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

**Division of the State Architect**
**Underwriters Laboratories Inc.**

**Minutes of Public Meeting**
**Wednesday, November 10, 2004**

1102 Q Street, 3rd Floor Conference Rooms
Sacramento, California

**Committee Members Present**
Victoria Burns
H. David Cordova
Doug Hensel
Jeff Holm
Arfaraz Khambatta
Eugene (Gene) Lozano, Jr.
Michael Paravagna
Paula Anne Reyes-Garcia
Richard Skaff (Teleconference)
Tom Whisler

**Committee Members Absent**
Minh Nguyen
John Paul Scott
Jane R. Vogel

**DSA Staff Present**
Karen Hodgkins
Aaron Noble
Derek M. Shaw
Linda Huber

**UL Staff Present**
Jeffrey Barnes
Billie Louise Bentzen (Consultant: Accessible Design for the Blind)
Michelle Courier
Esther Espinoza

**Others Present**
Hector Barvan, City of Sacramento
Carol Bradley, City of Sacramento
Pete Guisasola, City of Rocklin
Mark Heimlich, Armor-Tile
Norm Klapper, Transit-Tile, Inc.
Russ Klug, ADA Concrete Domes
Jeff Koenig, Detectable Warning Systems, Inc.
Jorgen Nielsen, Interlock San Diego
Lars Nielsen, Interlock San Diego
Pam Porteus-Hunt, SILC
Mike Simas, California Brick
Duane Sippola, MetaDome, LLC
Mike Stenko, Transpo Ind.
Chip Van Abel, Naviplate
Ed Vodegel, Flint Trading, Inc.
Michael Whipple, ADA Resource Associates
Jon Julnes, Vanguard ADA Systems Of America

***General*** *– A meeting of the Evaluation of the Detectable Warnings/Directional Surfaces Advisory Committee (EDWAC) was held on November 10, 2004 at the California Community Colleges Building in Sacramento, California. The purpose of the meeting was to introduce and discuss known technologies, testing programs, and to discuss other issues related to the evaluation of detectable warnings and directional surfaces.*

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

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

Jeffrey Barnes called the meeting to order at 10:00 a.m.

**2. Scope of EDWAC (Derek Shaw/DSA)**

Derek Shaw briefly outlined the scope of the EDWAC by making note of the following.

1) California Assembly Bill No. 685, Section 4460 directs the Division of the State Architect (DSA) to create an independent entity evaluation and certification program for detectable warnings and directional surfaces. The Evaluation of Detectable Warning/Directional Surfaces Advisory Committee (EDWAC) was formed to propose durability and degradation testing standards. Underwriters Laboratories Inc., who has been contracted to provide technical expertise and facilitate the efforts of the committee. See Exhibit A, from the Exhibits for EDWAC 11/10/04 Meeting document, for detailed information concerning the scope of this project.

2) There are currently various types of detectable warnings with differences in shapes, size, and colors.

3) The California code definition of detectable warning products is described as a standardized surface or feature built into or applied to a walking surface or other elements to warn the visually impaired persons of hazards in the path of travel.

4) Directional surfaces are similar products to detectable warning products; although raised bars are used instead of truncated domes, to indicate pedestrian access at transit boarding platforms.

5) The California Building Code specifies that detectable warnings and directional surfaces shall be used in areas with curb ramps, hazardous vehicle areas, and at transit boarding platforms.

6) The California Building Code presently describes certain properties, such as size, spacing, alignment of surface treatment, and color (light on dark, dark on light, and federal yellow on transit boarding platforms).

7) The California Building Code does not address the specific technical requirements for durability, shape retention, color fastness, conformation, acoustic quality, resilience, and attachment.

8) The purpose of the EDWAC is to provide definition and set standards to address the issues noted in item 7 above. The EDWAC has been formed to address durability and degradation testing standards only. Other issues currently addressed in the California Building Code, such as required locations, size, spacing, alignment and colors, are not the responsibility of the EDWAC.

9) The EDWAC members are to provide individual input, and collectively accept and analyze existing research, technical data, and public input. The committee will develop and propose testing standards for detectable warnings/directional surfaces, that address durability, shape retention, color fastness, conformity, acoustic quality, resilience, and attachment.

10) The EDWAC will meet 4 – 6 times, within the next ten months, and will periodically issue draft recommendations for public and industry comment.

11) The goal of the EDWAC will be to issue a final report of recommendations to be used by the DSA as they develop a standardized testing method for the evaluation of detectable warnings and directional surfaces.

**3. Roles and Responsibilities of EDWAC Members (Jeffrey Barnes/UL)**

Jeffrey Barnes discussed the roles and responsibilities of the EDWAC, which would include reviewing and analyzing public input, and attendance and participation in all EDWAC meetings. EDWAC members will also assist in drafting recommendations, address submitted comments, and conduct other duties as described below.

1) Participation during meetings, and between meetings. Participation shall include input and work provided outside of meetings, and on going for the next ten months. Additional assistance may be needed to help with research and provide feedback in order to expedite the work by the committee.
2) Conflict of Interest Statement – Members should have these statements signed and returned to DSA as soon as possible.
3) Meeting Attendance – On-site meeting attendance is very important and essential to the dynamics of the meeting process, however, if necessary, teleconferencing is available if requested in advance.
4) Discussions – Should be courteous and allow individuals to speak without interruptions. Robert's Rule of Order will be used at all EDWAC meetings.
5) The meeting report will be issued within 10 business days. The meeting agenda process will be initiated soon after publication of the meeting report.

