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

Division of the State Architect
Underwriters Laboratories Inc.

Minutes of a Public 2-Day Meeting held on:
Thursday, April 28, 2005 and
Friday, April 29, 2005

1102 Q Street, 5th Floor Conference Rooms
Sacramento, California

DAY ONE

MEETING ATTENDANCE ON THURSDAY, APRIL 28, 2005

Committee Members Present
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
Tom Whisler

Committee Members Absent
None

DSA Staff Present
Derek Shaw

UL Staff Present
Jeff Barnes
Esther Espinoza
Andre Miron

UL Consultant
Billie L. Bentzen, via Teleconference
(ULConsultant – from Accessible Design for the Blind)

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/Cast In Tact
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.
Ed Vodegel, Flint Trading, Inc.

APRIL 28, 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 discuss known technologies, review testing programs provided in a draft of proposed requirements, 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. Call to Order (Jeff Barnes/UL)

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

2. Review of Meeting Protocol/Committee Update (Jeff Barnes/UL)

Jeff Barnes provided information and a general update of committee activities/status.

a) EDWAC Membership Change – Victoria Burns has moved out of state to pursue a new career opportunity and has therefore resigned from EDWAC membership.

b) EDWAC Project Status – The remaining project work still needed by the EDWAC after this EDWAC meeting, will be nearly 50 percent complete. Additional 2 or 3 meetings are planned for the rest of this year in order to finalize the test proposals to be developed for submittal to the DSA.

c) Meeting Protocol – Jeff Barnes held a quick review of the meeting protocol noting that Robert's Rules of Order still applies to all EDWAC meetings. The meeting has been reformatted to regularly schedule and solicit comments from the public and manufacturers through out the 2-day meeting.

d) Committee Goals – Jeff emphasized the need to continue to focus on the scope and goals of the committee, so that the proposed test standard can be submitted

to the DSA within the designated timelines. Essentially there are two major tasks that need to be accomplished.

1) The completed proposal submitted to DSA must meet the requirements of architectural standards for the format, size, location, orientation of the detectable warnings.
2) Ensure in the written proposal that the shape, color fastness, sound-on-cane acoustic quality, attachment, and resilience will not degrade significantly over a 5-year period.

3. EDWAC Member Introductions/Roll Call (Jeff Barnes/UL)

EDWAC members, UL and DSA staff members each took a turn introducing themselves. Others in attendance who introduced themselves were: Jon Julnes, Mark Heimlich, Fred Meise, Martin Bearden, Mike Stenko, Lisa Berry, Paul Hantz, Ed Vodegel, Ron Baak, and Regina Baak.

4. Review/Adopt Minutes of February 17 – 18, 2005 Meeting (Jeff Barnes/UL)

Jeff asked if any committee members had questions or comments concerning the February 17 and 18, 2005 meeting minutes. There were two comments from EDWAC members, which included the following.

a) Gene Lozano – The term “section”, should be used instead of the word “article” in the code reference described in Page 6, Line 15, of the February 17, 2005 meeting report.
b) Paula Reyes-Garcia – Notes that page 76 of the February 17, 2005 minutes is missing a reference to the concrete utility box test, as noted by Mike Stenko. During a discussion at the meeting, Paula had suggested that current proposed testing did not appear to have enough testing based on real world concrete

compression, and asked Andre Miron if he knew the percentage of material types (metal, concrete, etc.) used in the construction of the detectable warnings installed by industry. Andre did not think the test would be needed, and was not aware of available percentages for installed detectable warnings. A ball standard was recommended, and a copy of the standard was sent to Michelle Courier for further review.

Jane Vogel made a motion to adopt the February 17 and 18, 2005 meeting minutes. Richard Skaff seconds the motion. There were no objections to adopting the minutes, so the meeting minutes were adopted.

Vote Results: 10 yes votes, 0 no votes

5. Research Design-Detectable Warnings/Directional Surfaces [Billie Louise Bentzen, PHD/Accessible Design for the Blind (Teleconference)]

Billie L. Bentzen provided a Power-Point presentation outlining specific details on a proposal for a research project, directed towards developing requirements for Detectable Warnings: Resiliency and Sound on Cane-Contact. The research study for resiliency as discussed at previous EDWAC meetings is scheduled to occur at the next EDWAC meeting. However the research study for sound on cane-contact is a new proposal that would not require participation by the EDWAC committee. Details on the research proposal for sound on cane contact will be provided by Billie L. Bentzen, and will be discussed with DSA as a possible project to pursue after the current DSA project has been completed. Billie recommended that the test area assembled for the research study on resiliency would also be usable for the research study on sound on cane contact. Key topics provided in the presentation by Billie Bentzen were as follows:

Research Study on Resiliency

Purpose: Jeff Barnes announced that the research design exercise has been designed to assist the committee in developing performance criterion on resilience. In addition, the research is intended to evaluate the proposed test measurement technique developed by UL on resiliency; which will be presented and discussed later as noted in the meeting agenda. Part of this research, is to identify or put a number indicating a level of resiliency on a particular product, so that this information is available to interested parties prior to product installation. Part of the research goal is to determine if a product retains its resiliency when surrounded by another or similar material. Therefore it's important to have the test site provide samples of products some of which rely on resilience, for its method of detection, and some of which do not rely on resilience. Data will be collected and reviewed by the committee, and if possible, a number or level identified which notes at what level a detectable warning product becomes detectable by its resiliency. Jeff Barnes noted that Beezy might use the constructed test pad for a second research project, that will be proposed to the DSA at a later date and which will not involve the committee's participation.

Preparation: Billie Bentzen reported that the research exercise would focus first on resiliency. Representatives of the public attending the next meeting would be invited to participate. Manufacturers would be encouraged to participate by contributing samples and installation services in order to create a test site suitable for both of the proposed research projects.

Testing would be conducted using a long rectangle test sample, with different types of detectable warning materials. Stamped concrete is being proposed as the main test material adjacent to all detectable tiles for comparisons between each of the tiles, and a

single base material. Concrete was also selected for the base material since this is the most common construction material available in the field.

Test Site: The proposed test site shall consist of a large rectangular area, consisting of 4 sq ft samples of different types of detectable warning surfaces, which are installed in a row adjacent to other detectable surfaces, flanked on one side by a 2 ft wide strip of stamped-in-place concrete truncated domes. The other side to consist of 2 ft wide strip of brushed concrete.

Test Subjects: Participants will consist of approximately 20 persons, mainly from the EDWAC committee or participants in the efforts of the committee, with the State of California participating, but no manufacturers. It would not be appropriate to have manufacturers participate as test subjects, since they are providing the test samples and are the manufacturers of the products being tested. Other meeting attendees, who are not manufacturers, will be welcomed as volunteers as a test subject. The age for the participants will likely range from 30 to 60 years of age, and will include both men and women.

Procedure: All testing will be conducted using high quality blindfolds, which blocks all light and blocks all vision from around the edges of the blindfold. Participants will work in pairs, with each person taking a turn using a blindfold, with an assigned partner guiding them along the test track, stopping at each experimental surface adjacent to a concrete detectable warning. The participant will report to their guiding partner, whether the surface is the same or different in resilience, as compared to the adjoining truncated concrete domes. They would also report other differences, such as whether the surfaces are slippery, more abrasive, sticky, or of different textures. The guiding partner will record the data for each

sample tested. The stops at each tested sample would be timed, providing the blindfolded participants with several seconds to respond to each detectable warning product and adjacent concrete surface.

Research Associate: Linda Myers will coordinate the research exercise, and provide brief training on research procedures for all test participants. In addition, Linda will outline basic safely guidelines for all test participants guiding a person in this exercise who have been provided with blindfolds.

Data Analysis: Original copies of data sheets, which do not have names of participants, will be mailed to Billie Louise Bentzen. The analysis will be conducted by a graduate student in psychology at Boston College, under the guidance of Randolph D. Easton, PhD.

Research Report: A written report of the test results will be submitted to EDWAC within six weeks of testing. The report will be the property of UL, and may be distributed for internal use only. An abstract approved by UL and B. Bentzen may be circulated to the public.

Research Study on Sound on Cane-Contact

General: Billie Bentzen noted that a research study on sound on cane-contact would require the participation of approximately 25 individuals who are blind, or have limited vision in which the individuals are incapable of detecting differences in color or surface texture of detectable warning products. In order to conduct research for this study, advance approval of the Institutional Review Board (IRB) would be required. This research would need to be conducted by contact with Boston College, using their IRB process.

Procedure: Test participants would be individually tested, using the same test track described earlier for testing differences in resiliency. Participants will be guided to each test sample, and allowed several seconds to provide data, which will be collected and analyzed. Data to be collected include indications of the same or different sound, and other differences noted, such as a sticky rebound, and different surface texture.

Data Analysis: Original copies of data sheets, which do not have names of participants, will be mailed to Billie Louise Bentzen. The analysis will be conducted by a graduate student in psychology at Boston College, under the guidance of Randolph D. Easton, PhD.

Research Report: A written report of the test results would be submitted to EDWAC within six weeks of testing. The report will be the property of UL, and may be distributed for internal use only. An abstract approved by UL and B. Bentzen may be circulated to the public.

Floor Discussions

The exercise serves as a demonstration of field application and permits the committee to experience comparisons of resiliency. This exercise is not intended to serve as a more rigorous scientific evaluation. In addition, this demonstration is intended to providing basic modeling for the ultimate testing that will be included as part of the detectable warning program testing.

Committee member Richard Skaff questioned why the test pad should have stamped concrete run parallel along one side of the Detectable Warnings (DW) test samples. Wouldn't it be more fair, to have the stamped concrete be one of the Detectable Warning (DW) test samples, and have brushed concrete provided on both sides of the detectable

warnings? In addition, concrete does not generally provide a consistent shape/form out in the field, so if trying to provide uniform resilience, then should consider differences in form and consistency for concrete. Inconsistency may cancel out some of the variables.

Jeff Barnes explained that the reason that the stamped concrete is proposed is because using stamped concrete with truncated domes will assist in the demonstration of the material, which is detected underfoot by either texture or resiliency. Using stamped concrete on one side with truncated domes would eliminate a variable, by offering similar textures, so that the focus can remain on resiliency. The goal is to determine which products are detectable only by its resiliency and not as a result of its texture and at what point does texture and resilience provide resiliency.

Billie Bentzen noted that for consistency, care should be taken to have as uniform a test surface as possible. However, perfect uniformity with this material is not possible, as it might be with other types of materials. Extreme care should be taken with the material if the concrete is used as a basis for the test pad, and so a compromise is necessary. This stamped concrete proposal so far is the best solution, so that in working to learn about resiliency and sound, the concept of texture is eliminated. Using stamped concrete, which is a common material in the field, also meets budget concerns, and is therefore reasonable.

