like the 70 percent contrast requirement, that is a regulation that is not binding.

Richard Skaff recommended that color should be an integral part of the curb ramp. A painted surface deteriorates much faster than an integral colored product.

David Cordova notes that this recommendation would rule out many products that rely on painting for its final product.

1 Gene Lozano reports that the reason for the regulation noted in the April 6 2002 documents  
2 and Tile 24, was because each successive coating was likely to make a product more  
3 dangerous, and more slippery.

4

5 David Cordova wants clarification of these requirements, and requests copies from the  
6 FHWA and DSA because this is information that he needs to be aware of for his product  
7 reviews. David has been reviewing products for the state highway system, for some time,  
8 and this information should be part of the review process for accepting or not accepting  
9 some of the products.

10

11 Derek Shaw reports that in the building code, Chapter 1133B.8.3, specifies that the  
12 detectable warning should provide contrast that is integral to the product. This is a curb  
13 ramp requirement.

14

15 David Cordova requested further clarification, since the contrast is required to be integral,  
16 however it might not be considered a color.

17

18 Gene Lozano adds that the US Access Board explained that color should be integral, in  
19 case the top starts to wear off, or if the domes were cut, the color would still be visible.

20

21 Jeff Barnes agreed that there might be sections in the code that appears vague as it relates  
22 to color, and that the committee may need to request a written interpretation of the  
23 requirement.

24

1 David Cordova makes a motion that DSA provide a written interpretation of Chapter  
2 1133b.8.3 from the building code. Clarification of the requirement for integral color or  
3 contrast will be needed.

4

5 Gene Lozano makes an amended motion for the boarding platform and curb ramp  
6 requirements to be included as additional chapters to review. Gene made a motion that  
7 DSA provide formal interpretations of the meaning of the code for the chapters 1133b.8.3,  
8 1127b.5, 1133b.8.4 and 1133b.8.5

9

10 Jeff Barnes summarized that a motion has been made to request that DSA provides a  
11 written interpretation on the chapters listed below, on the meaning of the statement that “the  
12 material used to provide contrast shall be an integral part of the walking surface”, and does  
13 the use of the word “integral” preclude the use of using paint?

14 a) 1127B.5

15 b) 1133B.8.3

16 c) 1133B.8.4

17 d) 1133B.8.5

18

19 David made a motion to request a written interpretation of the chapters, and Richard  
20 seconds the motion.

21 Test Results: 11 Yes votes, 0 No votes

22

23 Manufacturer/Public Comments

24

25 Mike Stenko Comments:

1 Mike asked about the test proposing to use the ASTM 2-inch disk on samples whether  
2 bonded or of edge-bonded material. How will a value be collected if you're testing a single  
3 line that is bonded, with two wings that are un-bonded?

4

5 Andre Miron replied that it would have to be bonded, so we may need to request pre-  
6 bonded samples or samples that are sized differently. Values are not yet determined, and  
7 he is still looking at degradation considerations as part of the scope for this committee. The  
8 yield value will be collected when testing for bond strength. No matter how the sample is  
9 attached, we will need to test the strength of attachment at the interface. If necessary we  
10 can retest the method of calculation, if necessary for comparing data.

11

12 Mark Heimlich Comments:

13 His company manufactures surface-applied products, and adhesive is not provided at the  
14 center. The adhesive is not in the center, nor is it located at the edge. Is there flexibility in  
15 where the testing will be done? What about when using anchors? Mark agrees that if a  
16 product is not intended to work with asphalt, then not fair to test for that material.

17

18 Andre replied that tests could be conducted at any location on the sample, however if the  
19 adhesion is not located at the center or at edge, then the manufacturer should indicate  
20 where the area of bonding would be located. Some of the products are provided with bolts,  
21 and Andre suggests that testing be conducted on the bolts, if referenced in the installation  
22 instructions. It's important for the manufacturers to submit installation instructions with test  
23 samples for determining correct test procedures. Andre agreed that testing on asphalt  
24 should be optional.

25

1 Jeff Barnes explained to Derek Shaw, that testing although required for concrete should be  
2 optional for asphalt, for manufacturers who will install in both materials. This appears to be  
3 agreeable to all, as long as it is identified as such on the list of acceptable products.