**4. EDWAC Member Introductions (Jeffrey Barnes/UL)**

EDWAC members, UL/DSA staff and other meeting participants and observers took turns introducing themselves.

**5. California Law on Detectable Warnings/Directional Surfaces (Derek Shaw/DSA)**

*Summary: California Assembly Bill No. 865 requires that all detectable warning products and directional surfaces installed after January 1, 2002, and be approved by an acceptable independent entity. See Exhibit B, from the Exhibits for EDWAC 11/10/04 Meeting document, for additional information.*

Derek Shaw provided background information that began in 1997, when the California Council for the Blind passed resolution CCBR97B-3 seeking legislation that would require detectable warnings and tactile signage products used in California, to be certified by an independent entity. The purpose of the resolution was to develop and propose recommendations that would determine if detectable warnings/directional surfaces products were in compliance with the requirements in the Code of Regulations, Title 24. In February 1999, Assembly bill No. 685 was introduced and reviewed by various government committees. The committees noted that Title 24 establishes standards for designs in use of detectable warnings for all site developments. The Department of General Services (DGS)/Division of the State Architect (DSA), are to have jurisdiction over enforcement of requirements for detectable warning surfaces. Plan reviews and site inspections are the main mechanisms to be used to ensure compliance with the California Code of Regulations. There were also concerns that deficiencies were found after substandard products had been purchased and installed, which would also be addressed by adopting Title 24. On September 15, 1999, Governor Davis signed California Assembly Bill No. 685 into law, and added Section 4460 to the Government Code of California. Derek read the text of AB 685 to the meeting participants, which is provided in written text in Exhibit B, from the Exhibits for EDWAC 11/10/04 Meeting document, from the Exhibits for EDWAC 11/10/04 Meeting document.

David Cordova requested confirmation that the goal of the committee is to determine the evaluation process and the testing requirements, and to fairly assess new product approvals. The new product approvals for detectable warning surfaces should be maintained by DSA and eventually a list of approved products should be provided on the Internet, which would provide 24-hour access by all interested parties. A product approval list on the Internet should be available for contractors, so that the revised standards special contract provisions currently used for state highway contracts (5-year warranty) could be replaced by the product approval list.

Derek Shaw confirmed that the goal as stated by David Cordova is essentially correct, however, using the Internet, as a method of providing the approved products list to the public has not yet been specifically discussed.

Gene Lonzano pointed out that when the legislation was first introduced, the intent by legislators was similar to the procedures used by other certified products. Certified detectable warning/directional surfaces would be provided with a UL rating and/or a UL stamp or marking label that would be provided so that a public works department, or property management company representative could see a visible marking indicating that the product met testing requirements.

Derek Shaw reported that use of markings and labels and similar concerns are part of administrative policies that will be established once test procedures and protocols have been determined. The first step in this process will be establishing testing standards.

**6. Detectable Warnings/Directional Surfaces – Human Factors (Billie Louise Benson, PHD/Accessible Design for the Blind)**

Billie Louise Benson provided a general overview of many of the human factors researched on detectable warnings in the United States. Topics presented in the overview were as follows:

1) Detectable Warnings are essentially a tactile stop line, providing information to pedestrians who are blind or visually impaired about the location of the edge of the street, platform edge, or boundary between pedestrian and hazardous vehicular way.
2) Some research has been done on the need for detectable warnings for curb ramps, and soon ended, although research continued for transit platforms.
3) 1992 research showed that blind participants walked into the street 48% of trials when they approached a curb ramp of 1 to 12 and less. When there were vehicles on the streets, participants were not as likely to step into the street. However, of those who stepped into the street, 50% of the participants faced vehicles that were either moving or idling. In addition, pedestrians who are blind are more likely to veer out of the crosswalk when curb ramps were at the apex. The results also demonstrated that pedestrians with mobility impairments did experience minor decrease of negotiation. The majority of participants with mobility impairment found the ramps with truncated domes to be safer, less slippery, more stable, and required less effort to negotiate, than concrete ramps.
4) Detectable warning products should be detectable by most persons, most of the time. It is important that detectable warning products be detectable by a long cane, and under foot. A minority of individuals, who are legally blind, may use a long cane, dog guides, and or have low vision issues.

5) Many surfaces have been tested since 1979, to determine the best detectable surfaces, with various textures and resiliences.

6) After testing many types of surfaces, tests showed that 90% of participants, who were totally blind, detected and stopped within 24 inches on surfaces with truncated domes. Truncated domes were found to be the most reliable surface available, and have been used worldwide for many years.

7) Examples of detectable surfaces that were not detectable by “most people” “most ” of the time included grooves in concrete in various widths, lengths, and spaces.

8) Sound on Cane Contact – Tests were done in Sacramento using canes on four different truncated dome surfaces, and found that those products with the most different surfaces subjected to sound on cane contact, were the most detectable. Differences appeared to be related to types of material used, and method of installation. Detectable warning materials with a slight gap between the warning surface and the substrate were the most detectable using objective and subjective measures.

9) Color testing – Hues have been determined to be more important than the actual color. Safety yellow detectable warning surfaces have been found to be more detectable than other colors with higher contrast levels. Some visual test research demonstrated that yellow or yellow-orange were preferred over black warning surfaces.

