

## **SECTION 9 – DRIVEWAYS & SIDEWALKS**

### **CITY OF CARO**

#### **ENGINEERING DESIGN STANDARDS**

##### **A. Plans and Specifications - Submittal Procedure**

1. Plans and specifications shall be submitted as part of a site development package in accordance with “Section 1 - General Requirements & Submittals.”

##### **B. Plans and Specifications - Design Criteria for Driveways**

1. Residential – All residential driveways within the road right of way shall be concrete with a minimum thickness of six (6) inches. Residential driveways shall have a minimum width of ten (10) feet or match the existing drive. No residential driveway shall be wider than thirty (30) feet (measured at the edge of the street), unless approved in writing by the City.
2. Commercial – All commercial driveways within the road right of way shall be concrete with a minimum thickness of eight (8) inches and reinforced with w/ 6x12, w14/w6 paving mesh. Commercial drives shall be of a width approved by the City.
3. Industrial – Heavily traveled industrial drives shall be designed by a qualified Professional Engineer and approved by the City. Industrial drive widths shall be approved by the City.
4. Residential approaches shall have adequate flares to provide a safe turning radius. Minimum flaring shall be five (5) feet. Flaring length shall be a minimum of ten (10) feet. If a residential driveway is wider than twenty (20) feet, the flaring widths shall be adjusted to provide a maximum drive opening of thirty (30) feet.
5. Commercial and industrial approaches shall be MDOT Type “M” openings.
6. Driveways shall be sloped to direct drainage to the street.
7. No curb cut or driveway approach shall be made to a public street or right-of-way without first obtaining a permit from the City.
8. Curb cuts or approaches installed unlawfully or unused shall be removed by the property owner including replacing the street curb and gutter. If such is not replaced by the property owner in accordance with City specifications, the City will have the work done and the cost thereof shall be charged to the property owner.
9. For approaches constructed on an existing curbed street, the curb and gutter shall be entirely removed and replaced to construct a MDOT type “N” curb opening for residential drives or a MDOT Type “M” curb opening for commercial drive approaches. The extent of the removal shall extend to the nearest joint past the spring line of the new curb opening. No horizontal curb cutting will be allowed.
10. Driveway construction shall also conform to the Michigan Department of Transportation Standard Plan sheets series R-29, latest revision. The most recent version of which (at the time of this document) is attached and the end of this section.

C. Plans and Specifications – Design Criteria for Sidewalks

1. Sidewalks shall generally be located one (1) foot inside of the right of way line and parallel to such line and shall be required on both sides of a new street. For commercial site plans, continuous sidewalk shall be provided across the parcels frontage.
2. Sidewalks shall be five (5) feet wide with control joints one (1) inch deep at five (5) foot intervals.
3. Sidewalks shall generally conform to the grade of the existing topography. Sidewalk transverse slopes shall not exceed one-half (1/2) inch per foot. Transverse slopes less than one-quarter (1/4) inch per foot shall not be used unless longitudinal drainage is provided. Longitudinal grades shall not exceed one (1) inch per foot.
4. Sidewalks shall also meet latest ADA (Americans with Disabilities Act) requirements.
5. Sidewalks shall have smooth transitions and gentle curves. No sharp edges or abrupt changes in alignment are allowed. Sidewalks shall “jog” around natural features (i.e. trees, etc.)
6. Plans for sidewalks shall include existing contours at a minimum of two (2) foot intervals. Proposed grades along the centerline of the sidewalk shall be at fifty (50) foot intervals.
7. In general, sidewalks shall be at a higher elevation than the street and slope transversely toward the street at two percent (2%) minimum.
8. Where sidewalks meet driveways, they shall run continuously through the drives. The slope of the drives shall be designed to meet the sidewalk.
9. At street intersections, sidewalk ramps shall be used to meet the existing street grade. If existing curb is involved, the curb shall be removed and the sidewalk ramped to meet the pavement. No horizontal curb cutting will be allowed.
10. Integrated curb and sidewalk shall not be used, except for commercial site plans.
11. Sidewalks shall have the following thicknesses:

Thru commercial drives*	8" w/6x12, w14/w6 paving mesh
Thru residential drives*	6"
Sidewalk ramps	6"
All others	4"

\*Plus one (1) flag each side of driveway

12. Sidewalk construction shall also conform to the Michigan Department of Transportation Standard Plan sheets series R-28 and R-29, latest revisions. The most recent versions of which (at the time of this document) are attached and the end of this section.

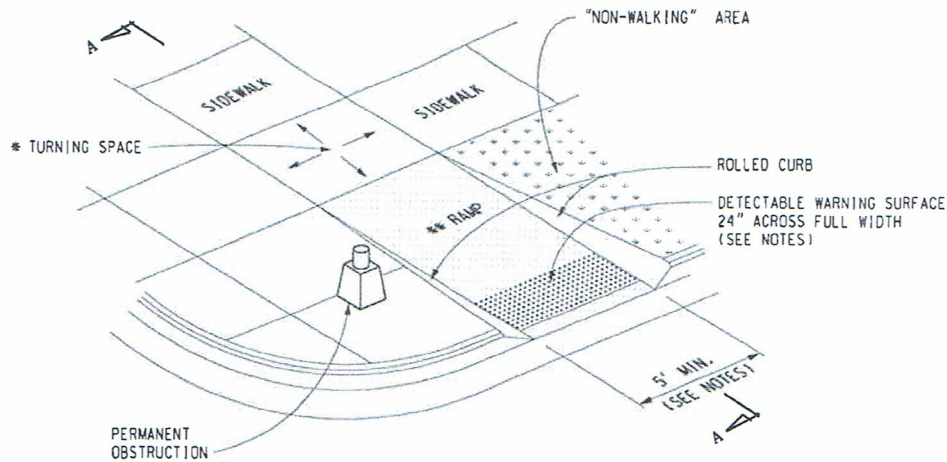
D. Materials

1. Sidewalks and driveways shall be air-entrained concrete with a minimum compressive strength of 3500 psi. Sidewalk shall be treated with one (1) coat of a curing compound membrane.
2. Sidewalk and driveway base shall be four (4) inches of Class II Sand, compacted to ninety-five percent (95%) maximum density.
3. Shoulders shall be graded gently away from the sidewalk and be either seeded and mulched, or sod.

