DESIGN GUIDELINES FOR TRAFFIC CALMING MEASURES FOR RESIDENTIAL STREETS IN THE DISTRICT OF COLUMBIA

JULY 2005

d.

District Department of Transportation

2000 14th Street, NW
Washington, DC 20009

GOVERNMENT OF THE DISTRICT OF COLUMBIA
Anthony A. Williams, Mayor

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11. Abstract

DDOT receives requests (and complaints) from citizens to curb high traffic speeds and volumes on residential streets. In response, the DDOT's Research Program led the development of DDOT's *Traffic Calming Policies and Guidelines* to assist in understanding residential traffic issues and, where appropriate, do something about them, all with the broader goal of neighborhood livability. The policies and guidelines, and the Traffic Calming Program it created, was a product of a coordinated effort among HUTRC staff, DDOT officials, Advisory Neighborhood Commission (ANC) representatives, and residents of the City.

The handbook outlines the traffic calming process, from requests to implementation to monitoring. However, it does not provide guidelines for design and installation purposes. Specific details including possible height, width, slope, signs, etc., of traffic calming measures (TCM) needs to be developed for implementation in the City. The design guidelines will be a resource to design engineers as they consider the best solution to traffic-calming problems on a case-by-case basis.

In developing this document for the District of Columbia, HUTRC reviewed existing and available traffic calming design guidelines from other jurisdictions. The guidelines also took into consideration both national (e.g., MUTCD) and the City's local design standards and guidelines.

12. Key Words

Traffic Calming Measures

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DISTRICT DEPARTMENT OF TRANSPORTATION

DESIGN GUIDELINES FOR TRAFFIC CALMING AND SAFETY MEASURES FOR RESIDENTIAL STREETS IN THE DISTRICT OF COLUMBIA

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INTRODUCTION

Background

In serving the residents of the District of Columbia, the District Department of Transportation (DDOT) is committed to delivering quality planning, engineering, construction, and management of the transportation infrastructure in a professional, timely and effective manner. DDOT is responsible for providing a variety of administrative services that promote responsible growth and development, and minimize the negative impacts of urban growth.

The Traffic Services Administration of the District of Columbia has been receiving complaints about high vehicular traffic speeds and volumes on residential streets. In response to the need to manage vehicular traffic speeds and volumes on residential streets, DDOT's Transportation Research Unit developed a set of "Traffic Calming Policies and Guidelines" that are made available to the public (1). The Guidelines assist DDOT's technical staff and the community in understanding residential traffic issues and, where appropriate, recommend potential solutions to specific problems, with a broader goal of enhancing the livability of the neighborhood. The Guidelines also present a traffic calming process, from planning through monitoring. The Guidelines, however, were not intended to include engineering design considerations for design and construction purposes. The design guidelines, presented in this report are intended to promote conformance to good practices that are approved by DDOT and provide a source reference for DDOT's technical staff and consultants involved in the development of traffic calming measures. The design guidelines document is intended to complement other related standards from national and local institutions including the following:

- AASHTO: Policy on Geometric Design
- ADA: Americans with Disabilities Act
- DDOT: District Department of Transportation
- ITE: Institute of Transportation Engineers
- TRB: Transportation Research Board
- MUTCD: Manual on Uniform Traffic Control Devices
- Roadside Design Guide

The information presented in this document is based on a review of available traffic calming design standards of jurisdictions with similar characteristics to Washington DC and its metropolitan area.

Selecting Potential Traffic Calming Measures

The selection of a traffic calming measure (TCM) should be based on:

- The potential of the measure to cause a reduction in traffic volume or speed
- The type of roadway
- Actual site conditions

TCMs have been typically grouped into four categories based on the manner in which they reduce volumes or speeds. The following is a description of the categories:

1. **Horizontal Deflection** – refers to two types of traffic calming measures that:

   (a) hinder the driver's ability to drive in a straight line by creating a horizontal shift in the roadway and

   (b) reduce the width of the travel lane

   Examples of horizontal deflection measures are curb extension (bulb-out), chicanes, gateway, on-street parking, raised median island (pedestrian refuge) and traffic roundabouts. Although these measures are mainly used to address speed concerns, applications that reduce the width of the travel lane can improve pedestrian safety by reducing the width of the crossing. Horizontal deflection measures may also have the secondary effect of reducing volumes. Examples of such TCMs are curb extension (bulb-out), chicane, gateway, on-street parking, raised median island (pedestrian refuge) and traffic circle.

2. **Vertical Deflection** – refers to traffic calming measures that create a change in the height of the roadway surface. Examples of vertical deflection measures are textured crosswalk, speed hump/bumps/tables, raised crosswalk and raised intersection. When designed properly, vertical deflections cause vehicles to slow down in order to avoid creating unpleasant bumping sensations. As with horizontal deflection measures, vertical deflection measures are mainly used to reduce vehicle speeds, while having only minor effects on traffic volumes. Vertical deflection measures can also be used to improve the safety of pedestrian crossings.

3. **Physical Obstruction** – refers to measures that prevent particular vehicle movements, thereby discouraging or eliminating the passage of vehicles. The overall traffic volume reduction depends upon the nature of the traffic calming measure and the number of movements obstructed, and drivers' perception of the inconvenience created by the physical obstruction strategy. Examples of such TCMs are semi-diverter, diagonal diverter, right-in / right-out island, raised median through intersection and street closures.

4. **ITS Technology** - With the introduction of Intelligent Transportation Systems (ITS) in recent times, a number of technologies have been (and are being) developed and are used to reduce speeds on roadways in some residential neighborhoods. These systems are either used in conjunction with existing traffic control systems or are used as stand-alone items. Examples of ITS technology applicable to traffic calming include the portable speed display units and flashing pedestrian crosswalks.

Besides their primary function of reducing speeds or volumes, a large majority of TCMs also has the ability to reduce conflicts between vehicles, pedestrians, and bicyclists. In addition, well-designed TMCs could be integrated with landscapes to enhance a neighborhood's general appearance.

Traffic calming measures that are implemented to improve pedestrian safety and accommodations must be designed to meet the requirements set forth by the Americans with Disabilities Act (ADA). They should also be designed in consistency with existing DDOT engineering standards.

DESIGN GUIDELINES FOR HORIZONTALLY DEFLECTING TRAFFIC CALMING MEASURES

CURB EXTENSIONS, BULB-OUTS or CHOKERS

Description:
Curb extensions, sometimes referred to as bulb-outs, are areas of expanded curbing. They may be located at intersections. They are called Chokers when installed at mid-block locations.

Appropriate Locations:
- May be appropriate for all street classifications.
  The curb extension should be at most 6 feet beyond the existing curb. This extension should protect parked vehicles, improve pedestrian visibility, and minimize crossing distance. They are appropriate for local streets with Average Daily Traffic (ADT) between 800 and 3500.
- Primarily used at intersections.
- Can be used at mid-block locations with significant pedestrian activity, school children, or senior citizens. Mid-block curb extensions may also be used to address speeding on streets where speed humps are not permitted.

Typical Uses:
- Reduce the crossing distance for pedestrians.
- Improve the line-of-sight for pedestrians.
- Make pedestrians more visible to oncoming traffic.
- Slow traffic by funneling it through a narrower street opening.
- Slow vehicles making a right turn by reducing the curb radius.

Signing and Markings:
- Signing and pavement markings may be needed, especially when installed at a mid-block location.

