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**PURPOSE:**

This document is interim guidance for installation and design of curb ramps per the revised standard drawings. The intent is to interpret and conform to federal guidance given in the ADAAG, using the Guidelines as minimum requirements and adding some best practice. Experience in other cities has shaped and will continue to shape the design guidelines. Terrain in Cincinnati and narrow right of way make it very challenging to meet ADAAG fully, so some judgement is required – in the field and in the design office.

ODOT Plan Insert Sheets show most of the intent. However, ODOT doesn't build many urban sidewalks or maintain curb ramps that they build. The City of Cincinnati has additional requirements – 5" thick sidewalks, brick pavers on sand (instead of grout) on concrete base, separate Cincinnati approved list of overlay products, additional ramp configurations for tight right of way, etc.

Some of these guidelines are in the formative stage. For example, a standard method of determining the required light-dark contrast at detectable warnings is not currently available until installed. Some proposed ADAAG revisions are in research, proposed rule making or comment stages. For retrofits, lots of judgement is required of the cement finisher and field engineer. As the City gains experience, the City drawings, specifications and guidelines will evolve.

Existing curb ramp installations that do not conform to ADAAG usually have omitted the landing at the top and bottom of the ramp, do not drain properly, direct pedestrians into the middle of the intersection and have flares that are too steep. Level landings are important because turning a wheelchair on a 12:1 slope is very difficult. These guidelines are more specific to avoid these problems in the future.

**For more details, designers may refer to the following recent reference material:**

1. ADA Accessibility Guidelines (ADAAG) – Current federal guidelines are dated Jan 1998, which the Department of Justice considers minimum standards (See Appendix A). Draft Guidelines are dated June 17, 2002 - currently in proposed rulemaking process, comment period.
2. Building a True Community, Final Report, Public Rights of Way Access Advisory Committee, January 10, 2001, U.S. Architectural & Transportation Barriers Compliance Board, Access Board. This 167-page report contains detailed recommendations from the PROWAAC Committee for the use of the Access Board. Not all of the recommendations were submitted for the proposed rulemaking in June 2002.
3. Designing Sidewalks and Trails for Access, Best Practices Design Guide, FHWA, Sept 2001, 360 pp. Part 1 consists of a review of current practices, Part 2 is the best practice recommendations – very similar to Building a True Community but more technical.
4. Detectable Warnings, Synthesis of U.S. and International Practice, 12 May 2000, U.S. Access Board, 150 pages. Review of ten years of research that led to the refinement of detectable warning design.
5. Memorandum, dated May 6, 2002, U.S. Department of Transportation, Federal Highway Administration, ADAAG Detectable Warnings (Truncated Domes)

**DEFINITIONS:**

ADAAG – The current version of American with Disabilities Act Accessibility Guidelines, (See Appendix A). Many of the new guidelines not in 1998 code are in the draft Guidelines (June 17, 2002). The FHWA memo clarifies that the Guidelines are regulatory standards.

Alteration – As determined by lawsuit (Kinney vs. Yerusalim, 1993) and 28 CFR 35.151. Street Rehab with grind and resurface is considered an alteration. Some maintenance work (i.e. crack sealing, microsurfacing, chip and seal) is not considered an Alteration. Utility work by itself should not be considered an Alteration unless it involves new pavement curb to curb.

Crosswalk – Crosswalks are implied at all intersections whether they are marked or not (Cincinnati Municipal Code 501-1-C3). The City will be submitting a request to modify the definition to include 15 additional feet behind the building line, so that curb ramps can be installed further from the intersection in some locations. Crosswalk pavement markings are currently used to modify the location of the crosswalk and encourage crossing at specific locations. Pedestrians may be detoured by closing a crosswalk with signs “No Ped Crossing”.

Curb Ramp – aka Handicap Ramp, Wheelchair Ramp. In some circles, “handicap” is a derogatory word, so it will be avoided here.

New Construction – Generally, new pavement curb to curb, base to surface. Pavement widening is included.

ODOT – Ohio Department of Transportation

DW, DWB, DWO - Detectable Warning using bricks or overlay, required as of July 21, 2001 on all projects.

Technically Infeasible – This is a very difficult term to pin down. The design guidelines are waived if conformance to ADAAG requires modifications to a “load bearing member” (i.e. vaults under the sidewalk, walls).

In alterations, if the existing sidewalk grades can not be met within a specific distance, the slope requirements will be waived. Currently, that distance is 15 feet from the bottom of a ramp.

## **BACKGROUND and PROBLEM STATEMENT**

There are currently about 7600 street-street intersections in the City limits – many are tees, most are four-way, some are five way. The number of existing curb ramps per intersection varies from neighborhood to neighborhood but currently averages about 6 per intersection (where there are sidewalks). In addition, there are mid-block crossings, alley crossings, sidewalks that are internal to City Parks, intersections where some pedestrian crossings are prohibited and other locations where they are appropriate but missing. Best guess is that there are 15,000 existing curb ramps.

A number of the streets do not have curb and/or concrete walks. As new streets are built, existing streets are improved and sidewalks installed, the number of curb ramps will grow.

Few of the existing ramps fully conform to ADAAG (due to the lack of detectable warning) but most are “grandfathered”. Some curb ramps were not built to standard (i.e. too steep) and the number and degree of non-compliance is unknown at this time. An evaluation of current ramps has not been performed to help predict the number of existing ramps that need to be rebuilt. In some locations, one existing ramp will be replaced with two new ramps (and vice versa).

There are approximately 5000 existing tee intersections (most without traffic signals) most of which do not have curb ramps across the “top” of the tee. New curb ramps will be installed at these intersections (unless an engineering study documents a safety concern).

Since (1981?), the City Street Rehabilitation program has been installing new curb ramps concurrent with grind and resurface and sidewalk work. This program has varied from year to year but improves accessibility on approximately 100 lane miles per year.

The unit cost will vary from \$200 to \$2000 per ramp. During the detectable warning “learning curve”, construction costs will be higher and should drop as experience is gained and methods improved. The bid prices will also be affected by the attention used in inspecting, accepting/rejecting and rebuilding ramps.

Finally, the long-term maintenance costs of various detectable warning products are not known fully. Some overlay products have lasted seven years under conditions similar to Cincinnati. Much of the future maintenance cost depends on the care used during installation.

All of these variables make it difficult to predict the number of ramps and budget impact to upgrade them. Currently, the curb ramp inventory field work is approximately 50% complete. The field work, data entry and analysis will be continuing through the winter of 2002-2003. When that work is done, a better estimate of curb ramp needs and budget impact can be produced.

## **GENERAL POLICY:**

Use – Like the building code, an alteration to a street triggers a requirement that the street be brought up to code – conforming curb ramps are installed or remodeled to current standards, bicycle grates upgraded, etc. The requirements apply to all projects in the public right of way, regardless of whether local, state or federal funding is involved.

Currently, sidewalks are required along both sides of each and every public street except for rare occasions, approved by the City Engineer. If sidewalk is installed, modified or exists already, curb ramps will be installed at most locations where pedestrians cross a curb. If crosswalks are marked, curb ramps must be installed unless documented as technically infeasible.

Cost – The cost of implementing ADAAG is to be paid for as a project cost. There are no separate ADA funds or stand alone projects at this time.

Responsibility - Conformity to ADAAG in the public right of way ultimately lies with the City Engineer. Technically, variations from ADAAG should be approved by the City Engineer. Realistically, this is not always possible. The Field Engineer also has some responsibility – they will direct the contractor in this work and take disputes to their supervisor as necessary.

Street Rehabilitation – Ramps will be installed or upgraded at all legal crossings within the limits of grind and pave contracts. Existing ramps will be removed and new ramps constructed where the existing ramp:

1. does not currently conform to ADAAG but it is technically feasible to conform,
2. surfaces are brick pavers or
3. existing concrete is not sound.

Curb Ramps for crosswalks across urban arterials at unsignalized intersections – City Policy has not been formally adopted yet – safety versus accessibility has to be weighed.

The proposed policy is to install curb ramps at all legal crosswalks (marked or unmarked) unless an engineering/traffic study documents that the crossing is unsafe. The study will take into account factors like traffic speed, alternate accessible routes, sight distance, pedestrian volumes, bus stop locations, etc.

Some legal crosswalks may be closed to all pedestrians and “No Ped Crossing” signs installed. At tee intersections, the City Traffic Engineer will determine if one crosswalk is sufficient and which crosswalk to close. A solution for communicating closed crosswalks to people with the visual impairments has yet to be adopted. At signalized intersections, crosswalks across all legs will be assumed unless a traffic/engineering study documents that one leg should be closed.

At tee intersections, providing crosswalks with curb ramps may require modifying on-street parking.

Because people with disabilities are more likely to be dependent on transit, bus stops at unsignalized intersections, or mid-block bus stops should have accessible crosswalks in close proximity.

Design Requirements – All new construction should be designed on plan drawings to verify that a design conforms to ADAAG. This requires a working drawing that shows existing and proposed curbs, pavement markings, traffic control signs, traffic signals, elevations (gutter, top of curb, ramp and sidewalk), dimensions, R/W lines, trees, street furniture, inlets, parking meters and utility covers. The City reserves the right to request this information (drawn at 1"= 10') be submitted prior to approval of construction drawings and permits.