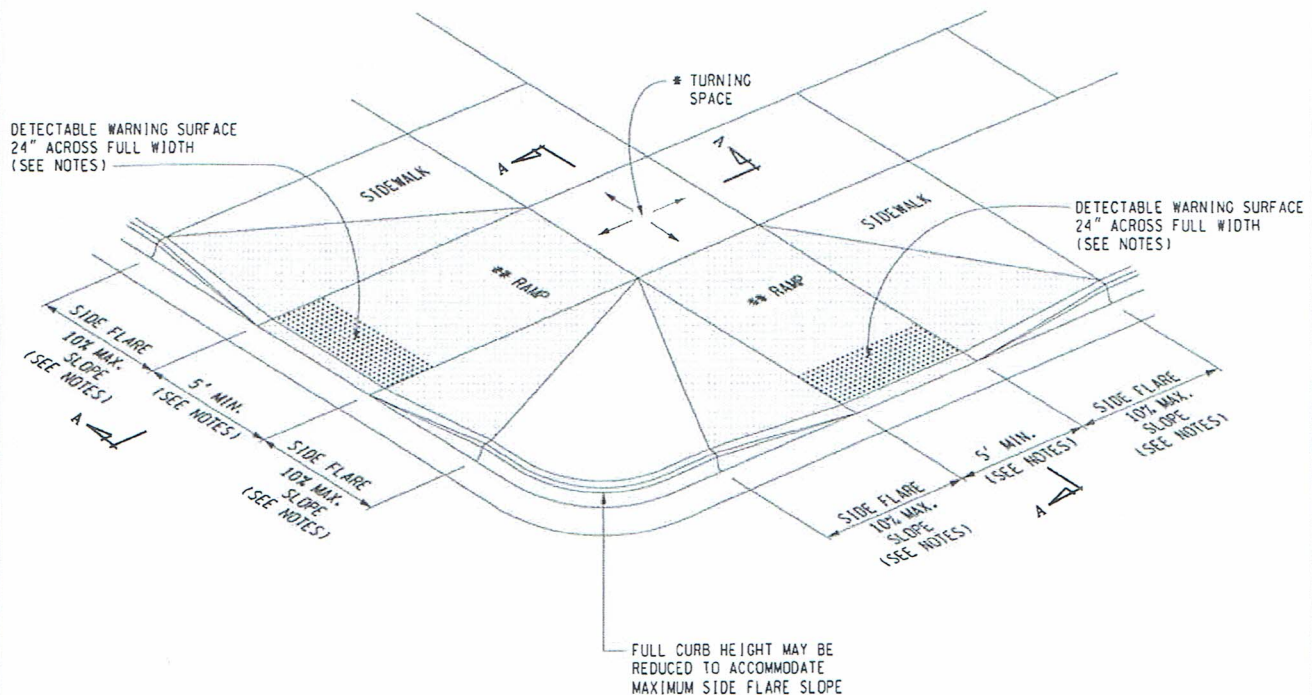


\* MAXIMUM TURNING SPACE SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

\*\* MAXIMUM RAMP CROSS SLOPE IS 2.0%, RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



**SIDEWALK RAMP TYPE R**  
(ROLLED SIDES)



**SIDEWALK RAMP TYPE F**  
(FLARED SIDES, TWO RAMPS SHOWN)



PREPARED  
BY  
DESIGN DIVISION

DRAWN BY: B.L.T.

CHECKED BY: W.K.P.

DEPARTMENT DIRECTOR  
Kirk T. Steudle

APPROVED BY:

*Randy Van Pelt*  
DIRECTOR, BUREAU OF FIELD SERVICES

APPROVED BY:

*Mark A. Van Pelt*  
DIRECTOR, BUREAU OF HIGHWAY DEVELOPMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

## SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

9-30-2014

F.H.W.A. APPROVAL

7-1-2014

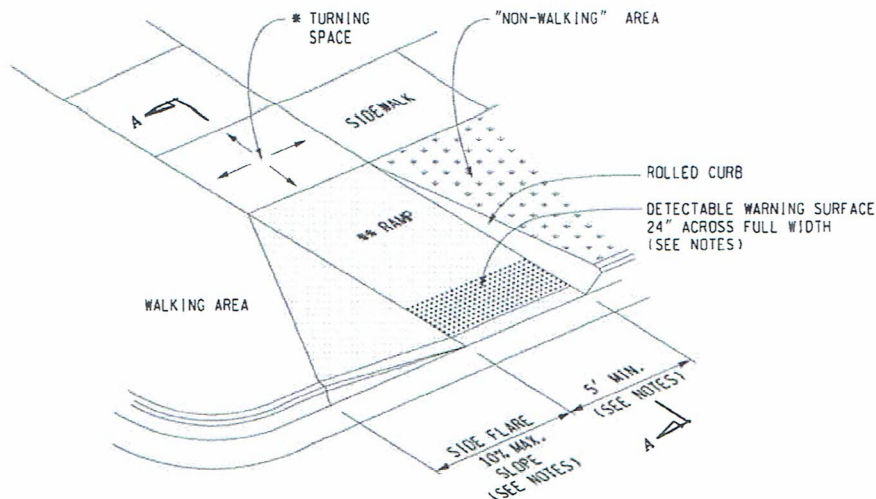
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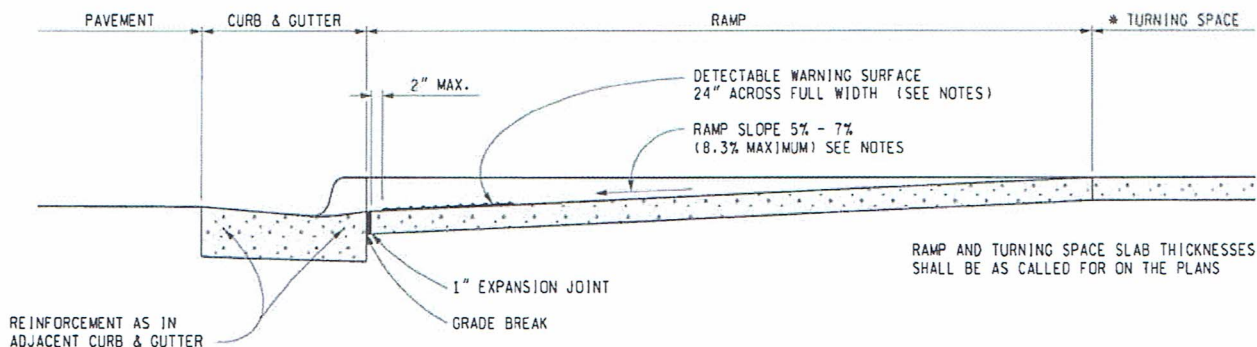
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\* MAXIMUM TURNING SPACE SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

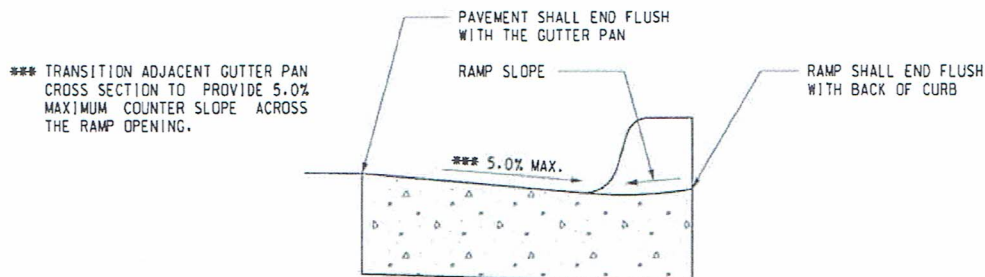
\*\* MAXIMUM RAMP CROSS SLOPE IS 2.0%, RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



**SIDEWALK RAMP TYPE RF**  
(ROLLED / FLARED SIDES)



**SECTION A-A**



**SECTION THROUGH CURB CUT**  
(TYPICAL ALL RAMP TYPES)

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DETECTABLE WARNING DETAILS**