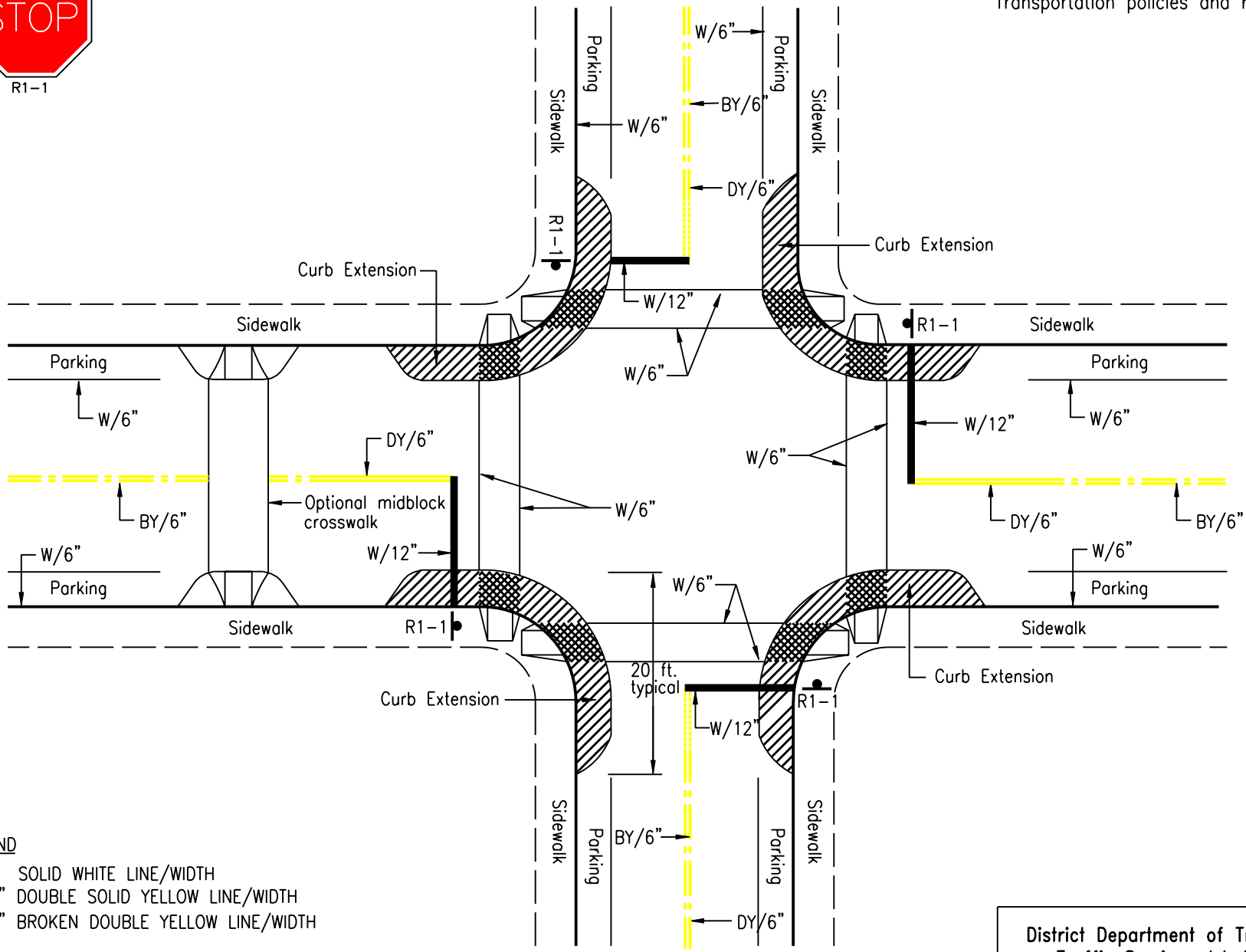
Caution:
- May not be appropriate for intersections that involve roundabouts due to the additional tracking needs of large vehicles.

Design Details:
The design schematic for a curb extension is presented in Figure 1A. That of a Choker is presented in Figure 1B. Handicap ramps must be accommodated in the curb extensions. Mid-block applications may involve pedestrian accommodations such as ramps and crosswalks. Parking should be provided where necessary and applicable.

SIGNS

Construction Notes:

All construction should be executed in accordance with District Department of Transportation policies and regulations.



LEGEND

W/6" SOLID WHITE LINE/WIDTH
DY/6" DOUBLE SOLID YELLOW LINE/WIDTH
BY/6" BROKEN DOUBLE YELLOW LINE/WIDTH

Figure 1A: Curb Extension or Bulb-out

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Curb Extension or Bulb-out	
DATE:	SCALE: N.T.S.	DGN.NO. A-01A

SIGNS

W5-1

Construction Notes:

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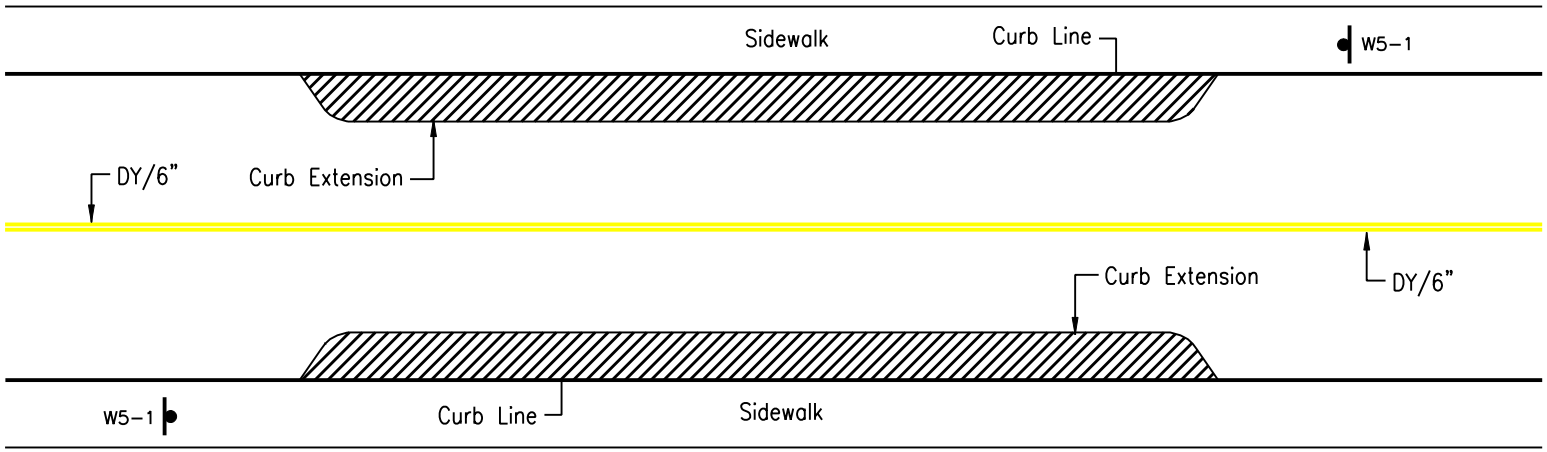

Figure 1B: Chokers

LEGEND

DY/6" DOUBLE SOLID YELLOW LINE/WIDTH

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Chokers	
DATE:	SCALE: N.T.S.	DWG.NO. A-01B

CHICANES

Description:
A chicane is formed by a series of three staggered curb extensions on alternating sides of the street, so that vehicular traffic is forced to negotiate the narrowed roadway in a snake-like fashion.

Appropriate Locations:
- Most appropriate on local streets that have volumes less than 3,500 vpd.
- Appropriate on two-lane, two-way streets, or on one-lane, one-way streets.

Typical Uses:
- Reduces vehicular speeds by forcing motorists to weave through the extensions.

Signing and Markings:
- The "Winding Road Sign" (W1-5) with an appropriate "Advisory Speed Sign" (W13-1) should be installed at least 150 feet in advance of the chicane. Reflectors, street lighting, and elevated landscaping are also recommended to improve visibility.

Other Considerations:
- Traffic volumes should be balanced in each direction. Chicanes lose effectiveness when volumes are significantly unbalanced.
- Chicanes may not be appropriate in areas with high truck traffic.
- Depending on the width of the roadway, it may be necessary to ban parking within the chicane.
- Locations where grades exceed 3 percent should be avoided.
- Placement of chicanes will depend on site conditions such as driveway locations.
- Devices used to construct chicanes typically include curb extensions, markings, planters, trees, barrels, fences or barricades. Care must be taken to ensure that these devices do not create a safety hazard through the introduction of fixed objections on or along the roadway.
- Compound curves or a combination of simple curves must be designed to form a chicane in order to accommodate the design speed and expected heavy vehicle (e.g. emergency vehicles and garbage trucks).

Design Details:
The design schematic for a chicane is presented in Figure 2. The sequence of compound reverse curves of the chicane must be based on standard geometric design principles. Allowance for curb parking near the terminals of the chicane must be consistent with the parking policies of the District of Columbia.