Alterations are typically designed in the field and do not include design drawings to verify that ADAAG requirements are satisfied. It is the responsibility of the contractor and field engineer to verify that the "most useable" solution is constructed.

Right of way Requirements – Providing accessible streets using these guidelines usually requires additional sidewalk space at curb ramp locations (or substandard designs). It is not possible to predict the right of way requirements until design is substantially complete. The subdivision manual will be revised in the near future to address this issue.

## DIFFICULT SITUATIONS

Although the intent is to make the City as fully accessible as possible and to fully conform to ADAAG in new construction, meeting ADAAG requirements sometimes requires changes to structures, renovation of buildings or chasing slopes. Judgment is required and allowed by ADAAG. Additional guidance documents for alterations are being drafted and are not available at this time. "Case-by-case professional design judgment, informed by an understanding of the rationale behind access provisions, must be applied to develop the most usable solution for each specific environment." (*Building a True Community*)



Golden Avenue at Delta



Ravine Street at McMicken – 12 ½ % Grade

## RAMP DESIGN Q&A

### PREFERRED RAMP TYPES

There are lots of variables to consider in choosing a preferred ramp design – available sidewalk space, curb radius, curb height, gutter slope, marked crosswalk vs. unmarked crosswalk, etc. Many guidelines show wide sidewalks, which aren't always available in Cincinnati. Some show crosswalks moved further from the intersection, which is less safe for the pedestrian.

Keeping the top landing as high as possible is desirable. Ramp types P and Q keep the landing at normal sidewalk elevation. Ramp types R and S ramp up part way, then a landing then another ramp. Ramp types T and U show the landing low, just above the gutter.

Forcing all pedestrians to go down a ramp and up another should also be minimized.

Until more experience is gained, our intention is to prioritize the ramp types as follows to keep marked crosswalks closer to the intersection and landings as high as possible:

1. Two Type P ramps per corner if possible. This usually requires wide crosswalks and wide sidewalks (which are typically only put in downtown) or small curb return radii. 6" curb height and 2% sidewalk, ramps perpendicular to the curb, aimed at the far corner should be the starting assumptions. The smallest curb return radius for the intersection should be used.
2. If the two ramps do not fit within the available space, the next attempt should be to reduce the ramp length by using 4" curb height and 1% cross slope.
3. If that does not fit, the next attempt should be two Type V ramps, oriented with the primary travel direction. See Figure 1.

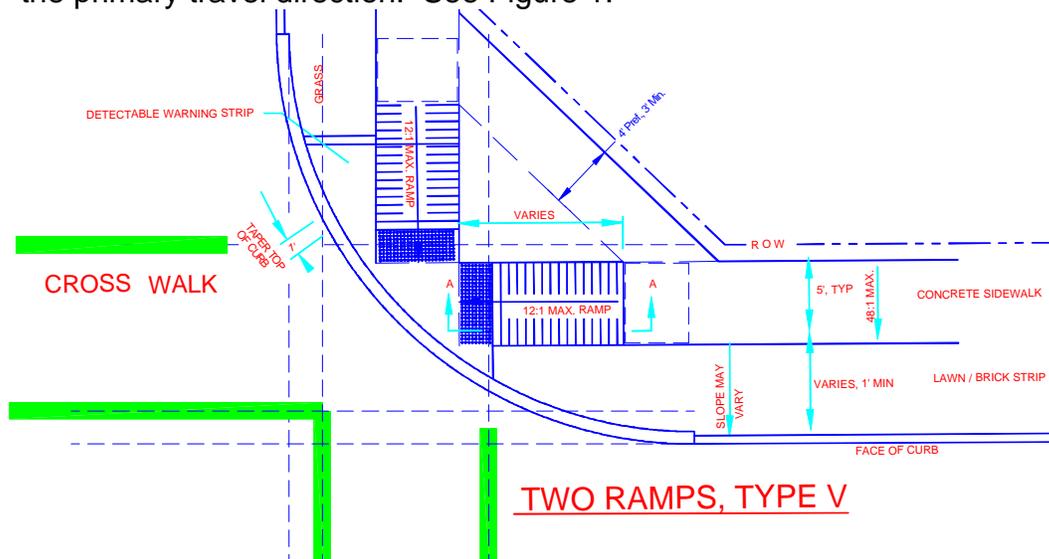
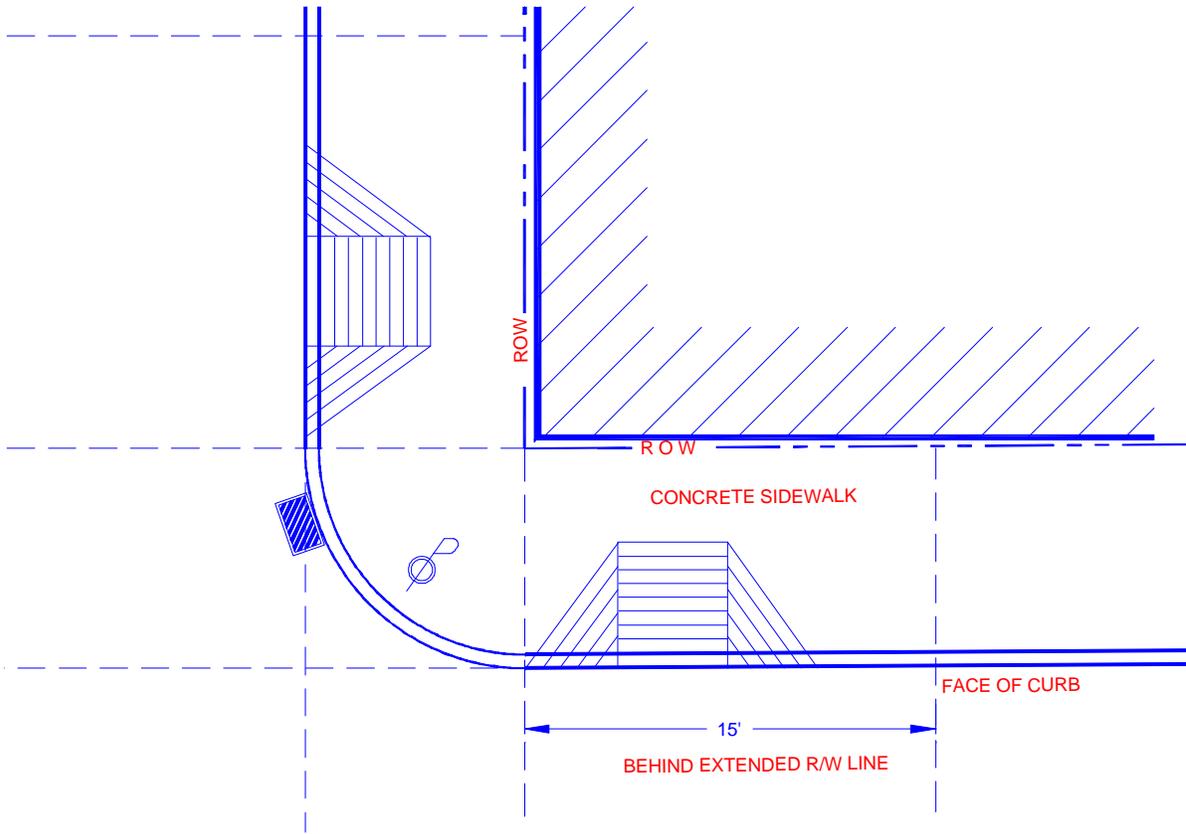


Figure 1.

4. If that does not fit, other designs (i.e. Type R,S,T, U) should be tried.

5. Diagonal ramp (i.e. Type Q) that aim the pedestrian into the center of the intersection is the least preferred design.

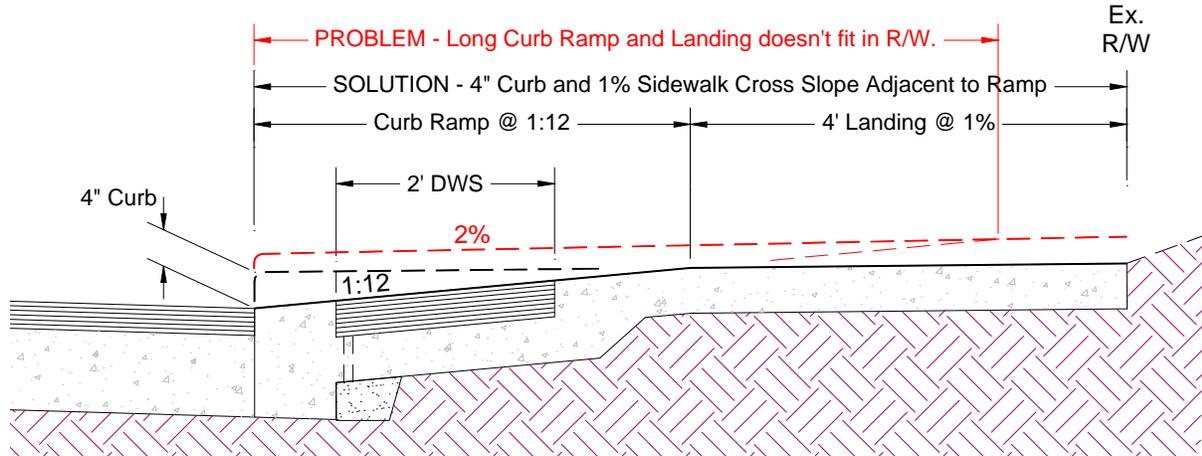


## MODIFIED CROSSWALK

WHERE OBSTACLES PREVENT CURB RAMP INSTALLATION IN THE NORMAL CROSSWALK, THE CITY ENGINEER AND CITY TRAFFIC ENGINEER MAY ALLOW THE MODIFICATION OF THE CROSSWALK LOCATION. MUNICIPAL CODE REVISION IS PENDING.