4

5 Derek Shaw notes that it seems appropriate for the committee to recommend this or include  
6 test procedures that may apply in given conditions, or recommends authorizing a product for  
7 use under given conditions or with a particular substrate.

8

9 Tom Whisler asked whether testing should be conducted at two different points?

10

11 Andre Miron replied that testing at two points may not be needed, however a calculation  
12 could be used to determine a value for the two points.

13

14 Arfaraz Khambatta makes note that there are products failing in the field. Products are  
15 tested, and values of failure calculated to determine if at least 90 percent was met on the  
16 bonding attachment. However this still doesn't address the failures that are occurring in the  
17 field as a result of poor bonding.

18

19 Andre Miron replied that this is the reason why developing a minimum fail value would be  
20 useful. However, more research is needed to determine a reasonable attachment number.

21

22 Jeff Barnes asked David Cordova if there is a minimum bond strength value for the dot  
23 markers located on the freeway.

24

25 David Cordova explained that Caltran has written specifications for the epoxy, and probably  
26 testing was done initially in order to determine appropriate values. David will provide a

1 contact name for Jeff to use to collect information on bond strength, and to verify those  
2 values with Caltran.

3

4 Derek Shaw asked Andre if there was any size limitation with the test equipment that  
5 prevents using larger test samples? Are disks larger than 2-inch disk available, and does  
6 the proposed test setups allow for this change?

7

8 Andre Miron replied that it is possible to conduct tests using larger samples, or with a larger  
9 disk. There is a limit to the amount of pressure that the machine can generate. One of the  
10 test references uses a 3-inch disk, however Andre would hesitate to test the entire sample.  
11 So yes, a larger disk sample could be used pending further research.

12

13 Mark Heimlich Comments:

14 There is a lot to learn from the research samples that will be tested by Andre. For surface-  
15 applied tiles, the concrete slab can be saw cut first, which is followed by attaching the  
16 device to the entire surface. The disk can be pushed upward from the bottom, and that test  
17 method could be useful if the center is likely to fall out. The concrete should be cut all the  
18 way out before conducting the push test, this would test the adhesion, and testing could be  
19 done on a full sized sample. Mark's company manufactures a tile with a smooth glassy  
20 surface, and the push testing would work well with this type of product. Should consider  
21 anchoring down concrete substrate, to avoid test fall out.

22

23 Andre Miron plans to carefully examine this test method, and check into testing larger  
24 sample sizes. Andre may need to conduct additional representative testing.

25

26 Paul Hantz Comments:

1 Paul notes that there are some tiles that are not meant to use adhesion. Paul also asked if  
2 testing could be conducted on the adhesive on screws, to ensure that they stay in place?

3

4 Andre Miron responded that if the intent is to test both the adhesive and the anchor on a  
5 product, then the bonding test should be conducted on those features together. The  
6 committee should also consider using a push test instead of pull test, which would eliminate  
7 the possibility of failure of the test apparatus.

8

9 Jeff Barnes agreed that there are some systems that are not designed to be attached with  
10 adhesives, such as sand-based tiles. Should these samples require a bonding test? A tight  
11 joint connection secures these tiles in place, which allow some flexibility of movement, and  
12 are located in areas subject to ground movement, such as landfill areas.

13

14 Richard Skaff notes that the tiles are often used in landfill area, where there is a settlement  
15 problem and concrete surfaces would crack if placed in the unsettled areas. Maintenance  
16 for these types of products can be a problem here, even if very diligent.

17

18 Mike Stenko Comments:

19 Mike has two issues to note. One is that the tensile strength of Portland cement concrete is  
20 250 psi, which is a concrete industry standard. This value could be used as a baseline  
21 failure value, since it is a value used for concrete. Secondly, pushing the core from the  
22 bottom would be introducing the strength of the tile into the test, because if you have a tile  
23 that is very rigid, it's going to transfer all the energy further and further out to a bonded area.  
24 As opposed to a tile that is not rigid, that is likely to begin failing right at the edge of the  
25 bottom core. That's the reason that why ASTM has developed a top core tests, because

1 you have a known area that you are actually conducting a tensile test on and that's  
2 necessary. Recommends staying with the proposed pull test.

3

4 Regina Baak notes that the tiles in Holland are located on unsettled areas, which is the old  
5 sea and this soil is worse than marsh areas. Although the tiles themselves are fine, proper  
6 maintenance has been found to be essential for maintaining these tiles. So problems were  
7 found not with the product, but with the poor maintenance.