SIGNS

Construction Notes:

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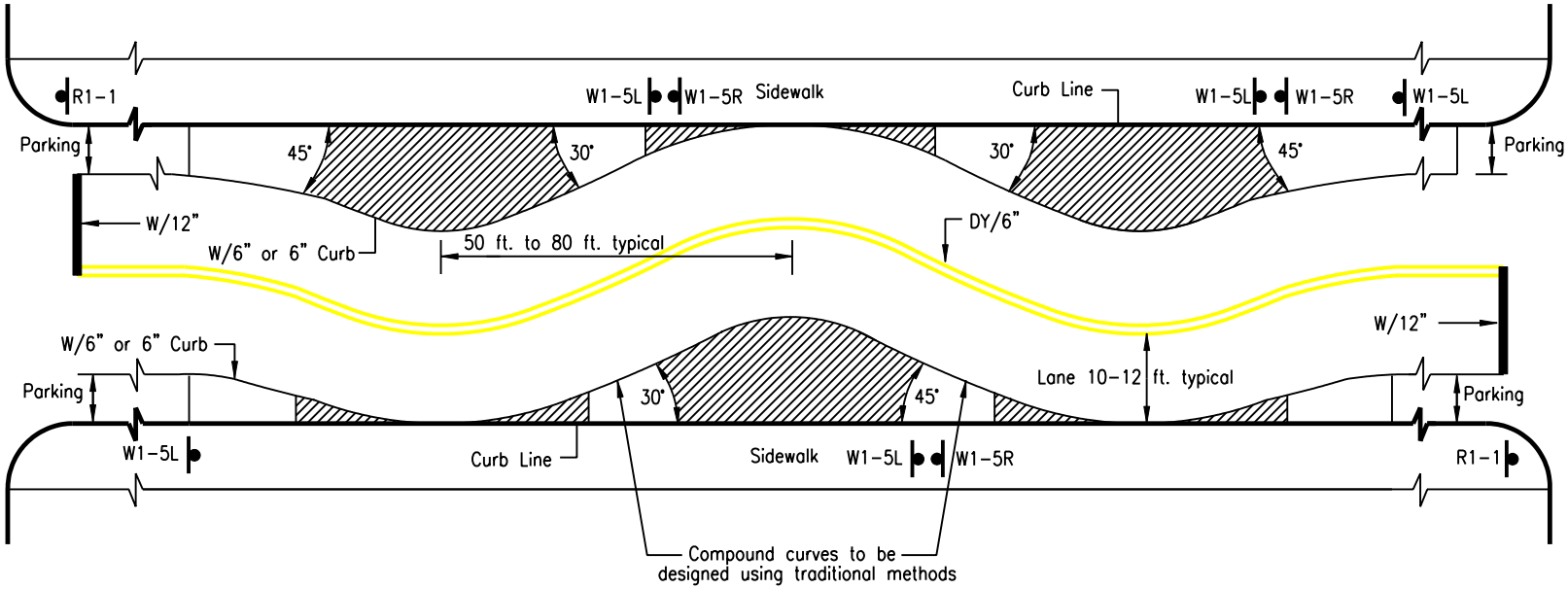


Figure 2: Typical Chicane for a 2-Lane Roadway

LEGEND

W/6" SOLID WHITE LINE/WIDTH
DY/6" DOUBLE SOLID YELLOW LINE/WIDTH

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Chicane	
DATE:	SCALE: N.T.S.	DGN.NO. A-02

RAISED MEDIAN ISLANDS / PEDESTRIAN REFUGES

Description:
Raised median islands are narrow longitudinal areas with curbs that are placed between opposing travel lanes at mid-block or on the leg of intersections for accommodating pedestrians.

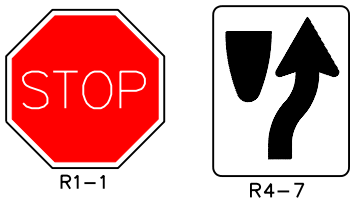
Appropriate Locations:
- Median islands may be appropriate for all classifications of streets: local, collector, and arterial.
- They may be used on high-volume roadways and on roadways with posted speed limits up to 35 mph, if they do not significantly narrow the travel lane.
- They may be located either at mid-block locations or at intersections.

Typical Uses:
- Provides a safe landing area for pedestrians (either on foot or in wheelchairs) who cannot complete the crossing after being on the way.
- Provides an elevated advantageous position for visibility between pedestrians and drivers.

Other Considerations:
- The extended length of median islands depends on the behavior of pedestrians and the location of crossing activity.
- Median islands should have a minimum width of 4 feet to comfortably accommodate pedestrians.
- Islands should be at least 12 feet in length.
- Provisions should be made for snow and ice removal.
- Height should be consistent with standard curb height in area.

Design Details:
The design schematics for raised median islands are presented in Figures 3A and 3B. The optional crossing in these Figures is of variable width that should be based on the need of the community. Wheel chairs and allowance for U-turns are among such needs.

SIGNS



Construction Notes:

All construction should be executed in accordance with District Department of Transportation policies and regulations.

LEGEND

W/6" SOLID WHITE LINE/WIDTH
DY/6" DOUBLE SOLID YELLOW LINE/WIDTH
BY/6" BROKEN DOUBLE YELLOW LINE/WIDTH

Figure 3A: Raised Median Island at Intersection

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Raised Median Island Intersection	
DATE:	SCALE: N.T.S.	DGN.NO. A-03A

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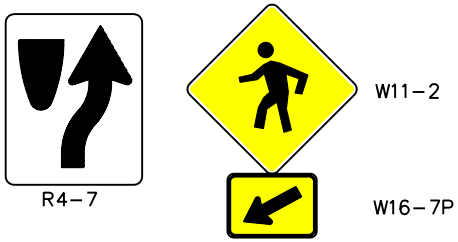

Construction Notes:

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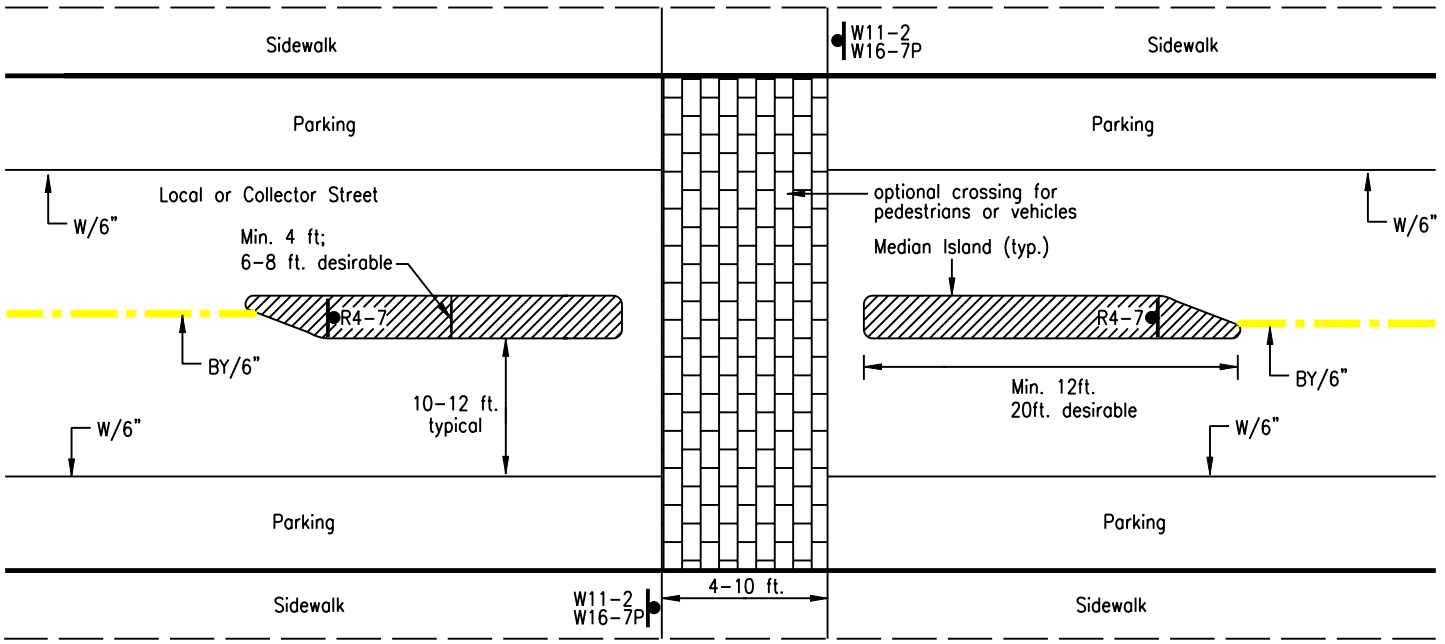


Figure 3B: Raised Median Island at Mid-Block

LEGEND

W/6" SOLID WHITE LINE/WIDTH
BY/6" BROKEN DOUBLE YELLOW LINE/WIDTH

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Raised Median Island Mid-Block	
DATE:	SCALE: N.T.S.	DGN.NO. A-03B

ROUNDABOUTS

Description:
Roundabouts are raised circular islands that can be located in the center of an unsignalized intersection. All vehicular traffic must negotiate the circle and move in a counterclockwise direction, yielding to vehicles approaching from the left within the circle. For the purpose of traffic calming, the roundabouts covered by these standards are generally less than 26 ft in the diameter and are non-signalized.

Appropriate Locations:
- Roundabouts are appropriate at intersections of local streets without high pedestrian or left-turning traffic volumes.
- The ADT volumes on each local street should not exceed 3,500.
- They are inappropriate for intersections that receive substantial bus and truck traffic.

Signings and Markings
- Typical signs to be installed include:
  W11-2: Pedestrian crosswalk (use where appropriate)
  W16-7P: Pedestrian crosswalk location
  W2-6: Circular intersection
  R1-2: Yield
- Pavement markings should be consistent with those outlined in the Section 3B.24 of MUTCD, Millennium Edition.

Typical Uses:
- Reduces vehicular speeds due to the horizontal deflection, and breaking up the line of sight (when appropriately landscaped).