## MISCELLANEOUS QUESTIONS and ANSWERS

- 1 Construct two ramps per corner? Alterations - Yes, if technically feasible. New construction – Yes, if technically feasible.
2. Detectable Warning Type B (bricks) required at all new curb ramps? – Yes, effective (December 6, 2002?).
3. Detectable Warning Type O (overlay) required on all existing curb ramps within the limits of grind and pave street rehab? – Yes, effective (December 6, 2002), if they conform to ADAAG. If they are difficult locations, put on a list for survey, design, utility and traffic coordination, and construction.
4. Allow 4" curb height and 1% sidewalk cross slope as the preferred method to reduce ramp length? Yes.



4" Curb and 1% Sidewalk Cross Slope is preferred method to reduce curb ramp lengths.

5. Omit 4'x4' landing at top of ramp? No.
6. Relocate utility and traffic poles to install two curb ramps? No.
7. Relocate existing inlets to install two curb ramps? – New construction, yes. Alteration, No.
8. Increase longitudinal slope steeper than 1:12? In new construction, No. In Alterations, if existing sidewalk/gutter grade can not be met within 15 feet of the bottom of ramp or is technically infeasible, steeper grade is allowable with approval of the City Engineer. Motorized wheelchairs can climb steeper slopes so, as more citizens obtain them, more sidewalk segments will be accessible to them.

9. Modify structural slabs to comply? New construction, Yes. Alterations, No.

10. Allow signs, poles in the flares? Yes but not preferable.

11. Remove on-street parking to install curb ramps? Yes. Parking is currently prohibited within 20 feet of intersection or within 30 feet of a flashing beacon, stop sign or traffic control signal. The municipal code may be modified to prohibit parking within \_\_\_ feet of a curb ramp at unmarked crossings. If parking meters need to be relocated or removed, coordinate with Traffic Engineering.

12. Utility covers allowed in the ramp? New Construction – No. Alterations, if necessary.

13. When a marked crosswalk leads to an existing alley or driveway apron, install detectable warning? If the driveway apron or alley entrance does not meet ADAAG, an accessible ramp is needed and, ideally, it would not overlap the driveway/alley. If a separate ramp cannot be provided within the marked crosswalk, the driveway apron should be modified to make it accessible. The conforming apron/alley should have detectable warning but they may be temporarily omitted until further discussion.

14. Can curb be used along the edge of a ramp? Only if the other adjacent surface is grass. Use curbs along the edge of Type R & T ramps to prevent Stormwater from leaving the R/W and to meet existing grades. Some ramps will have a flare along one edge and curb on the other.

## SPECIFICATION Q&A

Pay Items – Cincinnati will not pay “Each” for curb ramps in new sidewalks (which is different than ODOT 608 and PIS-BP7.1). Separate pay items will be paid for Curb Type L/S/B (L.F.), Concrete Walk (S.F.), Curb Ramp (S.F.), Detectable Warning, Type O or B (S.F.). The area under the detectable warning is paid for two times – as curb ramp and detectable warning. See Figure 2.

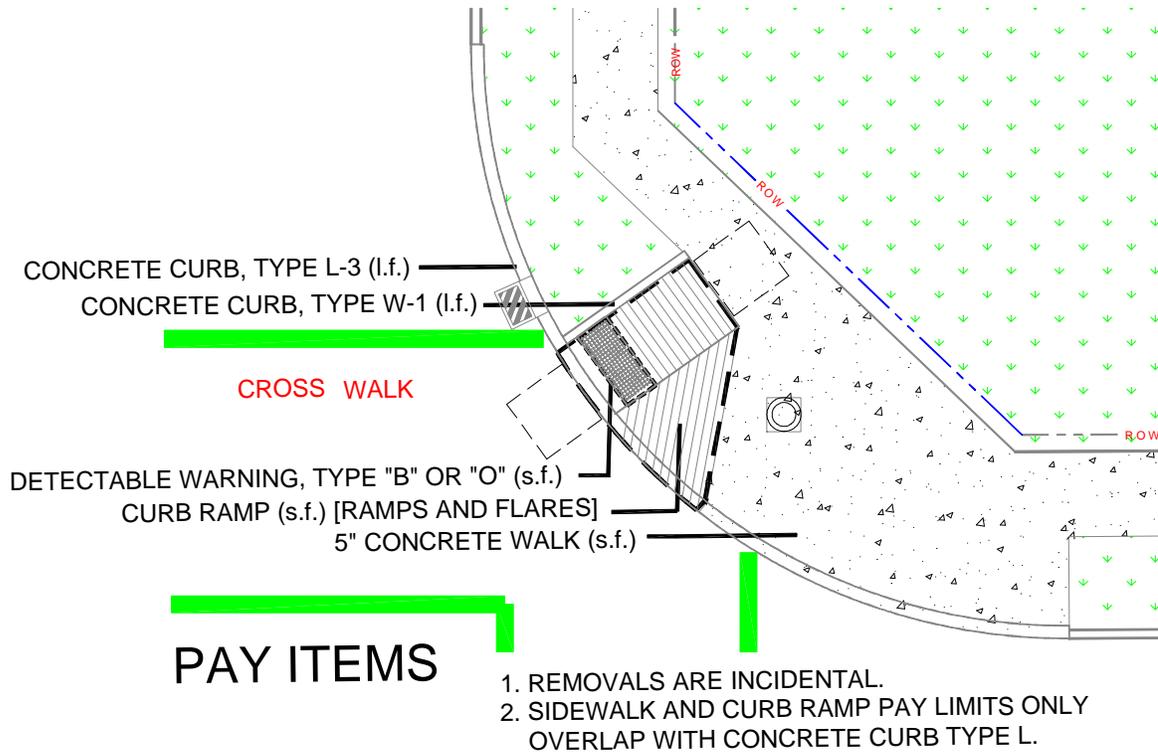


Figure 2.

**DETECTABLE WARNING:**

Detectable warnings are intended to warn people with visual disabilities using a curb ramp before they enter the path of motor vehicles on the street or alleys (not at driveways) and before crossing railroad tracks.

Currently, truncated domes are the only solution allowed. The spacing, alignment and shape are changing (in federal rule making) which will allow standard 4x8 “ADA bricks” to be used.

Product testing is currently underway in Madison Wisconsin. Until the performance of the variety of products is better known, the City will use a preferred overlay products list. Life-cycle costs of the various products are unknown at this time so there is no financial basis for including or excluding products yet.

Dimensions

Old dome patterns and spacing have been revised recently to allow standard 4”x8” brick products. The current “best practice” dimensions are shown in Figure 3. and described in the 608.021 of the City Supplemental Specifications.

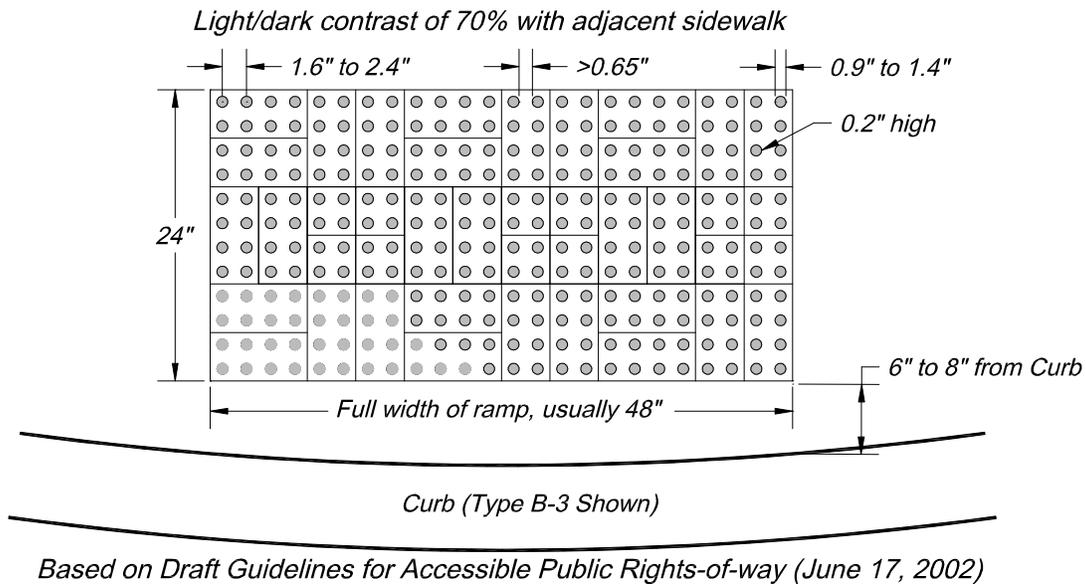


Figure 3.

