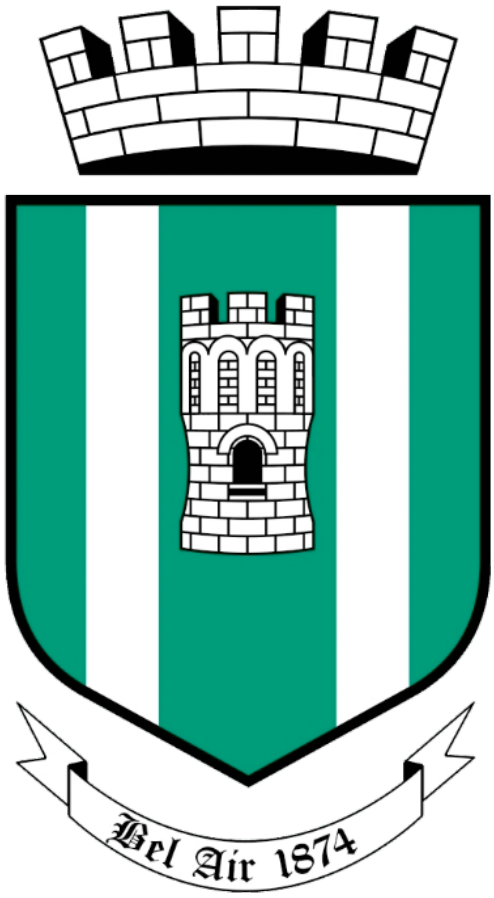
NEIGHBORHOOD TRANSPORTATION MANAGEMENT PROGRAM



Town of Bel Air
Committee Booklet

July, 2021

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Date _____

NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM

EVALUATION WORKSHEET

Street Name(s): _____

Petitioner Name: _____

Address: _____

CRITERIA	MAX POINTS	POINTS
Street Designation Local ____ Collector ____		
Traffic Volume (Peak Hour Volume) _____ PHV 100-149 (5 pts), 150-199 (10 pts), 200-249 (15 pts), 250-299 (20 pts), >300 (25 pts)	25 pts	
Speed Posted Limit ____ MPH 85th Percentile ____ MPH 85% exceeds 5-7 mph (5 pts), 8-11 mph (10 pts), 12-15 mph (15 pts), >15 mph (20 pts)	20 pts	
Elementary School or Playground Yes ____ No ____	10 pts	
Pedestrian Generator (park, school, transit, shopping) _____	5 pts	
Sidewalks (percent of road/intersection without walk x 10) _____%	10 pts	
Non-Local Traffic ____ dwellings x _____ multiplier = _____ AWDT >10% AWDT (5 pts), >20% (10 pts), >30% (15 pts), >40% (20 pts), >50% (25 pts)	25 pts	
Sight Distance or Intersection Visibility _____	5 pts	
Accident History Previous Year ___ (5 pt/accident) Prior 3 Years ___ (2 pt)	10 pts	
TOTAL	110 pts	_____

NTMP Points 0-49 – Level 1 _____

NTMP Points 50-79 – Level 2 _____

NTMP Points 80-110 – Level 3 _____

Town of Bel Air

NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM

POINT ASSIGNMENT SYSTEM

For the purpose of NTMP, "residential street" is defined as a Town maintained roadway with a majority of residential development fronting both sides of the street, excluding streets that function as major collectors or arterial roads. Level I intervention will be initiated for any valid complaint. If warranted, the Town will proceed with a point system evaluation to determine whether Level II or Level III intervention is appropriate.

The following information is used: to develop a numerical score for each requested residential street; rate the requested street according to its prevailing traffic conditions; and to determine which level of NTMP measures is appropriate. The resulting score, available funding and other factors are used to determine which roadways will proceed to the next NTMP phase. If warranted, the community will be required to obtain a minimum of two thirds community approval for the installation of such measures as traffic circles, chokers, and speed humps.

There are only two exceptions where installation of Level II measures will be installed when the road does not meet the aforementioned criteria. The exceptions are:

- Roads adjacent to an elementary school access where the majority of the students walk to school

- Roads that meet all of the following criteria:

  - A minimum Peak Hour Volume (PHV) of 125,
  - Non-local traffic is calculated at more than 50% vehicles per hour
  - Minimum length of road of 150 feet

POINT SYSTEM CRITERIA

The following point system criteria are used to determine the NTMP point score. **Qualified Town staff members will collect all necessary data and complete this point system analysis to determine the level of intervention or action.**

1. *Street Designation*
   Each street in Town is designated in a specific category as part of the Town Major Transportation Plan. The first step in the point analysis is to determine the street designation. If a street is a designated collector road, the point system does not apply.

   No point score is associated with this criteria

2. *Traffic Volume*
   Points are assigned according to the Peak Hourly Volume (PHV). Peak hour volumes are normally registered between the hours of 6am to 8am and 4pm to 6pm on weekdays. Points are given on a graduated scale. Level II Traffic Management requires 125 vehicles per hour. Speed humps will not be installed if the PHV exceeds 500 vehicles.

   25 points maximum score

3. *Speed*
   Points are assigned according to vehicle speed measured at the 85th percentile over the posted speed limit. The 85th percentile speed indicates that 85 percent of vehicles are traveling at this speed or lower and is a nationally recognized standard. Points are awarded on a graduated scale ranging up to values >15 MPH above the speed limit.

   20 points maximum score

4. *Elementary School or Town Community Playground adjacent to the street*
   Ten (10) points are assigned to a street on which an elementary school or community playground is located on the street.

   10 points maximum score

5. *Major Pedestrian Generators*
   Five (5) points are assigned to a street that has one or more major pedestrian generators within one-quarter mile of the street. Major pedestrian generators include schools, libraries, parks, playgrounds, major bus stops, retail shops and offices. (If points were awarded under item #4, they should also be awarded under this item.)

   5 points maximum score

6. *Sidewalk*

   Ten (10) points are assigned to a street that does not have a paved sidewalk. If only a portion of the street lacks sidewalks, a percentage is determined and assigned points are modified accordingly. Also, for areas with four (4) foot of unobstructed walking areas, an adjustment up to a maximum of five (5) points is allotted.

   10 points maximum score

7. *Non-Local Traffic*

   A maximum of twenty five (25) points are assigned to a street which a majority of the Average Weekday Daily Traffic (AWDT) volume is comprised of motorists who do not reside within the requesting community. It is expected that non-local motorists (typically commuters) may not be as sensitive to neighborhood safety as neighborhood residents and may be less receptive to neighborhood-sponsored educational measures. The non-local AWDT volume is determined by dividing the AWDT volume by the number of trips generated by homes in the neighborhood. Since most residential unit's average 10 trips per day, numbers more than this indicate non-local traffic.