Other Considerations:
- Depending on the configuration of the intersection, the shape of the traffic circle may not actually be round.
- Turning analysis should be completed to ensure that the design vehicle can negotiate the circle. A mountable concrete apron, 6 inches to 2 feet wide, may be used to accommodate emergency service vehicles, trucks, and buses.
- Drainage works best if the cross-section slopes away from the circle, despite the fact that this creates a reverse superelevation.
- It may be necessary to move crosswalks into the legs of the intersection to prevent vehicles in the circle from encroaching on the crosswalk.
- Roundabouts may require additional street lighting.
- Provisions should be made for snow and ice removal.
- Clear visibility across the roundabout from all approaching lanes is necessary.

Design Details:
General design schematic for fitting a typical circle into an existing 4-way and T-intersection are presented in Figures 4A and 4B.

SIGNS

W16-1

Construction Notes:

All construction should be executed in accordance with District Department of Transportation policies and regulations.

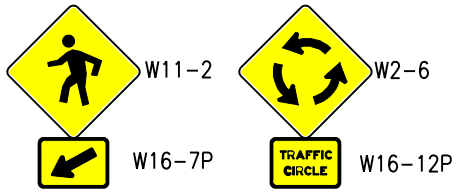
LEGEND

W/6" SOLID WHITE LINE/WIDTH
DY/6" DOUBLE YELLOW LINE/WIDTH

Figure 4A: Roundabout at a 4-Way Intersection

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Roundabout on a 4-way Intersection	
DATE:	SCALE: N.T.S.	DGN.NO. A-04A

SIGNS



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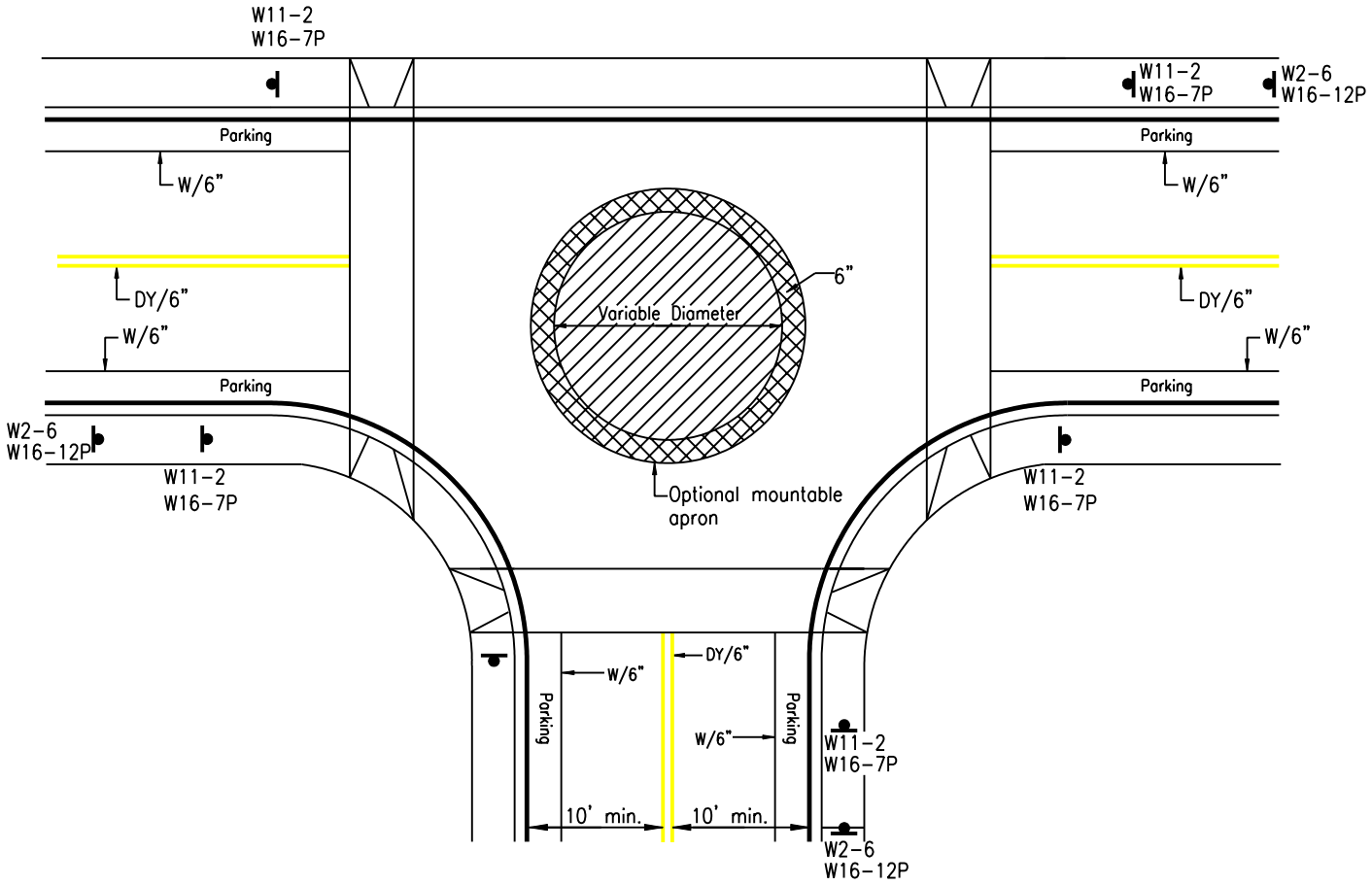


Figure 4B: Roundabout at a T-Internsection

LEGEND

W/6" SOLID WHITE LINE/WIDTH
DY/6" DOUBLE YELLOW LINE/WIDTH

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Roundabout on a T-Intersection	
DATE:	SCALE: N.T.S.	DWG.NO. A-04B

DESIGN GUIDELINES FOR VERTICALLY DEFLECTING TRAFFIC CALMING MEASURES

SPEED HUMP, SPEED BUMP & SPEED TABLE

Descriptions:
Speed humps, speed bumps, and speed tables are raised surfaces on the roadway that are typically 3 - 6 inches in height, 12 - 20 feet in length and are placed across the lane of travel to reduce speeds by creating a change in vertical deflection along the roadway. They are effective in reducing speeds by forcing motorists to slow down in order to smoothly travel over them.

Common Designs:

- The Watts speed hump (designed by the Transport and Road Research Laboratory in Great Britain) is a parabolic (or circular) hump 12 feet in length. This model was endorsed by ITE in *Guidelines for the Design and Application of Speed Humps*, June 1997.

- The Seminole County speed hump or the "Flat top" profile is the most popular alternative to the Watts hump. Designed by Seminole County, Florida, this hump is 22 feet in length with 6-foot approach ramps on both sides of its 10-foot flat top. This type of speed hump design is also referred to as a "speed table."

- Speed bumps are usually circular, less than 14 inches wide, and about 4 inches high. They force traffic to slow to 5 - 10 miles per hour. Speed bumps may generate severe vertical displacement at low speeds.

Appropriate Locations:

- The Watts humps is recommended only for local streets with volumes less than 3,500 ADT and posted speeds of 30 mph or less. In addition, it is not recommended for major emergency services routes.
- The Seminole County hump can be used in a greater variety of situations. This type of hump can be used on collector streets as well as local streets. It is inappropriate for streets with volumes over 6,500 ADT, and posted speed above 30 mph.
- They are primarily used at mid-block locations and are typically placed 250-550 feet apart.

Typical Uses:

- Within typical residential travel speeds, humps create a gentle rocking motion. The intensity of the rocking motion is reduces when motorists slow down.

Signing and Markings:

- A Speed Hump or Bump Warning Sign (MUTCD W8-1, W17-1) shall be installed in accordance to the MUTCD. When multiple humps are to be installed on a street, the sign before the first hump encountered shall be labeled "SPEED HUMPS AHEAD." It is also recommended that the "Speed Hump" sign be accompanied by an "Advisory Speed Plaque" (W13-1). The indicated advisory shall be installed in accordance with Section 2C.42 of the MUTCD.
- The pavement marking designs in the MUTCD section 3B.27 may be used.

Other Speed Considerations:

- Speed humps, speed bumps, and speed tables are most effective when they are installed in series on a roadway. They are typically placed 250 – 550 feet apart. One study showed that placing Watts speed humps at intervals of 275 feet resulted in 85th percentile speeds of 25 mph; intervals of 550 feet resulted in 85th percentile speeds of 30 mph.

Distance between speed humps (ft.)	Proposed 85th Percentile Speed to be Achieved (mph)
275	25
550	30

- Speed hump should not be placed within 150 feet of an unsignalized intersection or 250 feet of a signalized intersection.