Detectable Warning, Type B – Detectable warnings in new ramp construction will consist of 4"x8"x2 ¼" thick clay bricks on a 1-¼" sand bed on a 5" concrete base. 3-½" high forms (nominal 2x4 lumber) are used to create a tub for the DWB to sit in.

Pre-approved bricks are listed in the Specifications.



Detectable Warning, Type O – Existing concrete ramps that conform to ADAAG and have sound concrete may be overlaid with a truncated dome product. The City-approved products are mostly based on limited experience in other cities with freeze-thaw conditions. The products consist of:

- 1.) concrete preparation, base coat of polyurethane, preformed domes with adhesive, and three coats of polyurethane top coat.
- 2.) formed and poured modified structural repair mortar domes applied directly on concrete walk with coated with a pigmented sealer.
- 3.) plastic (monomer and resin) domes melted with a catalyst onto the concrete surface.



Cote-L Safti-Trax



Vanguard – Tileco (old dome pattern)



Stongwarn SWADA2000

Substitutes - As life-cycle costs are known, maintenance experience grows, field testing is completed and technology evolves, detectable warning products may be added to (or removed from) the City-approved list. Contractors submitting alternate products will be asked for information on maintenance experience from other northern cities prior to consideration as a substitute. Products and methods pre-qualified by ODOT is currently not sufficient for use in the City of Cincinnati.

Alignment – The domes should be aligned with the primary travel direction to allow wheels (wheelchairs, strollers, roller blades, bicycles) through. Type O domes are much easier to align than bricks. See Figure 4.

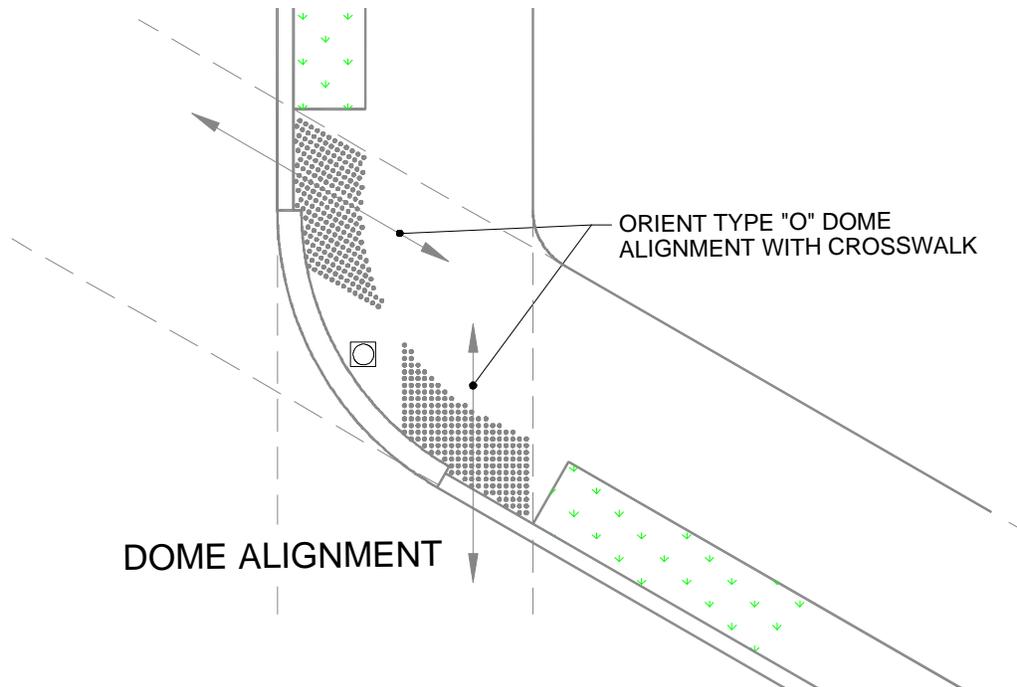


Figure 4.

Excluded methods –

Stamped Concrete - Experience in other cities shows that stamped concrete is very difficult to install correctly to get consistent, durable truncated domes. The weakest concrete goes into the domes. They are impossible to maintain without removing and replacing the entire ramp.

Colored concrete - Precast concrete bricks or cast in place colored concrete is not permitted until color fading problems are solved.

Overlay Products - There are a number of products (i.e. glue down or bolt down plastic sheets) that do not perform well over time due to freeze/thaw conditions in Cincinnati.

Light-dark Contrast

Contrast between the surrounding sidewalk/ramp and the detectable warning can be achieved with either dark detectable warning next to plain concrete or beige detectable warning next to dark flat pavers. If there is a question about achieving the 70% light reflectance, a mock up will be made to measure light reflectance in lux in daylight. In lieu of a mockup, a written certification by the project engineer is sufficient.

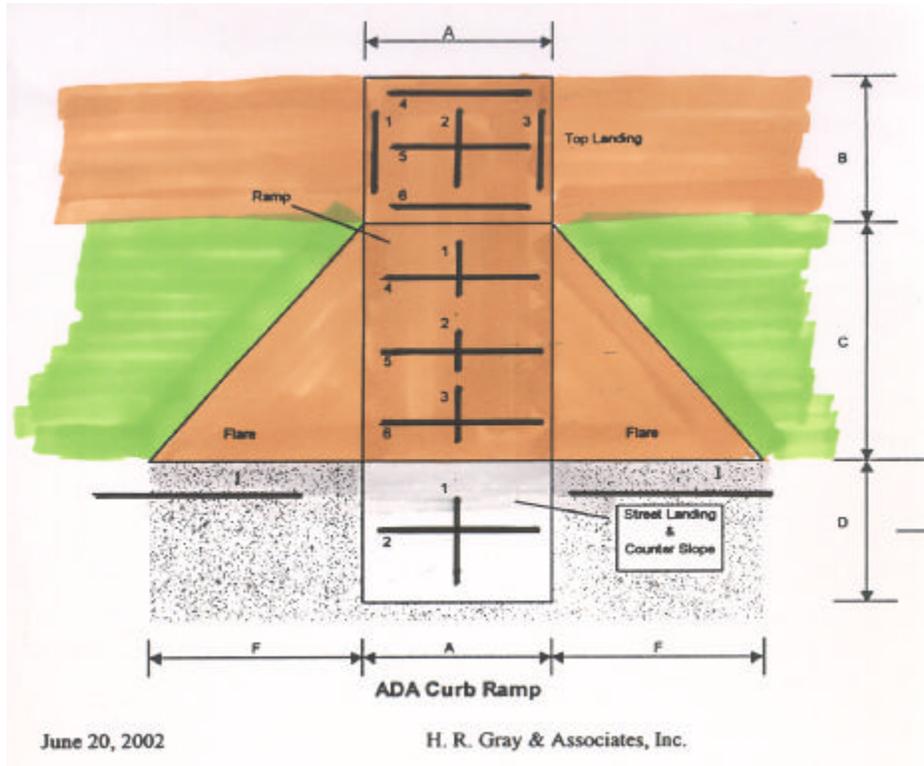
Safety yellow is not desirable for aesthetic reasons. Seeing-eye perceive black as a hole so they walk around black pavement.

Maintenance of Pedestrian Traffic (MOPT)

General signing requirements are included in Appendix C. MOPT at Detectable Warning, Type B includes placing stone (ODOT 304) in the tub until the pavers are installed. MOPT at Detectable Warning, Type O includes saw horse barricades while paint is drying.

**INSPECTION-  
ACCEPTANCE  
CRITERIA**

No national standard is available at this time. City of Cincinnati will be developing these in the near future. Guidelines from the City of Columbus Ohio are attached for review and comment only (Appendix B).



**STANDARD DRAWINGS**

**SUPPLEMENTAL SPECIFICATIONS**

## ITEM 608 - WALKS, CURB RAMPS AND STEPS

608.011	Description Detectable Warning
608.021	Materials Detectable Warning
608.07	Curb Ramps
608.071	Detectable Warning Submittals
608.072	Detectable Warning Application
608.08	Method of Measurement
608.081	Method of Measurement Detectable Warning
608.09	Basis of Payment

### 608.01 Description. Add:

**608.011 Description Detectable Warning.** Furnish all material, equipment, and labor necessary for the placement of detectable warning devices at curb ramps or other walking surfaces, complete and ready for service at locations shown on the plans. Perform the work in accordance with Sections 4.1 and 4.7 of the Americans with Disability Act Accessibility Guidelines (ADAAG) as amended through January 1998 and with Section 1108 of the Architectural and Transportation Barriers Compliance Board's "Draft Guidelines For Accessible Public Rights-of-Way," dated June 17, 2002 as amended, supplemented and adopted.