   AWDT divided by the # of Homes on Street = Non-Local Traffic

   5 points excess of 15%
   10 points excess of 20%
   15 points excess of 30%
   20 points excess of 40%
   25 points excess of 50%

   25 points maximum score

8. *Limited Sight Distance*

   Five (5) points are assigned to a street with uncorrectable and extensive sight distance limitations due to conditions such as vertical/horizontal curves, vegetation or parked vehicles.

   5 points maximum score

9. *Accident Rate*

   Five (5) points for each accident within the last year and two (2) points per accident for the prior three (3) years to a maximum of ten (10) points is assigned for each reported accident. Data is provided by the Bel Air Police Department.

   10 points maximum score

LEVEL 1

Level I (0 to 49 points) measures are passive in nature and include educational methods and special pavement markings. No minimum point assignment is required. For these measures to be implemented effectively, participation by a civic association is desirable or a majority of residents on an affected residential street if participate in implementation is needed.

Speed Awareness trailer – temporary variable graphics sign which conveys safety message
Police Enforcement – Police enforcement of traffic issue
Traffic Safety program – coordination with residents on a program supported by the Town to improve driver behavior and reinforce pedestrian/cyclist safety

LEVEL II

Level II (50 to 79 points) measures include traffic control devices and physical measures which control access to neighborhoods, change travel patterns and regulate the flow of traffic through the neighborhood. Prior to implementation, a petition must be signed by two thirds of the property owners affected by the proposal.

Line Striping – reduction in lane width, addition of center striping, placement of a stop bar at intersections or addition of striping to direct vehicles. This may be done on a temporary basis with the option of making the improvement permanent.
Speed Hump – addition of a Watts profile hump (six-foot parabolic curve three inches high) for low speed roads or Flat Top profile (ten-foot wide with a six-foot parabolic approach) typically placed at crosswalk locations
Curb Extension – extension of concrete curb to narrow the roadway typically located at intersections to slow traffic and reduce pedestrian crossing length
Landscape addition/subtraction – reduction of landscape to improve visibility and allow for increase in illumination or addition of landscape to create enclosure of the road and slow traffic.
Signage or Pavement Graphics – addition of graphics to allow the driver, pedestrian, or cyclist to slow down or become aware of an existing road condition. This could take the form of a pavement message such as 'PED XING' or 'SLOW DOWN' or be signs to accentuate a hazard such as dip in the pavement or location of a playground.

LEVEL III

Level III (80 to 110 points) measures are used solely for the purpose of addressing severe through traffic problems. These measures have the greatest detrimental impact on the residents of the neighborhood and should be considered only after all other measures have been shown to be ineffective. In addition to requiring a petition and a minimum NTMP point assessment (as in Level II), Level III measures require a public hearing to give the public an

opportunity to express their concerns. Due to the severe impact on travel patterns, Level III measures should be discouraged on residential collector streets. These include residential portions of Broadway, Gordon Street, Shamrock Road, Lee Way, MacPhail Road, Williams Street, Major's Choice Drive, Thomas Street and Boulton/George Street.

Roundabout – a traffic circle designed to slow traffic moving thru an intersection and safely distribute traffic in a uniform manner. Roundabouts have proven to reduce accidents and conflicts with pedestrians

Traffic Diversion – modification of traffic pattern at an intersection designed to reduce vehicle volumes by prohibiting specific movements. This application is effective in neighborhoods with high cut-thru traffic.

Chicane – adjustment in lane alignment to slow vehicle speed used frequently on straight road segments with speeding problems.

On-Street Parking – allowance of parking on one or both sides of a road to enclose the edge and slow traffic. Potential downside is limited visibility and greater potential for accidents.

Median Island – addition of an island choker to reduce speed. This application is best suited at crosswalks to provide a pedestrian refuge and a shorter crossing distance.

Traffic Flow adjustment – changing the traffic direction to create a one-way condition. This increases pedestrian safety by reducing potential conflicts and decreases accidents by eliminating on-coming traffic.

All solutions must accommodate emergency vehicles, school bus maneuvering, and refuse/recycling trucks. Ineligible Roads are:

- Dead-end streets
- Street sections with less than 500 feet between controlled intersections (signal or stop sign)
- Through truck routes
- Roadways with over 8% grade

PART 5
TRAFFIC CONTROL DEVICES FOR LOW-VOLUME ROADS

CHAPTER 5A. GENERAL

Section 5A.01 Function

Standard:

01 **A low-volume road shall be defined for this Part of the Manual as follows:**

A. A low-volume road shall be a facility lying outside of built-up areas of cities, towns, and communities, and it shall have a traffic volume of less than 400 AADT.

B. A low-volume road shall not be a freeway, an expressway, an interchange ramp, a freeway service road, a road on a designated State highway system, or a residential street in a neighborhood. In terms of highway classification, it shall be a variation of a conventional road or a special purpose road as defined in Section 1A.13.

C. A low-volume road shall be classified as either paved or unpaved.

Support:

02 Low-volume roads typically include agricultural, recreational, resource management and development such as mining and logging and grazing, and local roads in rural areas.

Guidance:

03 *The needs of unfamiliar road users for occasional, recreational, and commercial transportation purposes should be considered.*

Support:

04 At some locations on low-volume roads, the use of traffic control devices might be needed to provide the road user limited, but essential, information regarding regulation, guidance, and warning.

05 Other Parts of this Manual contain provisions applicable to all low-volume roads; however, Part 5 specifically supplements and references the provisions for traffic control devices commonly used on low-volume roads.

Section 5A.02 Application

Support:

01 It is possible, in many cases, to provide essential information to road users on low-volume roads with a limited number of traffic control devices. The focus might be on devices that:

A. Warn of conditions not normally encountered,
B. Prohibit unsafe movements, or
C. Provide minimal destination guidance.

Standard:

02 **The provisions contained in Part 5 shall not prohibit the installation or the full application of traffic control devices on a low-volume road where conditions justify their use.**

Guidance:

03 *Additional traffic control devices and provisions contained in other Parts of the Manual should be considered for use on low-volume roads.*

Support:

04 Section 1A.09 contains information regarding the assistance that is available to jurisdictions that do not have engineers on their staffs who are trained and/or experienced in traffic control devices.