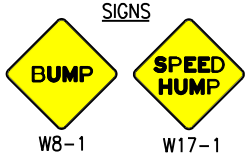
Intersection	Minimum measure of Distance from Intersection
Unsignalized	150
Signalized	250

- Speed humps should not be used on curves unless the radius is greater than 300 feet.
- Humps should not be installed on streets with a grade exceeding 5%.
- Humps should not be installed on streets without curbing unless obstructions such as signing, flexible delineator posts or bollards can be installed to prevent drivers from driving around the hump. Rocks, boulders, and other objects of this nature should not be used for this application.
- Ideally, speed humps should extend across the roadway from curb to curb ending at the gutter or edge.
- Hump installations must not disrupt the flow of gutters or cause ponding on the street pavement surface.
- In areas with snow removal problems, a measure such as a flexible delineator post may be needed at each hump to alert snowplow operators to lift their blades.
- There should be openings for bikes so that cars can't straddle the openings.
- The above considerations also apply to speed bumps and speed tables.

Design Details:

The design schematics for speed humps are presented in Figures 5A, 5B, 5C, 5D, and 5E.

SIGNS



Construction Notes:

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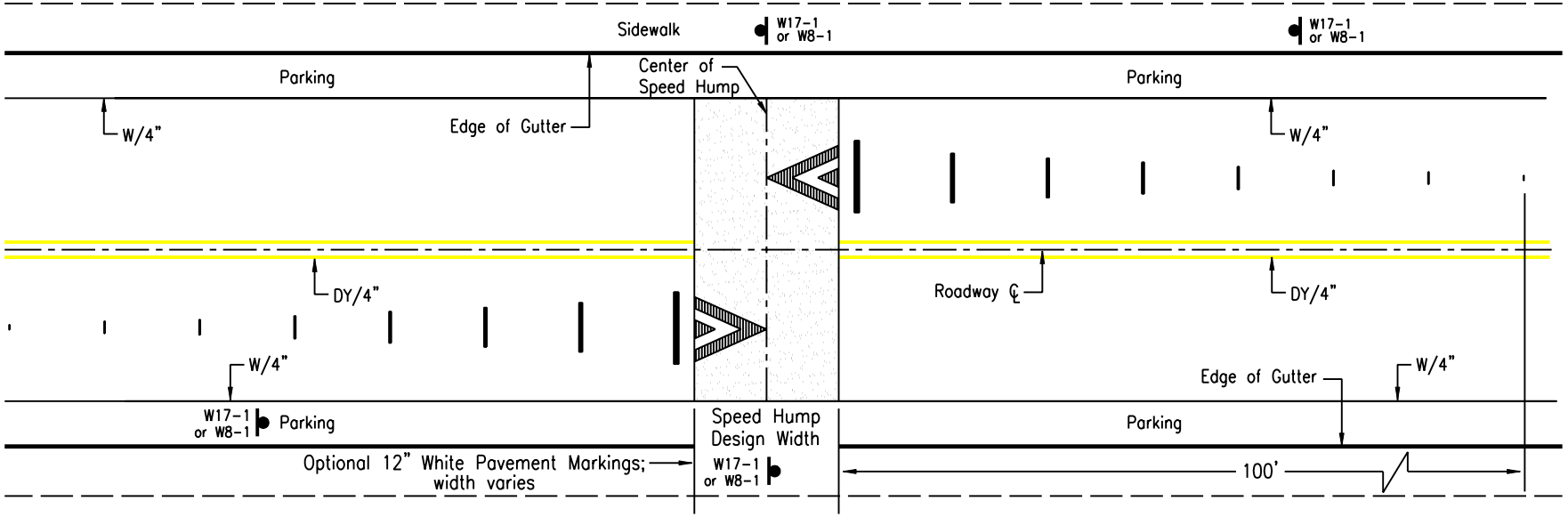

Figure 5A: Typical Advance Warning Markings For Speed Humps

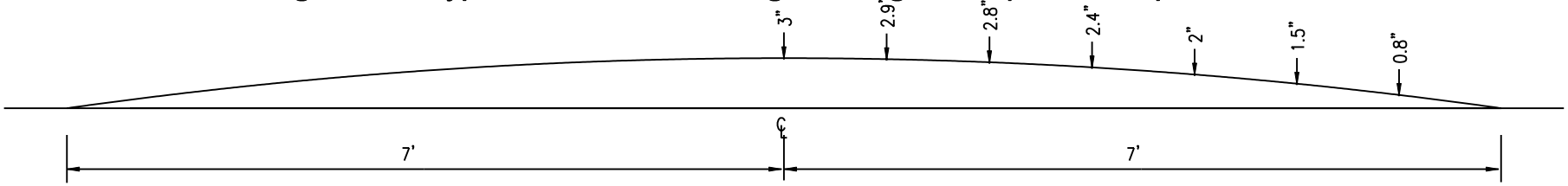

Figure 5B: Speed Hump - Parabolic Crown (Tolerance +0.5)

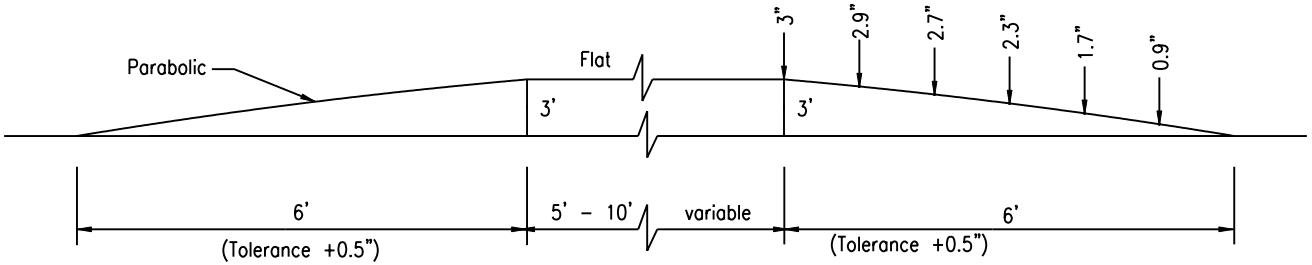

Figure 5C: Speed Table - Flat Crown

LEGEND

W/4" SOLID WHITE LINE/WIDTH
DY/4" DOUBLE SOLID YELLOW LINE/WIDTH

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Typical Advanced Warning For Speed Humps	
DATE:	SCALE: N.T.S.	DGN.NO. A-05

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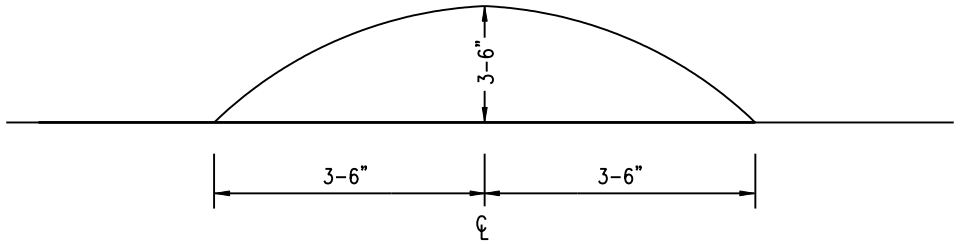


Figure 5D: Speed Bump - Circular Crown

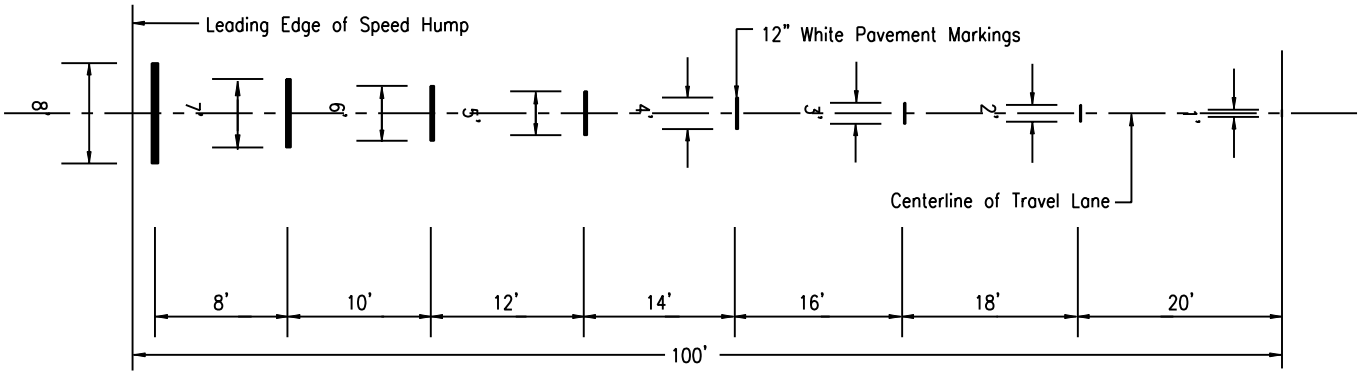


Figure 5E: Typical Detail (optional)
Speed Hump Advance Warning Markings

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Speed Hump Advance Warning Marks	
DATE:	SCALE: N.T.S.	DGN.NO. A-05E

RAISED CROSSWALKS

Description:
Raised crosswalks are marked and elevated pedestrian walkways across a roadway placed at right angles to the direction of traffic flow. Raised crosswalks are typically 3 to 6 inches above the road surface, or may be level with the curb. They often have the same profile as the flat crown speed hump shown in Figure 5C.