**Type B.** In new curb ramp construction, the detectable warning consists of ceramic/clay paving bricks on sand bedding on concrete base.

**Type O.** Overlay existing curb ramps which conform to current ADAAG specifications with pre-approved products.

### 608.02 Materials. Add:

**608.021 Materials Detectable Warning.** All detectable warning materials conform to ANSI A117.1—1998 Specifications. Submit manufacturer's certification of compliance with all applicable standards and drawings and/or catalog cutsheets to the City Engineer for approval at least three working days prior to installation.

Detectable warning surfaces contrast visually with adjacent walking surfaces either light-on-dark, or dark-on-light and shall be textured to provide slip resistance. Submit color samples for approval by the City Engineer at least three working days prior to installation. Color submittals include manufacturer's statement of percentage of visual contrast provided according to ADAAG A4.29.2. Brick red is the preferred color of a detectable warning used with a light background. Safety yellow or light granite is the preferred color of a detectable warning used with a dark background. The City Engineer may approve other colors.

**Detectable Warning Types.** Material type of detectable warnings includes the following classifications:

**Type “B”**— Pre-Cast Manufactured 4”x8”x2.25” (101.6mm x 202.2mm x 57.15mm) clay/ceramic paving brick, as manufactured by:

1. Whitacre-Greer, 1400 S. Mahoning Ave., Alliance Ohio 44601. Color: Clear Red (Rustic) #30.
2. Endicott Clay Products, PO Box 17, Fairbury Nebraska, 68352, 1-402-729-3315. Color: Red Blend.
3. Pine Hall Brick, P.O. Box 11044, 2701 Shorefair Drive, Winston-Salem, North Carolina 27116-1044, (800) 334-8689. Color: Pathway Red.

Or approved equal.

**Type “O”**— Surface Applied Polymer Domes as manufactured by:

1. Cote – L Safti-Trax (201) 836-0733, Color: Red.
2. TILCO Vanguard, (800) 290-5700, Color: Red (No mats).
3. Strongwarn, SWADA – 2000, (800) 535-0668, Color: Charcoal Grey.

Or approved equal.

**Type “B” Clay unit pavers.** Type “B” unit pavers conform to ASTM C902 Class SX, Type I, Specification for Pedestrian and Light Traffic Paving Brick. Color shall be as noted above unless otherwise specified on the plans. Minimum average compressive strength is 8,000 psi (60 MPa). Average cold water absorption is greater than 6% with no individual unit testing greater than 7%. Resistance of 50 freeze-thaw cycles, when tested in accordance with ASTM C67. Dimension tolerances meet the PX standard. The dimension tolerances around the mean values for length width, and depth are 1/16” (2 mm). The pavers must be solid units without core holes or other perforations. Ensure that the manufacturer conducts a test sampling of 24 pavers every 50,000 pavers manufactured to determine compliance with dimensional and water absorption characteristics.

**Bedding and Joint Sand.** The sand bedding course consists of clean coarse concrete sand, containing no more than 9% loam content. Grading of sand samples conform to ASTM C136. The particles are sharp and conform to the grading requirements of ASTM C33:

<b>Sieve Size</b>	<b>% Passing</b>
3/8”(9.5 mm)	100
No. 4 (4.75 mm)	95-100
No. 8 (2.36 mm)	80-100
No. 16 (1.18 mm)	50-85

No. 30 (600 ?m)	25-60
No. 50 (300 ?m)	10-30
No. 100 (150 ?m)	2-10

**Base Course.** The base consists of 5”(125 mm) thick plain Portland cement concrete conform to ODOT 608 – Concrete Walk with the following exceptions:

1. The surface finish toweled and broom finish is not required.
2. Provide at least two weep holes at low points in the depression. Fill the weep holes with pea gravel and cover with filter fabric to prevent sand migration out of the tub.

**Edge Restraint.** – Restrain the Type B detectable warning bricks on all edges by 6”(150 mm) wide by 9” (225 mm) thick cast in place concrete walk conforming to ODOT 608. Expansion joints are not allowed immediately adjacent to the brick pavers or through the edge restraint. Chamfer the transition between 9” (225 mm) thick walk and 5” (150 mm) thick walk over a distance of 5” (150 mm), as shown on the standard drawing.

**Truncated Dome Dimensions.** Truncated domes in a detectable warning surface 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).

Truncated domes in a detectable warning surface 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 (16 mm) minimum, measured between the most adjacent domes on a square grid.

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

Locate the detectable warning surface so that the edge nearest the curb line is 6 inches (150 mm) minimum and 8 inches (205 mm) maximum from the face of the curb line.

Align the domes on a square grid, aligned in rows parallel and perpendicular to the predominant direction of travel. Domes must not be skewed diagonally to the direction of travel.

### **608.071 Detectable Warning Submittals**

Submit two (2) copies of manufacturer’s technical data for each manufactured product, including certification that each product complies with the specified requirements. Indicate by transmittal that the installer has received a copy of each instruction. Submit three samples made up of actual unit pavers; color and texture required. Include in each set of samples the full range of exposed color and texture to be expected in the completed work.

**608.072 Detectable Warning Application.** Prepare the surface of existing conforming ramps and install the detectable warning devices in accordance with manufacturer's specifications and in accordance with this specification, or as otherwise specified on the plans. The finished surface is uniformly profiled to completely match the adjoining surfaces without lips, obstructions and drains completely. Provide a warranty that the application by the manufacturer to last no less than five years without losing more than two percent of the truncated domes. Also provide a warranty by the manufacturer for five years against fading, chipping, peeling, cracking, or loss of original shade due to sunlight, salt or exposure to weathering.

**A. Detectable Warning, Type B.** For Type "B" New Detectable Warning installations includes the forming of the recessed space required to accept the new pavers into the concrete ramp as a monolithic placement. See standard drawings, for typical details.

Protect unit pavers and aggregate during storage and construction against wetting by rain, snow or ground water and against soilage or intermixture with earth or other types of materials.

Compact sub-base to 8-1/2" (216 mm) below final grade. Provide base course material to bring the sub-base up to the appropriate level. Construct the top of concrete base course 3-1/2" (89 mm) below final grade. Shape the base course to grade and cross section with an allowable local tolerance of 1/4" (6 mm). Provide at least 2 weep holes, formed by concrete form stakes. After the forms are removed, fill the weep holes with pea gravel..

If there is a delay of more than 24 hours in installing the pavers, before the depressed base is open to pedestrian traffic, fill the hole with clean stone conforming to ODOT Item 304. Remove all stone prior to placement of the sand bedding course.

Obtain approval of the finished base course before placement of the sand bedding course. Cover the weep holes with filter fabric to prevent migration of sand bedding. Spread the sand bedding evenly over the areas to be paved and screened to a level that will produce the required 2-1/4" (56 mm) thickness when the paving bricks have been placed and vibrated. Do not disturb the sand bedding course once it has been screened and leveled.

Lay the paver units in the approved pattern. Lay the bricks in such a manner that the desired pattern is maintained and the joints between the bricks do not exceed 1/8" (3 mm). Fill the gaps at the edge of the paved surface with standard edge pieces or cut the bricks to fit. Cut the bricks to a straight even surface without cracks or chips. All cuts to be within 1/16" (1.5 mm).

Protect the paving bricks with mechanical protection (carpet, rubber material, etc.) and vibrate to their final level by 2 or 3 passes of a vibrating plate compactor. After the first vibration, brush sand containing at least 30% 1/16" (1.5 mm) particles over the surface and vibrate it into the joints with additional passes of the plate vibrator so as to completely fill the joints. Sweep the surplus material from the surface and leave the

entire site clean. After the final vibrating, test the surface with a 4 foot (1.2 m) board to verify that the surface is true to grade and does not vary by more than ¼”(3 mm) at any location.

**B. Detectable Warning, Type B Retrofit.** To install Type “B” Retrofit Detectable Warnings, remove existing sidewalk, replace with no less than the lower three feet of concrete curb ramp and install a new concrete ramp with recess to allow for the new bricks and sand bedding per 608.07. See standard drawings, for typical details.

**C. Detectable Warning, Type O.** Install Type “O” Detectable Warning installations, on pre-existing concrete curb ramp installations conforming to ADAAG and shall not be used on new construction. Install the detectable warnings in accordance with the manufacturers installation instructions.

**608.08 Method of Measurement - Add:**

**608.081 Method of Measurement Detectable Warning**

Measure the actual square feet of detectable warning devices, furnished and in place, complete and accepted and measured as specified in section 608.07. Measure from center-to-center of the outer-most domes as measured parallel and perpendicular to the ramp centerline, with both measurements each increased by 2 inches (50 mm). Round the square footage (square meter) calculation to the nearest one-tenth square foot (0.1 m). Complete this item and include all work necessary to provide a complete and useable detectable warning device. The work includes but is not be limited to: layout, maintenance of pedestrian traffic, saw-cutting, removals, concrete and cement base materials, bedding, surface preparation, surface sealant, and repair of adjoining areas disturbed by the installation of the detectable warning surface.