Several committee members proposed stretching the scope of the research demonstration to include a permanent site that would eventually provide real world testing of products, and to establish a benchmark that defines resiliency. Establishing a benchmark would involve working with existing products and although outside of the scope, would require requesting separate funding to develop a benchmark that falls within a specified range, for

manufacturers to use when creating a resilient product. It's important to quantify or find measurements using the code that specifies resilience.

Jeff Barnes responded by noting that the proposed Coefficient of Restitution Test has been developed for the purpose of determining the resiliency for a particular material. What is currently needed is some comparison data as to how the Coefficient of Restitution Test data can be used to indicate the levels in a product that is actually detectable, solely based on its resilience. UL has designed a new test, and although it is known that certain products have a resiliency value, there has been no scientific correlation between them. The goal of this study is to establish a baseline data sampling, that state that at these levels of coefficient of restitution, the committee at 90 percent was able to detect it, and not to determine which products are better than another. At higher levels of COR, resiliency will not likely be discernable from surrounding concrete. That's the resilient side, where the control comes from using the textured concrete instead of the brushed concrete. To further refine this concept, the goal is to gather data as accurate as possible, and work to eliminate the human factor so that a test can be built from this data.

Gene Lozano and Minh Nguyen were concerned about the additional variable of having assorted type of footwear used in the research demonstration. It's possible that using leather soles, or rubber soles or other types of walking shoes will add extra variables to the testing. This might or might not be advisable. Gene suggested providing guidelines for individuals wearing shoes of similar types, so as to control that variable better, and offer better shoe variety.

Billie Bentzen replied that there was not enough time before the next meeting to prepare for specific types of shoe wears, so instead the type of shoes worn by the test subjects will be recorded.

Richard Skaff made note that persons with Diabetes-Type 2, may have symptoms that affect their ability to detect objects, and should this be addressed by having representatives with Diabetes-Type 2 included in the testing?

Billie Bentzen responded that there is a loss of tactile sensitivity among the aged and/or persons with diabetes, and would expect that the subtle differences in resiliency was going to be minimally detectable by these individuals. These individuals will count on the more obvious differences in sound or texture to detect products. There would be minimum effect to these types of testers, so not greatly concerned if Type 2 testers are involved in this test**.** It should be noted that not all factors could be addressed in the demonstration.

6. Manufacturer/Public Comments on Research Design – Detectable Warnings/Directional Surfaces (Jeff Barnes/UL)

Jon Jules Comments:

Jon was not convinced that stamped truncated concrete surfaces are needed for the test pad. Understands the need for having a control, but stamped concrete will not provide this for all the reasons noted earlier. If a stamped concrete is needed and will benefit testing, would prefer to use pre-stamped concrete, rather than those stamped in the field. Pre-stamped concrete is more likely to be consistent as a material, than the field-formed type of stamped concrete. He noted that the material is intended not only for the blind, but should consider having representatives with limited vision, in wheel chairs, etc.

Billie Bentzen Beezy responded that resiliency is being tested in the demonstration, which can be best done by ruling out texture differences. In addition, having other participants be part of this project would be beyond the scope of this project.

Jeff Barnes added that the plan is provide a flat field so that manufacturers could install their products, lay concrete if needed, and provide approach paths afterwards.

Mark Heimlich Comment:

Mark suggested that having everyone do their own installation, lay concrete, and provide substrate of their choice, would introduce numerous unwanted variables.

Jeff Barnes replied that there would be only one substrate used, which is concrete, and the product selected for testing should normally use concrete as a substrate. UL will need to install the concrete first, and have manufacturers on site if they have a wet set product so that they manipulate the material as needed. Those with topical products that adhere to the surface, can come in after the fact, after the concrete has cured.

Richard Skaff asked if materials with special installation instructions or materials would affect the final results, or which required special processing? Billie Bentzen replied that yes this could be a factor, and essentially in the sound on cane contact, this would be very important. Manufacturers have the option of installing two samples, one possibly with a cavity as an option.

Jon Julnes Comments:

1) Jon asked about requesting a list of installation instructions, so that one designated installer could use the information to secure the test material, and this would have

everyone working with the same wet concrete. All the concrete would be the same and consistent.

2) Materials with wet setting products must use wet concrete, and if they are not using a wet setting product, then their criterion is to set the material on a surface that is cured.

Mike Stenko Comments:

1) There are many manufacturers in the detectable warning industry, and so if at least twenty respond with products, that would be too many and would result in crowded conditions. UL will need to simplify the process, and should find out what the installation process is for each product, develop a matrix, and keep track of the cement preparation.

2) A finishing crew will be needed to work with the various installation instructions. For fairness and uniformity, suggests using only one installation crew, who is assigned to install everyone's tiles.

Jeff Barnes reminds everyone that we should be focusing on the design of the resiliency, and not on the performance of the product for actual approval by the state.

Bill Naugle Comments:

1) Suggests providing a minimum of 6 to 8 inch space between each product, to solve some of the differences in height, to separate test samples properly, so that each sample can be set differently.

2) Recommends pouring the brushed concrete all at the same time, because the stamped tiles take time to set up. It would be a good idea to have the stamped concrete placed next to the brushed concrete.

Billie Bentzen agreed with Bill Naugle's suggestions, however a uniform height platform is necessary, and would prefer not to group the products together by specific groupings, and also suggests that those products with cavities, also not be placed together.

Jeff Holm suggested that the test beds be separated so manufacturers would not interfere with each other when installing their products.

David Cordova supported the recommendations that manufacturers bring pre-made samples of specific sizes and thickness, and that test bed sites would already have proper openings prepared in advance. Cement would be poured then, and this would be consistent.

Gene Lozano also agrees with the proposal separate test beds, because test areas might become too narrow. The committee should consider widths of 3 or 4 feet wide, so both feet are properly placed on products.

Billie Bentzen envisions having the test subject place one foot on each product, at the same time, for comparison. Billie will consider the possibility of conducting the test using both methods or determining if one method is better than the other. Beezy will determine which method is better during UL piloting, which will take place the day before the next EDWAC meeting.

Bill Naugle Comments:

1) Bill supports David's suggestion of having pre-made 2 by 2 ft samples provided by the manufacturers. This method would be easier to install, and more consistent.

2) Although 3-inch thick samples are being requested, and Jon is aware that there is a general concern with the weight issue of the samples, it should be noted that most sidewalks are a standard 4-inches thick. It would be easier to ship the standard 2 by 2, 4-inch thick samples and later install them. This makes more sense, and provides much more consistency on your brushed concrete than your stamped concrete.

Richard Skaff did not agree with having manufacturers install their product since this is not a real world situation. The reality is that state or installation crews, and contractors generally install the material, and there are few manufacturers that conduct their own installation. Generally speaking, whoever buys the product, installs the product. Better to have a different independent installation crew install the test samples.

David Cordova clarified his proposal to use pre-made samples. There are several benefits, to the proposal. First of all the demonstration is not intended to be used to evaluate how procedures work from instructions, or how written procedures are to be used to judge installation techniques. The purpose of the demonstration is to test the final product and collect data. So by specifying sample size requirements, overall material thickness, etc, we are really showing an interest in the final outcome. Providing sample specifications saves time, and does away with the issue of varying thickness. Some manufacturers will install on top, imbedded, or stamped, and so if we specify overall thickness, we should be able to fit the completed product sample into a designated stop, and pour concrete between the samples to secure the final product.

Bill Naugle Comments:

Bill reminds everyone that the focus should be on resiliency. In Kansas they only have sand, and Georgia uses a granite mix, or materials like river rock, and different types of compounds. These materials are really not going affect resiliency. Resiliency is going to be affected by the brushed and stamped concrete versus what the material is when it's finished.

Billie Bentzen is certain that there is information to be learned in studying installation procedures, but prefers that for the purpose of this demonstration, that the manufacturers deal with their own installation of the test samples. Billie is concerned that if a single designated crew is assigned to the project, that they might not have the experience to install all the products submitted for installation.

Minh Nguyen agrees with David Cordova that it is reasonable to use pre-made products, as long as the samples are properly and consistently installed, using installers who will install all samples with equal fairness and care. Using pre-made samples apparently is the normal procedure for most investigations conducted by safety certification companies such as UL.

Paul Hantz Comments:

Detectable warnings should be installed properly, and familiarly with the product is important because inexperience might cause some installations that are very complex, to be installed improperly.

Fred Meise Comments:

As a concrete contractor, his company has experience with installing almost every type of tile available. There are different procedures and criteria that he must follow, which may include providing recessed areas for tiles, or adding saw cuts, etc. The main criteria that he follows is that the variance of the product to the brushed concrete doesn't vary, or at least that is what inspectors usually look for, and is more likely to criticize. Fred suggests pouring a set of 4 inch thick, or possibly 6 to 8 inches of substrate under everything, pour all the brushed and stamped concrete, because all these products that are going to be installed need to be flushed to the adjoining finished products, or the difference will be felt when you cross from one material to another. Leave a wider area if a glue-on area is needed, and leave recessed areas about 1-1/2 inch thick for incoming tiles. If wet-set tiles are used, a 3-inch recessed area is needed. The manufacturer can come in and pour their wet-set concrete and push their product in to the recessed area. This would be cost effective, and equitable to all.

<u>Mark Heimlich Comments:</u>

There is no doubt that the test site with expended time; labor and materials will eventually result in an expensive test site set-up. Consideration should be made to take this opportunity to expand the proposed test pad area so that it can be used for other tests. Tests such as the abrasion test, wire-brush testing, or using an ice machine could test for real life situations for these products. Should consider using a full sized street sweeper, a snowplow for samples installed in the test area, both tests followed by a detectability test afterwards. It is important to consider using test setups for more purposes than the current demonstration plans, in order to maximize its use. It would be a good opportunity to verify the effectiveness of the proposed tests, establish baselines for the tests, and to verify that the tests represent real life situations.

Jeff Barnes emphasized that what is being developed by the project is a standard. The committee is working on developing a standard for a product that any safety agency or laboratory could use within their laboratory controls, and which allows for product design and product evolution over the years to come. Products are always changing and the standard needs to address that. This is a performance criterion, so this standard and other standards for this product must be based on a laboratory setting and because there is also a two-year review cycle on the product as required by the State of California that it needs to go thru testing once again. The standard should be prepared so that a standard can be used by any test agency. Although, it would be a good idea to consider all of these factors, but in terms of practicality, the committee needs to focus on collecting data on resiliency for the standard. We might consider using the test setup elsewhere, but we need to focus on collecting data. Two issues to consider at this time is the best method to permit all interested manufacturers to participate and share in the cost of preparing and operating the test demonstration. Although, the committee needs to focus on collecting data for resiliency, for now we can keep this test set up prepared for possible use elsewhere as UL and the EDWAC reviews each of the proposed tests currently being developed. Proposals and issues being considered are:

a) Provide a layout or pre-map of the area.
b) Lay out a substrate and have manufacturers install their samples on the same day if using a wet-set mix, or later if curing is required.
c) Manufacturer would prepare pre-made dimension samples measuring 2 by 2 ft or 3 by 3 ft in size, 3 or 4 inches thick, installed in a concrete base, with concrete poured around it.
d) Manufacturers would install their 2-foot square test samples.
e) Need to consider time, since we can’t let this entire process take too much time for research or we will be unable to stay on track with our main project.

f) Need to determine how we can provide all interested manufacturers an opportunity to participate, and

g) Consider how do we put together a test pad that meets the need for gathering the data that we need at this point, for a reasonable cost?

