



U.S. Department
of Transportation

Federal Highway
Administration

Memorandum

Subject: **INFORMATION:** ADAAG Detectable Warnings
(Truncated Domes)

Date: May 6, 2002

From: Dwight A. Horne *Dwight A. Horne*
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Reply to
Attn. of: HIPA-20

To: Resource Center Managers
Division Administrators
Federal Lands Highway Division Engineers

Recently a number of questions have been raised by people from various agencies concerning the use of detectable warnings, specifically truncated domes, when constructing or altering curb ramps. Truncated domes are the standard design requirement for detectable warnings for determining the boundary between the sidewalk and street by people with visual disabilities.

The Department of Justice (DOJ) is the lead agency that oversees the Americans with Disabilities Act (ADA)(1990). The U.S. Access Board develops the minimum design standards for complying with the ADA. The Department of Transportation is a designated agency responsible for enforcing the standards and implementing regulations of the ADA's Title II (State and Local Government Services). The Federal Highway Administration (FHWA) is the enforcement authority for overseeing pedestrian discrimination issues under the Title II implementing regulations.

Detectable warnings were required in 1991 by the Americans with Disabilities Act Accessible Guideline (ADAAG) (regulatory standards) for hazardous vehicular ways, transit platform edges, and curb ramps. A suspension was placed on requiring detectable warnings at curb ramps and hazardous vehicular ways, but not for transit platform edges. The reason for the suspension was to conduct research on the performance of their detectability. The DOJ continued the suspension through July 26, 2001, which allowed 10 years for conducting research. The research determined that other designs used in place of truncated domes such as grooves, striations, and exposed aggregate, were not detectable in the sidewalk and roadway environment because of the similarities to other surface textures and defects. Truncated domes have a unique design that can be detected underfoot and with a cane, and other surfaces are not considered ADA equivalent and therefore do not comply with the ADA requirements.

The DOJ had the option of allowing the suspension to expire on July 26, 2001 or publish a Federal Register Notice to continue the suspension. They decided to let the suspension expire. Consequently, since July 26, 2001 detectable warnings are again required. FHWA is obligated to enforce the requirements, and State and local governments are required to apply the minimum design standards when constructing and altering pedestrian facilities, though we encourage higher than minimum standards where possible.

The original ADA design standard for truncated domes is found in ADAAG (4.29.2). After the research was conducted, a new design recommendation was made for the dimension and placement of the domes on curb ramps. Both FHWA and the U.S. Access Board are encouraging the use of the new design over the original. Information on the recommended design and other useful information are included in the attachment.

Attachment

Information on Detectable Warnings (truncated domes)

Detectable warnings are an Americans with Disabilities Act (ADA) requirement in the current Americans with Disabilities Act Accessibility Guidelines (ADAAG) for the use of detecting the boundary between the sidewalk and the street. The original requirement in ADAAG was suspended for a time to conduct further research. Research was conducted, and the suspension of the requirement was lifted on July 26, 2001, and are now required when constructing and altering curb ramps. Truncated domes are the only detectable warnings allowed by ADAAG. Grooves, exposed aggregate, and other designs intended for use as detectable warning are too similar to pavement textures, cracks and joints and are not considered equivalent facilitation. Truncated domes are a unique design and have proven to be the most detectable surface.

Where to find information on detectable warnings:

Where to find the regulation on the suspension and requirement:

The US Department of Justice website, www.usdoj.gov/crt/ada/detwarn.htm, or visit the US Access Board's website, www.access-board.gov, click on "publications," go to "facilities," go to "Detectable Warnings: Final Rule"

Where to find the design and application requirement in ADAAG:

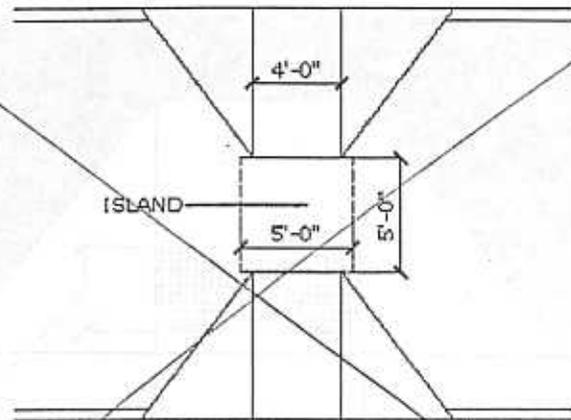
Visit the US Access Board's website, www.access-board.gov, click on "publications," go to "facilities," go to "ADA Accessibility Guidelines (ADAAG)" –the provision is in 4.7.7 under Curb Ramps