Appropriate Locations:
- They are appropriate on local streets and minor collectors, with ADT less than 10,000.
- Depending on high pedestrian volume and geometrical conditions, raised crosswalks may be designed to occupy the entire intersection to create a raised intersection.
- They are appropriate for signalized and unsignalized intersections.
- They may be extensions of sidewalks at mid-block locations or intersections.

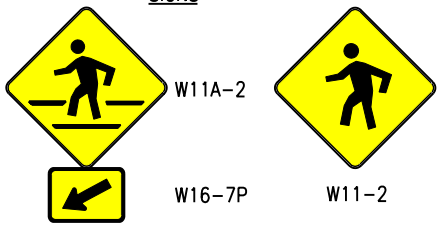
Typical Uses:
- Reduces vehicular speeds and improve visibility of the pedestrians.

Signing and Markings:
- It is recommended that the "Pedestrian Crossing Warning Sign" W11-2, (MUTCD) be used with each raised pedestrian crossing.
- Crosswalk pavement marking standards in MUTCD Section 3B.17 should be adhered to.

Other Considerations:
- If the raised pedestrian crossing is the same height as the curb, the edge of the raised crosswalk should be differentiated with a tactile measure to warn visually impaired people.
- The most appropriate use is in areas with significant pedestrian crossing activity and crashes involving fast moving vehicles and pedestrians.
- Effectiveness of the measure is increased when used with textured crosswalks or curb extensions.
- Installations on primary emergency access routes should be avoided, unless acceptable to emergency service providers.
- Proper drainage is essential for raised crosswalks.
- All ADA requirements must be met for users of wheelchairs.

Design Details:
The design schematics for a raised crosswalk and raised intersections are presented in Figures 6A, 6B, and 6C.

SIGNS



Construction Notes:

All construction should be executed in accordance with District Department of Transportation policies and regulations.

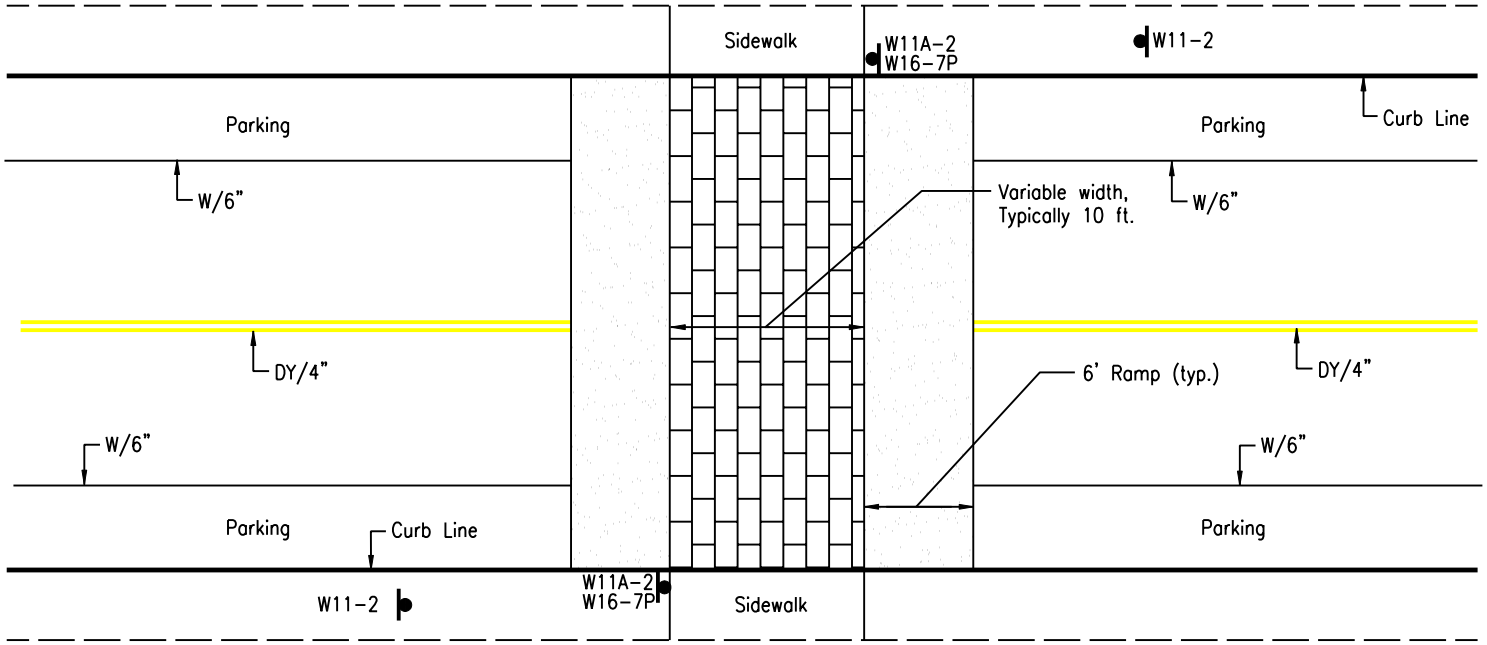


Figure 6A: Raised Crosswalk at Midblock

LEGEND

W/4" SOLID WHITE LINE/WIDTH
DY/4" DOUBLE SOLID YELLOW LINE/WIDTH

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Raised Crosswalk	
DATE:	SCALE: N.T.S.	DGN.NO. A-06A

SIGNS

R1-1

Construction Notes:

All construction should be executed in accordance with District Department of Transportation policies and regulations.

LEGEND

W/6" SOLID WHITE LINE/WIDTH
DY/6" DOUBLE SOLID YELLOW LINE/WIDTH
BY/6" BROKEN DOUBLE SOLID YELLOW LINE/WIDTH

Figure 6B: Raised Crosswalk at Intersection

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Raised Crosswalk	
DATE:	SCALE: N.T.S.	DGN.NO. A-06B

SIGNS

R1-1

Construction Notes:

All construction should be executed in accordance with District Department of Transportation policies and regulations.

LEGEND

W/6" SOLID WHITE LINE/WIDTH
DY/6" DOUBLE SOLID YELLOW LINE/WIDTH
BY/6" BROKEN DOUBLE YELLOW LINE/WIDTH

Figure 6C: Raised Intersection

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Raised Intersection	
DATE:	SCALE: N.T.S.	DGN.NO. A-06C

DESIGN GUIDELINES FOR USING PHYSICAL OBSTRUCTIONS AS TRAFFIC CALMING MEASURES

SEMI-DIVERTERS FOR FAR-SIDE AND NEAR SIDE CLOSURES

Description:
Semi-diverters are physical barriers (e.g., concrete barriers), that are used to prevent drivers from making certain turning movements at an intersection. Since all turns are not restricted by the barriers, they are sometimes referred to as half closures or partial diverters. Semi-diverters prevent travel in one direction on a street by blocking one travel lane with a physical barrier.

Appropriate Locations:
- Semi-diverters are appropriate only on local streets.
- Semi-diverters should be used only at local road intersections with collector (or arterial) streets, since those roadways can best accommodate the diverted traffic.
- They should be used only on streets with a documented cut-through problem.
- They may be used on streets with volumes up to 3,500 ADT.
- Alternative exit or entry routes should be identified to maintain the flow of traffic.

Typical Uses:
- By closing either the near-side entrance or the far-side exit of intersections, semi-diverters serve to reduce through traffic.

Signing and Markings:
- Signs, delineation, painted curbs, etc., should be incorporated to enhance visibility. Typical signs to be used include “Do Not Enter” (R5-1) and “Stop” (R1-1) signs.

Other Considerations:
- Traffic barricades can be used to test the effectiveness of the diversion on a temporary basis.
- On a permanent basis, semi-diverters can be constructed with curb gutter or sidewalks and landscaping.
- A safe bypass for bicycles and wheelchairs should be incorporated in the design.
- Semi-diverters intended to prevent exit are more readily violated.
- Semi-diverters at mid-block locations are more frequently violated than end of block measures.
- A 3-6-month trial period for the barrier is recommended before a measure is made permanent. Removable material should be used during the trial period.
- Enforcement may be necessary to keep traffic from violating the directional closure.
- Semi-diverters should not be used on transit routes or major emergency response routes.
- The width of the semi-diverter should be extended to cover all lanes in one direction.
- The longitudinal length of the barricaded area must be sufficient to prevent unauthorized turns near crosswalks.