A committee member notes that it should be appropriate to ask manufacturers for their participation in contributing test samples and sharing the cost in preparing a test site. This would be on behalf of conducting research for test data for UL test data and not for DSA, and should therefore be appropriate and not considered a conflict of interest. Richard questioned Billie Bentzen on whether flat vs. sloped surfaces effect resiliency? Richard asked because most applications are for sloped surfaces such as curb ramps. He notes that the federal codes do not require detectable warnings on blended walkways on private properties, like shopping centers. Should consider testing both slopes and flat area for resiliency in the test demonstration, especially since the manufacturers are likely to provide all the necessary samples needed.

Beezy replied that there is no previous research on flat vs. sloped surfaces, but would assume that a slope could affect resiliency slightly. A highly resilient sloped surface would likely have a shift towards the downhill side as you step on it.

Jeff Barnes agreed that we can consider it, but we need to stay with the issue of resiliency. We need to make sure that the demonstration project doesn't expand to an excessively large area in order to address numerous issues, and so based on time, cost, and area size, would suggest not adopting this suggestion yet, but may consider it later.

Gene Lozano agreed with Richard Skaff that there might be lots of useful information possible from testing with slopes, but based on the limits of space, time and funds, it would be more useful to stay with testing only flat horizontal surfaces. We would also need to consider other new variables when considering slopes, such as 1:12, or 1:15 slope angles. Would need to evaluate various slope angles, etc. but this could be timely and expensive, and Gene does not suggest doing all this work for the test demonstration. However, Gene and Richard and various disability groups need to consider approaching the state to request that they provide research funds to get this kind of work accomplished, as well as deal with spacings issues. For now, the committee needs to focus on using horizontal surfaces, and though there is merit in testing on slopes, it not realistic at this time.

<u>Mike Stenko Comments:</u>

Would be difficult to pull all this work together by the next meeting, unless handled properly. Suggests sending out a detailed letter to manufacturers, explaining that UL/EDWAC is putting together a program that requires specifically sized samples, and request that they get shipped to a specific address (minimum 2 weeks before the date of the meeting) and indicate that they will get the results of this research at a later date. This approach is likely to get a much better response from a larger group of manufacturers. If this research is being done to determine resilience, than minimum 3-inch thick concrete samples are sufficient to detect this and can be installed in beds of sand. Resilience is set up by that 3 inches of concrete. Need to make sure that all the samples are level, and do not rock. So samples can be shipped in by pallets measuring 2 feet by 2 feet, 3 inch thick, installed into a bed of sand, and a pad poured and set with thin-set of mortar to make sure it is bonded, and samples secured so that they don't rock. This process is efficient and more likely to get all the necessary work done by the next meeting, and more likely to get a large participation by manufacturers.

Gene Lozano notes that there are probably some products that cannot work with the pre-made sample process. The manufacturers may need to set the product in wet pavement to get a cavity, or may have another process to implement, if we plan to use the test pad later for detecting sound differences.

Jeff Barnes replied that this can be handled by having the manufacturer provide us with 2 by 2 ft installation of their product with any hollows or other features already installed as their product would normally be installed out in the field. The manufactures should be providing a test sample with its finished installation. Basically it's a finished piece of sidewalk with the detectable warning installed, and we would mount that so that we can put the surrounding materials around it.

<u>Mike Stenko Comments:</u>

Also recommends using the test site for continuous testing, by having tested samples periodically replaced by other samples, using the same test beds. The test beds can be reused until they wear out.

Jeff Barnes reported that there are two issues to decide on:

1) What is the make up of the samples and how will they be installed?
2) Current proposed idea is: Manufacturers provide a 2 by 2 ft sample, at a specified thickness (minimum 3 inches), laid in the test site with concrete applied to hold the material in place.

Richard Skaff disagrees with installing pre-made samples. Cost is no longer an issue, if manufacturers provide their assistance in covering the expenses of the test pad, although it

may still be a time issue. Would rather spend more time and provide a testing system that can give us more variable tests and more information than less. Does not agree with Jeff's statement about snowplows and street sweepers not being used for testing at the test demonstration site. We are making an effort now, that even the US ACESS board hasn't made, or the Dept. of Transportation (DOT) on the federal level. This is an opportunity that we probably won't have again, and we should set up the test area now for resilience, and a possible set up for future tests. We would have an excellent test set up that can be used for various tests, and would be a valuable test area for future use.

Bill Naugle Comments:

Asked if the samples should be submitted in only one specific color, no color, or any color?

Jeff Barnes responded that no specific color would be required, since we are only working with the issue of resiliency. In terms of color, we have a whole number test program to cover color.

Jon Julnes Comments:

Agrees with Richard Skaff that the committee should take the opportunity to use this created test tool for other testing and for those mentioned by Richard. It's impossible to vote for the best method of sample installations whether install preset samples or wet set of concrete, until we know the ultimate long term testing planned for this test pad. Granted we could spend 16 months or so discussing this issue. For example, inset concrete products, causes too may variables, such as to their adhesion to the surface in order to conduct accurate sweeping, abrasion and other types of testing. If we take this section here and make it into an island later on in the parking lot, it would be impossible to do sweeping and other tests in any kind of real world variable because it won't be attached to a driving surface that's

connected. So all of the issues in Richard's and Mark Heimlich proposals are pertinent and should be considered now for long-term product testing benefits. Why not spend a little extra money on the test pad now? Why not take time to come up with a test design that would permit numerous types of testing? It might take an extra month to decide on these tests, but would still be worth the time.

Arfaraz Khambatta had a concern about requesting pre-made samples be shipped to UL for installation. Based on testing resiliency, and in the case of a product that is placed in wet concrete, a determining factor of resiliency could be the gap between the product and the concrete. Manufacturers with pre-made samples would have control of the gap between the 3-inches and the concrete, and increasing the gap would probably increase resiliency, which could negatively affect bond strength, and this could not be verified since bond strength is not being tested for the demonstration.

Jeff Barnes reminded the committee that the field is not being tested. There is only one immediate need, which is resiliency. Project delays are to be avoided in order to keep the project on track, and thus meet our commitments to DSA. The demonstration is not being used to determine pass/failure criteria for resiliency. The key thing we need to establish is on the resiliency factor, and what is the level that it is detected? That doesn't mean that the product is not acceptable if we can't detect it as a result of resiliency, because the State code allows this type of product in specific installations. What we need to identify here is the resiliency level, where is it detectable, and can we prove the test that we have proposed? It's apparent that there are a lot of work that could be done with the test pad, however we need to conduct our tests on resiliency by the next meeting. If we don 't we will not meet our goals. For now we need to run our test at the next meeting to establish resiliency. Basically the findings that Billie Bentzen will have available, is a significant step

forward in the data that is currently available. The data will be correlated to the Coefficient of Restitution Test, so that we can identify what is the detectable level of resilience. That really is the one aspect that we are trying to pin down in our presentation to the state. Keep in mind that testing will be needed every two years, and we can't be moving and installing samples in this area indefinitely. We need a laboratory process, to keep this procedure going forward, to enable us to detect a baseline for resiliency. This group will not be able to accomplish everything it would like to accomplish, but this resiliency must be dealt by the next meeting.

Tom Whisler supported Jeff Barne's position, that the committee was going beyond the scope of the committee by considering running various tests at the test site. There is a whole set of criteria here, in that we are testing for resiliency, and we have a test for coefficient for restitution. The committee's goal should be to establish a sensory experiment with this material to determine what the coefficient of restitutions should be. To determine what an acceptable level range would be. In general, comparing samples to other samples that are 2 years, 4 years or 6 years old should be avoided. The EDWAC needs to avoid going beyond the scope of the committee, and get back on track and focus.

Andre Miron mentioned that testing for resiliency on the test site doesn't mean that it might not later be used to conduct real world tests on this or similar set ups if needed for other tests. Probably could reuse this field, but this is not an actual test set-up, for pass and fail factors. We should focus on the main issue, and establish a baseline. So although the test site could be reused, the main focus for now is to concentrate on resiliency. It's important to note that this test set-up is a tool for evaluating proposed tests, and will not be used as a pass/fail tests for products from manufacturers.

Arfaraz supported using pre-made samples as long as everyone agrees with using the same method of mixing across all test samples, so that there are no different specifications for bond strength and for the resiliency test.

Jeff Barnes stated that for this test, the product should be installed to the manufacturer's specifications. They are not being encouraged to make their product more resilient than it would be normally. There is an element of good faith and a certain expectation that UL receive a standard, production-line sample. General reviews will be conducted to verify that this is the case. However, it all goes back to the manufacturer, and installing products according to their installation instructions.

Minh Nguyen notes that only a cursory review and not a technical review, should be conducted by UL or a designate, and is all that would be needed to verify the installation instructions provided by the manufacturers. This would provide a quality control check of the installation instructions.

Jeff Barnes agrees, and notes that this comment has relevance to all test products that are submitted to UL for standard product evaluations. We can later discuss this when covering the topic on the sample submittal process and what we're going to be looking for

Jon Julnes:

Recommends that manufacturers submit a recorded video of the installation, and place a marker on the sample, to verify assembly of the samples.

Mark Heimlich:

Suggests requesting multiple samples (5) and select at random, samples needed for testing for resiliency.

Paula Reyes-Garcia makes the observation that the test data will be used to determine the Coefficient of Restitution. This could drive the Coefficient of Restitution value up, if the manufacturer does not provide a properly prepared sample, and this could result in more difficulties for the manufacturers to comply with the higher value on a long-term basis.

Jeff Barnes agrees and stated that according to the building code, a product used in certain installations, for example train platforms) must be discernable by color or resiliency, so its an either/or situation application. All products are not required to have to have a resiliency factor. What we're trying to establish by this test is that if a product is going to rely on resiliency, that we specify the level as defined by the coefficient of restitution that is readily discernable from its surroundings. And in response to a question from a manufacturer, Jeff reported that manufacturers would not be identified in the testing, so neither the test samples nor the test report will provide this information.

<u>Paul Hantz Comments</u>:
What about non-adhered products, which have hollow areas? How will these materials be installed?

Jeff Barnes replied that accommodation for this type of construction would be possible. The proposed installations could include fabrication of these types of hollows. This type of paver construction could be laid in place, if fabricated in advance.