Where to find technical information and a list of manufactures:

Visit the US Access Board's website, www.access-board.gov, click on "publications," go to "Public Rights-of-Way," go to *Detectable Warnings: Synthesis of US and International Practice*

Where to find the recommended design for curb ramps:

Visit the US Access Board's website, www.access-board.gov, click on "publications," go to "Public Rights-of-Way," go to *Building A True Community: Accessible Public Rights-of-Ways*, sections X02.5.6.2 through X02.5.7.3. After a number of years of research there is a new recommended design for detectable warning/truncated dome. Both the US Access Board and FHWA recommend the new design pattern and application over the original ADAAG design. FHWA's *Designing Sidewalks and Trails for Access, Part II, Best Practices Design Guide* has comparable information to the *Building A True Community* report. At the time the FHWA *Designing Sidewalks and Trails for Access*, went to print, the suspension had not been lifted, so the text in Chapter 6 does not mention that detectable warnings are required.



Partial plan view of an island with a landing 60 inches by 60 inches.

Discussion: Adequate stopping, queuing and passing places are necessary in mid-street pedestrian refuge locations. A five foot by five foot space is the minimum required for two persons traveling opposite directions to wait, out of the street, for opportunities to continue crossing the street.

X02.5.6.2 Detectable Warnings. Curb ramps at medians and refuge islands, and locations where medians and refuge islands are cut through level with the street at crosswalks, shall have *detectable warnings* complying with Section X02.5.7.

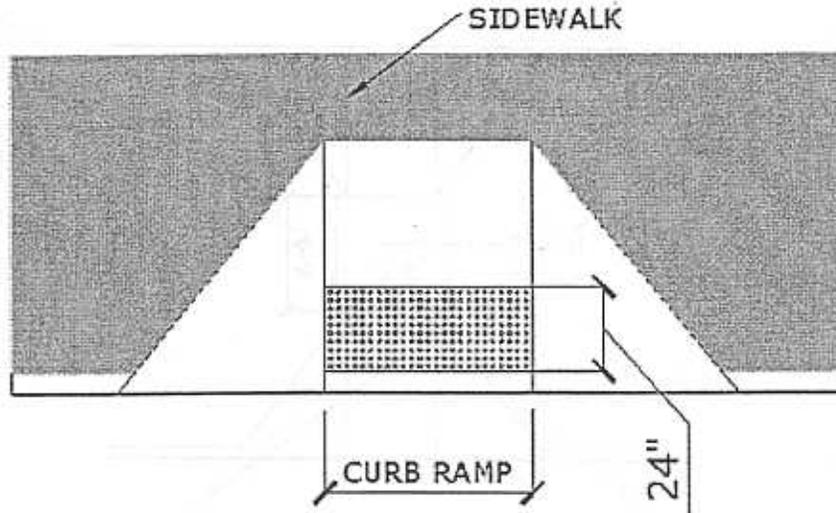
X02.5.7 Detectable warnings

X02.5.7.1 General. Where required, *detectable warnings* shall comply with Section X02.5.7.

X02.5.7.2 Application. Detectable warnings shall be provided *only* at the following locations:

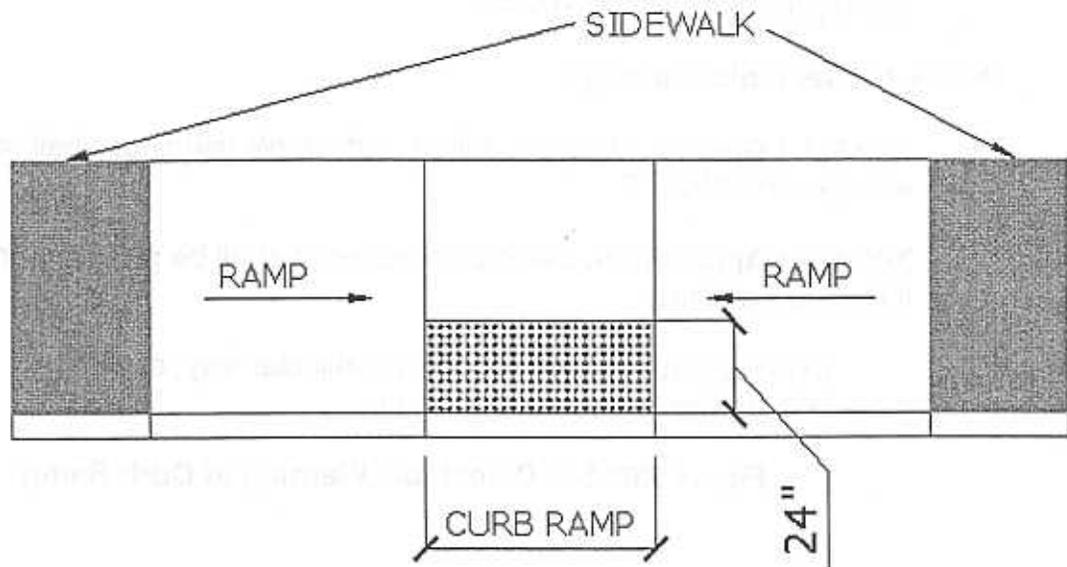
- (A) Where a sidewalk crosses a vehicular way, excluding unsignalized *driveway* crossings.

Figure X02.5 G Detectable Warning at Curb Ramp



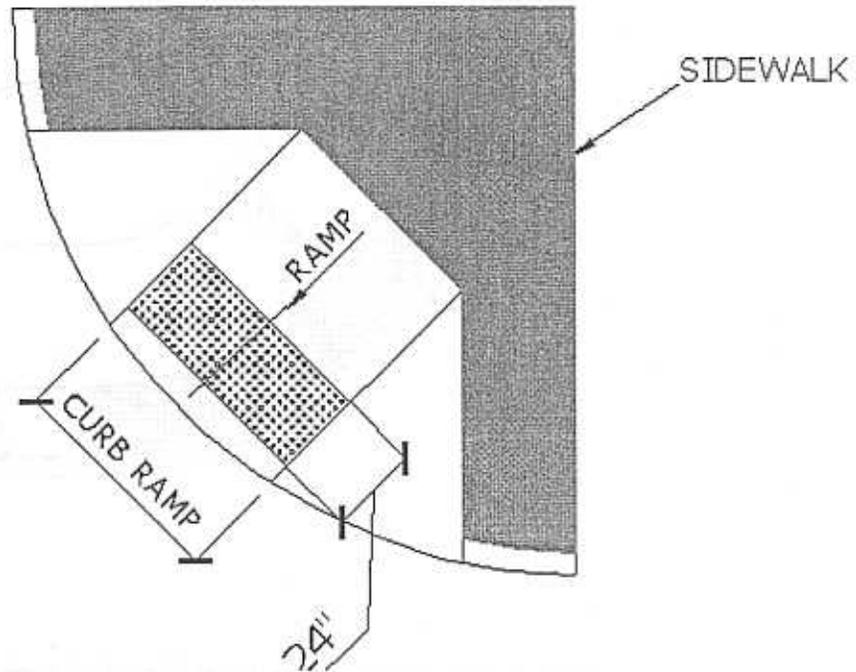
Illustrates 24" deep detectable warning located near the street edge of the curb ramp.