10) Truncated Dome Surface Testing – There are many types of truncated dome surfaces, because the federal specifications in the ADA guidelines, does not have specific requirements for truncated domes. Numerous truncated domes were tested in 1992 since designs consisted of various combinations of materials, spacings, dome dimensions, etc. Thirteen surface representative samples were tested, using various test procedures, mainly using a long cane. The detection rate was found to

be greater than 95% on all but one warning surface. Most domes were primarily cylindrical, at different heights. Small differences in resiliency parallel vs. diagonal spacings between domes and pavers or adjoining tiles and other minor differences did not significantly affect detectability. One factor that did decrease detectability was if the surrounding field of the detectable warning was a coarse aggregate. Truncated domes were determined to be the most reliable detectable warning surface; so additional testing on this type of construction was conducted. Testing continued, using persons with visual and mobility impairments, and the general public without visual and mobility impairments. Subjective results illustrated that many blind participants indicated that the warnings were very helpful. During objective testing, a higher proportion of unsuccessful crossings occurred where there were no detectable warnings, then where there were detectable warnings.

11) Ramp Testing – Persons with mobility impairments (wheelchairs, crutches, canes, walkers, scooters) who tested 9 different ramps with truncated domes, where found to have minimal increased effort in slipping, loss of stability, wheel/tip entrapment, when compared to brushed concrete. The two groups of participants most affected included the individuals who traveled with a lightweight manual chair w/ small wheels, and a group who used walkers with wheels. Both groups experienced minor vibrations, and decreased directionality. Research indicated that only a 24-inch surface of truncated domes was needed at the bottom of the ramp.

12) General test observations included the following:

a) Most test participants felt safer, more stable, better traction, on ramps with truncated domes, than on cement ramps.

b) Domes with the largest walking surfaces were the most stable.

c) Research showed that curb ramps should be set back from edges by a few inches, allowing individuals using the ramps more distance from the street, and moving vehicles.

d) There were no significant complaints from the general public who had full or partial mobility of movement. Also no significant problems with those pushing shopping carts, large gurneys, and baby strollers.

e) The ANSI A 117.1 2003 standard has different specifications for detectable warning textures than in previous requirements. These specifications are similar to the new ADA/ABA standard, which has not yet been adopted by the Department of Transportation and by the Department of Justice. The ANSI standard notes that detectable warnings shall contrast visually with adjacent surfaces either light on dark, or dark on light. For interior locations, detectable warning surfaces shall differ from adjoining walking surfaces in resiliency or by sound on cane contact. Truncated domes are to have a base diameter of 0.9 inches minimum to 1.4 inches maximum, and a top diameter of 50 percent minimum to 60 percent maximum of the base diameter. These measurements demonstrate that domes are to be tapered, and not cylinder-shaped. Truncated domes are to have a height of 0.2 inches, and center-to-center spacing of 1.6 inches minimum, and 2.4 inches maximum, and a base-to-base spacing of 0.65 inches minimum measured between the most adjacent domes on the grid.

Richard Skaff questioned whether the domes themselves increase the angle of the slope for individuals using wheelchairs, therefore causing difficulties in using ramps. If this is a potential problem, should the EDWAC consider spacing the domes further apart, to allow the wheelchair sufficient space between the domes for uninterrupted movement?

Billie Benson noted that previous testing on ramps was conducted using 1 and 12 angles, and those resulted in only minimal increased effort to use the ramps. Tests with in-line pattern domes, with wider spaces, were incidentally conducted once on a sample, with no definitive results.

Richard Skaff pointed out that a 24-inch surface panel provides a reasonable level of warning for blind and low vision pedestrians. A 24-inch panel did not provide that much more of a barrier because of the domes, or the possibly that the wheels on the wheelchairs wouldn't match the space between the domes. It also wouldn't provide that much more of an additional barrier to a wheel chair, using low-level quad or a manual chair with quad pegs. The EDWAC might eventually consider suggesting that the DSA consider researching the width issue between truncated domes. There isn't a clear definition of whether dome sizes, the space between domes, and the size of the panels (ie. 24 inches, 36 inches, etc.) are as effective, or as important as other issues such as color fastness, length and life of the material.

Gene Lonzano stated that a minimum 24-inch surface is a federal requirement, and questioned whether a spacings issue is part of the scope of the EDWAC, and clarification of this is needed before discussing this issue any further.

Jeff Barnes reported that the scope of the committee is geared toward durability and test standards for the detectable warnings (performance), and the longevity in the field. If there was consensus among the committee, a recommendation to address this could be submitted to DSA, but this should be discussed again at a later meeting. The committee may consider proposing further research as a future proposal to the DSA.

Richard Skaff requested that the committee later consider recommending this issue to the DSA so that they may considering funding for this type of research.

Jeff Barnes will table this suggestion to a meeting early next year after the proposed first draft has been developed, and after the test standards have been identified.

The committee discussed clarifying the definition of detectable warning surfaces, to consist of truncated domes, which includes the field area between the domes.

Gene Lozano submits a definition for detectable warning surfaces. Gene makes a motion to adopt this definition, which is seconded by Victoria Burns, and refined further by the committee to state the following:

> **Motion: Detectable Warning Surfaces are defined as detectable warning surfaces to consist of truncated domes and the field surface between and surrounding the truncated domes.**

Voting delayed until later, to allow time for Derek Shaw to collect information from the building code that might be related to this definition.

Providing a definition at this time is important for several reasons. For example, when requiring color on transit boarding platforms in California, vehicular ways, and as specified in Chapter 11 A, HCD's detectable warning surface is required to use the color safety yellow. Some interpret that to mean that only the truncated domes (not the surrounding areas) should be painted yellow, and others may interpret requirements to mean that the domes and the surrounding areas should all contain safety yellow. When the surface is required to contrast the adjoining area, than it is important to determine

which areas are defined as detectable warning surfaces. A straw vote was taken with 9 voting yes, and 1 voting no. A final vote will be taken at the next meeting, after receipt of industry and public comment.