Derek Shaw asked if using 2 by 2 ft sized samples in wet-set installations would permit enough space for a margin to be provided around the sample for proper installation. Some manufacturers, such as Armor Tile, may require larger samples to allow room for margins.

Mark Heimlich Comments:

Agreed that some of their products would need a 6-inch border. Mark recommends using samples sized either 2 by 3 ft, or 3 by 3 ft, with 12-inch spaces between the samples.

Jeff Barnes agreed that samples sizes could be revised to 3 by 3 feet, provided with centered margins, so that there are only 6 inches between samples. The current proposal is to ship preformed samples to the demonstration site that will be sized 3 by 3 ft square.

David Cordova makes a motion to proceed with the demonstration as proposed. Jeff Holm seconds the motion.

Vote Results: 11 Yes votes, 0 No votes

Jeff Barnes announced that textured surfaces are the next unresolved issue to discuss. A suggestion was made that using preformed products might result in inconsistency of textured patterns. This could be addressed by having careful and consistent installation done by the experienced installers, or have preformed pavers installed.

Gene Lozano supported using pre-cast concrete pavers or material panels, rather than stamped products. Gene recommended that pavers have the same type of inline or staggered pattern orientation across the test pad. The pattern doesn't make a difference in detectability, however it does provide consistency in the testing.

David Cordova adds that it would be more realistic to arrange the patterns inline, which is more real life, since DSA is accepting this pattern, and Caltran requires inline patterns. Caltran as a letter on record from DSA and the Federal Highway Association that indicates acceptance of inline patterns in their building codes.

Aaron Noble notes that the interpretation of the regulation on detectable warning surface using inline patterns is available online.

Richard Skaff noted for clarification purposes, that alternate offset truncated domes 2 ft by 24 inches deep; four feet wide panels are still acceptable. The FHWA and US Dept. of Justice have both issued clarification memos allowing both constructions on March 2003, which is available on both the FHWA and FHWA California Division websites.

Manufacturers/Public Comments:

Paul Hantz Comments:

Asked if slab pavers or interlock pavers should be used for the brushed areas of the test set-up? Should slab pavers be used on the other side? Using these pavers would provide comparative concrete on each side, and this might provide different densities. When using a paver, on one side you're looking at 4 ft unit, brushed on concrete, and the other side would have sand set pour slab and then thin setting or mortar setting the bricks so that equilibrium is provided between them.

Mark Heimlich Comments:

Why not use asphalt on the other side, so we have one of both concrete and asphalt, which would be a more typical approach and provide a real world feel?

Jeff Barnes replies that the original design had asphalt on one side and cement on the other side. The idea of using stamped cement is to compare with the domes on the material, for contrast, and remove the variable of using different materials and material textures. This provides an extra level of support to the data. A bumpy surface to a bumpy surface is provided, so that test subjects can focus just on the difference of resilience, and not on the differences of texture. In addition, the domes should remain consistent in pattern, size and shape, so that it's eliminated as a variable.

Jeff Barnes requested a committee vote on whether to use stamped concrete, in compliance with codes, for the test setup.

Vote Results: 9 Yes votes, 2 No votes

Arfaraz Khambatta opposed using stamped concrete because we need more consistent domes, in order to properly test resilience, and this is more likely if pre-cast samples are used.

Minh Nguyen notes that different manufacturers will have different sized domes on samples anyway, so why not try for a real world effect.

Gene Lozano recommends that DSA and UL review various submitted pre-cast samples, and decide to use the best ones for the test setup. Sometimes the domes don't form properly, and having options among the pre-cast samples would allow for more consistency on the test pad.

Arfaraz Khambatta notes that although Minh recommends stamped concrete to give a real world feel, the intent of the demonstration is to detect resiliency, and not dome consistency.

Jeff Barnes calls for a vote on using pre-cast concrete pavers.

Vote Results: 11 Yes votes, 0 No votes

Bill Naugle Comments:

His company would be willing to offer these pre-cast test panels, but how will this affect his company on the testing program and on establishing a resilience figure?

Jeff Barnes replies that the material could be used on one side, and a sample of the product could be used as one of the tested samples.

David Cordova suggests that DSA provide proper specifications for the precast detectable warnings. Would look to DSA to provide the interpretative regulation on the spacing issue.

Jeff Barnes asked the manufacturers if they would be interested in participating in this demonstration exercise, by contributing samples, and showcasing their products?

Manufacturers were in support with this proposal.

Jeff Barnes notes that as part of participating with this proposal that we may need to ask the manufacturers to bear part of the installation costs of installing the surrounding concrete. UL will look into these costs and provide details for those willing to participate.

Jeff announced that manufacturers would receive a formal request to participate in the demonstration project. UL will request that test products have four lifting points, properly

imbedded, using good engineering practice. Pavers should be approximately 3-1/2 to 4-inch thick, maximum 6 inches thick.

7. Acoustic Quality Definition (Jeff Barnes/UL)

Jeff Barnes submitted the following definition for review. The definition was originally proposed at the February 17, 2005 meeting. Jeff notes that at the request of DSA, minor editorial revisions were added to all of the previous definitions, which are consistent with the definition format used in building code documents. See Exhibit A, from the Exhibits for the April 28 – 29, 2005 Meeting Agenda, for the original text of the proposed definition.

ACOUSTIC QUALITY is the ability of a material to retain its original sound characteristics when impacted by an object. (Exhibit A)

Jeff Barnes proposed revising this definition since the material needs to retain its sound characteristics when exposed to environmental stresses over a five-year period. The definition was revised to the following:

ACOUSTIC QUALITY is the ability of a material to retain its original sound characteristics when subjected to environmental stresses. (Revised by Jeff Barnes)

Gene Lozano proposed that the committee consider two alternate definitions instead. The first definition was from a study by Templer, Lewis, and Sanford, dated March 1983. Gene developed the second definition, which defines the intent of the law and building code. The second definition notes the contrast between the adjoining walking surfaces and detectable warnings.

1) Acoustical Cue - The loudness and pitch of the sound made by a material when touched by a long cane or shoes. (Proposed, from a March 1983 study by Templer, Lewis, Sanford)

2) <u>Acoustic Quality</u> - The quantitative difference in sound between the warning surface and the adjoining walking surface when struck by a long cane. (Proposed by Gene Lozano)

David Cordova reminded everyone that there are two issues to consider. One is that government code number 4460 states that the sound on cane acoustic quality will not degrade significantly for at least five years, and the other issue is it's contrast with its surrounding surface. David asked Jeff Barnes if at the last meeting, did Jeff state that this was going beyond the scope of the UL/DSA contract? What are we're trying to accomplish with the definition of acoustic quality?

Jeff Barnes replied that in terms of the definition, we are trying to identify what is acoustics so that when we go into the performance section of the proposal we can note if the material maintained those original acoustic characteristics. We need to be able to note a change in resiliency. Acoustic is a sound property of that material, and the quality of the material to retain that is what we are really trying to create a definition for.

Richard Skaff suggested the need to define a standard for an acceptable acoustic quality. Every single product may have a different acoustic quality, so the next step is to determine if their typical acoustic quality will endure for five years.

David Cordova pointed out that we shouldn't be adding information to the definition that is already in the code. The definition should be simplified, and merely provide all the parameters of the material when impacted. There is no need to add any information to the definition about its ability to retain.

Andre Miron suggests using the format of the other definitions as a guide, since this issue is similar to the definitions for color fastness, shape, etc. We should simplify the definition to state that acoustic quality is the sound emitted by material when struck by an object.

Minh Nguyen agreed with David Cordova's comments, that the EDWAC is tasked to test the ability of the material itself, whether it is a field, or dome or a sheet fabricated with domes as part integral domes. It doesn't matter what type of product is submitted for testing. Therefore, if we discussing the acoustical quality of the item itself, then whether or not there is going to be a difference in acoustics between adjacent walking surfaces or not need not be addressed in the definition. Adjacent surfaces are going to be different on different surfaces, whether they are concrete, or asphalt, or so forth, so how do you judge the differences? And so, staying in the context of what we are doing, the definition of the product itself, the acoustical property of the product itself, and the ability to retain its sound with in the five-year period is more fitting since that is what we are doing.

Gene Lozano responded by stating that our mission is to implement the state code. Article 1133B.8.3, makes reference to contrasting resiliency or sound-on-cane contact from the adjoining walking surface, and that is where we should be checking the resilience sound, between those two surfaces.

Jeff Barnes pointed out that we have a definition section, and we're not trying to establish pass/fail criterion or acceptable use in the definition. We want to establish that when we reference acoustic quality in a test, or elsewhere, that the meaning of the term is provided. Jeff pointed out that the definition for color fastness agreed to at the last meeting is very similar in terms of an appropriate definition format to use for acoustic quality. Jeff proposes using a similar definition format for acoustic quality. Such as:

Acoustic Quality is the ability of the material to retain its original sound characteristics of the material, when exposed to environmental something.

Gene Lozano cautioned that if the approach taken is only that of a material retaining its sound, then we will find that if you place concrete against concrete, with density thickness, that it all sounds the same. This wouldn't serve any purpose. It's when there is a difference between two surfaces that's just like the resiliency we're trying to obtain, and establishing a baseline of resilience that is acceptable.

David Cordova agreed that there has to be a decision on how to define acoustic quality. It wasn't defined well before work began, because in State Code 1133B in the context they use, sound on cane, quality of sound on cane sound and what is stated in the government Code 4460, is described in two different contexts. One is the ability that it will not degrade; and 1133B is relative to the surrounding area. So there lies the difference, and it relies on which one where going for.

Andre Miron agreed that we need to consider the surrounding area, but it doesn't have anything to do with the definition of acoustic quality. If we want to deal with the surrounding area then we should refer to this information to Table 7.1 under acoustic quality. Table 7.1 already has a reference to this, and further details are to be covered on Friday. The requirement of acoustic quality is that acoustic quality of detectable material must be different from the acoustic quality of the surrounding material. You can't define acoustic quality by referring to acoustic quality as being different, and so if we define acoustic quality as being different from the surrounding material, and define the acoustic quality of the surrounding material as different from the detectable material, then we have created a loop back to itself. We need to define acoustic quality in simpler terms, such as acoustic quality

of being the audible range of sound in terms of frequency, amplitude, and pitch when struck by an object (i.e. long cane, nylon ball, etc.). We should leave the comparative points of what we are comparing it to and how we are comparing it to in a different portion of the standard. Although Andre Miron agreed with Gene Lozano in principle, he recommended separating the information.

Tom Whisler agreed with Andre Miron's comments. We should be looking strictly at the contrast of sound between the sounds of materials. You need to define the differences that you're looking at, if you are looking only at the differences.