9-30-2014  
F.H.W.A. APPROVAL

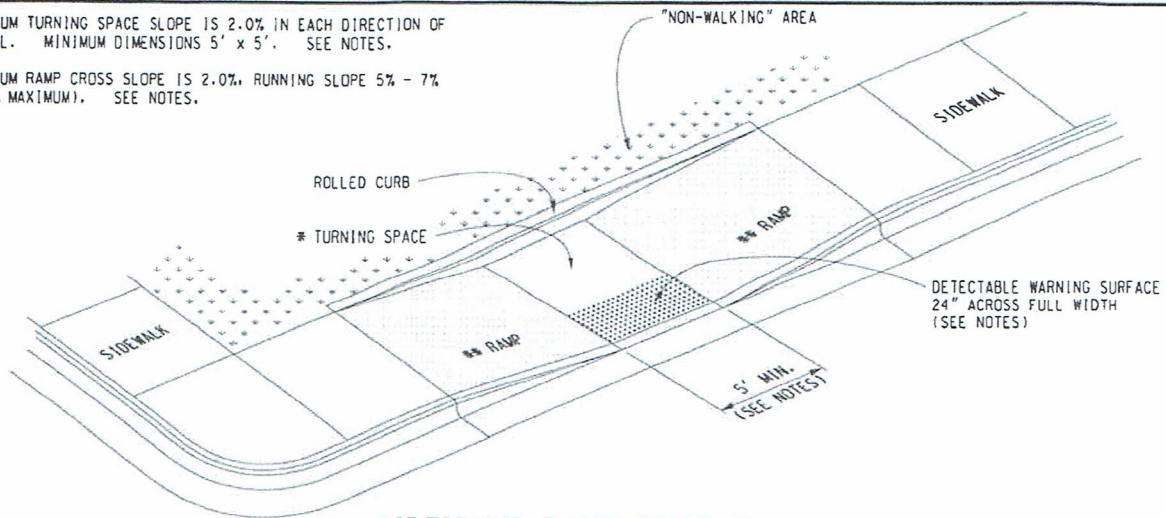
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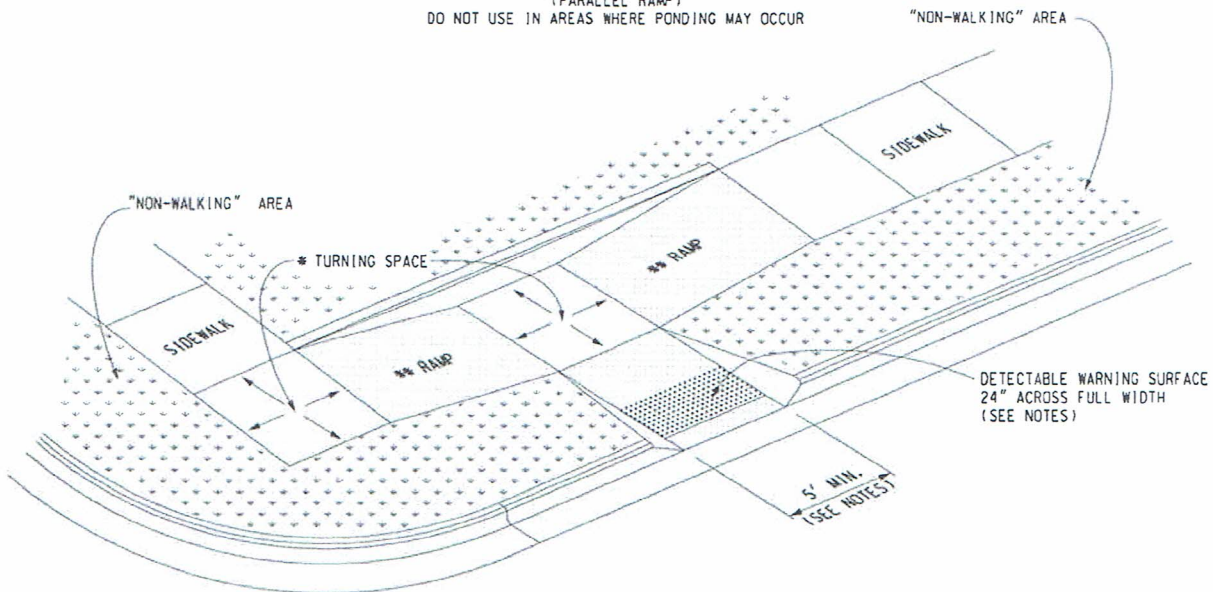
- \* MAXIMUM TURNING SPACE SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.
- \*\* MAXIMUM RAMP CROSS SLOPE IS 2.0%, RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



### SIDEWALK RAMP TYPE P

(PARALLEL RAMP)

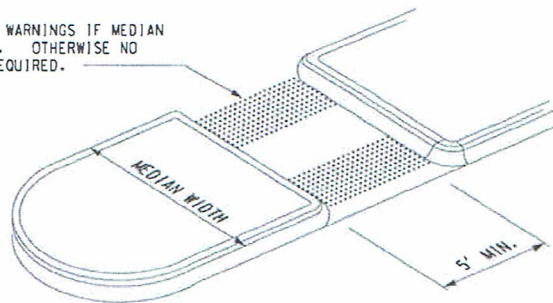
DO NOT USE IN AREAS WHERE PONDING MAY OCCUR



### SIDEWALK RAMP TYPE C

(COMBINATION RAMP)

USE 24" DEEP DETECTABLE WARNINGS IF MEDIAN WIDTH IS AT LEAST 6'-0". OTHERWISE NO DETECTABLE WARNING IS REQUIRED.



### SIDEWALK RAMP TYPE M

(MEDIAN ISLAND)

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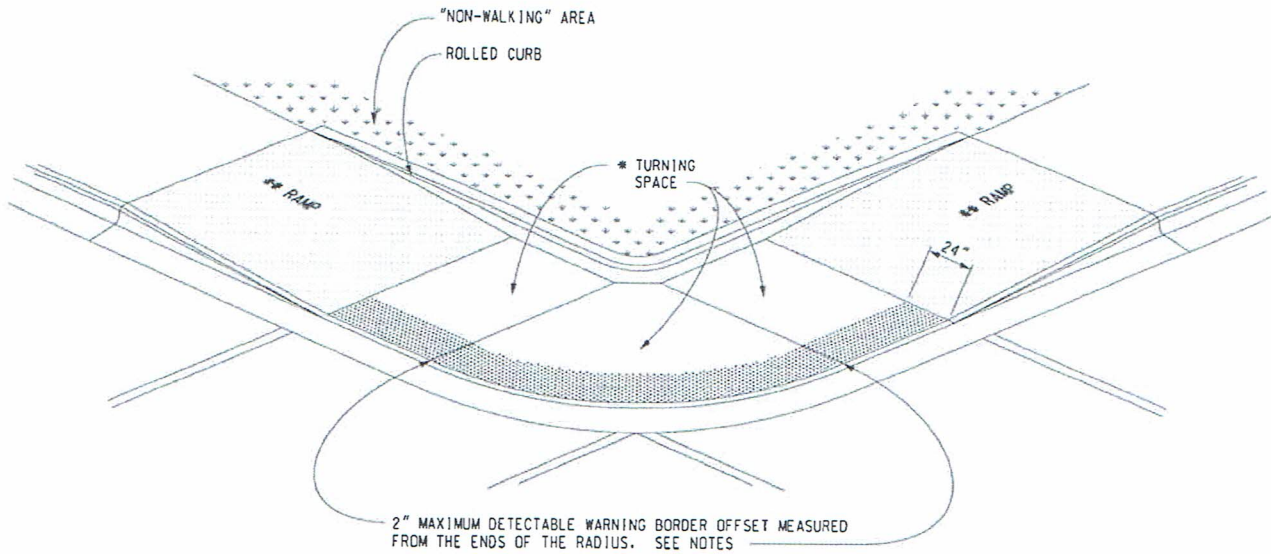
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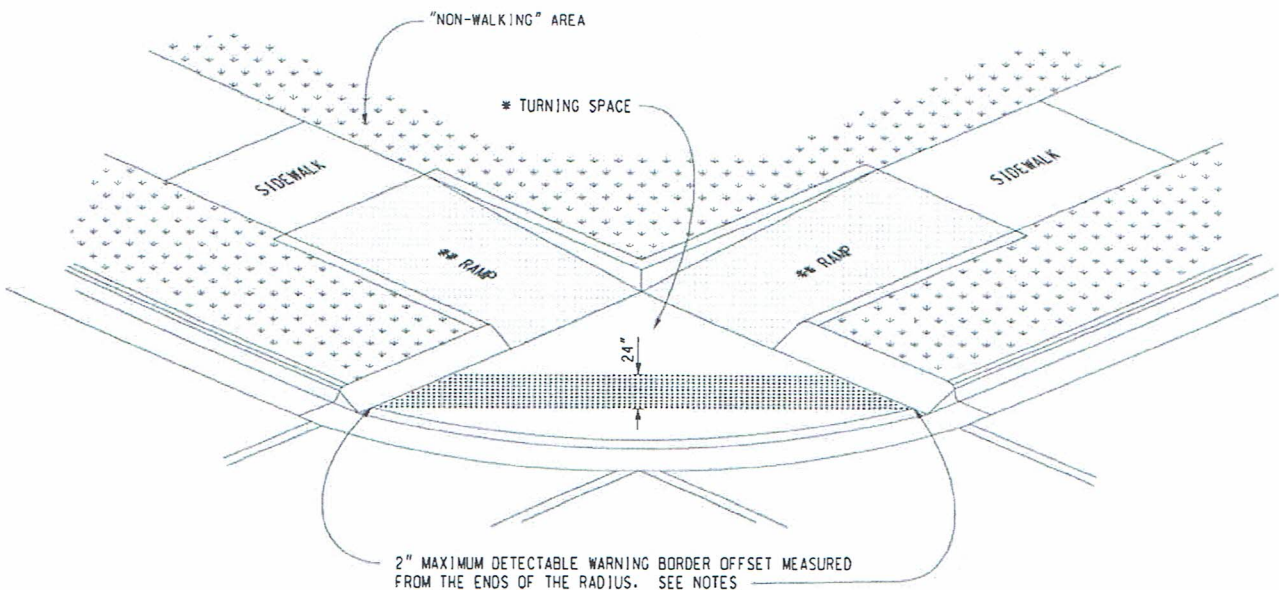
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\* MAXIMUM TURNING SPACE SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