8

9 Martin Bearden Comment:

10 Martin asked how can some products be excluded from bond strength testing, and yet ask  
11 others to meet the criteria?

12

13 Andre Miron explained that there was no intent to exclude any products from the bond  
14 strength testing. Looking at Wausau tiles for example, a bond strength test can be  
15 conducted on the interface there. There is a two-part mix, and testing could still be applied  
16 on this product, to show that the bonding of the surface or the domes isn't going to pop off.  
17 In the case of pavers, the testing can still be done. See Figure 1, which could be used on  
18 pavers, without material applied, so it's only testing of the substrate. The test would be  
19 done differently, but we could still get a strength value, and other useful data. Testing could  
20 demonstrate that the paver was as strong as it needs to be, and not poorly made. The  
21 difference would be mainly in where the failure occurs. A failure occurs in the paver,  
22 because there is no interface to fail, with a strength value obtained, and should demonstrate  
23 no degradation over a period of time.

24

25 b) 60-DEGREE LOAD TEST (Section 16)

1 Andre Miron was looking for a test to address the snow shovels issue, or provide some sort  
2 of shear strength attachment test. A manufacturer indicated in their report that they had  
3 conducted a load test at a 60-degree angle. Andre proposed a test using a bolted-down  
4 test fixture, which holds a sample at a 60-degree angle. A steel blade is applied at the 60-  
5 degree angle onto a dome, and the pressure is applied until yield. The applied force is  
6 recorded. The attachment issue as part of bond strength is noted. A steel blade with  
7 beveled edge is applied to the specimen. This is not an impact test; it's a load test. The  
8 proposed test is a preliminary test, and we are looking for feedback from the EDWAC and  
9 from the public. See Section 16. The test method is intended to evaluate the durability of  
10 the truncated domes or raised bars, and basically consists of:

- 11 a) A calibrated test apparatus, with a constant crosshead motion,
- 12 b) A steel specimen support designed to support a specimen at a 60-degree angle.
- 13 c) A steel blade,  $\frac{1}{4}$  inch, with beveled edge, and installed in the test apparatus to apply  
14 a load on the specimen.

15

16 The test is applied before and after conditioning. Samples are loaded into a fixture, with set  
17 crosshead speed, and a load applied until it can no longer be sustained. The specimens  
18 measure 3 by 5 inches. Andre is requesting feed back on the basic concept of test, and on  
19 the specifics details of the test.

20

21 Jeff Holm asked if the "45-degree Attachment Test" referenced in Table 8.1, item h, was still  
22 correct?

23

24 Andre replies that we are no longer proposing a 45-degree attachment test. The draft  
25 document will be revised to a "60-degree Load Test" instead. The load test could also show  
26 attachment data as well, but mainly you will get the strength of the dome information.

1  
2 Richard Skaff agreed with conducting the “60-degree Load Test” in order to test for specific  
3 applicability of the domes. Yesterday there were discussions about snow removal  
4 equipment, and although Caltran doesn’t damage detectable warnings on curbs, other snow  
5 equipment does. At malls or shopping centers there are small snow machines that edge  
6 over onto sidewalks, and small tractors and small vehicles at malls does cause blade  
7 application on domes. See Texas Transportation Institute Report for details, which notes  
8 that there is shearing of domes, and damages to the entire attachment in specific situations.  
9 Should expect this to occur and define it as a problem in California, although not a problem  
10 on a highway. The committee needs to consider testing with a snow removal blade, unless  
11 this test can be redesigned to simulate small snow equipment. See Texas Transportation  
12 Institute Report for details.

13  
14 Andre Miron agreed that the load test could be adapted, however that would require revising  
15 the test to consider blade angle, sharpness, geometry of blade, and pressure, all which  
16 should be reflective of the blades on a snowplow. Testing will be conducted at normal lab  
17 temperature, however testing under cold conditions would be considered for this test.

18  
19 Jeff Holm disagreed with Richard, noting that using a snowplow on domes is a maintenance  
20 problem, since blades should not be used on areas with detectable warnings. Domes are  
21 not made for this type of impact, and there are few products that can withstand this test.  
22 Jeff does not like the report because if you look at the photographs it looks like the  
23 snowplow has come up to a product, noticed that it was down there and turned away,  
24 because they are not all sheared off. The report doesn’t note how many times they were  
25 hit. This is the reason that dot markers are not on the highway in the snow country because  
26 it is well know that snowplows will damage the markers. If the markers are used, they are

1 recessed to avoid damage. Any maintenance program in the country that have sheared  
2 domes as a problem, needs to reexamine their maintenance program.