Gene Lozano agreed that if the features capturing the difference of two surfaces are covered by the tests, then it does not need to be provided in the definition. Gene agreed with the revised definitions as long as the comparison of the adjoining surfaces is captured elsewhere in the standard.

Jeff Barnes reports that the committee was looking at several definitions, which included the following:

1) ACOUSTIC QUALITY is the ability of a material to retain its original sound characteristics when impacted by an object. (Exhibit A)

2) <u>Acoustical Cue</u> - The loudness and pitch of the sound made by a material when touched by a long cane or shoes. (Proposed, from a March 1983 study by Templer, Lewis, Sanford)

3) <u>Acoustic Quality</u> - The quantitative difference in sound between the warning surface and the adjoining walking surface when struck by a long cane. (Proposed, by Gene Lozano)

4) Acoustic Quality is the ability of the material to retain its original sound

characteristics of the material, when exposed to environmental something. (Proposed, by Jeff Barnes)

Jeff Barnes made note that the definition for acoustical cue might be a good definition to adopt, since it would provide a solid baseline for comparison.

Minh Nguyen expressed reluctance to use that definition, because it refers to contact by a long cane or shoes, which is not defined. Minh would prefer a very simple definition, such as that proposed by UL, which is currently described in Exhibit A.

Andre Miron proposes to change the word “retain”, from UL’s description. Sound can be defined in different ways, such as pitch, loudness, and strength.

Jeff Barnes proposes the following definition for a vote:

Acoustic Quality is the sound characteristics of the material, when impacted by an object.

Richard Skaff makes a motion to adopt the definition, and Minh Nguyen seconds the motion.

Vote Results: 10 yes votes, 1 no vote

Doug Hensel was concerned that the definition didn’t specifically address degradation in the definition. Although the quality of acoustic quality would be allowed to degrade in 5 years, however it cannot degrade significantly. This information has not been provided in the definition. Doug didn’t see the connection in the definition to this issue of degradation. Doug would like to see this issued addressed later in the testing requirements.

Richard Skaff reported that this degradation issue would be covered by the testing, and is therefore not needed in the definition.

Jeff Barnes pointed out that there would be a pass/fail test criteria for degradation after several tests, including degradation, in the performance section of the document.

Doug Hensel agreed that this would be acceptable, as long as it's not called "acoustic quality".

David Cordova adds that for now we are providing a definition of the term. Later numbers or ranges related to tests will be attached to the standard indicating acceptable or not acceptable results, and if the product degrades more than a set value.

Doug Hensel replied that he supports the definition as long as the degradation issue is later addressed, although he prefers the first definition as shown in Exhibit A.

8. Manufacturer/Public Comments on Acoustic Quality Definition (Jeff Barnes/UL)

Ron Baak notes that research on sound tiles have been done in Holland that included conducting a vibrations test. Research has determined that vibration runs from cane to hand, and that this vibration in the cane is very important for detection, as shown in the vibration tests.

Several committee members reported that individuals use the cane differently, and part of that is based on training, personal preferences, and on the location and situation encountered by the individual using the cane.

9/10. Environmental Conditioning – Exhibit B, Section 8; and Manufacturer/Public Comments (Andre Miron/UL and Jeff Barnes/UL)

Topics:

a) Freeze-Thaw Cycling, Section 8.2 – Update

b) Salt Spray, Section 8.3 – Update

c) Chemical Resistance, Section 8.4 – Update

a) Freeze-Thaw Cycling, Section 8.2:

Andre Miron reported that Caltran no longer conducts freeze-thaw testing, because they have replaced it with a Sodium Sulfate Soundness Test. This testing is conducted on rock aggregate, and not on finished pieces of concrete so it would not be suitable for detectable warning products. However, they had previously used Caltran Test 528. This was their freeze-thaw test conducted on samples for 5 cycles per week for 10 weeks, for a total of 50 cycles. UL determined that this would be a good baseline to start with in developing freeze-thaw tests for detectable warning products. Andre reviewed weather data on a websites that had recorded weather history for approximately 50 years. The data showed that some areas in California see lots of freeze-thaw cycles in a given year, however there is a point of diminishing return with freeze-thaw cycles. Once a material has survived a certain number of cycles, further degradation is unlikely. Its been determined that if material survives 50 cycles, that it's not likely to degrade much further. UL therefore proposes 50 cycles of freeze-thaw cycling, which is based on the Caltran data, and appears to be reasonable since Caltran has used this test for a large amount of California freeways.

Richard Skaff questioned whether DOT FHWA in Washington DC, conducted national freeze-thaw testing or used any national standards for federal highway investigations? The

testing may not necessarily have been done on detectable warnings, but maybe using other types of products.

Jeff Holm was not aware of any national standards or national research done, except for those done within the states. It's likely if they conducted this type of testing, that they would use an ASTM standard on freeze-thaw cycling. It should be noted that Caltran adopted the ASTM standards for their standards, as have the FHWA for their highway projects.

Andre Miron reported that the tests Caltran was using previously didn't appear to have an equivalent ASTM standard available, so they used Caltran Test 528, which required testing of 5 cycles per week for ten weeks of freeze-thaw cycling on preinstall materials. The test apparatus used by Caltran was a little different from the test apparatus used by ASTM standards. Caltran appeared to be conducting a compressive strength-loading test on samples using a cylinder of concrete, which would be placed under stress, and then freeze-thawed repeatedly for the designated number of cycles and watched until it crunched together. This test method is slightly different from the test method that UL is considering adopting. We're proposing to conduct a number of tests on standard specimens that are adhered to concrete in some method. The freeze-thaw test by Caltran was similar but obviously the apparatus was different because they were accommodating for a different type of sample.

Richard Skaff questioned whether the test would include testing the sub-base and the connection between the top manufactured material and it's sub-base?

Andre Miron replied that yes it would include testing the sub-base and the connection. Although, there will be some conditioning tests that would not need this other material to be tested, because this is a condition that will be subjected to a number of different tests.

Richard made a motion to support the 50-cycles for the Freeze-Thaw Test. Michael Paravagna seconds the motion.

Vote Results: 10 yes votes, 0 no votes

b) Salt-Spray, Section 8.3:

Andre Miron reported that at the last meeting a rationale for the salt spray test was requested. Where did the test come from and why was UL recommending this test? The reason is based on a relevant standard at UL, which is used for numerous materials used for enclosures. The evaluated materials vary from metal to different types of plastics. The current proposed 200-hour test duration for the salt spray test was based on the UL 50 standard for enclosures. The salt spray test in UL 50 permitted testing at different time frames (50 hours or 200 hours), however the standard indicated that the most severe testing at 200 hours would be most suitable for coastal applications. UL's proposed salt spray test was derived from a UL standard used for a number of enclosure materials, such as metal and plastic enclosures. Basically, UL 50 is used for many products, because UL 50 is an enclosure standard that tests any products provided with enclosures for various environmental conditions, which include coastal areas. The testing is done on products that will be located in coastal areas, to test if the product doesn't corrode or degrade sufficiently as a result of being in that environment.

Jeff Barnes adds that UL 50 is an enclosure standard that addresses all applications and so there are different test criterions in the standard. Sometimes salt-spray testing is required

and sometimes not required, depending on where the product will be installed. In our case it's really relevant in terms of using salt-spray testing, since the test products are likely to be located near the coast, or on the beach, on an access path. A test duration of 200 hours should be sufficient for testing detectable warning products.

Arfaraz Khambatta mentioned that at the last meeting he proposed conducting a combination of tests on the same test samples. Does UL plan to conduct tests on samples individually, or in combination?

Andre Miron replied that for now, as the standard is written, testing for environmental conditions is proposed to be done one at a time and different specimens are being tested. At this time, the way the standard is being written, we have separated out the different tests and different test conditions and are not being done sequentially on one set of samples. However, this is still up for discussion. One reason that the tests are proposed to be conducted separately is because special test chambers would be needed for this type of combination testing. Combining environmental testing requires new test chambers that can handle multiple conditions. So for now products will be conditioned individually, then tested. Typically in testing or among testing communities when you do an evaluation of a product, tests are not done sequentially, or concurrently because the inside of conditioning chambers would likely be destroyed. Samples are not typically put under salt-spray, while under a xenon-arc, while being frozen or while diesel fuels or other acids are being applied. This type of testing could be very destructive for test chambers.

Jeff Barnes reemphasized there are specific environmental conditions that we are designing tests around. Some of the physical parameters of the tests themselves do not allow themselves to be combined, or the test chambers would self-destruct. The committee can

however consider conducting some environmental conditions tests in series, followed by standard testing.

Andre Miron suggests that UL/EDWAC eventually consider conducting some series combinations of environmental conditioning. This would also serve to cut down the number of tests that manufacturers would need conducted on their products, and fewer test samples would be needed. It is important to first develop the individual test methods, before discussions of combinations or series of tests and conditioning tests can be addressed.

Richard Skaff suggested use of Public Works information to help decide which tests should be combined. A possible option might be submit a questionnaire to the American Public Works Assoc. (APWA) members asking for the types of combination seen out in the field.

Richard Skaff makes a motion to adopt this test. Gene Lozano seconds the motion.

Vote Results: 10 Yes votes, 0 No votes

Manufacturer/Public Comments:

Jon Julnes Comments:

Jon notes that it would not take much time to assemble the information from the American Public Works Assoc. (APWA). The APWA provides this data already, sometimes in surveys, provided in newsletters, on their websites, etc. If a survey was prepared and posted on the website, results would be nearly instantaneous. The APWA would probably be willing to assist us in compiling this data. This is the type of area that they would like some input on, and they would probably do it for no fees.

Mark Heimlich Comments:

Detectable warnings are required in snowy climates, and are located on curb ramps that are the lowest points usually, so frequently curb ramps receive lots of water runoffs, dirt, debris, and salt. It's possible that in some areas, salt material would be lying around the curb ramps for months. A 200-hour salt-spray test is about a week and a half, and is likely not sufficient for this type of area or situation. Mark suggests salt-spray testing be conducted for approximately four months, which is a few thousand hours of salt-spray conditioning.

Andre Miron pointed out that "salt-sprays" vs. "immersion" testing are two different issues. A salt-spray salt solution would be tested at a higher temperature for 200 hours in very humid conditions, compared to immersion testing which would be very different. The immersion test and de-icing agents will be discussing later as part of chemical resistance.

c) Chemical Resistance, Section 8.4:

Andre Miron noted that at the previous meeting we discussed testing with many different chemicals, such as hydrochloric acid, ammonia hydroxide, soap solution, turpentine, and urea. Diesel fuel has been added to the list of tested materials, and others will be added later. When asked about leaching of base materials onto concrete, Andre replied that testing selected chemicals would cover these leached materials, such as strong acids, strong bases, etc. Andre plans to recheck the list of chemicals to verify that these leached materials have been addressed on the current list.

