Nevada Department of Transportation
Specifications Division
Standards and Manuals Section

Position Paper for: Detectable Warnings
Last updated: 24 August, 2009.

1. General.

a. All detectable warnings must conform to the U. S. Access Board requirements, as set forth in the Americans with Disabilities Act Accessibility Guidelines (ADAAG, current version), iterated in Appendix A for convenience.

b. Products used on Nevada's right-of-way for detectable warnings must provide a service life that will not create maintenance problems and that is synchronized with our normal road maintenance schedules. While a minimum of twenty years would be costly in terms of continued maintenance, such a life cycle may be acceptable. A service life of forty years or more seems to be reasonable for this type of product and should be considered the desired minimum service life for detectable warning materials.

c. Factory products such as pavers, tiles and panels produce the most accurate and consistent detectable warnings. The importance of this is inherent in the truncated dome specification. Many systems were tested, but the truncated dome, as specified by the Access Board, provides the optimum compromise between detect-ability and safety (mainly non-tripping). Any decrease in the dome dimensions or increase to the spacing would adversely affect detect-ability; any increase in the dome dimensions or decrease to the spacing would adversely affect safety.

d. All detectable warning products must meet the following color specifications based on the Dunn-Edwards color palette:
   i. Light detectable warning on dark walkway material (asphalt): DE-6255 to DE-6256
   ii. Dark detectable warning on light walkway material (concrete): DE-5117 to DE-5118

2. Concrete

a. Concrete is an acceptably durable material; however it is susceptible to failure during impact testing. Concrete products wear in a manner that sustains a consistent friction property. The acceptable durability of concrete in walkways is well documented and provides assurance of adequate performance of concrete detectable warnings over a reasonable service life.

b. Field and laboratory testing indicates that stamped concrete fails to consistently produce truncated dome shapes on sloped surfaces due to the influence of gravity on the wet concrete.

c. Concrete pavers
   i. Concrete pavers require good construction practices and perform well when installed per manufacturer's recommendations. Using unsuitable base material and not achieving specified compaction are the most common construction practices cited as causing premature failure. Fitting rectangular pavers to curved areas is cited as a difficulty however, the margin from the back of the curb allowed by the ADAAG, along with standard industry practices for installing pavers, seems to relegate this to that of a minor problem.
   ii. Concrete pavers easily accommodate both new construction and retrofitting existing ramps.
   iii. Concrete pavers allow for easy and economical replacement of isolated damaged areas.
   iv. Concrete pavers provide a safe detectable warning surface comparable to standard concrete sidewalks through consistent conformance with specified dimensions and relatively good friction properties. However, concrete formed to the dimensions of truncated domes is inherently weak. Accordingly, a minimum of 10,000 psi concrete

should be used in the manufacture of concrete pavers to assure acceptable durability of this feature.

v. Concrete pavers are a proven, prolific material with well-defined manufacturing and installation procedures and specifications. They do not introduce new or abnormal techniques, practices or methodology to the contracting community and adequate sources have been identified.

vi. During the four years from March 2004 to March 2008 concrete pavers were used on several contracts. Recent reviews revealed that, in general, the detectable warnings became non-compliant from irregular settlement; this due likely to improper base preparation and failure to properly place the interlocking sand material. It is difficult to correct problems that are associated with poor installation and inspection practices during construction; therefore, the use of concrete pavers for detectable warnings is not allowed.

d. Concrete panels

i. Concrete panels are thin by design. They are inlaid into the concrete ramp while the concrete is in a plastic state. The strength of the panel must be adequate to support normal expansion and contraction of the concrete. A minimum of 10,000 psi concrete should be used. The panel should have a minimum thickness of ½-inch and a maximum thickness of 1-inch. Additional measures for reinforcing and strengthening the concrete panel are desirable.

ii. Panels should not be less than 12-inches nor more than 24-inches in either plan dimension (length or width). One-piece panels custom cast to fit a site may be an exception to the maximum dimension.

iii. Concrete panels easily accommodate both new construction and retrofitting existing ramps.

iv. Concrete panels allow for easy and economical replacement of isolated damaged areas.

3. Plastic (synthetic rubber, vinyl and composites)

a. Due to the nature of plastics, friction coefficient requirements are met through the application of micro texture features. These small features are subject to swift degradation due to their small size and high weight loading when being walked on or ridden over. Inconsistent friction properties between the worn tops of the truncated domes, the base area of the detectable warning and the surrounding sidewalk are undesirable. For this reason, plastic detectable warnings are not allowed.

4. Metal

a. Due to the nature of metal, discrete colors (see section 1, paragraph d) must be externally applied. Any coating used to apply the desired color is subject to degradation, fading and damage. Any breach of the coating will compromise the integrity of the remaining coating and leave the panel susceptible to corrosion, and more importantly present an inconsistent friction surface to the pedestrian. For this reason, metal detectable warnings are not allowed.

Appendix A – Required ADAAG Specifications.

a. Definition. A detectable warning is: "A standardized surface feature built in or applied to walking surfaces or other elements to warn visually impaired people of hazards on a circulation path."

b. Detectable warnings are unique and standardized features, intended to function much like a stop sign. They alert pedestrians who are visually impaired to the presence of hazards in the line of travel, indicating that they should stop and determine the nature of the hazard before proceeding further.

c. Size. Detectable warning surfaces shall extend 24 inches (610 mm) minimum in the direction of travel and the full width of the curb ramp, landing, or blended transition.

d. Location. The detectable warning shall be located so that the edge nearest the curb line is 6 inches (150 mm) minimum and 8 inches (205 mm) maximum from the curb line.

e. Domes:

   i. Dome Size. Truncated domes in a detectable warning surface shall have a base diameter of 0.9 inches (23 mm) minimum to 1.4 inches (36 mm) maximum, a top diameter of 50% of the base diameter minimum to 65% of the base diameter maximum, and a height of 0.2 inches (5 mm).

   ii. Dome Spacing. Truncated domes in a detectable warning surface shall have a center-to-center spacing of 1.6 inches (41 mm) minimum and 2.4 inches (61 mm) maximum, and a base-to-base spacing of 0.65 inches (17 mm) minimum, measured between the most adjacent domes on square grid.

   iii. Alignment. Domes shall be aligned on a square grid in the predominant direction of travel to permit wheels to roll between domes.

f. Visual Contrast. Detectable warning surfaces shall contrast visually with adjacent walking surfaces: either light on dark or dark on light. There shall be a minimum of 70 percent contrast in light reflectance between the detectable warning and an adjoining surface, or the detectable warning shall be "safety yellow". The material used to provide visual contrast shall be an integral part of the detectable warning surface. Joint filler material, if required, must closely match the color of the pavers.
   i. Products tested by ASTM D2244 under 3.e above (20- & 40-year equivalents) must comply with 4.f.
   ii. Contrast in percent is determined by: Contrast = [(B1 – B2)/B1] x 100 where B1 = light reflectance value (LRV) of the lighter area and B2 = light reflectance value (LRV) of the darker area. Both white and black are never absolute: thus B1 never equals 100 and B2 is always greater than 0.