3

4 Richard Skaff notes that he served for 2 ½ years on the on a Public Right-ofWay Committee  
5 for the Access Board. He viewed reports that mentioned that machine operators had not  
6 intended on going up on the curb, however do so since the blade naturally moves onto the  
7 curb ramp because there are no curb edges to stop the movements. Richard has seen this  
8 as a problem in Alaska, where this type of damage has occurred in the past. They may use  
9 a blade, raised a bit, but it's still used to save time and maintenance cost. It might be  
10 worthwhile to let users of tiles have access to the test results of products tested for snow  
11 equipment. This can be accomplished by running tests.

12

13 Jeff Holm doesn't know how manufacturers of domes can be made responsible for these  
14 types of incidents that just happen.

15

16 Jeff Barnes notes that basically Richard is proposing that the list of acceptable products  
17 posted by DSA should also make recommendations based on snow removal test data.

18

19 Richard agreed that the information could be provided as a recommendation or basic  
20 information that private or public entities could access. However he would like the  
21 information be based on testing conducted on the samples.

22

23 Jeff Barnes replied that it would be difficult to conduct full snow plow tests. However, it  
24 might be reasonable for the committee this provide this information and cautionary  
25 comments in a statement of fact, which could be based on references to current studies  
26 such as those from Texas A & M. Reference could be made to reports, graphs, and

1 photographs describing known damages associated with poor maintenance in cold areas  
2 using snow removal equipment. It would be very practical to refer to real instances where  
3 the problems have been recorded, rather than take the time and expense to create new  
4 data.

5

6 Richard Skaff recommends finding a way to conduct testing in the lab to reflect a real life  
7 situation. The test could be simple and consist of a flat surface, with a blade applying  
8 reasonable pressure.

9

10 Andre Miron replied that a lab test could be developed in the form of an impact test, by  
11 putting the blade into a guillotine free fall, raised to a certain height, using a specific weight,  
12 and dropped on a dome. There are a number of test options available. UL could start out  
13 with a controlled version, using test equipment with a load cell, to determine the point of  
14 yield. This would be less a proof test, and more of a test designed to obtain a value.  
15 There's also the possibility of conducting the test on materials that are intended be placed  
16 down like mats and other materials that peel up. There is the other option of conducting a  
17 test like this that would have the material on concrete with the interface there, to test the  
18 interface strength.

19

20 Jeff Barnes adds that in the final report to the DSA, UL plans to present a statement of fact  
21 which states that damage to tiles by snow equipment is an important issue, that should be  
22 addressed with an appropriate maintenance program and installation sites. However, if a  
23 particular performance test or tests should be applied to the detectable warning to obtain a  
24 certification is needed, then the edge attachment test would be a good starting point.

25

1 Gene Lozano stated his preference that a test be proposed that deals with sharpness and  
2 angle, to determine if domes will shear off. Gene has no knowledge of the methods used  
3 to clean curb ramps in snow country, whether it is general practice to clean with snow  
4 shovels or use chemicals to melt the snow. However, Gene is concerned about products  
5 with stamped patterns on it, or products with domes glued onto existing surfaces. Will the  
6 glued domes or pavers shear off easily? This is not so much an issue about snow, but  
7 about the impact at an angle or sideways of blades, to determine if the domes will fall off.  
8 There is a need for testing to be conducted on these types of domes or pavers, to determine  
9 if peeling or other damage is likely to occur.

10

11 Jeff Barnes notes that there is concurrence from the committee to make certain that the  
12 domes on tiles will not be removed in the field. There is a 60-degree load test to consider  
13 as well as pursue the concept of an edge impact test, a surface-applied attachment test,  
14 and others, which may address this concern.

15

16 Tom Whisler asked the manufacturers if any of them had tested for snow removal  
17 equipment and what were the results of the testing?