Figure X02.5 H Transition Ramp with Detectable Warning



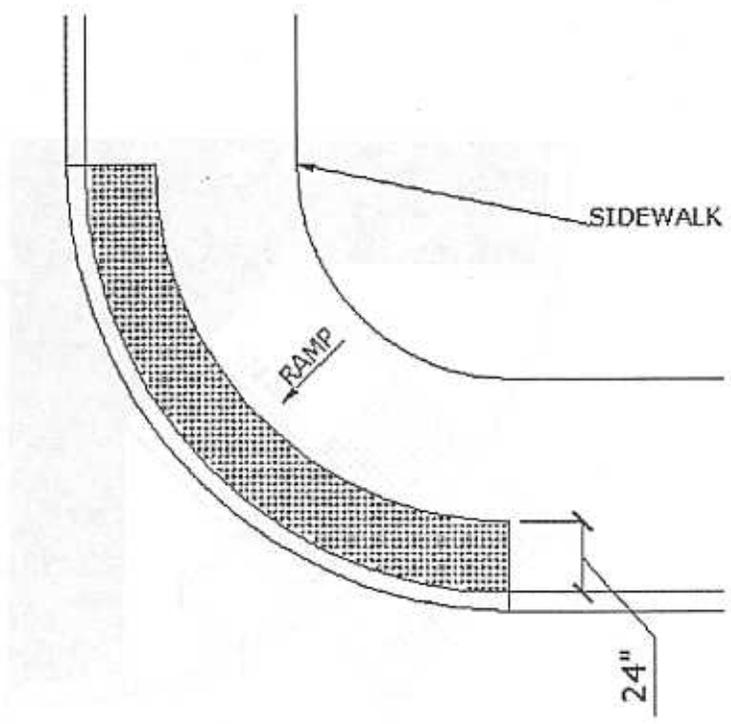
Shows detectable warning at a transition ramp.

Figure X02.5 I Shared Curb Ramp with Detectable Warning



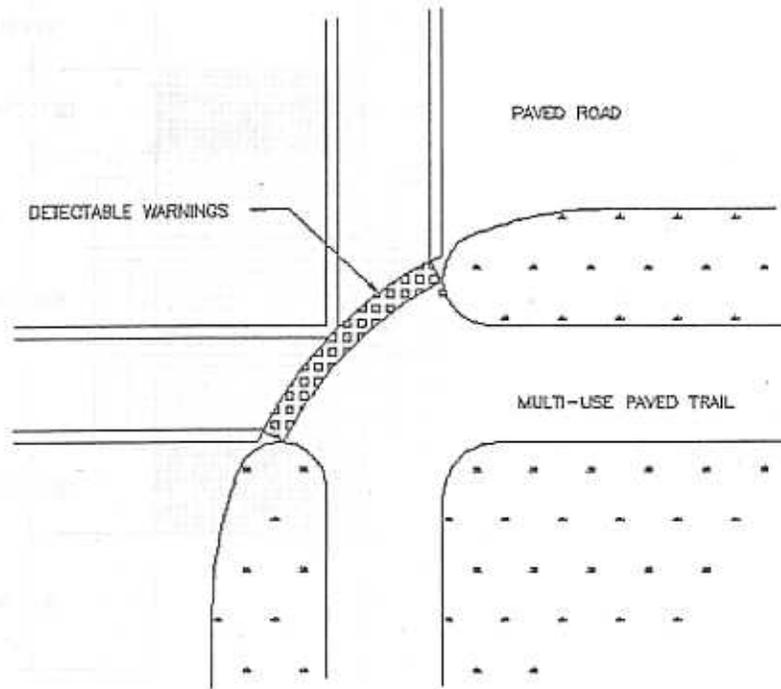
Shows detectable warning at a shared curb ramp.

Figure X02.5 J Detectable Warning at Blended Curb



Shows detectable warning at blended curb.

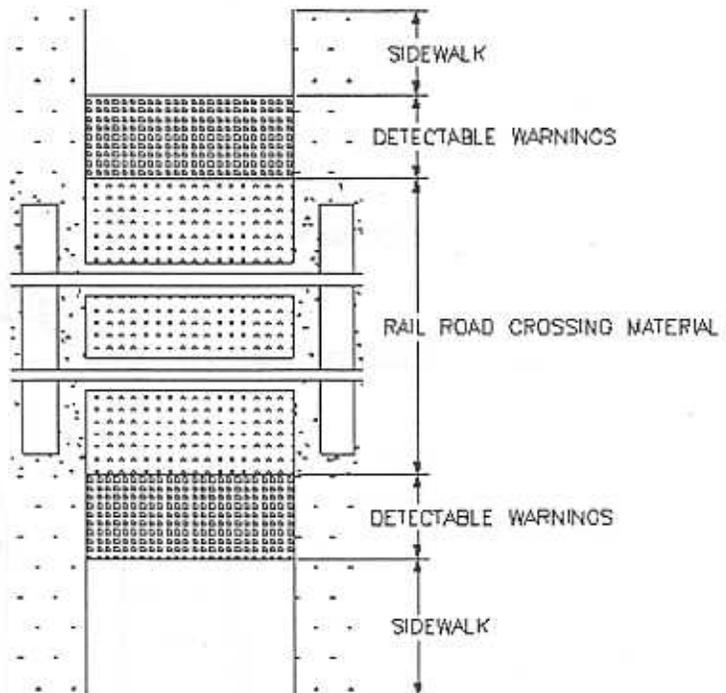
Figure X02.5 K Detectable Warnings at Multi-Use Path