\*\* MAXIMUM RAMP CROSS SLOPE IS 2.0%, RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



( RADIAL DETECTABLE WARNING SHOWN )



( TANGENT DETECTABLE WARNING SHOWN )

### SIDEWALK RAMP TYPE D

(DEPRESSED CORNER)

USE ONLY WHEN INDEPENDENT DIRECTIONAL RAMPS CAN NOT BE CONSTRUCTED FOR EACH CROSSING DIRECTION

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## SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

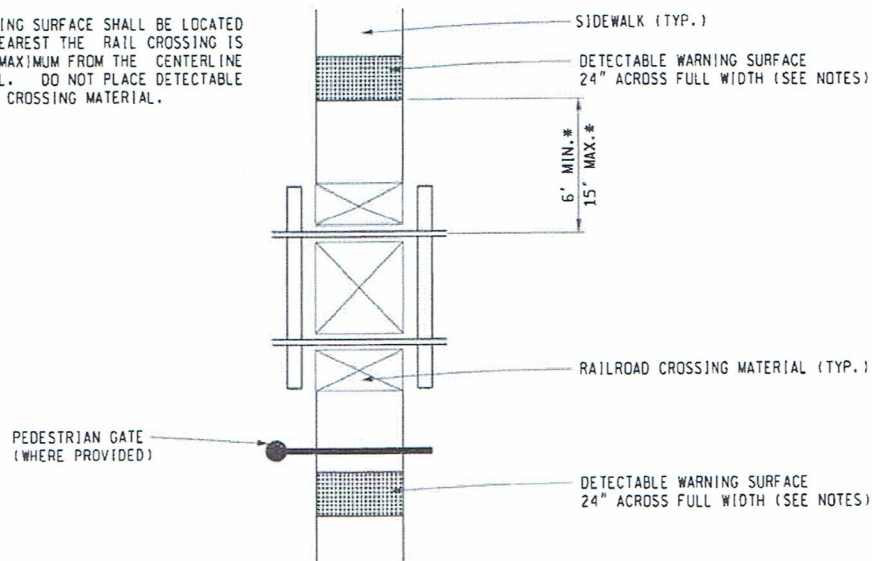
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\* THE DETECTABLE WARNING SURFACE SHALL BE LOCATED SO THAT THE EDGE NEAREST THE RAIL CROSSING IS 6' MINIMUM AND 15' MAXIMUM FROM THE CENTERLINE OF THE NEAREST RAIL. DO NOT PLACE DETECTABLE WARNING ON RAILROAD CROSSING MATERIAL.



DETECTABLE WARNING AT RAILROAD CROSSING



DETECTABLE WARNING AT FLUSH SHOULDER OR ROADWAY

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# SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