Section 5A.03 Design

Standard:

01 **Traffic control devices for use on low-volume roads shall be designed in accordance with the provisions contained in Part 5, and where required, in other applicable Parts of this Manual.**

02 **The typical sizes for signs and plaques installed on low-volume roads shall be as shown in Table 5A-1. The sizes in the minimum column shall only be used on low-volume roads where the 85th-percentile speed or posted speed limit is less than 35 mph.**

Guidance:

03 *The sizes in the oversized column should be used where engineering judgment indicates a need based on high vehicle operating speeds, driver expectancy, traffic operations, or roadway conditions.*

Option:

04 Signs and plaques larger than those shown in Table 5A-1 may be used (see Section 2A.11).

Table 5A-1. Sign and Plaque Sizes on Low-Volume Roads (Sheet 1 of 2)

Sign or Plaque	Sign Designation	Section	Sign Sizes		
			Typical	Minimum	Oversized
Stop	R1-1	5B.02	30 x 30	—	36 x 36
Yield	R1-2	5B.02	30 x 30 x 30	—	36 x 36 x 36
Speed Limit (English)	R2-1	5B.03	24 x 30	18 x 24	36 x 48
Do Not Pass	R4-1	5B.04	24 x 30	—	36 x 48
Pass With Care	R4-2	5B.04	24 x 30	18 x 24	36 x 48
Keep Right	R4-7	5B.04	24 x 30	18 x 24	36 x 48
Do Not Enter	R5-1	5B.04	30 x 30	—	36 x 36
No Trucks	R5-2	5B.04	24 x 24	—	30 x 30
One Way	R6-2	5B.04	18 x 24	—	24 x 30
No Parking (symbol)	R8-3	5B.05	24 x 24	18 x 18	30 x 30
No Parking	R8-3a	5B.05	18 x 24	—	24 x 30
No Parking (plaque)	R8-3cP,3dP	5B.05	24 x 18	18 x 12	30 x 24
Road Closed	R11-2	5B.04	48 x 30	—	—
Road Closed, Local Traffic Only	R11-3a	5B.04	60 x 30	—	—
Bridge Out, Local Traffic Only	R11-3b	5B.04	60 x 30	—	—
Road Closed to Thru Traffic	R11-4	5B.04	60 x 30	—	—
Weight Limit	R12-1	5B.04	24 x 30	—	36 x 48
Grade Crossing (Crossbuck)	R15-1	5F.02	48 x 9	—	—
Number of Tracks (plaque)	R15-2P	5F.02	27 x 18	—	—
Horizontal Alignment	W1-1,2,3,4,5	5C.02	30 x 30	—	36 x 36
One-Direction Large Arrow	W1-6	5C.02	36 x 18	—	48 x 24
Two-Direction Large Arrow	W1-7	5C.02	36 x 18	—	48 x 24
Chevron Alignment	W1-8	5C.02	12 x 18	—	18 x 24
Intersection Warning	W2-1,2,3,4,5,6	5C.03	30 x 30	—	36 x 36
Stop Ahead	W3-1	5C.04	30 x 30	—	36 x 36
Yield Ahead	W3-2	5C.04	30 x 30	—	36 x 36
Be Prepared to Stop	W3-4	5G.05	36 x 36	—	48 x 48
Narrow Bridge	W5-2	5C.05	30 x 30	—	36 x 36
One Lane Bridge	W5-3	5C.06	30 x 30	—	36 x 36
Hill	W7-1	5C.07	30 x 30	—	36 x 36
XX % Grade (plaque)	W7-3P	5C.07	24 x 18	—	30 x 24
Next XX Miles (plaque)	W7-3aP	5C.09	24 x 18	—	30 x 24
Pavement Ends	W8-3	5C.08	30 x 30	—	36 x 36
Truck Crossing	W8-6	5C.09	30 x 30	—	36 x 36
Loose Gravel	W8-7	5G.05	30 x 30	—	36 x 36
Rough Road	W8-8	5G.05	30 x 30	—	36 x 36
Road May Flood	W8-18	5G.05	30 x 30	—	36 x 36
Grade Crossing Advance Warning	W10-1	5F.03	30 Dia.	—	36 Dia.
Grade Crossing Advance Warning	W10-2,3,4	5F.03	30 x 30	—	36 x 36
Trains May Exceed 80 mph	W10-8	5F.06	30 x 30	—	36 x 36
Storage Space Symbol	W10-11	5F.06	30 x 30	—	36 x 36
Skewed Crossing	W10-12	5F.06	30 x 30	—	36 x 36
Entering/Crossing	W11 Series	5C.09	30 x 30	—	36 x 36
Advisory Speed (plaque)	W13-1P	5C.10	18 x 18	—	24 x 24
Dead End/No Outlet	W14-1,2	5C.11	30 x 30	—	36 x 36
Dead End/No Outlet	W14-1a,2a	5C.11	36 x 9	24 x 6	—

Table 5A-1. Sign and Plaque Sizes on Low-Volume Roads (Sheet 2 of 2)

Sign or Plaque	Sign Designation	Section	Sign Sizes		
			Typical	Minimum	Oversized
No Passing Zone (pennant)	W14-3	5G.05	40 x 40 x 30	—	48 x 48 x 36
Supplemental Distance (plaque)	W16-2P	5C.09	24 x 18	18 x 12	30 x 24
Diagonal Arrow (plaque)	W16-7P	5C.09	24 x 12	—	30 x 18
Ahead (plaque)	W16-9P	5C.09	24 x 12	—	30 x 18
No Traffic Signs	W18-1	5C.12	30 x 30	24 x 24	36 x 36
Road Work (with distance)	W20-1	5G.05	36 x 36	—	48 x 48
Road Closed (with distance)	W20-3	5G.05	36 x 36	—	48 x 48
One Lane Road (with distance)	W20-4	5G.05	36 x 36	—	48 x 48
Flagger	W20-7	5G.05	36 x 36	—	48 x 48
Workers	W21-1	5G.05	36 x 36	—	48 x 48
Fresh Oil	W21-2	5G.05	30 x 30	—	48 x 48
Road Machinery Ahead	W21-3	5G.05	30 x 30	—	48 x 48
Shoulder Work	W21-5	5G.05	36 x 36	—	48 x 48
Survey Crew	W21-6	5G.05	36 x 36	—	48 x 48
Utility Work (with distance)	W21-7	5G.05	36 x 36	—	48 x 48

Notes: 1. Larger sizes may be used when appropriate
2. Dimensions are shown in inches and are shown as width x height

Standard:

05 **All signs shall be retroreflective or illuminated to show the same shape and similar color both day and night, unless specifically stated otherwise in other applicable Parts of this Manual. The requirements for sign illumination shall not be considered to be satisfied by street, highway, or strobe lighting.**

06 **All markings shall be visible at night and shall be retroreflective unless ambient illumination provides adequate visibility of the markings.**

Section 5A.04 Placement

Standard:

01 **Except as provided in Paragraph 3, the traffic control devices used on low-volume roads shall be placed and positioned in accordance with the lateral, longitudinal, and vertical placement provisions contained in Part 2 and other applicable Sections of this Manual.**

Guidance:

02 *The placement of warning signs should comply with the guidance contained in Section 2C.05 and other applicable Sections of this Manual.*

Option:

03 A lateral offset of not less than 2 feet from the roadway edge to the roadside edge of a sign may be used where roadside features such as terrain, shrubbery, and/or trees prevent lateral placement in accordance with Section 2A.19.