Floor Discussion: David Cordova disagrees with the motion, noting that a definition is unnecessary, since the Federal ADAAG describes the geometry that describes the detectable surfaces. This geometry includes the field area between the domes; therefore further definition is not necessary, and causes an extra layer of bureaucracy.

Other committee member's supported clarifying this definition, which will provide a common definition for this committee to work with, and will assist in establishing testing procedures. It was also noted by an industry member that the Department of Justice defines detectable warning surfaces as the entire field of truncated domes and surrounding areas.

David Cordova expressed concern that manufacturers of detectable warning surfaces may encounter difficulties in installation, if detectable warning surfaces include both domes and the area between domes. Instructions to cut a detectable warning surface, if defined as proposed, may result in cutting the panels either across the truncated domes, or in the spaces between the domes, resulting in overall confusion.

Derek Shaw volunteered to research the definition of the detectable warnings, and how it relates to truncated domes and the area around them. Derek will provide this information in the afternoon.

An industry member noted that manufacturers are capable of cutting domes carefully, maybe at an angle, or can allow sufficient space between domes to permit cutting, which would address the concerns addressed by D. Cordova.

Jeff Barnes reviewed meeting policy, and explained the expectations for participants. First of all, a quorum is to be established, in which a minimum of 9 of the 13 EDWAC committee members must be present in order to hold a meeting. In terms of voting, a simple majority of votes is all that is needed to proceed or address issues. (Note - During the meeting, it was mistakenly noted that the committee was comprised of 12 members).

**7. Detectable Warnings/Directional Surfaces – Overview of Existing Technologies (Michelle Courier/UL)**

Michelle Courier provided an overview of existing technologies, offering general information on known technologies, materials, and installation methods of dimensional pavers, thin tiles, and sheets and on site-applications type products. A written copy of this presentation is available in Exhibit C, from the Exhibits for EDWAC 11/10/04 Meeting document.

Several committee members mentioned that some pavers are made of aluminum or of galvanized metal, adhered typically by anchor bolts, cast in place or retrofitted.

Jeff Barnes confirmed that this information would be recorded, and added to the collected information for known technologies. Jeff reminded meeting participants that it is important to be aware of available technologies when considering test standards.

This information can be used to plan the types of testing needed to evaluate specific characteristics of these materials, which may require different test methods for the different types of materials.

A committee member recommends correlating this information with the three methods specified by Title 24 for detectable warning surfaces. These methods are a) Cast in Place, b) Stamped, c) or Prefabricated Surface Treatments, as mentioned in Title 24.

Derek notes that according to the California Building Code, domes may be constructed by various methods, which is not restrictive to only a) Cast in Place, b) Stamped, or c) Prefabricated Surface.

Gene proposed providing a definition for directional surfaces. The committee discussed this, and Gene Lozano made a motion to adopt the following worded definition:

> **Motion: Directional Surfaces are defined as directional surfaces to consist of raised bars and the field surface between and surrounding the raised bars.**

Paul Reyes-Garcia seconded this motion. Voting delayed until later, to allow time for Derek Shaw to collect information from the building code that might be related to this definition.

**8. Durability of Detectable Warnings/Directional Surfaces – Accelerated Aging (Michelle Courier/UL)**

Michelle Courier provided general information on accelerated aging of detectable warning and directional surface products. Michelle reported four types of accelerated aging tests methods. Tests using these test methods are conducted on both conditioned

and unconditioned samples. Subjecting product samples to extreme conditions in climate-controlled environment speeds up the natural aging process, so that the samples can be evaluated to determine if key performance criteria have or have not been affected. Accelerated aging artificially ages a product so that future performance of the material can be predicted, after exposure over a designated period of time. The results of a tested sample are compared to an untested sample, to determine if there is evidence of significant degradation. Section 4451, defines a product with no "significant degradation," as a product that maintains at least 90 percent of its approved design characteristics for over five years. The written text of this presentation is available in Exhibit D, from the Exhibits for EDWAC 11/10/04 Meeting document.

Jeff Barnes proposed that the committee consider conducting either field-testing, or small scale sample testing. Each test should be reviewed to determine if small-scale (representative testing) or in-place (large scale) testing should be conducted for each test.

A committee member (David Cordova) proposed conducting a UV test on plastics, using an ASTM standard, with approximately 3000 hours of testing. This test would determine if the plastic sample fades over time. The standard number and title will be provided to the committee to consider adopting as part of the test standards for detectable warning/directional surface products.

Jeff Barnes confirms that all tests presented today are identified in several standards, and are provided to generate discussions for future meetings. It's possible that some of these tests may need to be modified specifically for detectable warning/directional surfaces, or there may be tests recommended today by committee members that should

be also considered and discussed at future meetings. Test input from the committee, manufacturers, and public are being sought for discussion, if applicable.

Paula Reyes-Garcia recommends a test that would address the extremely hot repetitive weather conditions in certain areas in California.

Michelle Courier agrees that testing for extreme temperatures can be addressed by conducting accelerated aging tests using ovens. Michelle will also identify other tests for heat/cold, or freeze/thaw, which will represent desert type weather conditions with extreme hot/cold weather. These suggestions will be submitted to the committee for discussion at the next meeting. Whenever possible, Michelle will identify the materials used for each of the tests presented at today's meeting.