Design Details:
The design schematics for semi-diverters used for far-side exit and near-side entrance closures are presented in Figures 7A and 7B.

Construction Notes:

All construction should be executed in accordance with District Department of Transportation policies and regulations.

SIGNS

LEGEND

W/6" SOLID WHITE LINE/WIDTH
DY/6" DOUBLE SOLID YELLOW LINE/WIDTH
BY/6" BROKEN DOUBLE YELLOW LINE/WIDTH

Figure 7A: Semi-Diverters in Far-Side Exit Closure

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Semi-Diverters: Far-Side Exit Closure	
DATE:	SCALE: N.T.S.	DGN.NO. A-07A

SIGNS

R1-1

R11-2

R11-4

Construction Notes:

All construction should be executed in accordance with District Department of Transportation policies and regulations.

LEGEND

W/6" SOLID WHITE LINE/WIDTH
DY/6" DOUBLE SOLID YELLOW LINE/WIDTH
BY/6" BROKEN DOUBLE YELLOW LINE/WIDTH

Figure 7B: Semi-Diverters In Near-Side Entrance Closure

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Semi-Diverters: Near-Side Entrance Closure	
DATE:	SCALE: N.T.S.	DGN.NO. A-07B

DIAGONAL DIVERTERS

Description:
A diagonal diverter is a physical barrier placed diagonally across a four-way intersection to cause motorists to make only left or right turns at the intersection. The through movement is eliminated.

Appropriate Locations:
- Diagonal diverters are appropriate for local streets only with volumes up to 3,500 ADT.

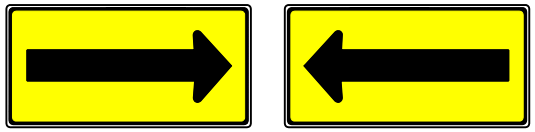
Typical Uses:
- Eliminate unwanted through traffic.

Signing and Markings:
- Diverters should be clearly visible at all times. Painted curbs, delineations, streetlights, and advance warning directional arrow signs (W1-6) should be considered for enhancing visibility.

Other Considerations:
- Collisions may be reduced, but some studies indicate that the collisions could be shifted to the collectors or arterials that receive the diverted traffic.
- Because of their impact on traffic patterns, diagonal diverters can be controversial and should receive strong local support before installation.
- Diverters can be designed with gaps and curb-cuts for pedestrians, wheelchairs, and bicycles. Provisions should be made for continuity of bicycle routes around the diverter. If necessary, pedestrian crossings can be maintained with sidewalk extensions across the diverter.
- The radius of the diagonal diverter should reflect the posted speed of the street or the speed should be appropriately modified.
- Temporary installations and monitoring are recommended prior to construction of permanent measures.
- Design and location of diverters should be coordinated with emergency service providers. Diverters may be modified with gates, bollards, and mountable curbs to allow emergency vehicle access.
- Unless the neighborhood is confined to a limited area, installing a single diverter may merely shift through traffic to other local streets. As a result, diagonal diverters generally need to be installed in a group or cluster to effectively route traffic to collector and arterial roadways.
- Where there is substantial pedestrian traffic, stop signs, stop bars and marked crosswalks would improve safety at the intersection

Design Details:
The design schematic for a diagonal diverter is presented in Figure 8.

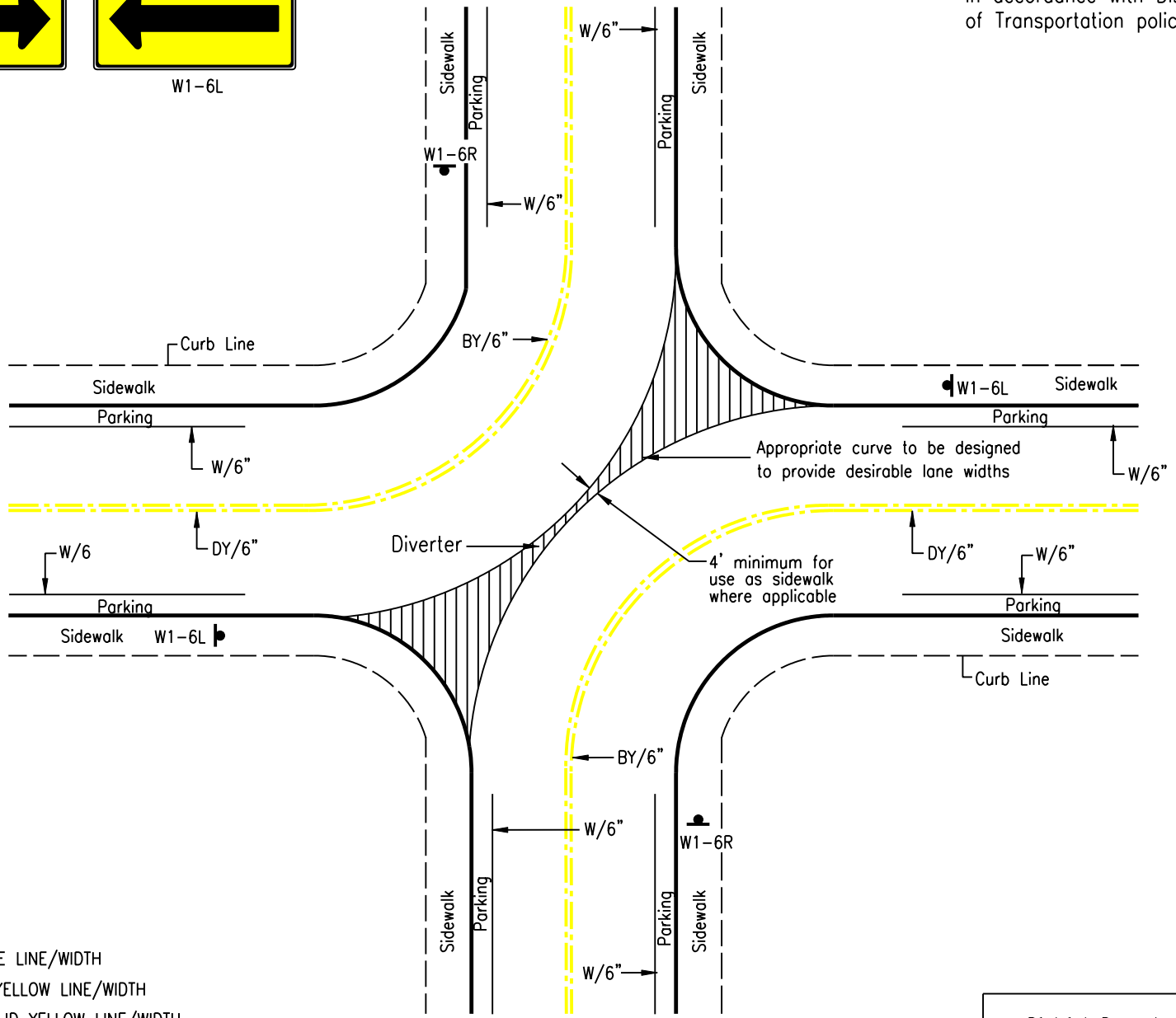
SIGNS



W1-6R W1-6L

Construction Notes:

All construction should be executed in accordance with District Department of Transportation policies and regulations.



LEGEND

W/6" SOLID WHITE LINE/WIDTH

BY/6" BROKEN YELLOW LINE/WIDTH

DY/6" DOUBLE SOLID YELLOW LINE/WIDTH

Figure 8: Diagonal Diverter

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Diagonal Diverter	
DATE:	SCALE: N.T.S.	DGN.NO. A-08

FORCED TURN ISLAND

Description:
A forced turn island is a form of intersection channelization that causes all the traffic on an approach to turn right. Forced turn islands may be designed as a physical channelization, pavement marking, or a combination of the above.

Appropriate Locations:
- Forced turn islands are appropriate for local streets that intersect arterials or major collectors.

Typical Uses:
- They are employed to eliminate adverse safety and operating conditions caused by through and left turn traffic from minor streets.
- This type of channelization also reduces cut-through traffic on local streets.

Other Considerations:
- Designs can include depressed or mountable curbs to accommodate oversized vehicles, including emergency vehicles.
- The effectiveness of the island in reducing cut through traffic will improve when used in combination with other measures on an area-wide basis.
- Crosswalks may be intregrated into the forced turn island with appropriate accommodation for wheelchairs.
- Reduction of parking spaces near corners may be necessary.
- Lane width of the major road must not be reduced.
- The radius of the right curb may need modification to safely accommodate turning vehicles.
- Raised islands are more effective in channeling the traffic and could accommodate an additional turn sign.
- Raised islands must be designed to facilitate snow removal operations, especially on the major street.

Design Details:
The design schematic for forced turn islands is presented in Figure 9.