Standard:

04 **If located within a clear zone, post-mounted sign supports shall be yielding, breakaway, or shielded with a longitudinal barrier or crash cushion as required in Section 2A.19.**

CHAPTER 5B. REGULATORY SIGNS

Section 5B.01 Introduction

Support:

01 The purpose of a regulatory sign is to inform highway users of traffic laws or regulations, and to indicate the applicability of legal requirements that would not otherwise be apparent.

02 The provisions for regulatory signs are contained in Chapter 2B and in other Sections of this Manual. Provisions for regulatory signs that are specific to low-volume roads are contained in this Chapter.

Section 5B.02 STOP and YIELD Signs (R1-1 and R1-2)

Guidance:

01 *STOP (R1-1) and YIELD (R1-2) signs (see Figure 5B-1) should be considered for use on low-volume roads where engineering judgment or study, consistent with the provisions of Sections 2B.04 to 2B.10, indicates that either of the following conditions applies:*

A. An intersection of a less-important road with a main road where application of the normal right-of-way rule might not be readily apparent.

B. An intersection that has restricted sight distance for the prevailing vehicle speeds.

Section 5B.03 Speed Limit Signs (R2 Series)

Standard:

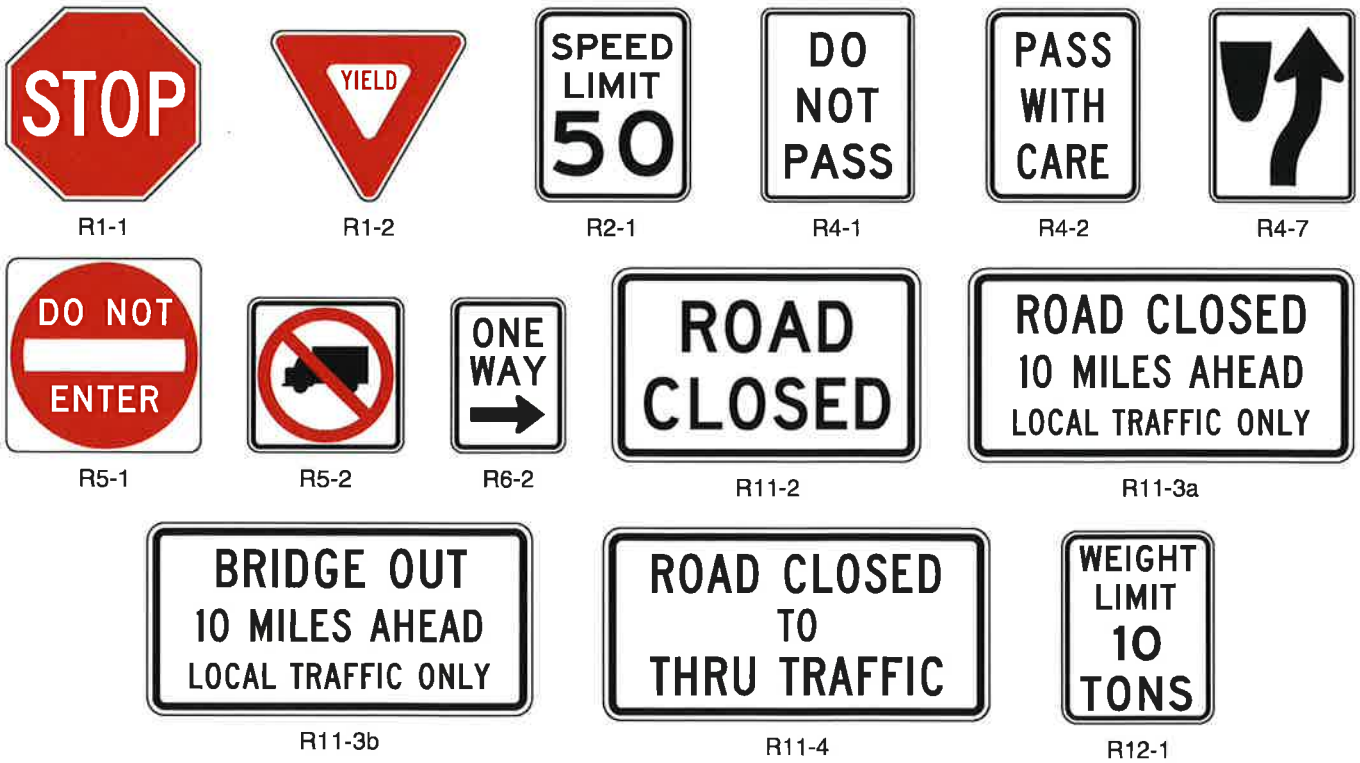
01 **If used, Speed Limit (R2 series) signs (see Figure 5B-1) shall display the speed limit established by law, ordinance, regulation, or as adopted by the authorized agency following an engineering study. The displayed speed limits shall be in multiples of 5 mph.**

02 **Speed limits shall be established in accordance with Section 2B.13.**

Option:

03 Speed limit signs may be used on low-volume roads that carry traffic from, onto, or adjacent to higher-volume roads that have posted speed limits.

Figure 5B-1. Regulatory Signs on Low-Volume Roads



R1-1 R1-2 R2-1 R4-1 R4-2 R4-7

R5-1 R5-2 R6-2 R11-2 R11-3a

R11-3b R11-4 R12-1

Section 5B.04 Traffic Movement and Prohibition Signs (R3, R4, R5, R6, R9, R10, R11, R12, R13, and R14 Series)

Support:

01 The regulatory signs (see Figure 5B-1) in these series inform road users of required, permitted, or prohibited traffic movements involving turn, alignment, exclusion, and pedestrians.

Standard:

02 **If used, signs for traffic prohibitions or restrictions shall be placed in advance of the prohibition or restriction so that traffic can use an alternate route or turn around.**

Guidance:

03 *Signs should be used on low-volume roads to indicate traffic prohibitions and restrictions such as road closures and weight restrictions.*

Option:

04 Signs for traffic prohibitions or restrictions may be used on a low-volume road near and at the intersections or the connections with a higher class of road, and where the regulatory message is essential for transition from the low-volume road to the higher-class facility or vice versa.