Plan view of a multi-use path and road intersection. Detectable warnings are indicated at the intersection.

(B) Where a rail system crosses *pedestrian* facilities that are not shared with vehicular ways.

Figure X02.5 L Detectable Warnings at Railroad Crossing

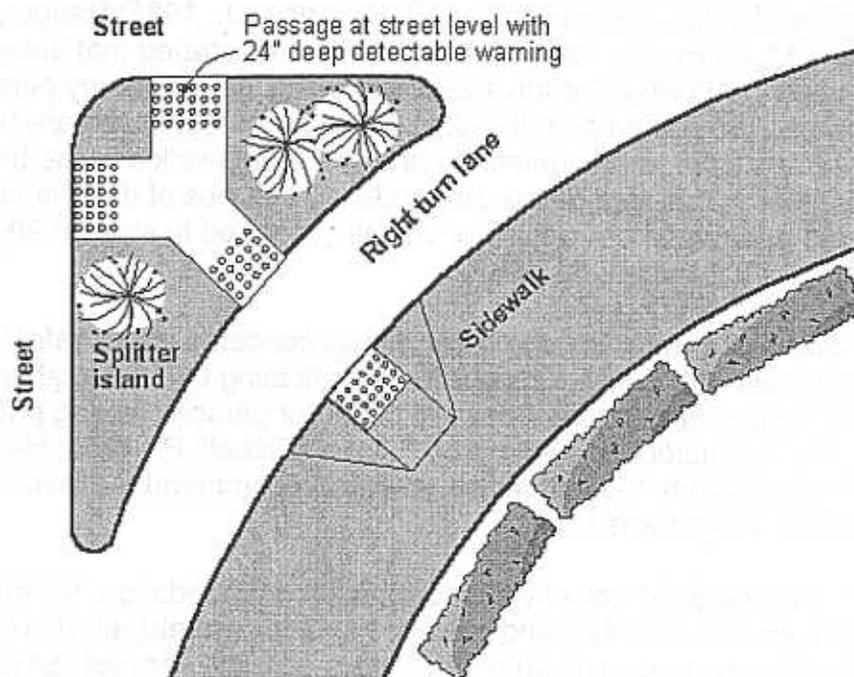


Plan view of detectable warnings at a railroad crossing.

(C) At reflecting pools within the *public right-of-way*, which have no curb or rim protruding above the walking surface.

(D) At islands and medians that are cut through level with the roadway.

Figure X02.5 M Refuge Island with Detectable Warnings



Plan view of pedestrian passage that cuts through a refuge island at the same level as the street. Detectable warnings are shown at each end of the cuts.

Advisory: *Where islands or medians are less than 4 feet wide, the detectable warning should extend across the full length of the cut through the island or median.*

(E) Where required by proposed ADAAG Chapter 10.

Discussion: The detectable warning is a unique and standardized surface intended to function much like a stop sign to alert pedestrians who are blind or visually impaired to the presence of hazards in the line of travel. The truncated dome surface should not be used for wayfinding or directional information. The removal of curbs, which provided a clearly defined indication of the location of the edge of the street, has caused difficulty for individuals who are blind or visually impaired. The locations above were identified by the committee as being appropriate for the installation of detectable warnings. Detectable warnings are not required at unsignalized driveways based on comments to the committee that installation at driveways would make it harder to truly identify the streets.

X02.5.7.3 Specifications.

(A) **Size.** Detectable warnings shall be 24 inches (610mm) in the direction of travel and extend the full width of the *curb ramp* or flush surface.