18

19 Mark Heimlich Comments:

20 Mark's company has tested full size metal tiles, which were tested recently by the state of  
21 Wisconsin, who operated a snowplow with blades over the surface 50 times, using normal  
22 pressure, and found that the domes did not peel off. Mark suggests expanding the  
23 demonstration test site by 8 feet wide, to allow space for running a snowplow over the area  
24 in order to test tile products.

25

1 Arfaraz replied that the end result of the project will be to have DSA adopt the proposed test  
2 requirements for certification of products. Does DSA plan to comment about warning  
3 systems used in colder climates where snow removal equipment is used?

4

5 Derek Shaw replied that DSA would receive and study the recommendations, and using  
6 these and other recommendations to establish a test and certification program. As far as  
7 providing commentary, it might be a good idea if the committee provides suggested  
8 comments to pass on for review. There is a need to be careful since the committee is on  
9 that line between product and maintenance, and they are two separate issues. For  
10 accessibility, both issues are extremely important. At what point does poor maintenance  
11 overcome the quality of the product, is an issue that needs to be considered.

12

13 Arfaraz agreed with Derek that the committee was assigned the task of proposing a  
14 durability standard for detectable warning, and now the EDWAC is considering reviewing  
15 poor maintenance of products, and applying durability standards to it. Is this an appropriate  
16 direction that the EDWAC should pursue? One way to proceed would be to provide a  
17 testing standard for concrete, a testing standard for asphalt, and another standard for  
18 materials that will be abused by snow equipment.

19

20 Richard Skaff replies that this issue is applicable to all detectable warning requirements, and  
21 is a major issue of the effectiveness and durability of the tiles under certain weather  
22 conditions. Although it's not an issue in areas like Los Angeles, it is an issue in other areas.  
23 Although poor maintenance is not a problem for Caltran, it is a problem for other programs  
24 or applications. It is very important that users of the tiles know what works and doesn't work  
25 in their particular environment. Otherwise they are buying a product that doesn't work in  
26 their environment.

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David Cordova notes that products should be tested for normal hazards such as street sweepers, snow shovels, and not for mistreatment of the product by the unintended contact with snowplows.

Derek Shaw asked Jeff Holms, whether transportation organizations (Federal Highway) publish any sort of issue paper that might describe recommended considerations for snow removal? Because this appears to be an educational issue that needs to be addressed.

Jeff Holm notes that there is a large conference on snow removal that takes place every year in Minnesota. Recommended practices for snow removal are offered at the conference.

Derek Shaw acknowledged that there is a wide range of abuse on the products. At some point the maintenance issue on all levels should be addressed and maybe this can be done with an educational program. Damage to detectable warnings is a much higher level of abuse than more typical wear from street sweepers and snow shovels. So looking at a testing methodology, an angled piece of metal that will scrape across a product may provide a solution to providing additional testing to simulate snowplows. And at one end of the spectrum is basic durability. A product with a heavier piece of metal, with higher pressures that are applied to it, starts getting into a mechanical abuse system. Derek suggested that there is some point where the expectation of the product and its performance is reasonable. Therefore, when considering testing methods, moving the blades in a direction parallel to the surface, to get a more shearing effect rather than digging into the surface, results in a test method that starts to resemble snow blades.

1 Minh Nguyen suggested looking at the larger, hand-held snowplow equipment, power  
2 movers and to see how the blade reacts in this equipment, and to view the angle of the  
3 blades. This information could be used as a base for developing a test based on how a  
4 smaller snowplow works, instead of using large snowplow in extreme conditions. The use of  
5 these smaller snowplows is a more likely in the real world, than a snow shovel. Would  
6 suggest that instead of using constant pressure use constant pounding force, which is a  
7 similar motion to the blade of a plow. UL should revise a couple of test, one like the 60-  
8 degree load test, operated parallel to the plane of the equipment to simulate 180 degree  
9 shearing, and add another test to simulate a constant pounding test at an angle, both tests  
10 to represent hand-held snow removal equipment.

11

12 Andre Miron adds that from a standard certification point of view, actual specific test results  
13 are not disclosed, however the final results of the test could end up with a corresponding  
14 ratings for the product. For example, a jurisdiction could be given a list of recommended list  
15 of acceptable ratings acceptable for a particular area. A cross-reference that explains how  
16 to use this data would be posted on a website.

17

18 Derek Shaw didn't see any problems with the committee proposing that DSA post a rating  
19 system, or statement of facts, product recommendations, or test results, if necessary.