Section 5B.05 Parking Signs (R8 Series)

Option:

01 Parking signs (see Figure 5B-2) may be installed selectively on low-volume roads with due consideration of enforcement.

Section 5B.06 Other Regulatory Signs

Standard:

01 **Other regulatory signs used on low-volume roads that are not discussed in Part 5 shall comply with the provisions contained in other Parts of this Manual.**

Figure 5B-2. Parking Signs and Plaques on Low-Volume Roads

R8-3 R8-3a R8-3cP R8-3dP

CHAPTER 5C. WARNING SIGNS

Section 5C.01 Introduction

Support:

01 The purpose of a warning sign is to provide advance warning to the road user of unexpected conditions on or adjacent to the roadway that might not be readily apparent.

02 The provisions for warning signs are contained in Chapter 2C and in other Sections of this Manual. Provisions for warning signs that are specific to low-volume roads are contained in this Chapter.

Section 5C.02 Horizontal Alignment Signs (W1-1 through W1-8)

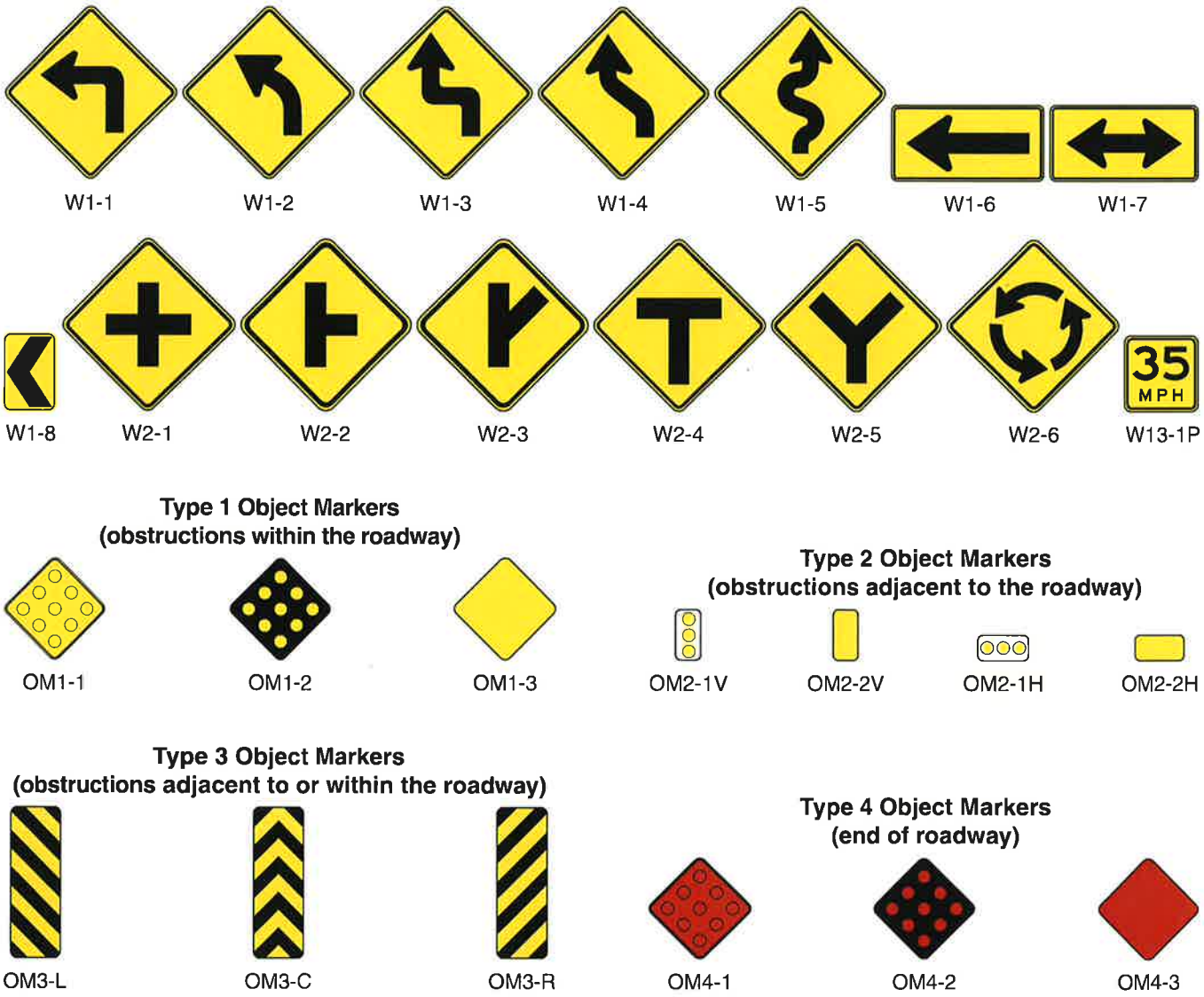
Support:

01 Horizontal Alignment signs (see Sections 2C.06 through 2C.12 and Figure 5C-1) include turn, curve, reverse turn, reverse curve, winding road, large arrow, and chevron alignment signs.

Option:

02 Horizontal Alignment signs may be used where engineering judgment indicates a need to inform the road user of a change in the horizontal alignment of the roadway.

Figure 5C-1. Horizontal Alignment and Intersection Warning Signs and Plaques and Object Markers on Low-Volume Roads



Section 5C.03 Intersection Warning Signs (W2-1 through W2-6)

Support:

01 Intersection signs (see Figure 5C-1) include the crossroad, side road, T-symbol, Y-symbol, and circular intersection signs.

Option:

02 Intersection signs may be used where engineering judgment indicates a need to inform the road user in advance of an intersection.

Section 5C.04 Stop Ahead and Yield Ahead Signs (W3-1, W3-2)

Standard:

01 **A Stop Ahead (W3-1) sign (see Figure 5C-2) shall be used where a STOP sign is not visible for a sufficient distance to permit the road user to bring the vehicle to a stop at the STOP sign.**

02 **A Yield Ahead (W3-2) sign (see Figure 5C-2) shall be used where a YIELD sign is not visible for a sufficient distance to permit the road user to bring the vehicle to a stop, if necessary, at the YIELD sign.**

Section 5C.05 NARROW BRIDGE Sign (W5-2)

Option:

01 The NARROW BRIDGE (W5-2) sign (see Figure 5C-2) may be used on an approach to a bridge or culvert that has a clear width less than that of the approach roadway.