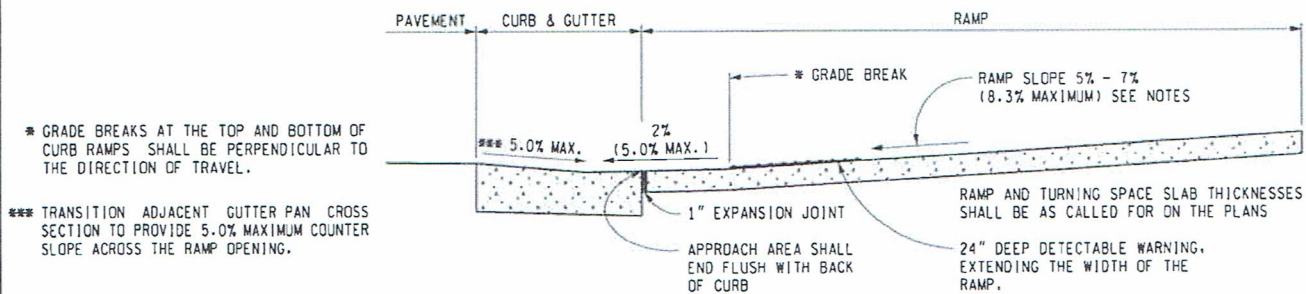
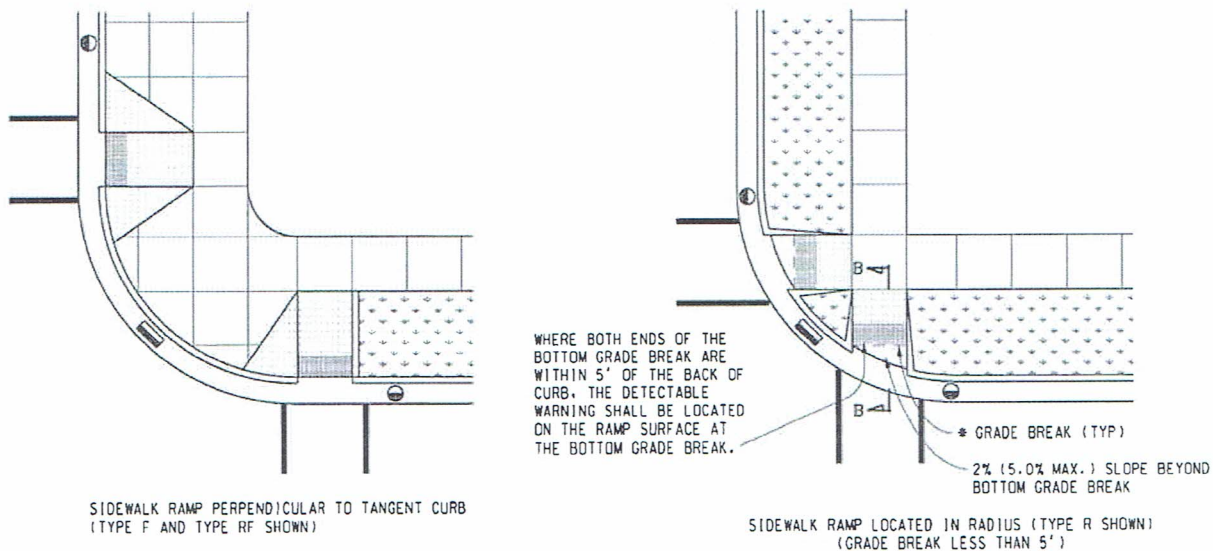
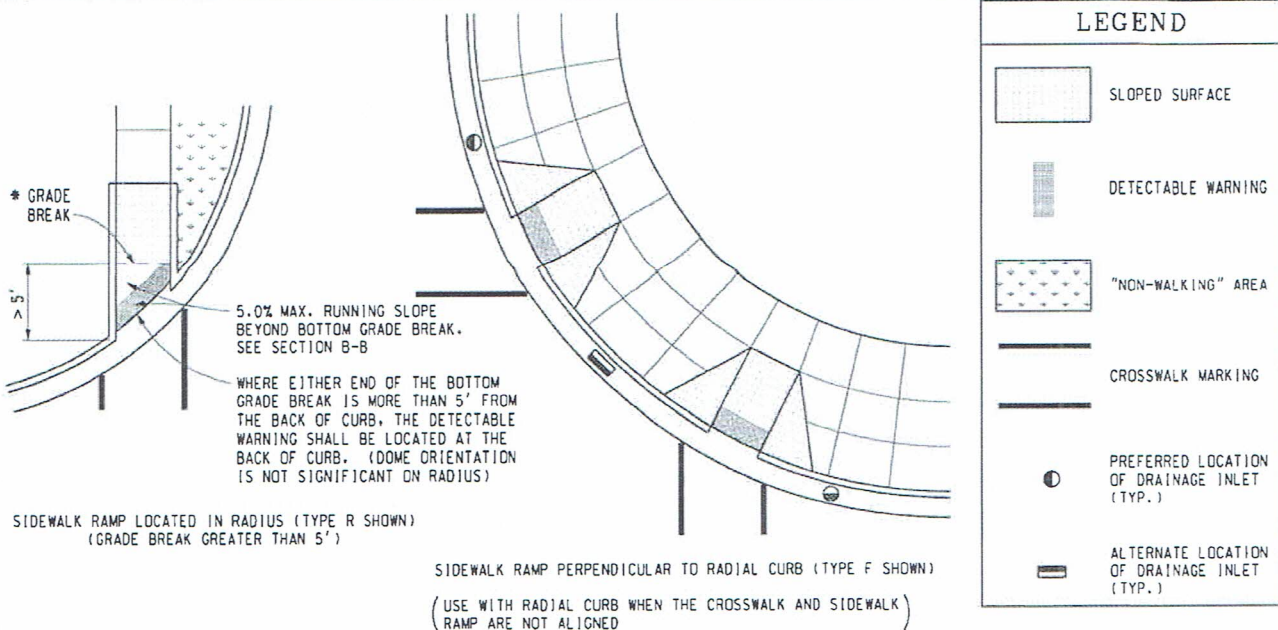
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### SECTION B-B SIDEWALK RAMP ORIENTATION

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BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

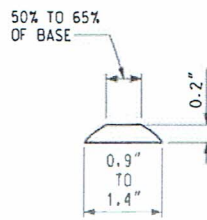
## SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

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F.H.W.A. APPROVAL

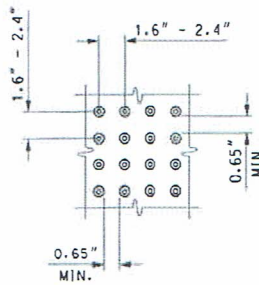
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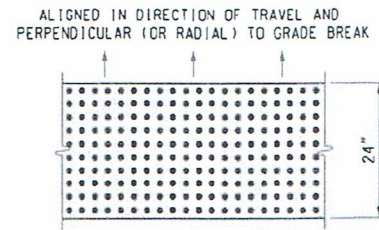
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DOME SECTION



DOME SPACING



DOME ALIGNMENT

## DETECTABLE WARNING DETAILS

### NOTES:

DETAILS SPECIFIED ON THIS PLAN APPLY TO ALL CONSTRUCTION, RECONSTRUCTION, OR ALTERATION OF STREETS, CURBS, OR SIDEWALKS IN THE PUBLIC RIGHT OF WAY.

SIDEWALK RAMPS ARE TO BE LOCATED AS SPECIFIED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.

RAMPS SHALL BE PROVIDED AT ALL CORNERS OF AN INTERSECTION WHERE THERE IS EXISTING OR PROPOSED SIDEWALK AND CURB. RAMPS SHALL ALSO BE PROVIDED AT MARKED AND/OR SIGNALIZED MID-BLOCK CROSSINGS.

SURFACE TEXTURE OF THE RAMP SHALL BE THAT OBTAINED BY A COARSE BROOMING, TRANSVERSE TO THE RUNNING SLOPE.

SIDEWALK SHALL BE RAMPED WHERE THE DRIVEWAY CURB IS EXTENDED ACROSS THE WALK.

CARE SHALL BE TAKEN TO ASSURE A UNIFORM GRADE ON THE RAMP. WHERE CONDITIONS PERMIT, IT IS DESIRABLE THAT THE SLOPE OF THE RAMP BE IN ONLY ONE DIRECTION, PARALLEL TO THE DIRECTION OF TRAVEL.

RAMP WIDTH SHALL BE INCREASED, IF NECESSARY, TO ACCOMMODATE SIDEWALK SNOW REMOVAL EQUIPMENT NORMALLY USED BY THE MUNICIPALITY.

PROVIDE TURNING SPACES WHERE PEDESTRIAN TURNING MOVEMENTS ARE REQUIRED.

WHEN 5' MINIMUM WIDTHS ARE NOT FEASIBLE, RAMP WIDTH MAY BE REDUCED TO NOT LESS THAN 4' AND TURNING SPACES TO NOT LESS THAN 4' x 4'.

DETECTABLE WARNING SURFACE COVERAGE IS 24" MINIMUM IN THE DIRECTION OF RAMP/PATH TRAVEL AND THE FULL WIDTH OF THE RAMP/PATH OPENING EXCLUDING CURBED OR FLARED CURB TRANSITION AREAS. A BORDER OFFSET NOT GREATER THAN 2" MEASURED ALONG THE EDGES OF THE DETECTABLE WARNING IS ALLOWABLE. FOR RADIAL CURB THE OFFSET IS MEASURED FROM THE ENDS OF THE RADIUS.

FOR NEW ROADWAY CONSTRUCTION, THE RAMP CROSS SLOPE MAY NOT EXCEED 2.0%. FOR ALTERATIONS TO EXISTING ROADWAYS, THE CROSS SLOPE MAY BE TRANSITIONED TO MEET AN EXISTING ROADWAY GRADE. THE CROSS SLOPE TRANSITION SHALL BE APPLIED UNIFORMLY OVER THE FULL LENGTH OF THE RAMP.

THE MAXIMUM RUNNING SLOPE OF 8.3% IS RELATIVE TO A FLAT (0%) REFERENCE. HOWEVER, IT SHALL NOT REQUIRE ANY RAMP OR SERIES OF RAMPS TO EXCEED 15 FEET IN LENGTH.