20

21 Michael Paravagna, stated that with the snow removal issue, any method of removing the  
22 snow from detectable warning is a hardship for the product to endure, and sharing this  
23 information would provide a service to the users

24

25 David Cordova noted that at the first day of meeting, David had asked about government  
26 code 4460, which states that an independent entity would be evaluating the products, and

1 specifically states that there will be a product approval. So whatever the rating assigned to  
2 the products, there should be a threshold of product approval, so that there is a complete  
3 list created of approved products. This is critical for Caltran who has a standard spec and  
4 right now the 5-year bulletin notes this to be the case. Product approval, is needed, in  
5 addition to the ratings, which hopefully will be available on a website.

6

7 Derek Shaw agreed that a list would be established by DSA and published, although he is  
8 not sure if the list will be available in print or on a website.

9

10 David Cordova replied that it is critical that the information be posted on a website, because  
11 local agencies and Caltran needs the information in order to comply with the code, and it is  
12 essential to have the most convenient method available for obtaining that information.

13

14 Derek Shaw notes that there are a variety of locations in California, and throughout other  
15 states and if an approval process and list is established, that list could provide secondary  
16 information so that you could have an approved product, with various snow ratings.

17 However, Derek is not suggesting different categories of product approval. It would be too  
18 soon to decide on the final approval method needed for different locations, if that  
19 information is even to be provided.

20

21 Gene Lozano suggested issuing a bulletin on specific issues, similar to bulletins issued by  
22 the ACCESS board, that provides useful information, that would be separate from product  
23 evaluations, that notes which products or types of products handled snowplow conditions  
24 properly.

25

1 Andre Miron stated that issuing bulletins is similar to a process of documents issued by UL.  
2 No reason that a rating system couldn't be provided as a result of test data for certain tests,  
3 for specific characteristics. Test data can be converted into test range systems.

4

5 Arfaraz Khambatta reported that in Alaska (from Beezy's report) snow on sidewalks is  
6 regularly removed with brushes, not plows. They use a small tractor, with brushes. UL  
7 should consider revising the tests to incorporate smaller vehicles, and not the larger full  
8 sized snowplows.

9

10 Andre Miron emphasized the importance of recognizing that tests modeled after snow  
11 shovels, or a light snowplow, are also intended to simulate general stress. Similar to the  
12 abrasion test, which simulates many types of long-term, wear. The 60-degree load test is  
13 intended to account for many objects under lateral stress such as skateboards, skates,  
14 wheel chairs, etc. The test data can be used to determine the product's durability to a  
15 number of different factors.

16

17 Gene asked if the blade would only move forward? Or could the blade move forward and  
18 back, to account for wheel chairs, skateboards, and other motions?

19

20 Andre replied that the direction load, either backwards or forwards is not a concern, since  
21 the direction of the load is not an issue when applying a shear force to domes. However,  
22 Andre will consider developing a blunt test for these products, if research indicates that  
23 additional testing is necessary.

24

25

Manufacturer/Public Comments

26

1 Jon Julnes Comments:

- 2 1. Agreed with Richard about testing and maintenance problems. Would caution if  
3 there were a need to provide a test for all products that covers all the snow issues,  
4 which are truly extraordinary types of abuse. Persons who live in these areas have  
5 learned to deal with these issues, and will take the necessary precautions to avoid  
6 tile damage. With that said, Jon notes that the tests are important. Would suggest  
7 that the committee provide information on how to repair the units with the posted data  
8 by DSA. Cost of damaged tiles could be an issue because of lack of information.  
9 Jon explained that Richard has shown photos of tiles with a de-lamination problem,  
10 caused often because of improper adhesion.
- 11 2. Should consider changing the 60-degree impact test to a 90-degree impact test to  
12 more readily replicate a snowplow. An additional test to consider would be a side  
13 shear test, which is similar to the original proposed adhesion test, however it  
14 operates at 180°F instead of 90°F, and would specifically state that it should be done  
15 with a side section of the installation. Dealing with a dome and the perimeter edge  
16 would provide a true representation of shear action. This will help with the de-  
17 lamination issue.

18

19 Mark Heimlich Comment:

20 Mark has installed stainless steel tiles in cold weather states, which addresses problems  
21 with damaged domes. There is a need for snow durable products.