Section 5C.06 ONE LANE BRIDGE Sign (W5-3)

Guidance:

01 *A ONE LANE BRIDGE (W5-3) sign (see Figure 5C-2) should be used on low-volume two-way roadways in advance of any bridge or culvert:*

- *A. Having a clear roadway width of less than 16 feet, or*
- *B. Having a clear roadway width of less than 18 feet when commercial vehicles constitute a high proportion of the traffic, or*
- *C. Having a clear roadway width of 18 feet or less where the approach sight distance is limited on the approach to the structure.*

Option:

02 Roadway alignment and additional warning may be provided on the approach to a bridge or culvert by the use of object markers and/or delineators.

Section 5C.07 Hill Sign (W7-1)

Option:

01 An engineering study of vehicles and road characteristics, such as percent grade and length of grade, may be conducted to determine hill signing requirements.

Section 5C.08 PAVEMENT ENDS Sign (W8-3)

Option:

01 A PAVEMENT ENDS (W8-3) sign (see Figure 5C-2) may be used to warn road users where a paved surface changes to a gravel or earth road surface.

Section 5C.09 Vehicular Traffic Warning and Non-Vehicular Warning Signs (W11 Series and W8-6)

Guidance:

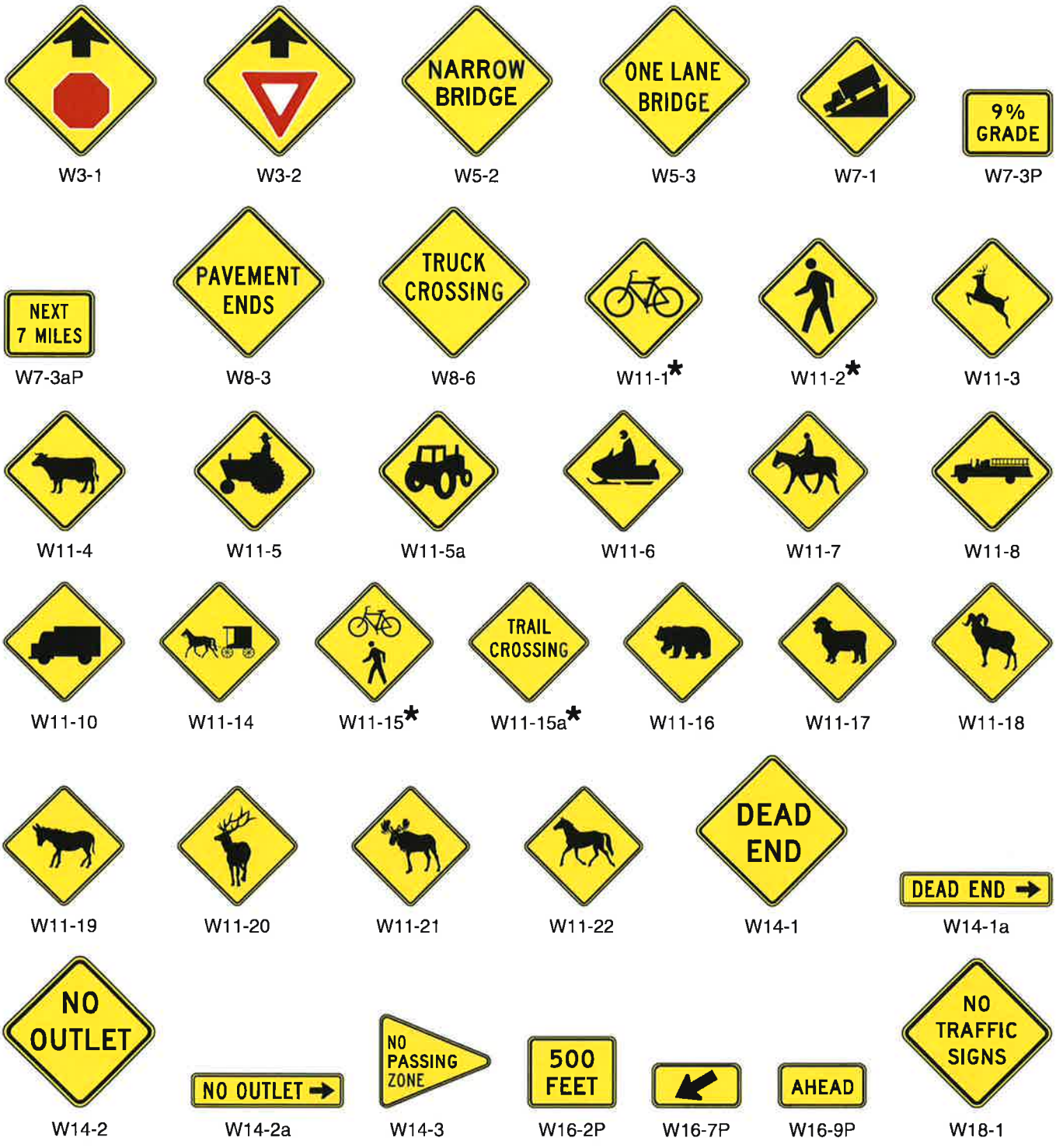
01 *Vehicular Traffic Warning signs (see Figure 5C-2) should be used to alert road users to locations where frequent unexpected entries into the roadway by trucks, bicyclists, farm vehicles, fire trucks, and other vehicles might occur. Such signs should be used only at locations where the road user's sight distance is restricted or the condition, activity, or entering traffic would be unexpected.*

Option:

02 Non-Vehicular Warning signs (see Figure 5C-2) may be used to alert road users in advance of locations where unexpected entries into the roadway or shared use by pedestrians, large animals, or other crossing activities might occur.

03 A W7-3aP, W16-2P, or W16-9P supplemental plaque (see Figure 5C-2), with the legend NEXT XX MILES, XX FEET, or AHEAD may be installed below a Vehicular Traffic Warning or Non-Vehicular Warning sign (see Sections 2C.49 and 2C.50) to inform road users that they are approaching a portion of the roadway or a point where crossing activity might occur.

Figure 5C-2. Other Warning Signs and Plaques on Low-Volume Roads



* A fluorescent yellow-green background color may be used for this sign or plaque

Standard:

04 **When a Non-Vehicular Warning sign is placed at the location of the crossing point, a diagonal downward pointing arrow (W16-7P) plaque (see Figure 5C-2) shall be mounted below the sign.**

Guidance:

05 *If the activity is seasonal or temporary, the sign should be removed or covered when the condition or activity does not exist.*

Section 5C.10 Advisory Speed Plaque (W13-1P)

Option:

01 An Advisory Speed (W13-1P) plaque (see Figure 5C-1) may be mounted below a warning sign when the condition requires a reduced speed.

Section 5C.11 DEAD END or NO OUTLET Signs (W14-1, W14-1a, W14-2, W14-2a)

Option:

01 The DEAD END (W14-1) and NO OUTLET (W14-2) signs (see Figure 5C-2) and the DEAD END (W14-1a) and NO OUTLET (W14-2a) signs (see Figure 5C-2) may be used to warn road users of a road that has no outlet or that terminates in a dead end or cul-de-sac.