Gene Lozano also requested that Andre Miron check into the chemical content of materials in clay soil that stains. Water runoffs sometimes cause built up of clay soil on ramps, which may lie around for months, and will cause staining on the detectable warning products. Gene questioned if testing for these types of chemicals would be possible?

Andre Miron replied that this issue was already on his list of topics to discuss. At the last meeting, there was a lot of interest in the staining problem from various sources mentioned which included clay, chewing gum, berries, coffee, etc. It's not possible to test for every possible material, however a test program can be developed based on finding worst-case stains, to represent all the other stains, and include adding a color fastness test. It's not likely that staining would affect the Impact Test or other types of test results. Also, Andre plans to look into the cleaning ability of these materials, although this is ultimately the responsibility of the municipal agencies. We are looking at the application of stains on detectable warnings for a reasonable amount of time, however municipal agencies should be providing periodic cleaning services to address most potential stains.

Jeff Barnes notes that this staining issue may result in appearing in the final report as a recommendation, since it is not part of the scope of the project, which is durability. We could include this as a proposal in our draft requirements, for further consideration by DSA. Maintenance of the product is an issue that needs to be addressed eventually.

Andre Miron adds that in addition, we are looking for input on additional chemicals that should be examined as part of the chemical resistance test. In particular, de-icing chemicals should be considered. These chemicals are used in areas where it snows, where ice forms, and obviously can cause a slipping hazard, and so de-icing agents will be placed on these areas. UL would like to review the most common de-icing agents used, such as salt. Perhaps there are worst-case de-icing agents, or maybe a type of salt that's more concentrated or damaging to e detectable warning products. Andre is working on finding different de-icing agents, but is looking for more information from the committee, manufacturers and public agencies.

David Cordova offered to contact the Caltran staff in the Lake Tahoe area, to obtain specific information on the de-icing agents used in that area, and will provide Andre with this information.

Richard Skaff remembered that in the city of San Francisco, carbon black material was once used for providing contrasting color in the actual curb ramp, to make it dark on light or light on dark. The curb ramps were designed to be a different color from the ceramic sidewalks. Over time, it was found that UV rays, affected the color, and the color would eventually deteriorate. Hicon Black, and other chemical mix materials were added into the concrete pour materials. These and other materials added to concrete might affect test results. We may want to consider asking APWA for input on the type of chemicals likely to be added to concrete materials.

Gene Lozano added that some chemicals are added to speed up drying, curing, etc. Gene has seen that some chemicals added to curb ramps have changed the sound in the concrete. It deadens the sound, and sometimes it sounds almost like plastic.

<u>Phil Montgomery Comments:</u>

Phil has seen problems with curing agents, and found that the adhering properties may change when some adhesives are used with certain types of sealers.

Andre Miron pointed out that Table 8.1 has been revised, and will be finalized later. Basically this table will allow us to document our test methods. Later if tests are conducted in series, they will be documented in Table 8.1. For now Table 8.1 is just a draft table, to be worked on and updated as tests are developed.

Arfaraz Khambatta mentioned that Paragraph 8.4.6 specifies that samples should be conditioned at 23ºC prior to testing, but it did not specify a test temperature during testing. Is this a typing error, and will elevated temperatures be added to some of the test conditions?

Andre Miron replied that the test temperatures are documented in ASTM D 543. The actual test exposure is specified in paragraph 10.2. Although, the standard refers to using standard laboratory temperatures, we can choose to select our own higher temperatures.

Andre Miron reported that tests would include hot acid, and hot base conditioning tests. It should be noted that ASTM D 543 standard does make provisions for testing at higher temperatures in Section 11. The recommended temperatures are at 50ºC, 70ºC or other temperatures as recommended in the ASTM D 618 standard. It's important that the test temperatures of the reagents be set at the elevated temperatures prior to adding the specimens to the reagents for immersion. These temperatures will be reviewed and clarified later. The standard provides recommended temperatures of 50ºC or 70ºC, however we can consider other temperatures, but over boiling temperatures would not be recommended.

Minh Nguyen noticed that the chemical resistance test in paragraph 8.4.4, notes that the duration for exposure should be for 24 hours. Can it be revised to 7 days instead of 24 hours, since ASTM standard D543 actually recommends 7 days?

Andre Miron replied that this is probably a typing error, and the test duration should probably be revised to 7 days. Andre will review this information, and verify if it is in accordance with the ASTM standard and will revise the test description if necessary.

Paula Reyes-Garcia asked Andre if when looking up the different weather conditions, did he find lots of areas with high summer temperatures, such as in Bakersfield and the Fresno areas? Would any of the recorded temperatures warrant adding elevated temperatures to the exposure condition tests?

Andre Miron reported that the temperatures in Death Valley and other areas in California were very hot. These temperatures will be considered later when discussing the Attachment and Ball Pressure Tests. Andre is now reviewing the high temperatures of asphalt, rather than air temperatures, since the asphalt surface gets much hotter than air temperatures. Using the City of Phoenix temperature data, which provide some extremely high temperatures, Andre was able to use these temperatures for determining the maximum temperatures for testing. A university developed a model for determining asphalt temperatures as a function of air temperature as well as radiant from the sun. So it is possible to calculate for those, to get an approximation, however Andre was able to use a year's worth of data for Phoenix, which will provide a good starting point. And Phoenix presents a more severe case than the other cities, and that would cover all bases as far as California is concerned. There is a formula for calculating temperatures for Fresno, however Phoenix has been shown to provide worst-case temperatures. For example, on a very extreme case, when looking at data, temperatures in Phoenix measured 115ºF in the air, 153ºF on the asphalt surface.

Andre Miron added that the issues now with elevated temperatures is first of all, the softening of the detectable warning materials, for example polymers and PVC's mats. The other concern is attachment, and whether it degrades as a result of elevated temperatures, and whether the adhesive softens or becomes elastic at the higher temperatures. At the

last meeting manufacturers were asked to send in specifications on their adhesives. In reviewing that information, Andre found that none of adhesives would likely soften with the elevated temperatures. However, there may be some adhesives currently used out in the field that might soften with higher temperatures. UL is considering the addition of testing at elevated temperatures, and plans to discuss this further later, during the discussion on attachment testing.

Gene Lozano mentions that early materials had problems in the difference of contraction between the detectable warning and the surface and some caused the material to bubble up and stretch, and which resulted with failing attachments.

Andre Miron notes that there are two areas in the standard that will address these types of problems. First is the freeze-thaw conditioning test, and in cases were there is a difference of thermal expansion between two materials, then the freeze-thaw will bring this to light. Second, in the course of UV conditioning with the light on the samples, it will likely experience a black panel temperature of 65ºC, which is very warm. This test exposes samples to an elevated temperature, and so it's likely that with the freeze-thaw and UV conditioning, that any issue of with differences of thermal expansion rates will be covered.

Manufacturers/Public Comments:

Mark Heimlich Comments:

Regarding chemical resistance, there has been no discussions yet about corrosion. It's well known that calcium hydroxide, which is a major component of concrete, has a corrosive reaction with aluminum material, which can happen very quickly. There has been no mention yet that tiles will be exposed to the components in concrete.

Andre Miron replied that in a lot of cases or with most of the specimens, testing will require that the samples be imbedded in concrete or cement while being tested. If typical material is imbedded in the concrete, testing of the material should be covered by virtue of the testing being conducted on the samples. As far as special sealants, accelerators, or other components, they would need to be considered separately. Corrosion will be addressed later as part of shape and attachment.

Mark Heimlich Comments:

It's clear that aluminum and concrete does not mix. This corrosion is severely accelerated by salt and water, although this problem is not likely to appear in a 7-day test. This material will corrode, but possibly not necessarily within 7 days. So how does the committee deal with this?

Andre Miron notes that tests performed in elevated temperatures, may well show signs of corrosion within the 7-day test period. Chemical reactions are generally accelerated with elevated temperatures. So the addition of a salt immersion or salt-spray test at elevated test temperatures for 200-hours or as part of chemical immersions, may likely result in a reaction within 7 days, once we determine the type of conditions that will be implemented. In fact, this information can be used as a benchmark, if it is known that aluminum will deteriorate in a couple of years or so, we can apply an aluminum plate onto concrete under this condition and see what happens, and this can be done as part of the research phase.

Mark Heimlich Comments:

It's essential that this committee provide thorough testing, or there will be inferior cheaply made products installed in huge quantities all over the state, and will not be evident a few years later when the samples have deteriorated.

Andre Miron emphasized that the goal of the project is to make certain that products do not degrade significantly for five years. Every effort will be made to make certain that this goal is met. There are accelerated aging tests available, and the EDWAC can consider conducting oven-aging tests under particular conditions as needed. For now, it is necessary to establish all the basic tests, and address other tests later, if necessary. So if an elevated temperature test is added, this may address testing for the degradation of some of the materials. This would require plotting and determining the typical kinetics for these materials, and to extrapolate out to see how long x temperatures should be added, in order to approximate 5 years of service.

Mark Heimlich Comments:

One chemical that has been part of the testing so far is water, and Drano when combined with water, expands tremendously. This is an example of a test that is conducted with more than one test condition on the same sample.

Andre Miron notes that the concrete-backed specimens being immersed in sodium hydroxide solution, during one of the test, should cover a multiple test condition situation. Keep in mind that when considering sodium hydroxide, we are talking about a solution, and not a spray or sprinkling onto the material. And with additional research, we may determine that this test should be conducted in elevated temperatures.

Mark Heimlich Comments:

Mark asked about general corrosion problems and if corrosion tests would be covered by chemical resistance testing? However, some corrosion can corrode the concrete and the concrete falls apart.

Andre Miron replied that corrosion might be covered by shape testing, since if there is corrosion, it's likely to change the shape of the product. However, the attachment tests would address also concrete corrosion, which would become apparent when the material is pulled apart during testing.

Mark Heimlich Comments:

Mark expressed concern that the corrosion in the concrete would not be evident unless the test was run for a long enough time.

Jeff Barnes replies that more research will be conducted on this issue because UL has dealt with this before because of aluminum enclosures that do get adhered to, or require protective backing. UL plans to conduct more research and will provide more information at the next meeting.

11. Testing for Resilience – Exhibit B, Section 14 (Andre Miron/UL)

Topic: Coefficient of Restitution, Section 14 – Update

Andre made a presentation demonstrating the test apparatus, and sound system. Andre used a sound system for measuring sound that was developed by John Burke from Wisconsin. Andre tested 3 samples, and showed average values of 0.4341, with a Coefficient of Restitution of 0.480706 (COR). Andre plans to calibrate the length, time of the test apparatus, and to provide a magnetic start that will provide a more accurate start of apparatus. Further research will indicate a pattern or range for each type of material tested. At the last meeting, testing the dome was considered, however the COR of the dome testing was found to be the same, as the surrounding field area. Tests on the domes would be needed only if the domes were constructed of a different material as surrounding field

areas. Will need to consider which value would be more important for the test records, if both the domes and field are to be measured. This test appears to be reproducible, and should be considered. However, if the collected data does not confirm this, then other tests such as a compression test, may need to be considered. Research has shown that the test will not harm samples, whether or not there is sample discoloration as a result of the dropped test ball.