DRAINAGE STRUCTURES SHOULD NOT BE PLACED IN LINE WITH RAMPS. THE LOCATION OF THE RAMP SHOULD TAKE PRECEDENCE OVER THE LOCATION OF THE DRAINAGE STRUCTURE. WHERE EXISTING DRAINAGE STRUCTURES ARE LOCATED IN THE RAMP PATH OF TRAVEL, USE A MANUFACTURER'S ADA COMPLIANT GRATE. OPENINGS SHALL NOT BE GREATER THAN 1/2". ELONGATED OPENINGS SHALL BE PLACED SO THAT THE LONG DIMENSION IS PERPENDICULAR TO THE DOMINANT DIRECTION OF TRAVEL.

TRANSITION THE GUTTER PAN CROSS SECTION SUCH THAT THE COUNTER SLOPE IN THE DIRECTION OF RAMP TRAVEL IS NOT GREATER THAN 5.0%. MAINTAIN THE NORMAL GUTTER PAN CROSS SECTION ACROSS DRAINAGE STRUCTURES.

THE TOP OF THE JOINT FILLER FOR ALL RAMP TYPES SHALL BE FLUSH WITH THE ADJACENT CONCRETE.

CROSSWALK AND STOP LINE MARKINGS, IF USED, SHALL BE SO LOCATED AS TO STOP TRAFFIC SHORT OF RAMP CROSSINGS. SPECIFIC DETAILS FOR MARKING APPLICATIONS ARE GIVEN IN THE "MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES".

FLARED SIDES WITH A SLOPE OF 10% MAXIMUM, MEASURED ALONG THE ROADSIDE CURB LINE, SHALL BE PROVIDED WHERE AN UNOBSTRUCTED CIRCULATION PATH LATERALLY CROSSES THE SIDEWALK RAMP. FLARED SIDES ARE NOT REQUIRED WHERE THE RAMP IS BORDERED BY LANDSCAPING, UNPAVED SURFACE OR PERMANENT FIXED OBJECTS. WHERE THEY ARE NOT REQUIRED, FLARED SIDES CAN BE CONSIDERED IN ORDER TO AVOID SHARP CURB RETURNS AT RAMP OPENINGS.

DETECTABLE WARNING PLATES MUST BE INSTALLED USING FABRICATED OR FIELD CUT UNITS CAST AND/OR ANCHORED IN THE PAVEMENT TO RESIST SHIFTING OR HEAVING.

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

## SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

9-30-2014  
F.H.W.A. APPROVAL

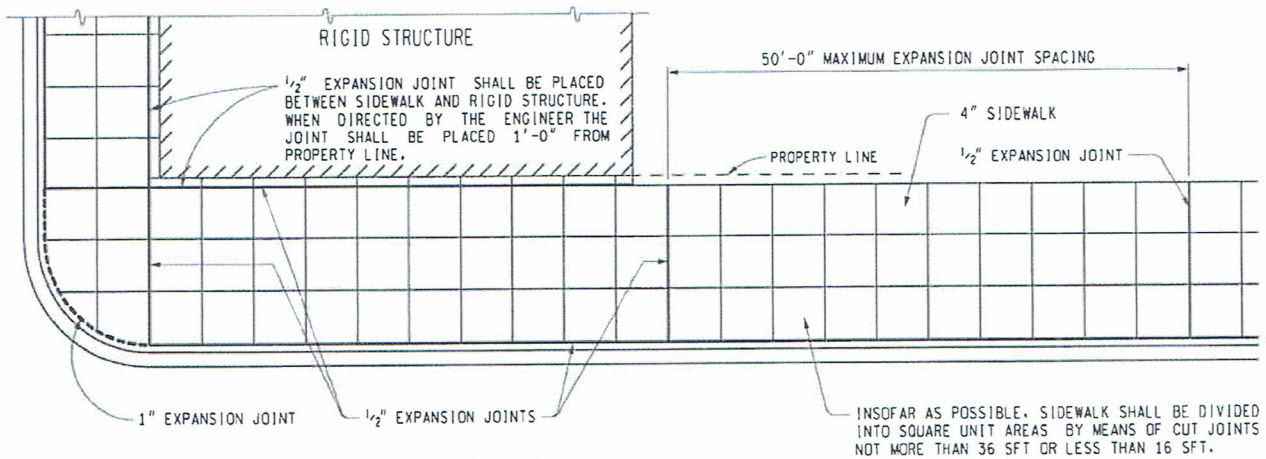
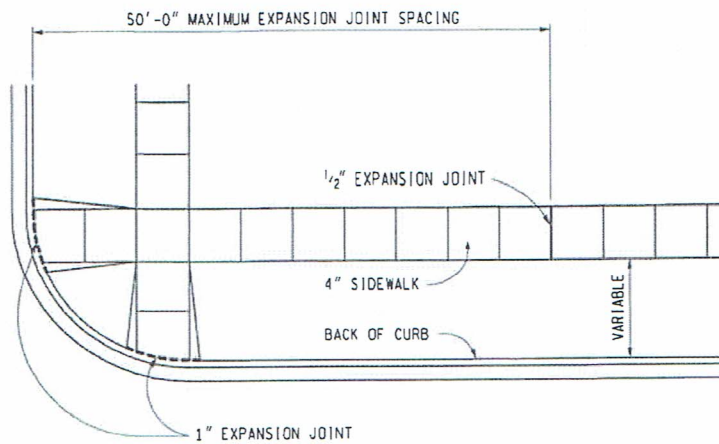
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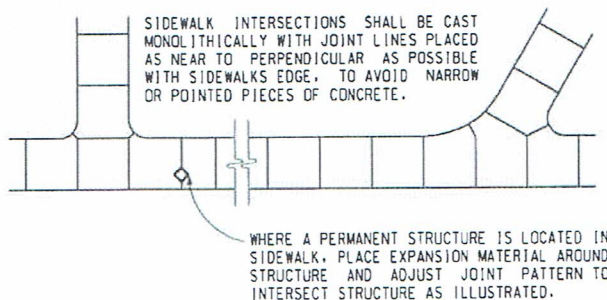
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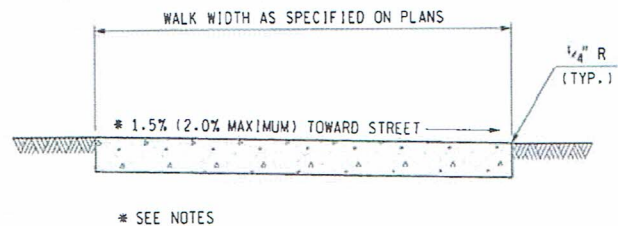




### LOCATION OF JOINTS IN CONCRETE SIDEWALK



### TYPICAL SIDEWALK JOINT LAYOUTS



### 4" CONCRETE SIDEWALK



PREPARED  
BY  
DESIGN DIVISION

DRAWN BY: B.L.T.

CHECKED BY: W.K.P.