**608.09 Basis of Payment. Add:**

<b>Item</b>	<b>Unit</b>	<b>Description</b>
<b>608</b>	<b>Square Foot (Square Meter).</b>	<b>Detectable Warning, Type “B”</b>
<b>608</b>	<b>Square Foot (Square Meter)</b>	<b>Detectable Warning, Type “B” Retrofit</b>
<b>608</b>	<b>Square Foot (Square Meter)</b>	<b>Detectable Warning, Type “O”</b>

## **APPENDIX A**

### ADA Accessibility Guidelines (ADAAG) - Section 4.7 Curb Ramps As amended through January 1998 Accessibility Guidelines for Buildings and Facilities Section 4.7

#### 4.5 Ground and Floor Surfaces.

4.5.1\* General. Ground and floor surfaces along accessible routes and in accessible rooms and spaces including floors, walks, ramps, stairs, and curb ramps, shall be stable, firm, slip-resistant, and shall comply with 4.5.

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#### 4.7 Curb Ramps.

4.7.1 Location. Curb ramps complying with 4.7 shall be provided wherever an accessible route crosses a curb.

4.7.2 Slope. Slopes of curb ramps shall comply with 4.8.2. The slope shall be measured as shown in Fig. 11.

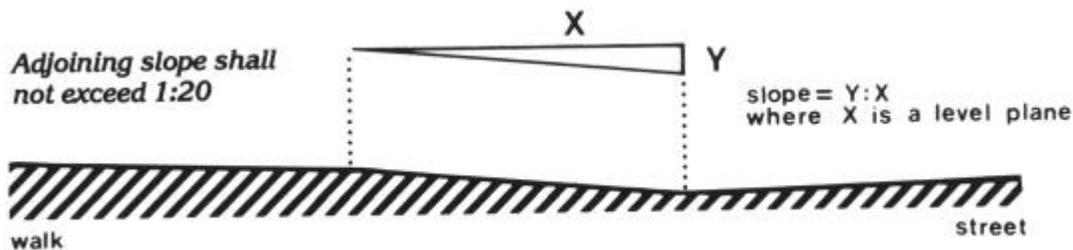


Fig 11

Transitions from ramps to walks, gutters, or streets shall be flush and free of abrupt changes. Maximum slopes of adjoining gutters, road surface immediately adjacent to the curb ramp, or accessible route shall not exceed 1:20.

4.7.3 Width. The minimum width of a curb ramp shall be 36 in (915 mm), exclusive of flared sides.

4.7.4 Surface. Surfaces of curb ramps shall comply with 4.5.

4.7.5 Sides of Curb Ramps. If a curb ramp is located where pedestrians must walk across the ramp, or where it is not protected by handrails or guardrails, it shall have flared sides; the maximum slope of the flare shall be 1:10. (see Fig.12(a)).

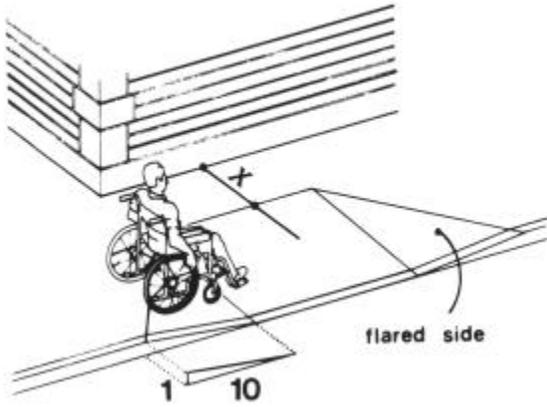


Fig 12a

Curb ramps with returned curbs may be used where pedestrians would not normally walk across the ramp (see Fig. 12(b)).

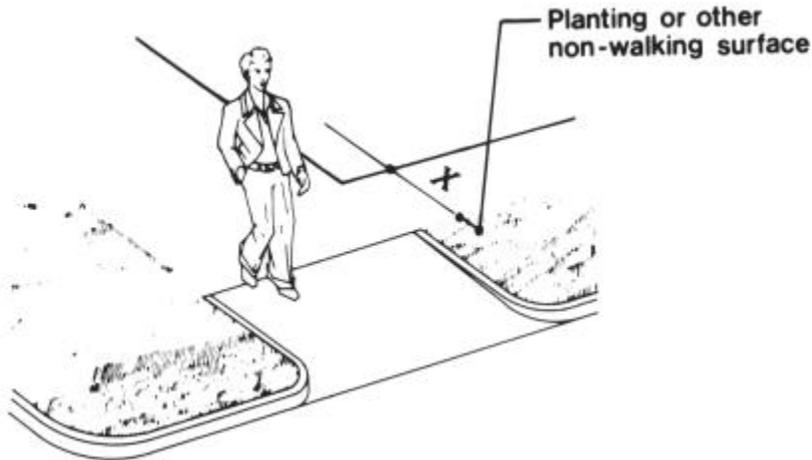


Fig 12b

4.7.6 Built-up Curb Ramps. Built-up curb ramps shall be located so that they do not project into vehicular traffic lanes (see Fig. 13).

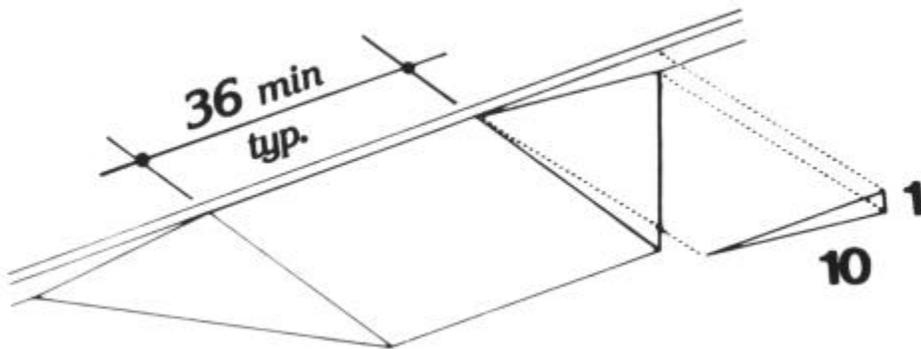


Fig 13

4.7.7 Detectable Warnings. A curb ramp shall have a detectable warning complying with 4.29.2. The detectable warning shall extend the full width and depth of the curb ramp.

4.7.8 Obstructions. Curb ramps shall be located or protected to prevent their obstruction by parked vehicles.

4.7.9 Location at Marked Crossings. Curb ramps at marked crossings shall be wholly contained within the markings, excluding any flared sides. (see Fig. 15).

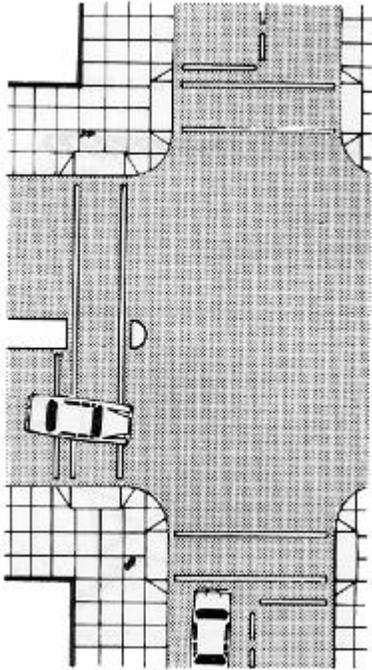


Fig 15a

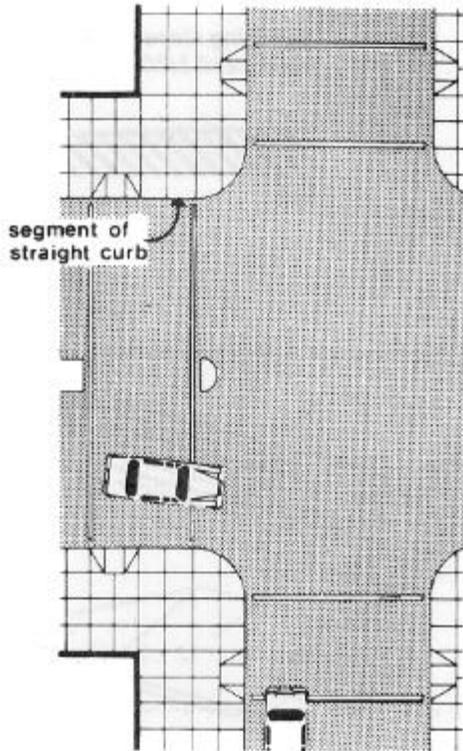


Fig 15b

4.7.10 Diagonal Curb Ramps. If diagonal (or corner type) curb ramps have returned curbs or other well-defined edges, such edges shall be parallel to the direction of pedestrian flow. The bottom of diagonal curb ramps shall have 48 in (1220 mm) minimum clear space as shown in Fig. 15(c) and (d).