Discussion: Research has confirmed that for persons who are visually impaired, there is a high

level of risk of inadvertent street entry associated with the presence of curb ramps, particularly those having slopes of 1:12 or less (Bentzen, B. & Barlow, J., 1995; Hauger, S., Rigby, J., Safewright, M. and McAuley, W., 1996). It has been demonstrated that detectable warnings complying with existing ADAAG Section 4.29.2 are highly detectable by persons with visual impairments, and can provide an effective stop signal for persons who are blind or visually impaired which can be used to determine the end of the sidewalk and the beginning of the vehicular way. Research has also demonstrated that 24 inches of detectable warning material is sufficient to enable persons who are blind or visually impaired to stop on 90 percent of approaches (Peck, A. & Bentzen, B., 1987).

Research has now been conducted which addresses concerns about safety of detectable warnings for individuals with mobility impairments, indicating that detectable warnings on slopes have minimal impact on the safety and ease of travel for persons having physical disabilities (Bentzen, B., Nolin, T., Easton, R., Desmaris, P., and Mitchell, P., 1994; Hauger, et al, 1996). On the basis of this research, the committee voted to recommend the installation of detectable warnings at sidewalk/street transitions.

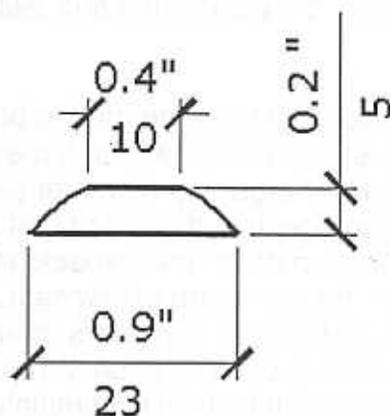
A few committee members did not fully support this recommendation, feeling there might be a significant adverse impact on safety and ease of travel for wheelchair users. The committee discussed threshold ramp grade requirements where only the gentlest ramps (1:15 and flatter) would have detectable warnings. Nonetheless, because such a requirement would tend to confuse both designers and builders and would give inconsistent information to individuals who are visually impaired, the committee voted to require detectable warnings on all sidewalk/street transitions regardless of slope.

(B) Location. The detectable warning shall be located so that the edge nearest the curb line or other potential hazard is 6 to 8 inches (150 to 205mm) from the curb line or other potential hazard, such as a reflecting pool edge or the dynamic envelope of rail operations.

Discussion: Placement of the detectable warnings a maximum of 6 to 8 inches back from the curb line gives some latitude in placement of the detectable warning. Where curbing is embedded at the sidewalk/street junction, this will not need to be replaced. In addition, allowing 6 to 8 inches of ramp (or curb) surface beyond the detectable warning will give pedestrians who are blind an additional stopping distance before they step into the street. It will also enable some persons having mobility impairments to make a smoother transition between the street and the curb ramp.

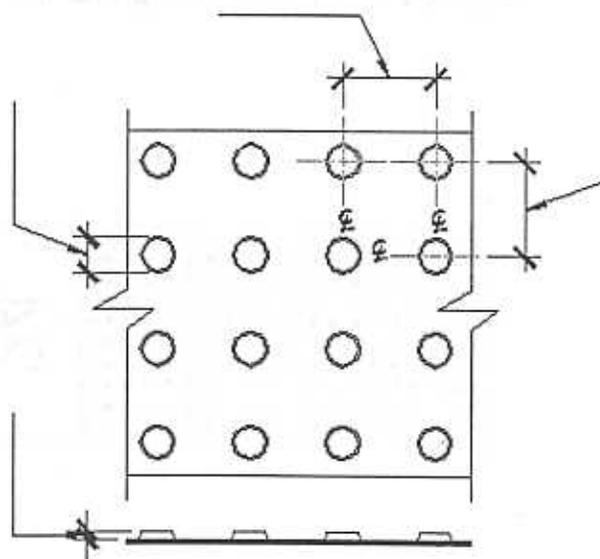
(C) Dome size and spacing. Truncated domes shall have a diameter of 0.9 inch (23 mm) at the bottom, a diameter of 0.4 inch (10 mm) at the top, a height of 0.2 inch (5 mm) and a center-to-center spacing of 2.35 inches (60 mm) measured along one side of a square arrangement.