Several manufacturers had previously offered to provide test data on current materials being tested at their facilities. The EDWAC will collect this information; analyze this test data at future meetings. Jeff Barnes made a formal request that manufacturers provide this information for as many different types of materials as possible for the EDWAC to review.

**9. Shape (Michelle Courier/UL)**

Michelle Courier provided information on several tests conducted on products to determine if the original shape had been maintained. A definition of "Shape" was proposed for discussion. In addition, various test methods (Abrasion Resistance, Impact Resistance, Water Absorption and the Compressive Strength Test) were presented to the committee for their consideration. It should be noted that the written

text of this presentation is available in Exhibit E, from the Exhibits for EDWAC 11/10/04 Meeting document.

Michael Parvagna questioned if the Abrasion Resistance, Impact Resistance, Water Absorption or the Compressive Strength Tests addressed damage caused by snow removal or brush wheels, which are used in colder climates?

Michelle Courier notes that neither the abrasion resistance test nor other tests appear to address this type of wear. The committee should consider conducting further research, and may need to development a specific test that addresses this situation.

An industry member noted that there is no ASTM standard to replicate cold weather conditions. His company that applies pressure at a 45-degree angle to replicate cold weather-wear created a test fixture. His company has developed a test that utilizes a test fixture, which applies pressure at a 45-degree angle over domes, which represents the common wear of winter snow clearing equipment. Jeff Barnes requested that the industry member provide additional test information in written form, so that it can be discussed during a future EDWAC meeting.

The committee reviewed the current definition of shape, as provided in Exhibit E, from the Exhibits for EDWAC 11/10/04 Meeting document. After further discussion, the EDWAC amended the definition for “shape” to the following:

**Ability of the detectable warning/directional surface material, and in particular the surface features (truncated domes and raised bars) of the**

**material, to retain its original shape when subjected to varying degrees of temperature, moisture, pressure, or other stress**.

A motion was made to adopt this definition by, Gene Lozano, and seconded by Victoria Burns.

Straw Vote Results: 10 yes votes, 0 no votes.

After a detailed discussion among committee members, the EDWAC agreed that rough areas on the domes, textures, and micro-dots providing a non-slip resistance feature, should be subjected to the 90 percent degradation rule, as dictated by state law. Non-slip features in particular, are required on all accessible walking surfaces, as covered in a separate code provision in Title 24, and should be part of the evaluation for shape, although it isn't currently part of the project's scope. This slip resistance issue should be discussed later, and if necessary, information should be gathered for future meeting discussions. Individuals are encouraged to submit research and other information available on this topic to the committee.

Derek provided a California state code definition of detectable warning devices from Section 1127B .5, item 8, that notes detectable warnings shall consist of raised truncated domes, with specific dimensions. No reference is made to the space between domes, or around the domes. However, typically, based on several code references, the entire area is considered to be detectable warnings, which includes the domes and areas around the domes. David Cordova observed that the code does describe the geometry, and illustrates a figure that is inclusive of all discussed features.

A straw vote was taken on accepting the definition of detectable warning surfaces. Note: As noted earlier, the motion was made by Gene Lozano, seconded by Victoria Burns.

Straw Vote Results: 9 yes votes, 1 no vote.

The fundamental process of committee voting was questioned, on whether it is appropriate or practical to vote on motions before public comments have been collected and addressed. The committee can revote or delay final voting until after the public comment period has been completed. The DSA will conduct research on this issue, and provide further guidance at the next meeting. A recommendation was made for now that the committee record it's position at the time of this meeting, vote, post the information for public comments, and conduct a final vote after considering any submitted comments and/or after further discussions at the next meeting. A motion was made to adopt this recommendation for now by Paula Reyes-Garcia, seconded by Jeff Barnes. This issue will be readdressed at the next meeting.

Straw Vote Results: 9 yes votes, 1 no votes

The committee voted on the definition of directional surfaces. Note: As noted earlier, the original motion was made by Gene Lozano, seconded by Paula Reyes-Garcia.

Straw Vote Results: 9 yes votes, 1 abstain

**10. Resilience (Michelle Courier/UL)**

Michelle made a presentation on resilience. Resilience was defined as the ability of the material to absorb energy when deformed elastically without creating a permanent deformation. This definition of "resilience" was proposed for discussion. Both the

Flexural Strength, and the Tensile Strength or Ultimate Tensile Strength (UTS) test methods were proposed for consideration by the EDWAC. The written text of this presentation is provided in Exhibit F, from the Exhibits for EDWAC 11/10/04 Meeting document.

Beezy Benson makes note that this test may be relevant to previous testing conducted by the Access Board. The test measured resilience, by measuring the amount of bounce back from the long cane, which is usable mainly for dome testing. Although long cane access can be used on both dome and flat surfaces.

Gene Lozano notes that contrast of surfaces, if there is any, attracts attention. If you wear thick-soled shoes, the effect of this attention is decreased. There are several standards that have established resilience values, and that maintains stability. Some surface flexibility without affecting stability is desired.

Jeff Barnes notes that a California code does provide guidelines. However, how should the EDWAC define resilience?

Beezy Benson states that defining resilience is a very difficult and complex problem. A ratio may be needed since surrounding surface material is often unknown.

Paula Garcia notes that there different interpretations possible, and we should assume that there is no large degradation of sound from the sound of surrounding material within a 5-year period.