DEPARTMENT DIRECTOR  
Kirk T. Steudle

APPROVED BY: Randy U. Poffel  
DIRECTOR, BUREAU OF FIELD SERVICES

APPROVED BY: Mark A. Van Pelt  
DIRECTOR, BUREAU OF HIGHWAY DEVELOPMENT

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BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

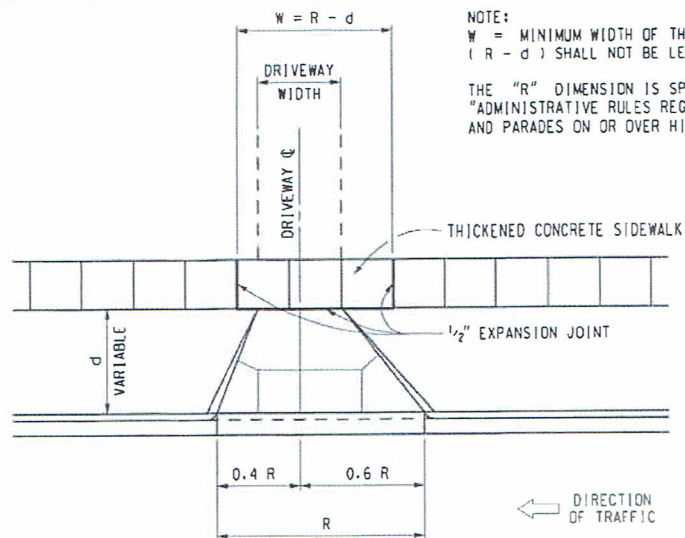
### DRIVEWAY OPENINGS & APPROACHES, AND CONCRETE SIDEWALK

9-30-2014  
F.H.W.A. APPROVAL

7-1-2014  
PLAN DATE

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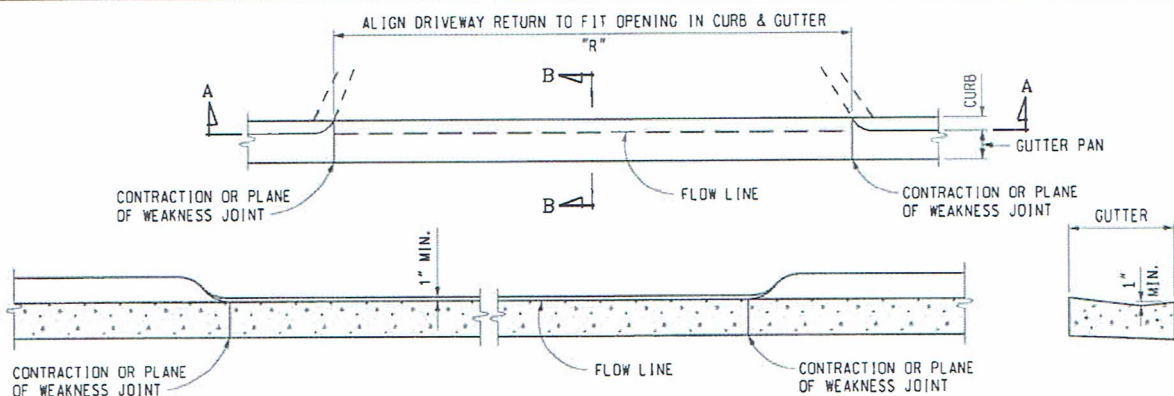
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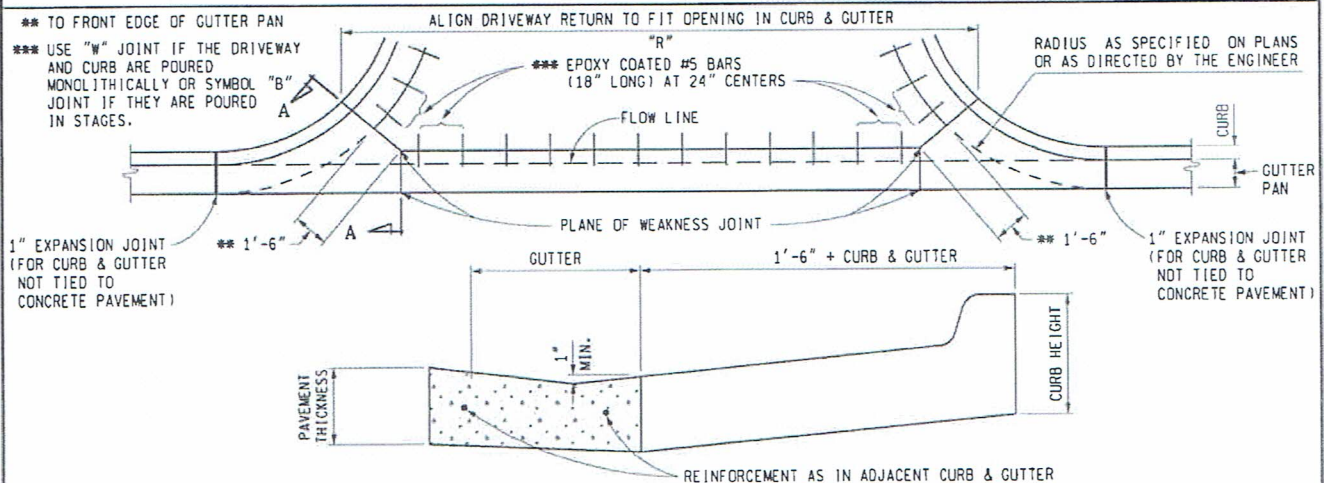
NOTE:  
 $W$  = MINIMUM WIDTH OF THICKENED CONCRETE SIDEWALK.  
 $(R - d)$  SHALL NOT BE LESS THAN DRIVEWAY WIDTH.

THE "R" DIMENSION IS SPECIFIED IN THE PUBLICATION  
 "ADMINISTRATIVE RULES REGULATING DRIVEWAYS, BANNERS  
 AND PARADES ON OR OVER HIGHWAYS".

CONCRETE DRIVEWAY OPENING LAYOUT



SECTION A - A  
 CONCRETE DRIVEWAY OPENING, DETAIL L



SECTION A - A  
 CONCRETE DRIVEWAY OPENING, DETAIL M

NOTE:  
 FOR ROADWAYS WITH CONCRETE PAVEMENTS, LONGITUDINAL LANE TIES WILL  
 BE CONTINUOUS THROUGH THE DRIVEWAY OPENING AND THE SPACING OF THE  
 #5 BARS IN CONCRETE DRIVEWAYS SHALL BE ADJUSTED TO AVOID CONFLICT  
 WITH THE LONGITUDINAL LANE TIES.

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

**DRIVEWAY OPENINGS  
 & APPROACHES,  
 AND CONCRETE SIDEWALK**

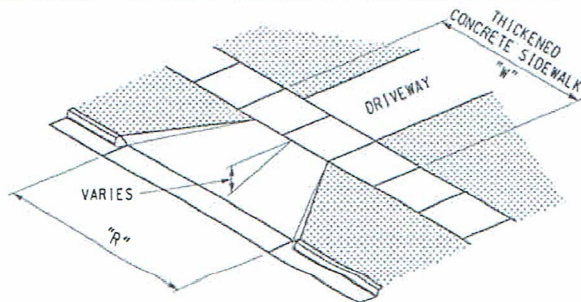
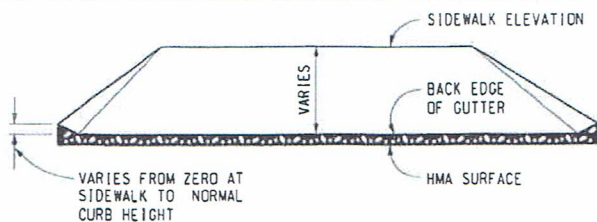
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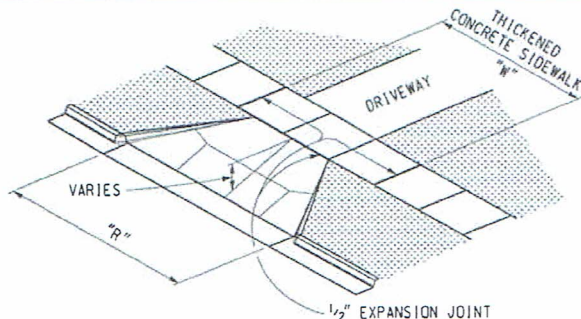
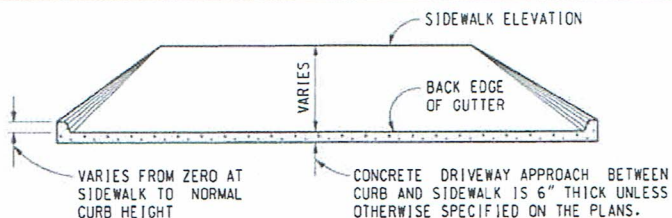
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### HMA DRIVEWAY APPROACH (TO BE USED WITH DETAIL L)