22

23 Mike Stenko Comment:

24 If a list of acceptable products are placed on the website, the contractors and installers will  
25 not care about the rating, and just use whatever is on the list. Products will continue to be  
26 used in areas, no matter the rating systems provided on the list. For example, in the

1 highway system, bridge expansion joints cannot handle snowplows. So signs are provided  
2 on bridges noting possible damage by snowplows, and snowplows drivers either avoid the  
3 bridges, or raise the snow blades so that there is no damage to the bridge expansion joints.  
4 Mike recommends providing warning labels on shipped detectable warning products, noting  
5 that snowplows should not be used on the detectable warnings. Burlington, Vermont plows  
6 their tiles with bobcats, and put together a list of products that handles these plows. This is  
7 a knowledge thing that gets covered as it happens. You can't make a product that handles  
8 all abuses. Railway tracks are also not for snowplows.

9

10 Martin Bearden Comments:

11 Richard was showing private industry photos and not sure if state needs to get involved,  
12 since agencies work directly with the manufacturers to get the products repaired or  
13 replaced. Martin suggests that all testing be conducted in a lab, because snowplow testing  
14 would be expensive.

15

16 Jeff Koenig Comments:

17 His Company does not conduct testing of vehicles over detectable warnings, because this is  
18 illegal to have vehicular traffic on the detectable warnings and it creates hazards for the  
19 visually impaired. There is no point to test for event that is no legal, and should not be  
20 occurring. This is a law enforcement issue, and should not be permitted to occur. Should  
21 be careful not to imply that vehicular traffic on curb ramps are condoned because of tests  
22 that have been developed to test for these unsafe situations.

23

24 Regina Baak Comments:

25 Vehicular crossing areas are dangerous, and should not be permitted. This is an  
26 educational issue and vehicular traffic on curb ramps should be fined.

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Paul Hantz Comments:

This could become a zoning issue, if a snowplow test is added to the test program. This could be a marketing issue, if snow criterion is provided. The committee should consider offering an additional link on the website providing information on snow removal testing.

Jeff Barnes notes that there is a general consensus that a modified dome strength test needs to be added to the test program. In addition, possibly a side impact test on the dome should be developed to simulate the banging of a snowplow or snow shovel, and the test should provide a minimum pass level. Should also consider providing an edge attachment test for surface-applied detectable warning systems, to make sure there is no peeling after repeated lateral hits. Performance ratings could be provided that would indicate the particular areas or environments where the tiles could be installed. Would appreciate some comments on this from the EDWAC and from the public. UL will work on conducting more research and prepare some proposals for the next meeting. UL would appreciate assistance with the research on small snowplows. Additional data is needed on the type of lateral forces that is likely to be applied to detectable warning, so that UL can add that information to the proposed test program. Jeff asked if Minh Nguyen has access to links or data with any of this information?

Minh Nguyen agreed to provide Andre Miron with some useful links to ASTM links, and other vendor data, which has a full range of tests available for review.

Jeff Barnes added that the committee would need to establish minimum guidance on snow plows themselves in terms of lateral forces.

1 Minh Nguyen agreed to conduct some research on this subject and send the information  
2 Andre Miron for further consideration.

3

4 Gene Lozano asks that his comments about the issues on wheels, and the shearing  
5 downward and sideways on domes, should be addressed in some test as a blunt test, with  
6 these motions.

7

8 Jeff Barnes agrees that UL will look into those stresses, review current tests to see whether  
9 they are covered by a proposed test or if a new test is needed. Jeff asks Jeff Holm and  
10 David Cordova if there is any available information in their agencies, in terms of lateral  
11 attachment to the surface applied?

12

13 David Cordova will refer Jeff to the lab staff, who oversee pavement markers, and specs for  
14 pavement markers, because the epoxy used would have required review and testing. David  
15 will find contacts that will provide information on shear lateral tests.

16

17 Jeff Holm agrees to locating information on shear lateral tests.

18

19 **6/7. Testing for Color Fastness, Exhibit B, Section 17; and Manufacturer/Public**

20 **Comments (Andre Miron/UL)**

21 Andre Miron reported that the test method for Testing for Color Fastness, Section 17, is  
22 based on ASTM D2244, and is intended to determine the difference in color between two  
23 specimens, through the use of tristimulus data of the two specimens in combination with a  
24 known white object. Andre demonstrates a color graph that takes three values. X Y and Z  
25 values, into an X Y grid.