Gene Lozano has offered to conduct research, and provide a definition for review at the next scheduled meeting.

Jeff Barnes reminds committee members that recommending resilience levels may not be part of the scope of this project. An issue with the EDWAC is that there should be a difference or tactile difference between the detectable warning, and the surrounding area. It is important to consider what resilience means in relation to the durability and testing of detectable warnings. Additional research information is needed in order to hold future discussions on this issue.

Jeff Barnes provided an update on the committee voting process, based on information provided during the afternoon break from DSA staff. The motion process should be to conduct a final vote on motions after the public comment stage has been completed. The committee will handle this process today by recording the vote of the two voted motions. The two definitions that are being proposed will be added to the meeting agenda for the next meeting, under agenda action items. Final voting will be done at the next meeting.

**11. Attachment/Securement (Michelle Courier/UL)**

Michelle presented information on attachment/securement and provided a definition of "attachment' and two test methods for bond strength testing which were submitted to the committee for review and comment. The written text of the presentation is available in Exhibit G, from the Exhibits for EDWAC 11/10/04 Meeting document. Michelle notes that the applicable ASTM standard referenced in Exhibit G is incorrect. The standard number of ASTM C 1026 should be revised to ASTM C1583.

**12. Discussion – Future EDWAC Meetings (Jeffrey Barnes/UL)**

Topic: Discussed nominations for EDWAC Chairperson, and vice-chairperson. In addition, discussed location, format and dates of future meetings.

The committee nominated Jeff Barnes to be the EDWAC Chairperson, and Paula Reyes-Garcia was selected as Vice-Chairperson. All voted in favor of these nominations (10 yes votes, 0 no votes).

Jeff Barnes informed the committee that both UL and DSA do not have official EDWAC votes.

Several committee members requested that if possible, hotel rates with reduced rates should be provided. DSA staff will investigate the possibility of getting reduced hotel rates for committee members.

EDWAC meetings are scheduled to occur every other month, with the following timelines for 2-day meetings.

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

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

Tentative Meeting Schedule:

January 13 and 14, 2005 (2-day meeting)

March 10 and 11, 2005 (2-day meeting)

May 19 and 20, 2005 (2-day meeting)

July – December 2005 Meetings (1- or 2-day meetings): These dates to be determined at future meetings.

**13. Acoustic Quality (Michelle Courier/UL)**

Michelle provided a definition of “Acoustic Quality” and described a test method that subjected a test sample, using a standard impact device in an acoustical chamber. The presentation on acoustic quality is available in written form, in Exhibit H, from the Exhibits for EDWAC 11/10/04 Meeting document. Michelle recommended that the committee discuss whether the intent of acoustic quality is the difference in sound characteristics between the substrate material that the detectable warning/directional surface system connects to, and the directional detectable warning material itself. The sound acoustics are to be measured using decibels, and by recording the physical waveform, to identify the acoustical quality of the material. The waveform is a repeatable sound, which can be used for comparison 5 years after testing. This comparison can be used to determine if there has been a change in the characteristics of the sample that has caused a different acoustical quality.

Gene Lozano recommends that the product be tested in the field, since this would truly reflect the surrounding acoustic quality. Need to verify that there is contrast between adjacent materials. Gene suggested that committee members consider a brief field trip at next meeting, to a nearby transit station to view samples of acoustical quality. The intent is to review the sound difference when the sample is imbedded in a surface in the field, and adjacent to the surrounding surfaces.

Derek Shaw stated that on the issue of resilience and of acoustic quality, the California Building Code does not address acoustics or resilience at the curb ramps, but is covered in other areas (i.e. transit platforms, hazardous vehicular ways, etc). Gene

Lozano suggested that the intent behind the legislation was that products are required to meet resilience or acoustic qualities, not both.

Jeff Barnes restated that the scope of the committee is to establish durability and test standards for the detectable warnings/direction surfaces to ensure longevity in the field. Since the acoustical properties of adjacent materials is unknown and will vary from installation to installation, Jeff suggested that the committee focus on the ability of the detectable warning/directional surface maintain its original acoustical properties of the life of the product. The committee may also wish to propose establishing a baseline acoustical quality (frequency/decibel) of the product.

David Cordova suggests for the purpose of establishing a consistent and uniform test requirement, David proposed that any testing be conducted with the product installed with the adjacent surface constructed of concrete material.

Michelle Courier notes that there is no standard that identifies sound differences. For example, is the difference one decibel, two, or more? Should consider whether sound on cane can be tested using a plastic tip instead of a metal tip.

Jeff Barnes suggests that in terms of judging performances of acoustic performance with resistance to aging, a recommendation could be made that the acoustical difference in the field can be measured against its surrounding substrate. If it is established at the point of installation, that there is sufficient acoustic difference between the substrate and the detectable warning, we can safely assume that the acoustical difference will remain the same through the life of the product through the

use of a detectable warning/directional surface that has been evaluated to an established test protocol for acoustic durability.

Jeff Barnes points out that the EDWAC may need to provide feedback to DSA on establishing an acceptable acoustical level in the field and the EDWAC needs to consider how that is to be determined. The committee needs to address the durability of maintaining that acoustical level. Other issues to consider, is the loudness of the acoustical properties.

Jeff Barnes notes that the committee is requesting DSA guidance on whether it is appropriate for the EDWAC to establish a proposed acoustical nature of the initial sound of the product, although for now the committee will work on determining the durability of that sound.