Gene Lozano recommends recording field area values, if domes are spaced far apart.

Minh Nguyen suggests testing on field areas, and both dome and field areas when dome materials varies from the field areas.

Andre Miron agreed that this testing sounded acceptable, however would need to conduct further research first to determine which of the two values to use for lab records. This issue will be addressed later, if data shows that a COR test addresses resiliency.

Andre Miron notes that in the standard there are a number of places were tests require using concrete for a basis for testing, and 1 or 2 inches of Portland type cement is being considered. Input has indicated that this may not be a realistic material to use for testing. Andre requested suggestions for concrete material? It will be necessary to define the kind of concrete that should be used for the proposed tests. This should be based on the manufacturer's recommendation, and on what is typically seen in field installations. Although it is important to provide a level playing field in testing, it should also be representative of the real world. We're trying to find the lowest common denominator to use, although the concrete will be used with a lot of different types of surfaces.

Several comments/recommendations were as follows:

a) David Cordova suggested using the Standards Specifications document used by Caltran. The Miscellaneous Concrete standard, Section 73, is used for sidewalks and curb ramps. The County of Santa Clara, and the City of San Francisco should be contacted for a copy of their specifications. This would provide city, county, and state specifications for concrete material used on sidewalk and curb ramps, and there may be common denominator. David will provide a website link to Miscellaneous Concrete Standard, Section 73.

b) Richard Skaff recommends contacting Kevin Janson, from the City and County of San Francisco, Public Works Dept. ADA coordinator for a copy of their specifications.

c) Tom Whisler will contact the Public Works Dept. to determine if he can obtain a copy of the specifications for the County of Santa Clara.

d) Jeff Holm recommends reviewing the green book used by southern California, which is used by some of the local agencies. Jeff may have the latest addition of the green book. He will review this information, and provide details to Andre.

e) Gene Lozano notes that Sacramento County and the City of Sacramento uses Portland concrete. There are some occasions like the county where the corners haven't been developed and where they are creating a path using asphalt with detectable warnings used there.

f) Andre Miron notes that once an appropriate concrete is selected for testing, the committee should consider the option of allowing manufacturers to request testing for concrete or asphalt, or request testing samples for both.

g) David Cordova stated that when it comes to asphalt concrete, the ADA does not preclude asphalt, and it is considered a legitimate surface. Caltran uses this material many times for temporary situations, such as for temporary curb ramps

with detectable warnings until the area is redone using concrete for permanent installations.

h) Minh Nguyen volunteered to provide two architectural sections with specifications, which are master specifications used for the federal government.

12. Manufacturer/Public Comments on Testing for Resilience (Jeff Barnes/UL)

Martin Bearden Comments:

Recommends using the design mix from Home Depot, called “Spec Mix” for manufacturers to submit with their samples. This would make certain that everyone provides the same ready-made material, easily available for manufacturers to provide when submitting samples for product testing.

Jeff Barnes agrees that UL can look into using this material and see how it compares with some of the other standard mixes. On that note, UL is requesting contributions of test samples to experiment with while developing new tests. A good sample size would be a 1-foot square, minimum 2-inches thick. Jeff asked if manufacturers would please provide 2 or 3 samples of any type of concrete within a few weeks for sample testing of new tests, and to indicate the type of substrate used for UL’s data collection. These samples will be needed so that UL can run some of the tests proposed in the draft standard, and evaluate how they will operate in a laboratory setting, and provide information back to the committee in terms of real life exposure.

Mark Heimlich:

For those samples that are adhered with some sort of urethane adhesive, it is important that the concrete cure for 30 days before the adhesion is made. So it should be noted that

samples with certain types of adhesives would arrive later than in a few weeks, as requested by Jeff Barnes.

Andre Miron noted that the thickness of the sample should be at least two inches, however a thicker material would be acceptable if it makes it easier for shipping or preparing samples. The thickness should be measured from the bottom of the concrete to the top of the field. Although the current standard sometimes refers to one-inch thickness, or a two-inch thickness, final thickness determinations will be made later as to whether we want to standardize it to only one thickness size. Concrete backings are optional. Andre Miron provided business cards for anyone interested in obtaining an address for shipping of the samples.

13/14. Testing for Shape, Exhibit B, Section 9 – 13; and Manufacturer/Public Comments (Andre Miron and Jeff Barnes/UL)

Topics:

a) Abrasion Resistance, Section 9, Update

b) Impact Resistance, Section 10, Update

c) Cold Impact, Section 11, Update

d) Water Absorption, Section 12, Update

e) Ball Pressure, Section 13, Update

a) Abrasion Resistance, Section 9:

Andre Miron started his research on abrasion resistance with street sweepers. This is a test that is under consideration, which uses a rotating wire brush brought into contact onto samples with applied pressure. The brushes are made of various materials, which include those made of polypropylene, however the most common brush is abrasive since it is made

of raw wire. A number of manufacturers have assured Andre that these street sweepers are still being manufactured and are still used out in the field. Unfortunately, so far no manufacturer provides recommended down pressure ranges. One manufacturer noted that they just provide a product with a range of pressure available, and let the customers decide which pressure range they will use. Andre had no values available for pressure applications. Manufacturers recommended that Andre contact municipalities, to determine their recommended pressure ranges. The manufacturers of the sweepers recommended that Andre contact municipalities because they are likely to have operating manuals and experienced machine operators that might be able to provide pressure values. Andre asked if any members had contact with municipalities who operate street sweepers, and if they could request street pressure values used by the public street sweepers?

Andre Miron adds that UL may need to contact the City of Santa Clara, and other cities, to obtain permission to measure their equipment. However, anyone who knows someone who can provide this information should contact Andre. In the meantime, Andre will continue to research this situation. Since UL doesn't have pressure values to work with, UL will continue for now, to use the current proposed 5 pounds of force applied on top of the wire brush. At the last meeting, several individuals may have been concerned that this value was not enough pressure for testing. However, the brush being used consists of 880 metal wires, each measuring 0.012 inch diameter, and when you calculate that out with the 5 pounds, you are actually getting about 50 psi.

Richard Skaff asked if Andre is considering a rotating motion, or a back and forth motion for the test? Or does it make any difference?

Andre Miron replied that for now, the test apparatus specifies a back and forth motion, however this value can be modified if necessary. However, if a rotating motion is to be used, we should also consider adding a back and forth motion be added to simulate a street sweeper going over the sample. At this time, we don't know if it would make a big difference. The back and forth motion is really not an issue. It's about how many cycles are used, the amount of pressure applied, and the size of the wire brushes. Andre hasn't discounted using other forms of abrasion, however he is leaning towards the wire brushes, and leaning against taber and sand blasting testing. Taber abrasion would only test the domes, and sand blasting may be overkill, and is intended only for concrete material, not for polymer materials. Not a real world situation, and the wire is more a real world test. UL will need to consider the number of cycles needed in testing to simulate five years. For now UL is proposing 500 cycles, but this value may change with more research. It's just a starting point, and a pressure value will still need to be determined. In the meantime, Andre will continue to research this situation.

Richard Skaff asked if after abrasion testing shouldn't the COR test be run? Some areas become slippery with common abrasion. Thermal glass, with glass beads, should also be examined.

David Cordova disagreed since slip resistance is not actually part of the government code of what needs to be meet.

Jeff Barnes explained that at the last meeting we had consensus that we should at least consider preparing a list of recommendations that address slip resistance. It's only a recommendation located as an appendix or exhibit item, and would not be part of the core standard.

Minh Nguyen noticed that according to ASTM D 4977, the size of the test specimen is 2 inches by 9 inches. This specimen size does not appear to be large enough for full brush strokes across the domes and field areas. Will the testing include both field and dome areas when apply a brush stroke over the 2-inch wide area?

Andre Miron replied that the test sample is wide enough for at least two domes or portions of two directional bars, even if they run diagonal. The standard currently requires at least two domes or portions of two directional bars. UL did consider correct sample size and are considering abrasion of the domes. However, the field of the samples may need to be increased, if we are recommending a slip resistance test afterwards. The current specimen size would not be large enough to conduct a slip resistance test. UL may consider using a rotating brush, or buy a standard small gutter broom and attaching it to a motor, which would supply downward pressure, and apply a broom to 1 by 1 ft test specimens.

Andre Miron agreed that if necessary, UL would develop a new test to address this, if a rotating brush cannot be found, rather than adopt the test method in the ASTM standard. Performing a slip resistance test would probably consist of using a Brungraber slip resistance tester following an abrasion test. The abrasion test would serve as both a regular test and a test condition for other tests.

David Cordova mentioned that Caltran uses a test unique for Caltran for testing friction at intersections and roadways, and that UL should consider reviewing this test.

Andre Miron responded that he is interested in reviewing any test methods available, if appropriate for our product testing. It was noted that basically the tests to be proposed the

next day as far as coefficient of friction or slip resistance tests, is based on the experience that Andre has with the specified instrumentation, which includes the Brungraber, Mark 1, which is a standard slip resistance type test apparatus. UL is considering proposing that that this test be conducted in wet conditions.

Manufacturer/Public Comments:

Paul Hantz:

As far as finding a rotating style of test equipment, we may want to consider examining floor cleaners, buffers, or similar equipment that uses a rotating system, sometimes with bristles/brushes attached.