Guidance:

02 *If used, these signs should be placed at a location that gives drivers of large commercial or recreational vehicles an opportunity to select a different route or turn around.*

Section 5C.12 NO TRAFFIC SIGNS Sign (W18-1)

Option:

01 A W18-1 warning sign (see Figure 5C-2) with the legend NO TRAFFIC SIGNS may be used only on unpaved, low-volume roads to advise users that no signs are installed along the distance of the road. If used, the sign may be installed at the point where road users would enter the low-volume road or where, based on engineering judgment, the road user might need this information.

02 A W7-3aP, W16-2P, or W16-9P supplemental plaque (see Figure 5C-2) with the legend NEXT XX MILES, XX FEET, or AHEAD may be installed below the W18-1 sign when appropriate.

Section 5C.13 Other Warning Signs

Standard:

01 **Other warning signs used on low-volume roads that are not discussed in Part 5, but are in this Manual, shall comply with the provisions contained in other Parts of this Manual. Warning signs that are not provided in this Manual shall comply with the provisions in Sections 2C.02 and 2C.03.**

Section 5C.14 Object Markers and Barricades

Support:

01 The purpose of object markers is to mark obstructions located within or adjacent to the roadway, such as bridge abutments, drainage structures, and other physical objects.

Guidance:

02 *The end of a low-volume road should be marked with a Type 4 object marker in compliance with Section 2C.66.*

Option:

03 A Type 3 Barricade may be used where engineering studies or judgment indicates a need for a more visible end-of-roadway treatment (see Section 2B.67).

Standard:

04 **Barricades used on low-volume roads shall comply with the provisions contained in Section 2B.67.**

CHAPTER 5D. GUIDE SIGNS

Section 5D.01 Introduction

Support:

01 The purpose of a guide sign is to inform road users regarding positions, directions, destinations, and routes.

02 The provisions for guide signs, in general, are contained in Chapters 2D through 2N and in other Sections of this Manual. Provisions for guide signs that are specific to low-volume roads are contained in this Chapter.

Guidance:

03 *The familiarity of the road users with the road should be considered in determining the need for guide signs on low-volume roads.*

Support:

04 Low-volume roads generally do not require guide signs to the extent that they are needed on higher classes of roads. Because guide signs are typically only beneficial as a navigational aid for road users who are unfamiliar with a low-volume road, guide signs might not be needed on low-volume roads that serve only local traffic.

Guidance:

05 *If used, destination names should be as specific and descriptive as possible. Destinations such as campgrounds, ranger stations, recreational areas, and the like should be clearly indicated so that they are not interpreted to be communities or locations with road user services.*

Option:

06 Guide signs may be used at intersections to provide information for road users returning to a higher class of roads.

CHAPTER 5E. MARKINGS

Section 5E.01 Introduction

Support:

01 The purpose of markings on highways is to provide guidance and information for road users regarding roadway conditions and restrictions.

02 The provisions for markings and delineators, in general, are contained in Part 3 and in other Sections of this Manual. Provisions for markings that are specific to low-volume roads are contained in this Chapter.

Section 5E.02 Center Line Markings

Standard:

01 **Where center line markings are installed, no-passing zone markings in compliance with Section 3B.02 shall also be installed.**

Guidance:

02 *Center line markings should be used on paved low-volume roads consistent with the principles of this Manual and with the policies and practices of the road agency and on the basis of either an engineering study or the application of engineering judgment.*

Option:

03 Center line markings may be placed on highways with or without edge line markings.

Section 5E.03 Edge Line Markings

Support:

01 The purpose of edge line markings is to delineate the left-hand or right-hand edge of the roadway.

Guidance:

02 *Edge line markings should be considered for use on paved low-volume roads based on engineering judgment or an engineering study.*

Option:

03 Edge line markings may be placed on highways with or without center line markings.

04 Edge line markings may be placed on paved low-volume roads for roadway features such as horizontal curves, narrow bridges, pavement width transitions, curvilinear alignment, and at other locations based on engineering judgment or an engineering study.

Section 5E.04 Delineators

Support:

01 The purpose of delineators is to enhance driver safety where it is desirable to call attention to a changed or changing condition such as abrupt roadway narrowing or curvature.

Option:

02 Delineators may be used on low-volume roads based on engineering judgment, such as for curves, T-intersections, and abrupt changes in the roadway width. In addition, they may be used to mark the location of driveways or other minor roads entering the low-volume road.

Section 5E.05 Other Markings

Standard:

01 **Other markings, such as stop lines, crosswalks, pavement legends, channelizing devices, and islands, used on low-volume roads shall comply with the provisions contained in this Manual.**

CHAPTER 5F. TRAFFIC CONTROL FOR HIGHWAY-RAIL GRADE CROSSINGS

Section 5F.01 Introduction

Support:

01 The provisions for highway-rail grade crossing traffic control devices are contained in Part 8 and in other Sections of this Manual.

02 Traffic control for highway-rail grade crossings includes all signs, signals, markings, illumination, and other warning devices and their supports along roadways either approaching or at highway-rail grade crossings. The purpose of this traffic control is to promote a safer and more efficient operation of both rail and highway traffic at highway-rail grade crossings.

Section 5F.02 Grade Crossing (Crossbuck) Sign and Number of Tracks Plaque (R15-1, R15-2P)

Support:

01 In most States, the Grade Crossing (Crossbuck) (R15-1) sign (see Figure 5F-1) requires road users to yield the right-of-way to rail traffic at a highway-rail grade crossing.

Standard:

02 **The Crossbuck (R15-1) sign shall be used at all highway-rail grade crossings, except as otherwise provided in Section 8B.03. For all low-volume roads, Crossbuck signs shall be used on the right-hand side of each approach. If there are two or more tracks, the supplemental Number of Tracks (R15-2P) plaque (see Figure 5F-1) shall display the number of tracks and shall be installed below the Crossbuck sign.**

03 **A strip of retroreflective white material not less than 2 inches in width shall be used on the back of each blade of each Crossbuck sign for the length of each blade, at all highway-rail grade crossings, except those where Crossbuck signs have been installed back-to-back.**

04 **A vertical strip of retroreflective white material, not less than 2 inches in width, shall be used on each support at passive highway-rail grade crossings for the full length of the front and back of the support from the Crossbuck sign or Number of Tracks plaque to within 2 feet above the ground, except on the side of those supports where a STOP (R1-1) or YIELD (R1-2) sign or flashing lights have been installed or on the back side of supports for Crossbuck signs installed on one-way streets.**