Aaron Noble notes that the California Code contains many built in contradictions, and proposes that the committee consider reviewing some of these contradictions, and later recommend code changes to the DSA. For example, resilience and sound on cane requirements are required for curb ramps, however most of the time ramps occur in concrete area, and establishing resiliency in stamped concrete would as described in the code is difficult.

**14. Color Fastness (Michelle Courier/UL)**

Michelle provided a definition of “Color Fastness”, and described a color fastness test method using a colorimeter to determine the differences in color between a reference and the test sample. Written text for this presentation is provided in Exhibit I, from the Exhibits for EDWAC 11/10/04 Meeting document.

Beezy Benson requests clarification of the California Code in relation to color. To retain its original hue, should the EDWAC consider only one hue, and is that only safety yellow?

Derek Shaw explains that different parts of the code require only one color, for example federal yellow (safety yellow). Curb ramps have no color requirement except to state that light on dark, or dark on light contrast is required. All transit-boarding platforms use federal color No. 33538, which is required for both for detectable warning and directional surfaces. Federal yellow is also required for hazardous vehicular areas.

Arfaraz questioned whether the color federal yellow in some cases might not contrast less than 70 percent when adjacent to concrete, and would this be a violation of the federal code requirements.

Gene responded by noting that a black stripe with a 1-inch ban can be added to the yellow to increase contrast.

Doug Hensel volunteered to conduct more research on this, to confirm specific requirements.

Arfaraz offers a follow-up question, by asking if the black 1-inch bar is part of the product, and is it subject to product testing?

A committee member made the observation that it is usually part of the detectable warning product. A test criterion in this case needs to be reviewed to determine if testing is needed.

Beezy explained that the federal requirement is to have light on dark, and dark on light, and an appendix addresses the contrast ratio. Previous research shows that safety yellow is very visible, even if the contrast is as low as 40 percent. The Federal highway organization is currently conducting color contrast research in regards to detectable warnings. Research is also being done on the contrasting black stripe. Beezy will provide a status update of this project at future meetings.

Jeff Barnes notes that the committee needs to look at establishing a performance method to determine if a detectable warning product retains its color through the life of the product. A secondary discussion may be needed to discuss the actual color in terms of a recommendation to the DSA for possible adoption, if the committee is in agreement with this plan.

Aaron Noble stated that the color issue has created problems. Codes are confusing when it specifies that the product can be dark on light or light on dark, and then specifies that the color yellow shall be used. Aaron recommends that the code be clarified and revised. The EDWAC should consider reviewing some of these codes, and making recommendations to change the codes when appropriate.

**15. Confirmation (Michelle Courier/UL)**

Michelle Courier stated that this test requirement is unclear. The intent of confirmation may be to insure that the user knows that the detectable warning products are reliable,

and available when needed. That means that there is no single test program available to determine this. It is possible to use the development of the other planned tests to demonstrate that the detectable warning/directional surface has been confirmed and/or conformed. These terms are confusing because they are used interchangeably through out the standard. And it's possible that one of the words has become a typo that has been used repeatedly for years.

Jeff Barnes (with additional recommendations from the committee) states that a definition for conformation should be defined as:

**Verification that the detectable warning/directional surface meets dimensional specifications of the truncated domes and raised bars as specified in the codes.**

The motion was made by Jeff Barnes and seconded by the committee. This definition will be added to the next meeting agenda for discussion and to solicit input from the public.

Vote Results:10 yes, 0 no votes.

Karen Hodgkins requested confirmation on the roster information to be exchanged among committee members. After some discussion, the committee members agreed to exchange a roster containing only committee names, company names, and e-mail addresses, among the other members. Industry members agreed to have their names appear in the meeting minutes, if they used the sign-in list.

Vote Results: 10 yes, 0 No votes

**16. Manufacturer/Public Comment (Jeffrey Barnes/UL)**

Norm Kapper Comments:

a) Requested additional information on fees assessed to manufacturers, as described in Exhibit B, from the Exhibits for EDWAC 11/10/04 Meeting document, second paragraph. Need more information on how those fees would be collected or assessed.

b) Establishing standards for various materials may be difficult, and these standards will need to specifically address many differ material types. If resiliency becomes an issue or a standard that everyone must meet, than the use of concrete and porcelain material would become a problem.

c) In terms of the overall standard, Norm assumed that the committee was charged with only physical properties of products, such as resiliency. As a physical property, flexural compressive strength, tensile properties are more an engineering materials science issues, and is not sure how do they pertain to the scope of the EDWAC committee. Will surfaces constructed of concrete and tile comply with the acoustical requirements?

d) Scope – Assumed that the scope of the committee was to determine the physical properties of products, such as the durability, product longevity, and the long-term effect of weather aging and sunlight on samples. Specifically as it relates to resiliency, it is more appropriate to address these physical issues, than to address the tactile properties of samples. Norm notes however, that the committee has already addressed this issue.

e) Adhesion and bonding – There are several issues that pertain to the overall quality of the product. Substrate integrity, age of concrete, installation, physical condition of site, and the quality of installers, influence the integrity of a product.

f) There are three basic test factors. One being a coupon property, which is the

property of the material itself. Very specific tests can be provided on that material. The second test factor is the actual product, than finally the third factor is to conduct product testing in situ tests. The reason for this is that the tests results will vary, if conducted on a small or large-scale test set-up.

Jeff Barnes notes that all comments will be recorded, and addressed either at the end of this meeting time permitting, or the next meeting.