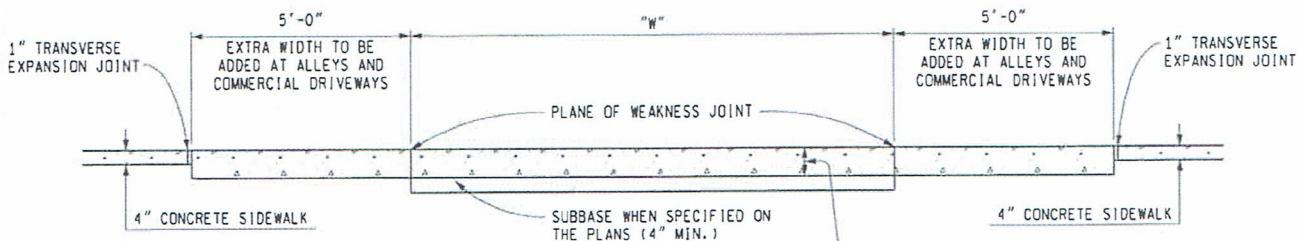


#### NOTES:

MONOLITHIC CURB IS INCLUDED IN THE CONCRETE DRIVEWAY APPROACH QUANTITY.

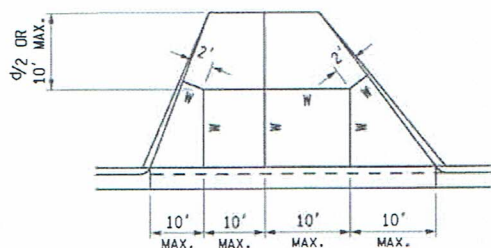
REINFORCEMENT IS NOT REQUIRED UNLESS SPECIFIED ON THE PLANS. WHEN REINFORCEMENT IS SPECIFIED, SEE CHART ON THIS SHEET.

### CONCRETE DRIVEWAY APPROACH (TO BE USED WITH DETAIL L OR M)



WHEN CONCRETE DRIVEWAY APPROACH IS SPECIFIED, THE THICKENED CONCRETE SIDEWALK THICKNESS IS EQUAL TO THE THICKNESS OF THE CONCRETE DRIVEWAY APPROACH. WHEN HMA DRIVEWAY APPROACH IS SPECIFIED, THE THICKENED CONCRETE SIDEWALK THICKNESS IS 6" MIN.

### THICKENED CONCRETE SIDEWALK



ADJUST DRIVEWAY JOINTS AS NEEDED TO ALIGN WITH ANY COINCIDING TRANSVERSE PAVEMENT JOINTS.

JOINT LAYOUT IS AS INDICATED OR AS DIRECTED BY THE ENGINEER.

### INTERMEDIATE DRIVEWAY JOINT DETAILS

#### REINFORCEMENT FOR CONCRETE DRIVEWAYS

CONCRETE DRIVEWAY THICKNESS	WIRE SIZE (6" x 6" MESH)	AVERAGE WEIGHT (LBS/100 SFT)
LESS THAN 8"	W1.4	21
	W2.9	42
8" OR GREATER	USE WIRE FABRIC REINFORCEMENT SPECIFIED ON STANDARD PLAN R-37-SERIES	

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

### DRIVEWAY OPENINGS & APPROACHES, AND CONCRETE SIDEWALK

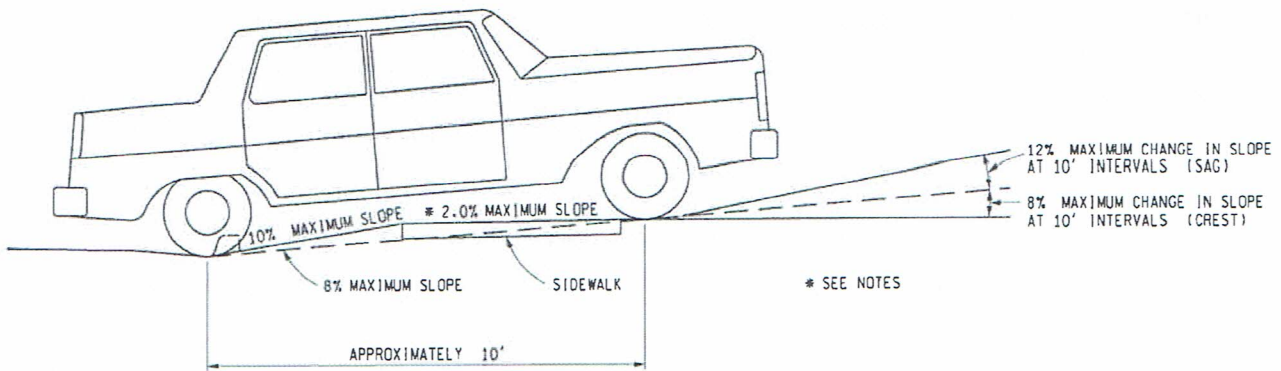
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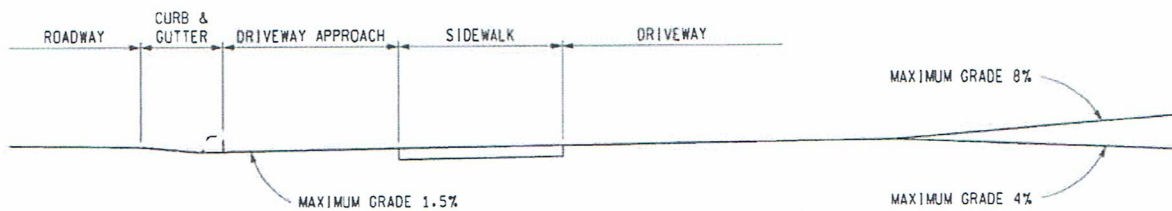
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### LOW VOLUME COMMERCIAL OR RESIDENTIAL DRIVEWAY SLOPES



### COMMERCIAL DRIVEWAY PROFILE FOR MAJOR TRAFFIC GENERATORS

#### NOTES:

FOR DRIVEWAY DESIGN REFER ALSO TO "ADMINISTRATIVE RULES REGULATING DRIVEWAYS, BANNERS, AND PARADES ON OR OVER HIGHWAYS" AND GEOMETRIC DESIGN G-680-SERIES, COMMERCIAL DRIVEWAYS.

FOR CURB AND GUTTER DETAILS, SEE STANDARD PLAN R-30-SERIES.

TRANSVERSE SIDEWALK SLOPES ARE TYPICALLY 1.5% (2.0% MAXIMUM). IN ORDER TO MEET SITE CONDITIONS, IF THE TRANSVERSE SLOPE IS REQUIRED TO BE LESS THAN 1.5%, LONGITUDINAL DRAINAGE MUST BE PROVIDED.

WHEN SETTING GRADES FOR COMMERCIAL DRIVES, THE TYPES OF VEHICLES USING THE DRIVE SHOULD BE CONSIDERED.

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

### DRIVEWAY OPENINGS & APPROACHES, AND CONCRETE SIDEWALK

9-30-2014  
F.H.W.A. APPROVAL

7-1-2014  
PLAN DATE

R-29-I

SHEET  
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