SIGNS

R3-5R

R1-1

Construction Notes:

All construction should be executed in accordance with District Department of Transportation policies and regulations.

Note: The right-turn islands should be designed in consistence with existing DC turn-island standards

Figure 9: Forced-Turn Island

LEGEND

W/6" SOLID WHITE LINE/WIDTH
DY/6" DOUBLE SOLID YELLOW LINE/WIDTH
BY/6" BROKEN DOUBLE YELLOW LINE/WIDTH

District Department of Transportation Traffic Services Administration		
TRADE:	DRAWING TITLE: Forced-Turn Island	
DATE:	SCALE: NTS	DGN.NO. A-09

RAISED MEDIAN THROUGH INTERSECTION

Description:
A raised median through an intersection is a physical barrier that prevents left turns and through movements to and from a minor street that intersects with a major street.

Appropriate Locations:
- Most appropriate on major arterials and collectors that intersect with a minor street.

Typical Uses:
- This measure is often used to prohibit through traffic in residential areas.

Other Considerations:
- Median barriers can be constructed in various ways, including a closely spaced row of flexible delineator posts, a series of pre-cast curb sections, and a barrier constructed on a curbed island with landscaping.
- Given access restrictions, this measure is not recommended for use on a primary fire response route.
- To avoid shifting traffic from one local street to another, raised medians should be part of a broader plan that includes treatments for near-by local street intersections that are likely to be impacted by diverted traffic.
- Designs should incorporate gaps that permit access by bicyclists, wheelchairs, and pedestrians.

Design Details:
The design schematic for raised medians is presented in Figure 10.

SIGNS

R3-5R

R1-1

Construction Notes:

All construction should be executed in accordance with District Department of Transportation policies and regulations.

LEGEND

W/6" SOLID WHITE LINE/WIDTH
DY/6" DOUBLE SOLID YELLOW LINE/WIDTH
BY/6" BROKEN DOUBLE SOLID YELLOW LINE/WIDTH

Figure 10: Raised Median Through Intersection

District Department of Transportation
Traffic Services Administration

APPROVED BY:	DRAWING TITLE: Raised Median Through Intersection	
DATE:	SCALE: N.T.S.	DGN.NO. A-10

FULL STREET CLOSURES

Description:
A full street closure is formed by a barrier extending the entire width of the roadway, obstructing all traffic movements to and from that roadway.

Appropriate Locations:
- Full closures are appropriate only on local streets with volumes up to 3,000 ADT.

Typical Uses:
- Closures are intended to change traffic patterns by eliminating unwanted through traffic. Due to their impact on traffic patterns, they can be controversial and should be installed only with strong community support.
- Street closures are most effective when used with other treatments in a neighborhood. This creates a maze that effectively eliminates through traffic.
- Closures can be used to create cul-de-sacs either at an intersection or at mid-block locations. The mid-block type is recommended primarily in locations where adjacent land use patterns change and a high traffic generator borders a residential area.

Signing and Markings:
- Proper signing such as "Dead End" (W14-1) or "No Outlet" (W14-2) should be installed at the block entrance for warning motorists that the street is not a through street.

Other Considerations:
- AASHTO's design criteria for converting existing residential streets into cul-de-sacs and dead-end streets (A Policy on Geometric of Highways and Streets) should be considered.
- Street closures should not be installed on transit routes.
- The barrier for closing the street should be placed at an intersecting through street, rather than in the interior of a neighborhood.
- Pedestrians, bicyclists, and people with disabilities can be accommodated by the provision of sidewalks and/or ramps.
- Ordinary barricades or other devices are recommended for use in testing the closure for its impact on traffic flow within the neighborhood before installation of the pavement closure.

Design Details:
The design schematic for street closures is presented in Figure 11.

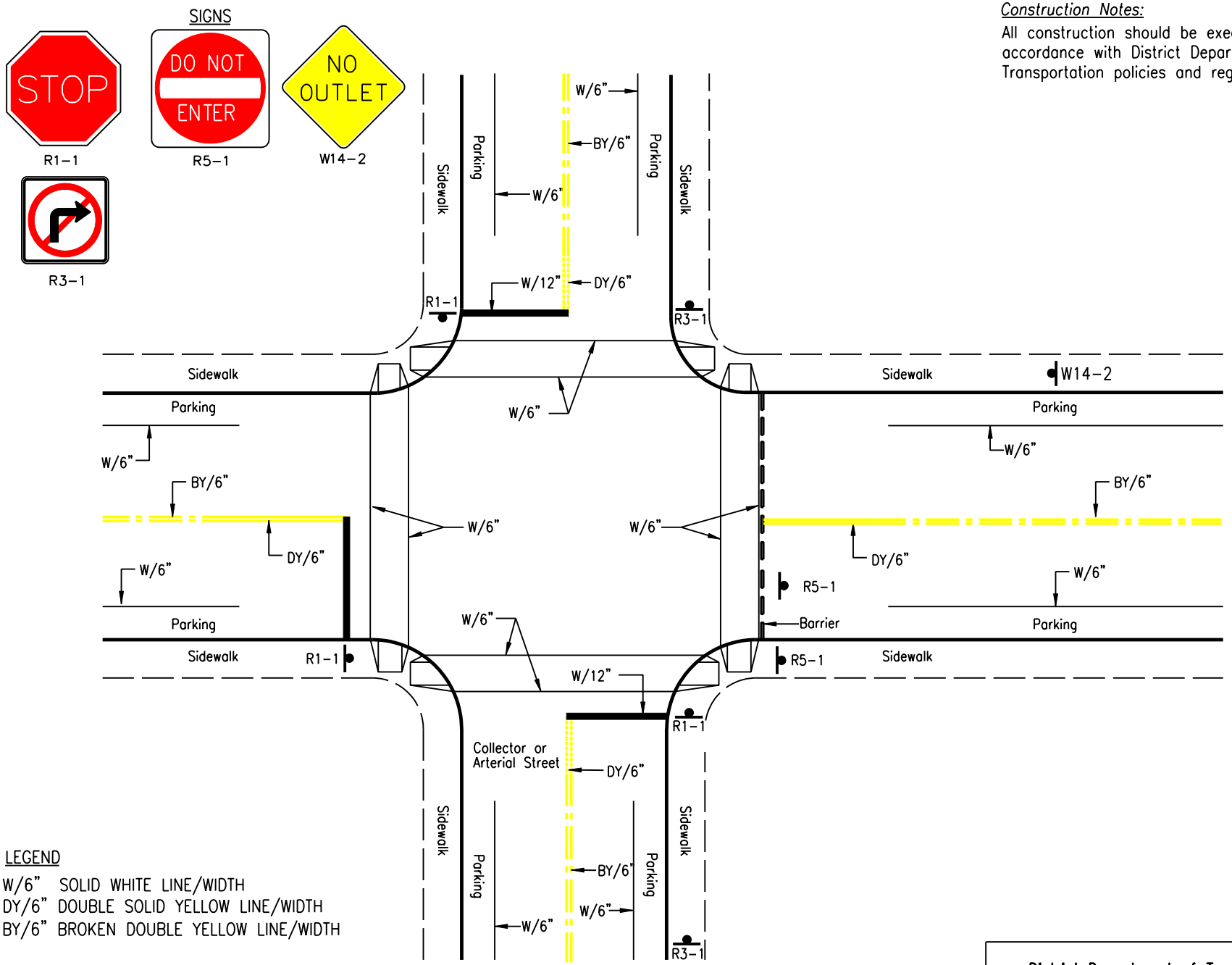


Figure 11: Full Street Closure

District Department of Transportation Traffic Services Administration		
APPROVED BY:	DRAWING TITLE: Full Street Closure	
DATE:	SCALE: N.T.S.	DGN.NO. A-11

REFERENCES

1. District Department of Transportation "*Design Guidelines For Traffic Calming Measures for Residential Streets in the District of Columbia*," (www.dc.gov) 2002
2. AASHTO: Policy on Geometric Design of Highways and Streets, 2001
3. ADA: Americans with Disabilities Act: www.ada.gov
4. ITE: Institute of Transportation Engineers: www.ite.org
5. TRB: Transportation Research Board: www.trb.org
6. MUTCD: Manual On Uniform Traffic Control Devices (Millennium Edition, 2000)
7. Roadside Design Guide, AASHTO 2002
8. City of Portland, OR: www.trans.ci.portland.or.us
5. Fehr & Peers: www.trafficcalming.org
6. City of Beaverton, OR: www.ci.beaverton.or.us
7. State of Vermont: www.aot.state.vt.us

8 Canberra Urban Parks and Places: www.parksandplaces.act.gov.au

9. Pedestrian and Bicycle Information Center: www.bicyclinginfo.org
10. Salt Lake City, UT: www.ci.slc.ut.us
11. City of Sandusky, OH: www.sandusky.oh.us