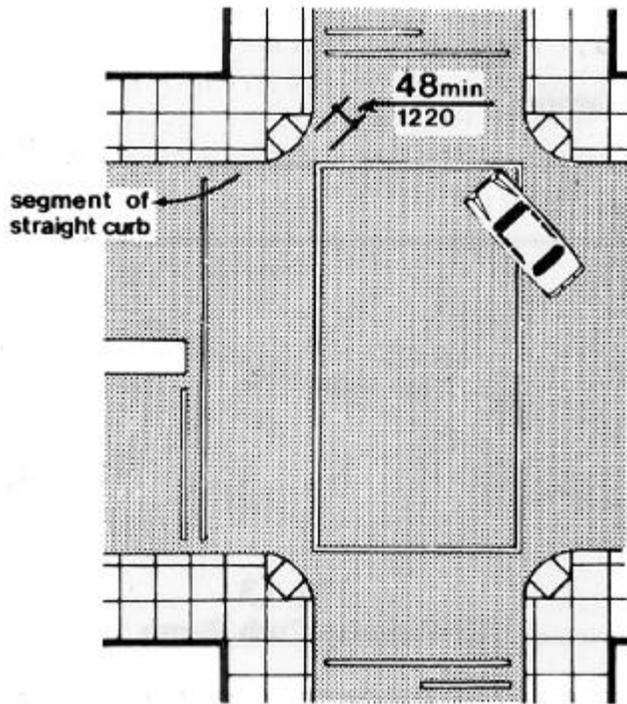


Fig 15c

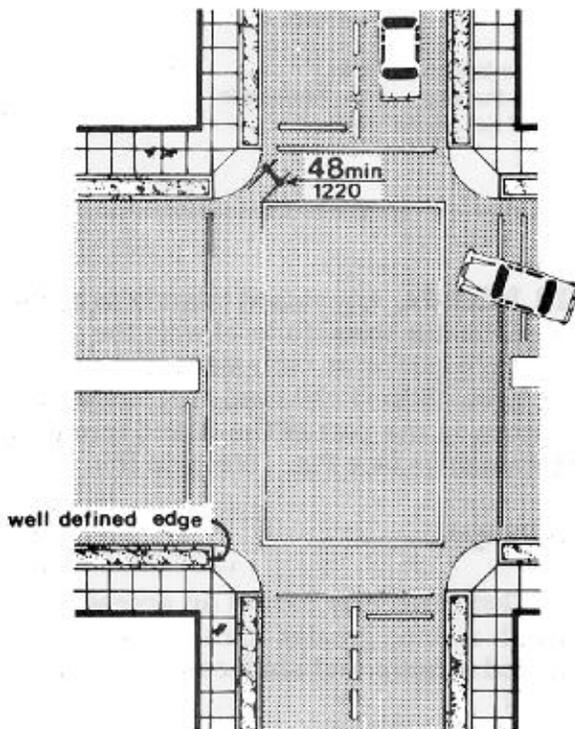


Fig 15d

If diagonal curb ramps are provided at marked crossings, the 48 in (1220 mm) clear space shall be within the markings (see Fig. 15(c) and (d)). If diagonal curb ramps have flared sides, they shall also have at least a 24 in (610 mm) long segment of straight curb located on each side of the curb ramp and within the marked crossing (see Fig. 15(c)).

4.7.11 Islands. Any raised islands in crossings shall be cut through level with the street or have curb ramps at both sides and a level area at least 48 in (1220 mm) long between the curb ramps in the part of the island intersected by the crossings (see Fig. 15(a) and (b)).

4.8.2\* Slope and Rise. The least possible slope shall be used for any ramp. The maximum slope of a ramp in new construction shall be 1:12. The maximum rise for any run shall be 30 in (760 mm) (see Fig. 16).

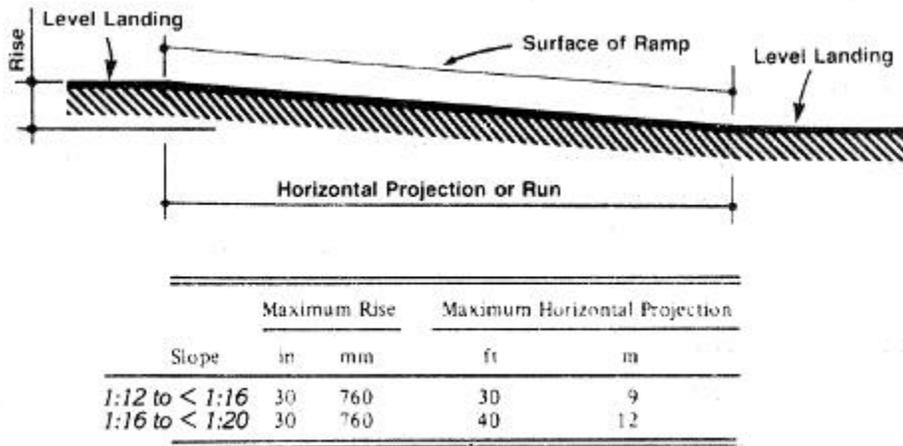


Fig 16

Curb ramps and ramps to be constructed on existing sites or in existing buildings or facilities may have slopes and rises as allowed in 4.1.6(3)(a) if space limitations prohibit the use of a 1:12 slope or less.

**Detectable Warnings.**

4.29.1 General. Detectable warnings required by 4.1 and 4.7 shall comply with 4.29.

4.29.2\* Detectable Warnings on Walking Surfaces. Detectable warnings shall consist of raised truncated domes with a diameter of nominal 0.9 in (23 mm), a height of nominal 0.2 in (5 mm) and a center-to-center spacing of nominal 2.35 in (60 mm) and shall contrast visually with adjoining surfaces, either light-on-dark, or dark-on-light.

The material used to provide contrast shall be an integral part of the walking surface. Detectable warnings used on interior surfaces shall differ from adjoining walking surfaces in resiliency or sound-on-cane contact.

**APPENDIX B**

Columbus Ohio Inspection and Acceptance Criteria – For Comment Only

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**Example of  
ADA Curb Ramp  
Inspection Criteria  
&  
Acceptance Criteria for  
Alterations to Existing Facilities**

**Note: Acceptance criteria was developed by  
H. R. Gray & Associates for the City of Columbus  
to be used for their contracts.**