Chip Van Abel Comments: (Commends committee for working well together)

a) Advises that some of the testing on the product be conducted in concrete.

b) Regarding the attachments is not sure if both retrofit and cast in place testing will be conducted. Will both tests be conducted in most of the tests?

c) Color – Current codes are unclear, and not very appealing to developers and builders of business areas, who in most cases do not want yellow surfaces, which may not match the color scheme of the business areas. Residential areas do not appear to have a problem using safety yellow.

Russ Klug Comments:

a) Slip Resistance – Any person crossing detectable warning surfaces should be safe, so testing the product new, and after testing should be considered by the EDWAC.

b) Some domes are unsafe because they have been cut, and individuals may trip over these damaged surfaces. However, although domes are cut, they should still retain their color.

c) Do state regulations permit partial domes? Should address handling domes that pop off, and are not adhered properly.

Mark Heimlich:

a) Pleased to see all the work being placed in establishing performance specifications.
b) Important to review and rate performance of products properly, and those products should wear well.
c) Armor tile has experience in developing performance specs so that products can be rated.
d) Cut domes can be dangerous, and it should be noted that the spacing between the domes is pretty specific, and since radius curvature is not as important, then cut domes will occur. If less then 50 percent cut, then the manufacture should remove the dome to prevent tripping.
e) Color Fastness – Xenon arc testing should be seriously considered for testing these products. Some products had colors fade when tested at lest than at less than 1000 arcs.
f) Durability is important.
g) Acoustics are important to consider, and should look for long-term durability. Long cane sound testing is very effective for testing sound differences.
h) Resilience – Should review bounce back ability and durability.
i) Samples used for testing should be anonymous, so that submitted samples are not enhanced, and therefore not reflective of real samples.
j) Slip Resistance – This is important, however, depletion microdots surfaces need not be visually inspected, since it is not likely to change slip resistance extensively.
k) How are new products to be viewed? Or, should manufactures provide their own test data, based on test criteria developed by the committee?

Ed Vodegel:

His company has products that are not typical of most constructions, and is interested in learning the evaluation process to be developed by the committee. Ed supports conducting both lab and field-testing when appropriate. Recently informed that the US Access board deleted acoustic quality requirements for detectable warning products.

Jon Julnes Comments:

a) Considers field-testing to be important.
b) Will send liquid epoxy, non-skid information to Michelle for updating of available information on known technologies.
c) Abrasion Resistance – Abrasion test uses a metal wheel to abrade, and records amount abraded. Sandblasting is not a realistic test and should not be used. Domes with coatings in the middle will wear off quickly and the sandblasting will force the domes with rubber domes to bounce off, thus any material attached to concrete will fail testing.
d) It has been reported that sound on cane testing is to be discontinued by the U.S. Access Board. Federal does not require this in exterior locations, only interior areas. Advises deleting this type of testing since most states do not use this test method. Jon prefers not to use products designed to meet sound on cane testing, because of potential construction problems. For example, many times the hollow in the surfaces, collects water, causing rotting in concrete, in the domes, and other similar damages. If sound on cane testing is needed, should consider a difference as an acceptable test, or require the same-recorded differences measured in today's tested sample, and in samples tested 5 years later. Does not support a sound on cane test requiring a percentage difference of sound, because the environment is a big factor in affecting sound differences, and may cause unreliable test results.

e) Most of the country does not require sound on cane testing, so would like to suggest that California not use this test method.

f) Suggests committee develop installation guidelines, since most products are reliable, and faulty installation can be a problem. Suggests more focus be placed on installation requirements and technology.

g) California code should define slip resistance, and establish standards.

Other Industry comments:

a) Durability testing for dome attachments. Has seen no requirements for domes attached to field, to meet 5 years requirement. Should these domes be still attached after 5 years, and how will this test. For example, occasionally street sweepers will remove these domes accidentally.

b) Committee should allow enough time for manufacturers to provide input for those manufacturers not in attendance at the meetings, so that lots of valuable information can be provided by industry.

Michelle reminds industry members that they can contact committee members between meetings, if they wish to convey information for the committee to review. Specifically, information can be mailed, faxed, or e-mailed to Esther Espinoza at Underwriters Laboratories Inc. This information can be submitted as supporting documents, at future meetings.

**17. Evaluation/Suggestions of Meeting Format (Jeffrey Barnes/UL)**

Jeff Barnes discussed the general format of the meeting and requested recommendations for future meetings.

Recommendations were as follows:

a) Consider having manufacturers post questions on board during the meeting, so that information is not forgotten.

b) Have public comment input available for discussion after each topic is discussed.

c) The committee should continue to invite manufacturers to all the meetings whenever possible.

d) Should use a flip chart to be used to list and track items that are to be discussed later. This would make sure that nothing is forgotten.

e) Should continue to keep bullet items on the flip chart.

f) Use flip chart to note topics for future meetings, and track various other items on the chart.

g) Teleconferencing is disruptive. Either eliminate, or handle differently. For example, when a committee member using the teleconference system left and returned from phone contact, the meeting was delayed when he requested updates. Should not offer the updates, since this halts the entire meeting process.

h) Use digital camera & microphone for teleconferencing. Consider using wireless microphones. A microphone on a stand should be available for public input.

h) All speakers should speak up or a bit louder whenever possible, so that everyone in the room, or connected by phone, can hear.

Jeff Barnes noted that all comments would be considered and utilized whenever possible. For example, holding public input after each topic is covered will be considered for future meetings, rather that have all input collected at the end of the meeting.

**18. Adjournment (Jeffrey Barnes/UL)**

The meeting was adjourned at 5:00 p.m.