26

1 Richard Skaff asked if either of the two colors had been based on vision lost. What is the  
2 premise that ANSI used?

3

4 Gene Lozano replied that there have been vision-impaired studies on these, mainly in the  
5 yellow/orange colors. Gene notes that when Beezy Bentzen conducted her research, that  
6 most persons could see these colors better than other colors.

7

8 Jeff Barnes announces that there is a difference of opinion in the color and definition of  
9 safety yellow. Is the committee considering selecting a particular shade or color?

10

11 David Cordova notes that the building code specifies 33538, shouldn't that be followed?

12

13 Jeff Barnes mentioned that some of the samples sent in were very similar to 33538; so how  
14 similar should samples be to this color?

15

16 David Cordova replies that selecting an allowable tolerance may need to be considered by  
17 the EDWAC.

18

19 Jeff Holm adds that the Federal Code only requires a contrast, and that the color yellow is  
20 only a requirement for curb ramps.

21

22 Minh Nguyen observed that it is very difficult to duplicate an exact shade of color. Therefore  
23 it is important to determine an acceptable tolerance to be used when examining samples  
24 prior to testing?

25

1 Arfaraz Khambatta mentions that the CBC notes that color should have a contrast of more  
2 than 70 percent. Suggested adding a one-inch black border to the samples for testing,  
3 although not to exterior programs.

4

5 Andre Miron found that the Ohio Traffic Dept, and the military require minimum 6.0 levels,  
6 but this value may be too stringent for detectable warnings. The committee may want to  
7 consider a delta E value of 10 or more, which would be reasonable for a color change.

8

9 Minh Nguyen asked if color requirement would need to be considered when reviewing test  
10 specimens?

11

12 Jeff Barnes replied that color verification is needed, if required by the code to meet federal  
13 color requirements, such as the color yellow (33538). We need to determine the degree of  
14 closeness to the specified color.

15

16 Minh suggests using the more reasonable value of 6 rather than the value 10.

17

18 Martin Bearden asked who would supply the color chips, because printing copies of the  
19 download information and color chips can really vary in the shade of color based on the  
20 computer software and printer used.

21

22 Gene Lozano notes that the color chips can be ordered for a few dollars, or the standard  
23 can be ordered.

24

25 Jeff Holm questioned how significant any changes in paint color actually affect those using  
26 the systems. How tight a figure should be maintained?

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Gene Lozano volunteered to look into getting information on this by contacting an organization for the blind in San Francisco.

Arfaraz Khambatta asked if specks of glass would affect the results of the colorimetric spectrometer?

Andre Miron replied that so far specks of glass have not affected the color results, however it may be affected by texture, and further research will be conducted to collect more data on this issue.

**8/9. Testing for Slip Resistance, Exhibit B, Section 19; and Manufacturers/Public Comments (Andre Miron/UL)**

Topic: Static Fiction, Section 19 – Update

This topic was not covered at this meeting, and will be discussed at a future EWAC meeting.

**10/11. Testing for Flammability, Exhibit B, Section 20 and Manufacturer/Public Comments (Andre Miron/UL)**

This topic was not covered at this meeting, and will be discussed at a future EWAC meeting.

Jeff Barnes announced that the Flammability Test is still under development and suggestions and/or comments from the committee and public would be appreciated.

**12. Next EDWAC Meeting (Jeffrey Barnes/UL)**

Proposed Meeting Dates:

1 July 21 and 22, 2005 were tentatively selected as possible dates for the next meeting.  
2 These are tentative dates and final selection of the next meeting date will be made in the  
3 near future. All EDWAC meetings will be scheduled using the timelines below unless noted  
4 otherwise:

5 On Thursdays: Start at 10:00 am, end meeting at 5:00 pm.

6 On Fridays: Start at 9:00 am, and end meeting at 3:00 pm.

7

8 **13. Pending Discussion Items (Jeffrey Barnes/UL)**

- 9 a). Confirmation – Reserved for discussion at the next meeting.  
10 b) Flammability – Reserved for discussion at a future EDWAC meeting.  
11 c) Slip Resistance – Reserved for discussion at a future EDWAC meeting.

12

13 **14. Adjourn**

14 Jeff Barnes adjourns the meeting at 3:00 p.m.

15