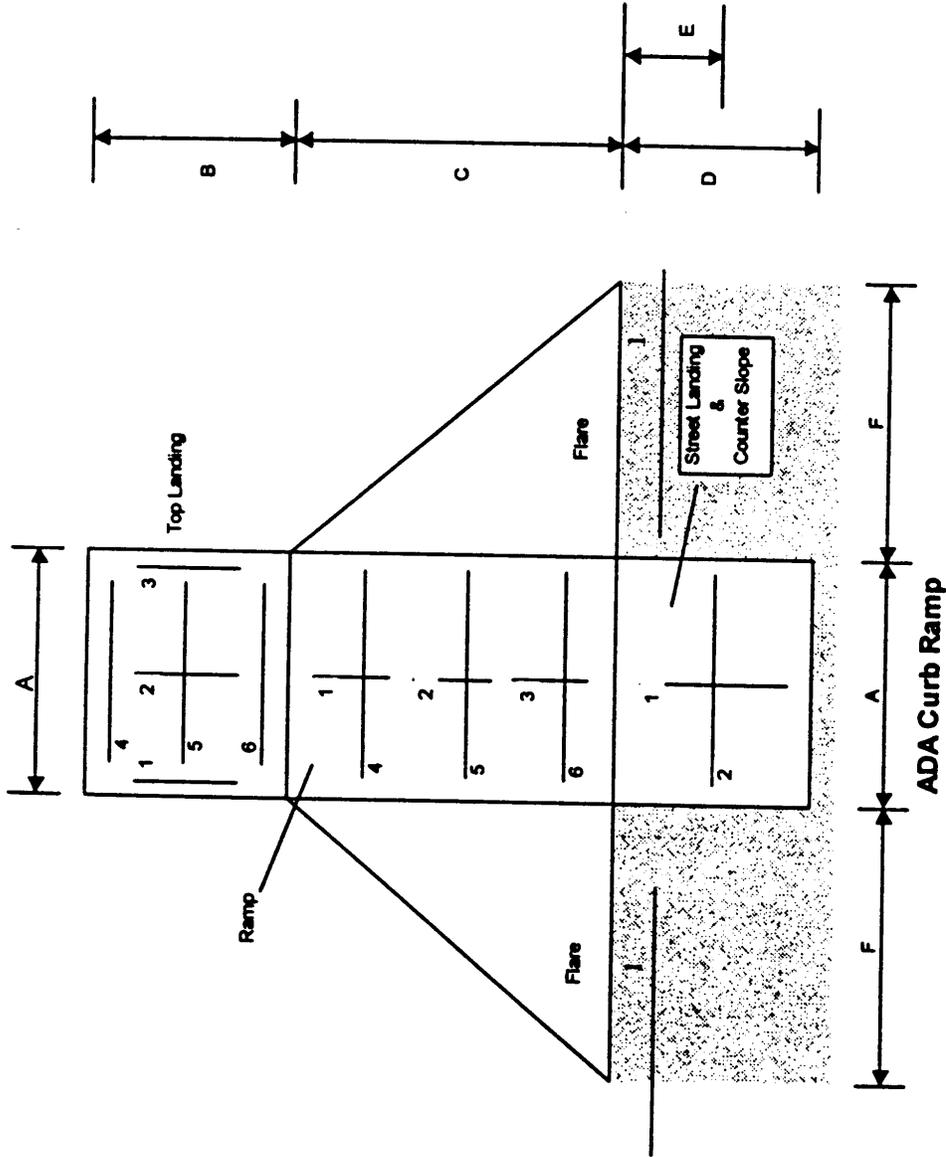
*not a national  
criteria*

June 20, 2002

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June 20, 2002

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<u>ACI Guidelines</u>	<u>Recommended Inspection Criteria</u>
<p>Standard Specifications for Tolerances for Concrete Construction and Materials (ACI 117-90). Section 12, Pavements &amp; Sidewalks, Level Alignment</p> <p>ACI 117-90, Section 12, Pavements &amp; Sidewalks, Level Alignment</p>	<p>Ramps, sidewalks, &amp; interchanges, in any direction, the gap below a 10 ft unlevelled straightedge resting on highspots shall not exceed 1/4".</p> <p>Measurements are to be taken within 72 hours after ramp slab installation and before forms are removed. (ACI 117-90)</p>
<u>ADA Guidelines</u>	<u>Recommended Acceptance Criteria</u>
<p><u>RAMP</u></p> <p>Width (A): 4 feet wide</p> <p>Length (C): 4 feet long</p> <p>Running Slope: Maximum 8.33% (1:12) (1, 2 &amp; 3)</p> <p>Cross Slope: Maximum 2.06% (1:48) (4, 5 &amp; 6)</p>	<p>Recommended 4 feet wide, may be reduced to 3 feet minimum, if conditions prohibit construction of a 4 foot wide ramp.</p> <p>Length will vary depending on the height of the curb and the elevation and setback of the sidewalk.</p> <p>Recommended 8.33%. The slope of the ramp may be increased to 10 percent (1:10) to allow for installation of a landing at the top of the ramp. Take three measurements in-line down the centerline of the ramp in percent slope (1, 2 &amp; 3). If the average of the three measurements is less than 10% with no single measurement greater than 10% the running slope is acceptable.</p> <p>Recommended 2.06%. Take 3 measurements across ramp (4, 5 &amp; 6). If average of 3 measurements is less than 3% with no single measurement equal to or greater than 4% the cross slope is acceptable.</p>



**COUNTER SLOPE**      If there is no street level landing the counter slope shall meet the following:

- Width (A):**                      4 feet wide                      Recommended 4 feet wide, may be reduced to 3 feet minimum, if ramp width is reduced to 3 feet.
- Length (E):**                      2 feet long from bottom of ramp                      Recommended 2 feet long.
- Running Slope: (1)**    Maximum 5.0% (1:20)                      Recommended 5.0%. Take two measurements. One on the ramp at the bottom along the centerline. Take a second measurement along the centerline of the counter slope. Add the two numbers. If the counter slope is less than or equal to 10 percent and the sum of the ramp slope AND the counter slope is less than 16.5%, then the counter slope is acceptable.
- Cross Slope: (2)**                      Maximum 2.08% (1:48)                      Recommended 2.08%. Take 1 measurement across ramp. If less than or equal to 3% the cross slope is acceptable.

**FLARES**

- Flare Slope (F):**                      Maximum 10% (1:10)                      Recommended 10%. Take one measurement at the face of the curb. If the flare slope is greater than 10% and the flare length is a minimum of 10 times the curb height, then the flare is acceptable. For example, if the curb height is equal to 6", then the flare length should be a minimum of 60 inches.

June 20, 2002

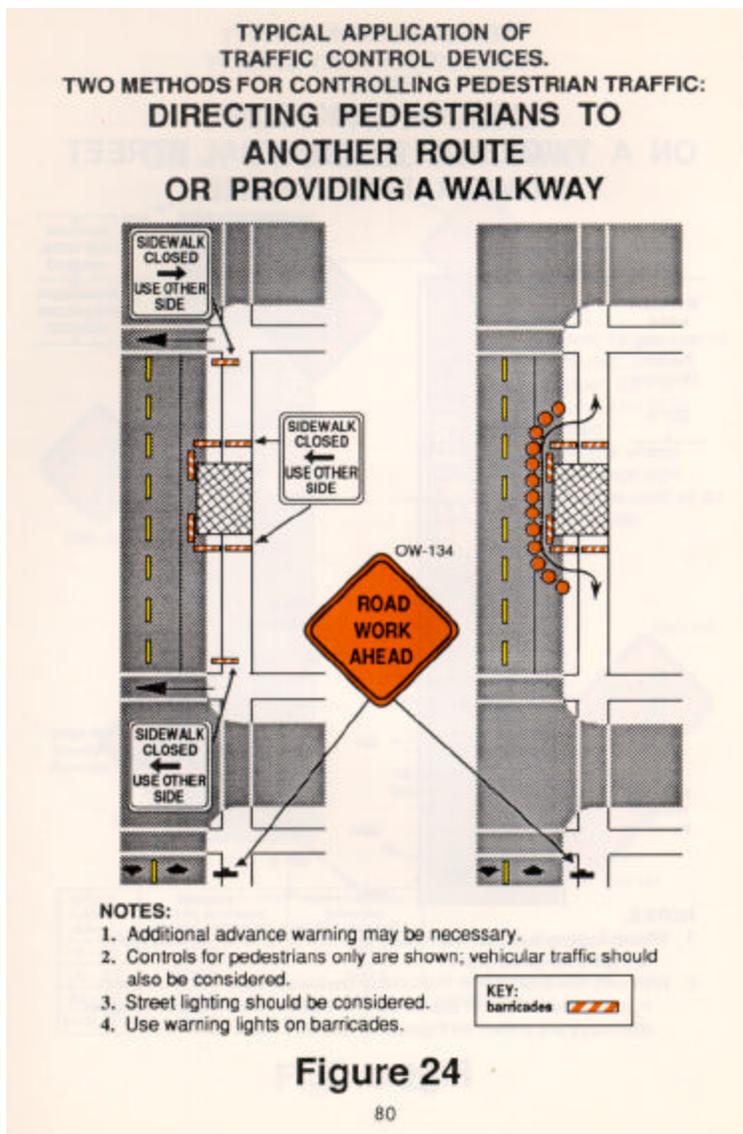
H. R. Gray & Associates, Inc.

## **APPENDIX C**

### **MAINTENANCE OF PEDESTRIAN TRAFFIC**

The Contractor is required to notify Metro five (5) days prior to any lane closure or bus stop closure. Metro contract is Ted Meyer at 513-632-7545. Contractor shall also contact TANK if work is in the Central Business District. Contractor shall also refer to the requirements of Item 614 in the City of Cincinnati Supplement to the ODOT Specifications for Maintenance of Traffic.

Pedestrian protection and pedestrian access shall be maintained at all times. Pedestrian safety is of utmost importance throughout the life of the contract. Pedestrians shall be directed to the safest crossing point at all times, and their safety is the responsibility of the Contractor.



(Source: City of Cincinnati, Traffic Safety Handbook, August 1989)

## Appendix C (Cont'd)

### 10. Pedestrians

When there is pedestrian traffic in the area, walkways should be provided. (Figure 24, page 80) The following situations would normally warrant including walkways in the TCP:

- Where sidewalks traverse the work zone,
- Where a designated school route traverses the work zone,
- Where significant pedestrian activity or evidence of such activity exists (i.e., a worn path), and
- Where existing land use generates pedestrian activity.

The following principles should be considered in designing or constructing pedestrian facilities:

- Pedestrian and vehicles should be physically separated (i.e., by barrier, barricade, or similar items). See Figure 24, page 80.
- Pedestrian walkways should be maintained free of any obstructions and hazards such as holes, debris, mud, construction equipment, stored materials, etc.
- Temporary lighting should be considered by all walkways that are used at night, particularly if adjacent walkways are lighted.
- Walkways should be at least 4 or 5 feet wide, and should be wider in areas of high pedestrian activity.
- All hazards (ditches, trenches, excavations, etc.) near or adjacent to walkways should be clearly delineated.
- Walkways under or adjacent to elevated work activities such as bridges or retaining walls may require covered walkways.

## Appendix C (Cont'd)

- Where safe pedestrian passage cannot be provided, pedestrians should be directed to the other side of the street by appropriate traffic control devices. See Figure 24, page 80.
- Signs and traffic control devices should not be a hazard to pedestrians.
- Signs located near or adjacent to a sidewalk should have a 7-foot clearance.
- Where construction activities involve sidewalks on both sides of the street efforts should be made to stage the work so that both sidewalks are not out of service at the same time.
- In the event that sidewalks on both sides of the street are closed, pedestrians should be guided around the construction site.
- Reflectorized traffic control devices are of little value to pedestrians. Warning lights should be used to delineate the pedestrians pathway and to mark hazards as appropriate.

### **11. Bicycles**

Bicycles also need protection and access to the roadway. If a bicycle path is closed because of the work being done, an alternate route should be provided and signed if appropriate. Bicycles should not be directed into the same path being used by pedestrians.