Andre Miron agreed to look into these types of equipment. This equipment, if used, would need to be mounted on a suspension system so that it could be loaded properly, or instead consider using an oscillating brush, with a wider brush.

b) Impact Resistance, Section 10:

Andre Miron reported that at the last meeting testing for impact resistance was reviewed, and little has been changed since the previous meeting. At the last meeting, someone had suggested trying to set up a threshold value with a worst-case scenario of a rock stuck in a truck tread with a truck running over it. This suggestion was reviewed, and attempts were made to run a calculation on this scenario. Unfortunately, it was determined that there were too many variables, such as the diameter of the tire, the hardness of the rock, the shape of the rock, the speed of the truck, etc. This situation was found not to be a viable problem to calculate. So whereas in the future a figure for minimum impact resistance will be developed, it is probable that this proposed method will not be the method used.

c) Cold Impact, Section 11:

Andre Miron announced that the intent of Section 11 is to conduct a Cold Impact Test. At the last meeting someone brought up the idea that when material freezes, it gets brittle. When material gets brittle it may shatter easily on impact of debris, moving particles, etc. Although, Impact Tests are planned for various other conditions, it seemed reasonable to research cold impact conditions. Andre spent time researching cold impacts, and discovered that this test is conducted in numerous UL standards on subjects such as enclosures, wire cables, conduits, etc. Andre developed the new Cold Impact Test from the test procedures of several UL standards. Basically the procedure is that a one-foot by one-foot section on a substrate is cooled to a temperature of minus 35ºC, and maintained in the cold temperature for 3 hours. After 3 hours, the sample is removed from the conditioning chamber, and within 30 seconds a steel ball (5 ft-lb force) is dropped onto the test sample. The force applied is 6.8 joules or 5 ft-lb impact forces, which is applied by using a 2-inch diameter steel ball, 1.18 lbs weight, dropped from a height of 4.25 ft. This is a starting point for the tests, and trial impact tests will be run on the incoming test samples so that UL/EDWAC can make the determination if this test has viable impact value. It's important to determine if the test is too stringent or too lenient. One suggestion that occurred as a result of technical discussions with colleagues is to take the cold impact values and base it upon whatever impact value is found in the regular impact resistance test. For the regular impact resistance test, 20 samples will be selected, and a staircase evaluation conducted to determine the mean value energy for the samples. The Cold Impact Test would be an extension of this calculation and subject to the same impact values. The value would be based on the as-received value of the material rather than some absolute cold impact value. This method may be the best option however; the proposed cold impact is currently based on other known Cold Impact Tests. All comments and input are welcome, and additional research on this test will be on going.

Gene Lozano recalled that one of the manufacturers had suggested conducting the Impact Test on the front end of a skateboard using the wheels, to determine its impact on the domes. Gene asked whether UL would consider adding this type of testing to the Impact Test.

Andre replied that this test might be covered by another test that would be discussed on Friday. This topic can be discussed further while reviewing the attachment test, which is geared more towards snow shovels or snowplows. Testing snow shovels and snowplows is considered more severe testing than testing the skateboards wheels, since the other equipment uses blades. Care needs to be taken when considering testing multiple items, such as skateboards, inline skate, and tap shoes, or other items. The goal is to develop testing for worst-case scenarios and then continue from there. It's likely that the test will be written to gear towards testing the blade.

Minh Nguyen recommended considering tests that would test the areas with truncated domes where students hang around the area, and often drop their backpacks on the domes, or operate the backpacks on wheels, which also may cause pressure or abrasion on the domes. The weight of the backpacks and the weight point of the wheels as they roll the backpacks over the domes on the detectable warning products should be considered.

Andre Miron responded that when considering developing a minimum threshold value, a minimum impact value would be possible. The threshold value, and establishing a minimum threshold value needs to be considered.

Paula Reyes-Garcia asked Andre if he had had an opportunity yet to review the concrete utility box test as mentioned by Mike Stenko at the previous meeting?

Andre Miron replied that he had not yet fully reviewed the document since he had only recently received a copy of the test. At first glance, Andre made note that the compressive loading test might be a good suggestion to consider, and he has plans to review the test more thoroughly.

Richard Skaff asked Andre if the proposed Cold Impact Test would be tested on both domes and fields?

Andre Miron notes that the Cold Impact Test was needed, and would be conducted on both domes and fields. The impact value is going to be run on a few of the as-received specimens, and if the regular as-received samples can't handle the tests, then we will learn that the specimens can't handle the Cold Impact Test, and will move to change the threshold value, or change the cold to another condition, and then the regular Impact Test will be conducted immediately following the test condition. The Cold Impact Tests will be conducted in a cold condition, and not frozen first after removal from a chamber, and testing the product at room temperature. The product will be tested while still in the cold condition.

<u>Manufacturer/Public Comments:</u>

<u>Mark Heimlich Comments:</u>

Recommends designing a test that takes place in the cold, with an impact applied sideways into the domes. It would appear to be reasonable to design a test that simulates the snowplow blade, with the blade dropped down onto the tile, to the point where when pushed down the front wheels are lifted off the ground. This test would be run fully loaded,

operating for 50 cycles, and would simulate a real world situation, and should therefore be considered for adoption.

Andre Miron replied that he wasn't certain if any tile could pass this test, which appeared to be very stringent. This topic would be transferred to Friday's discussions about attachment and the attachment of domes, and will consider cold impact testing when discussion attachment tests.

Mark Heimlich Comments:

Notes that some of the domes may become unattached, if not integral to the field surface. Possibly 1500 lbs of pressure could be applied on the tiles (by the time the front wheels are lifted off the ground), although if it fails at that, try again at 1000 lbs, or down to 50 lbs. This test would be a real life test that combines impact and abrasion testing.

Andre Miron replied that UL was considering a test developed by a manufacturer that provides a yield strength on the domes as the sharpened blade is applied at a 60 degree angle, however this is a Slow Loading Test, and not an Impact Test. More discussions on these tests will be held on Friday. UL may consider conducting the proposed test in the cold since this condition is likely to occur in cold weather with snow packed on top.

Richard Skaff adds that these domes can become unattached in wet cool whether too. During rainy weather, there is rain and mud and Caltran may use cleaning equipment with blades to clear the mud and debris from highways and pedestrian ways because of mud from hills.

David Cordova disagreed with Richard's comment. Since this subject was discussed at the first meeting, David had questioned other Caltran staff in the Lake Tahoe area, and spoke to the maintenance chief, who clearly states that snowplows are operated only on roadways, not sidewalks. So their response to David's inquiries was that they did not snowplow sidewalks or curb ramps. Although there may be counties or local agencies that operate snowplows on sidewalks or curb ramps, Caltran does not.

Richard Skaff notes that typically snowplows are not being used on a sidewalks directly, however the snowplow on curb ramps occurs as it's operated across the gutters with a blade. The blade may catch or slip over the portion of the curb ramp with detectable warnings on it. The operator does not intend to go over the sidewalk, however it occurs when they catch the edge of the curb ramp as it's going around and in the return. Richard notes having seen this happen in once before.

Jeff Holm responds that snowplows operating on curb ramps are "unintentional acts" by the operator of the snowplows machines. Since the committee has no plans to cover earthquakes instability or damages, other unintentional acts or events such as snowplows should not be covered. The committee may not be capable of specifying materials that can survive all snowplow testing.

David Cordova agreed, and notes that a big blade can destroy any kind of detectable warning surface out in the field. Agrees that this committee cannot cover every situation.

Andre Miron concurred, and on Friday intends to discuss snow shovels, which are used for clearing off platforms.

Bill Naugle Comments:

Field reports show that snow shovels cause the majority of damage to curb ramps. Two years of experience in North Dakota and upper state New York and Minnesota, have shown that most damage to ramps have been caused by snow shovels, not by snowplows. Bill witnessed testing done by Colorado DOT who used a large blade and the damage in that testing was mostly incidental. Most people who have private property with truncated domes switch to brush attachments if they want the domes to endure. The other issue to address is the ice builds-up on the sidewalk.

d) Water Absorption, Section 12:

Andre Miron reported that at the last meeting, the 7-day test duration was questioned, and his more recent research has found that 7-days is usually a sufficient time period to absorb water adequately. A 7-day test duration is standard for Water Absorption Tests. For polymers and other materials, 7-days allows enough time to absorb all the water that it is likely to be absorbed in that time frame. So there is no point in leaving it longer, if only checking for absorption. Usually a week in 70ºC is sufficient time for the material to absorb all the material that it is likely absorb.

Jeff Barnes pointed out that the test values in Table 7.1 should be readdressed, in terms of the pass/failure criteria for this test. The table currently specifies 10 percent increase in mass as a result of water absorption, or a 10 percent change in any dimension. Staying within our 90 percent criteria, we should probably change the 10 percent value to ½ of a percent change or less, because this value would still be a significant amount. Therefore, we will need to refine this value later.

e) Ball Pressure, Section 13:

Andre Miron reported that the Ball Pressure Test had been added to address elevated temperatures and their effects on materials. As noted earlier, UL hasn't reviewed adhesives yet, because only limited information as arrived for adhesives, and from the information received so far, none of those adhesives would appear to have a problem with elevated temperatures. That in concert with the fact that there are other exposures that are occurring where the adhesives are being exposed to higher temperatures that the differences in thermal expansion, will be observed in those situations. It hasn't yet been determined that an elevated temperature condition is needed. However, UL was concerned because someone at our previous meeting mentioned that PVC and other materials when exposed to higher temperatures, would soften up, flatten or otherwise change. In plastic test categories, UL has used the Ball Pressure Test (IEC test) that tests for the softening of materials. There are three softening tests that are typically done:

1) Vicat softening, is when a needle is pressed into material in a oil bath, heated up, and the temperature recorded when the needle goes in;
2) Heat deflection temperature is where a bar of the sample is taken and held at one end, and heated up to check at what temperature does the sample deflect to an angle.
3) The Ball Pressure Test uses a small ball with applied pressure on at test specimen, which is place in an oven.

The first two tests did not appear to be the best choices for this application, since the needle, if placed on rubberized material, might sink in immediately, and might not provide a good indication if softened or not. The heat deflection, if of a flexible material, may also not provide a good read if softened. However with the Ball Pressure Test, a small metal ball, with a 20-eutron weight is placed on the test sample, and inserted into an oven. The oven is heated for a specified time, and the ball removed to examine the indention made by the ball

onto the material. If the indentation is greater than a certain diameter, than it means that the material is considered a failure at that given temperature. If the indentation is below that value, usually 2 mm value, the material is considered to have passed the test at that temperature. Andre used a study performed by the Dept. of Civil and Architectural Engineering, at the University of Wyoming, who conducted a research study basically assessing the temperature fluctuation of asphalt pavements due to thermal environmental conditions. Andre reported that the highest temperatures recorded were from Phoenix, with pavement temperatures of up to 67ºC, or 153ºF. Typically the Ball Pressure Test is usually done at 75ºC (167ºF), which provides a cushion of 8 degrees. Andre Miron reported that the Ball Pressure Test would be tested at 75ºC, using standard IEC 695-10-2. This test would be conducted only on polymeric materials, and is not needed for concrete materials.

Minh Nguyen questioned how a small 2-mm diameter ball could represent a person.

Andre Miron replied that the ball is concentrated, and has pressure applied to it. The test is to determine if the material softened to permit sinking by ball, and should not have an impression on the material of more that 2 mm. The measurement is taken after the test specimen has cooled.

There were no further comments on the Ball Pressure Test from manufacturers or public representatives.

15. Confirmation (Andre Miron/UL)

Discussion of Confirmation, Topic 15, was postponed until Friday, April 29, 2005.

16. First Day Meeting Evaluation (Jeff Barnes/UL)

Gene Lozano described the day's meeting as very productive. Gene requested that DSA provide a copy of the DSA bulletin on inline patterns that Aaron Noble mentioned was available on the Internet. The committee can use this bulletin on Friday, during the discussion on confirmation.

17. Adjourn

Jeff Barnes adjourns the meeting at 5:00 pm.