Figure X02.5 N Dome Section



Section of dome from a detectable warning. Drawing shows height, top and bottom dimensions.

Figure X02.5 O Dome Spacing



Plan and section views of detectable warning domes and their relative spacing on the x and y axis.

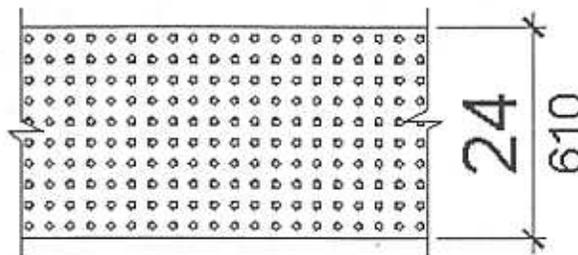
Discussion: The size and spacing of the domes affect detectability by pedestrians who are blind. This specification is much more detailed than that in the current ADAAG, and offers much less latitude in dimensions and spacing. It ensures that the dome spacing is the maximum currently known to be consistent with high detectability. The diameter measurement in the present ADAAG is ambiguous if the user of these guidelines is not told whether the diameter is

to be measured at the bottom or the top of the truncated domes. As currently implemented by most US manufacturers, it is the bottom diameter that measures 0.9 inch, and the top diameter varies widely. The diameter of the dome where it touches the sole of the shoe affects detectability, and the top diameter of 0.4 inch, in the suggested language, is based on current research (see below).

A few members of the committee felt that there needed to be more flexibility in the size and shape of the domes. Some suggestions were that the domes be a semi-spherical shape using a 1-inch base, or a "butte" design with a larger top diameter (0.6 inch). Wider spacing, up to 3 inches, between domes was also suggested. It was felt that the wider gaps or lanes between the domes would better accept the wheel path of most wheelchairs so that users would not need to "bump" over the domes. However, there was no evidence that either of these alternatives would be better or worse than the proposed standard in terms of ease of traversal by wheelchair users and detectability for individuals who are blind or visually impaired. The proposed standard is supported by research on spacing and detectability completed in Japan in 1998. The committee voted to recommend the parallel alignment of domes as well as the two-foot depth of the detectable warning, in consideration of minimizing bumpiness for wheelchair users.

(D) Dome alignment. Domes shall be aligned on a square grid in the predominant direction of travel to permit wheels to roll between domes.

Figure X02.5 P Dome Alignment



Plan view of a detectable warning surface showing domes aligned in rows, not skewed diagonally.

Discussion: This specification ensures the greatest degree of safety and negotiability for persons with mobility impairments. It requires square alignment, to give persons using wheeled mobility aids the greatest chance of being able to avoid the truncated domes.

(E) Visual Contrast. 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.

Advisory. Both domes and the underlying surface must meet the contrast requirement. Visual contrast shall be measured in accordance with existing ADAAG, A4.2.9.2, appendix.

Discussion: For pedestrians with low vision, a visual contrast will provide information about the location of the detectable warning and the street edge. Safety yellow is a color that is standardized for use as a warning in the pedestrian/highway environment. It has been demonstrated to be highly detectable when used as a detectable warning in contrasts as low as 40 percent (Bentzen, B.L., Nolin, T.L & Easton, R.D. (1994) Detectable warning surfaces: Color, contrast and reflectance. Final report, US Department of Transportation, Federal Transit Administration, Volpe National Transportation Systems Center. VNTSC-DTRS 57093-P-80546.) ADAAG currently recommends a 70 percent contrast, dark-on-light or light-on-dark.

There was concern on the part of some members that it may be impossible to develop and maintain a minimum 70 percent visual contrast with the materials commonly used in construction of public street improvements, such as Portland cement concrete. The committee agreed that visual contrast was essential but some members suggested that a lesser level of contrast could be as effective and more economical to provide than a minimum 70%.

Some members of the committee noted that safety yellow is not conspicuous to many persons with low vision, and that therefore high visual contrast should be the sole measure of whether detectable warnings are visible.

Research need: The committee encourages the transportation industry to broaden its testing of color and contrast of typical construction materials and to include pedestrians with vision impairments in the development of standards. Work performed at The Lighthouse in New York City and research by Bentzen et al. (1994) can provide a useful basis for future research.