Section 5F.03 Grade Crossing Advance Warning Signs (W10 Series)

Standard:

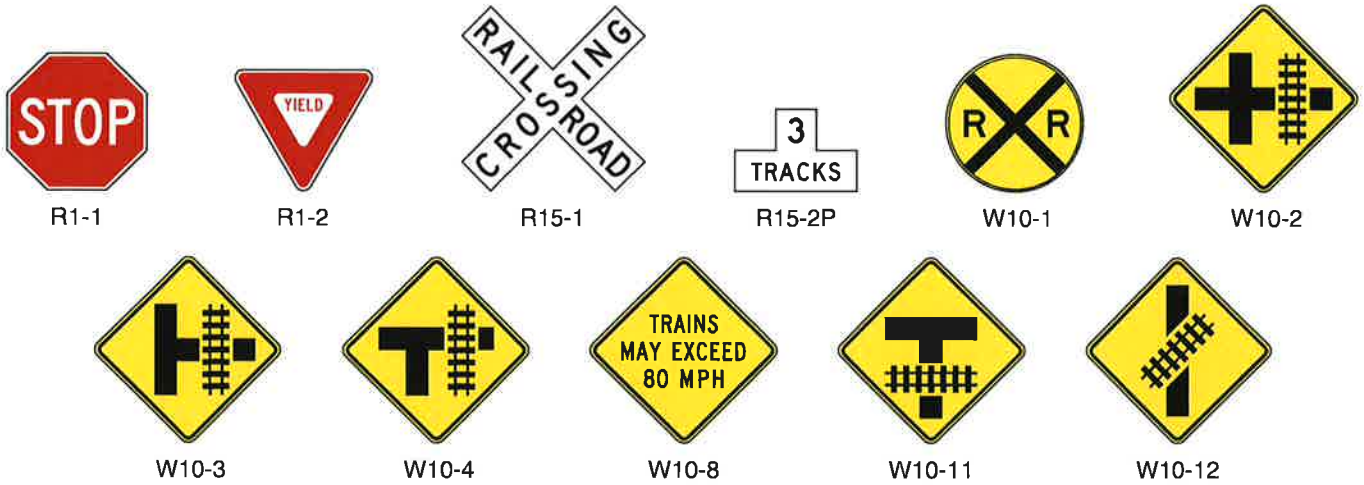
01 **Except as provided in Paragraph 2, a Grade Crossing Advance Warning (W10-1) sign (see Figure 5F-1) shall be used on all low-volume roads in advance of every highway-rail grade crossing.**

Option:

02 The Grade Crossing Advance Warning sign may be omitted for highway-rail grade crossings that are flagged by train crews.

03 The W10-2, W10-3, and W10-4 signs (see Figure 5F-1) may be used on low-volume roads that run parallel to railroad tracks to warn road users making a turn that they will encounter a highway-rail grade crossing soon after making the turn.

Figure 5F-1. Highway-Rail Grade Crossing Signs and Plaques for Low-Volume Roads



R1-1 R1-2 R15-1 R15-2P W10-1 W10-2

W10-3 W10-4 W10-8 W10-11 W10-12

Section 5F.04 STOP and YIELD Signs (R1-1, R1-2)

Standard:

01 **The use and application at passive highway-rail grade crossings on low-volume roads of Crossbuck Assemblies with YIELD (R1-2) signs or STOP (R1-1) signs shall comply with the provisions of Section 8B.04.**

02 **At all highway-rail grade crossings where YIELD or STOP signs are installed, Yield Ahead (W3-2) or Stop Ahead (W3-1) signs shall also be installed if the criteria for their installation in Section 2C.36 is met.**

Section 5F.05 Pavement Markings

Guidance:

01 *Pavement markings at highway-rail grade crossings should be used on paved low-volume roads, particularly if they are already deployed at most other highway-rail grade crossings within the immediate vicinity, or when the roadway has center line markings.*

Section 5F.06 Other Traffic Control Devices

Standard:

01 **Other traffic control devices that are used at highway-rail grade crossings on low-volume roads, such as other signs, signals, and illumination that are not in this Chapter, shall comply with the provisions contained in Part 8 and other applicable Parts of this Manual.**

CHAPTER 5G. TEMPORARY TRAFFIC CONTROL ZONES

Section 5G.01 Introduction

Guidance:

01 *The safety of road users, including pedestrians and bicyclists, as well as personnel in work zones, should be an integral and high priority element of every project in the planning, design, maintenance, and construction phases. Part 6 should be reviewed for additional criteria, specific details, and more complex temporary traffic control zone requirements. The following principles should be applied to temporary traffic control zones:*

A. Traffic movement should be disrupted as little as possible.
B. Road users should be guided in a clear and positive manner while approaching and within construction, maintenance, and utility work areas.
C. Routine inspection and maintenance of traffic control elements should be performed both day and night.
D. Both the contracting agency and the contractor should assign at least one person on each project to have day-to-day responsibility for assuring that the traffic control elements are operating effectively and any needed operational changes are brought to the attention of their supervisors.

02 *Traffic control in temporary traffic control zones should be designed on the assumption that road users will only reduce their speeds if they clearly perceive a need to do so, and then only in small increments of speed. Temporary traffic control zones should not present a surprise to the road user. Frequent and/or abrupt changes in geometrics and other features should be avoided. Transitions should be well delineated and long enough to accommodate driving conditions at the speeds vehicles are realistically expected to travel.*

03 *A temporary traffic control plan (see Section 6C.01) should be used for a temporary traffic control zone on a low-volume road to specify particular traffic control devices and features, or to reference typical drawings such as those contained in Part 6.*

Support:

04 Applications of speed reduction countermeasures and enforcement can be effective in reducing traffic speeds in temporary traffic control zones.

Section 5G.02 Applications

Guidance:

01 *Planned work phasing and sequencing should be the basis for the use of traffic control devices for temporary traffic control zones. Part 6 should be consulted for specific traffic control requirements and examples where construction or maintenance work is planned.*

Support:

02 Maintenance activities might not require extensive temporary traffic control if the traffic volumes and speeds are low.

Option:

03 The traffic applications shown in Figures 6H-1, 6H-10, 6H-11, 6H-13, 6H-15, 6H-16, and 6H-18 of Part 6 are among those that may be used on low-volume roads.

Support:

04 Table 6H-3 provides distances for the advance placement of the traffic control devices shown in the typical applications.

Option:

05 For low-volume roadways with speeds of 30 miles per hour or less, a minimum distance of 100 feet may be used for the advance placement distance and the distance between signs shown in the typical applications.

06 For temporary traffic control zones on low-volume roads that require flaggers, a single flagger may be adequate if the flagger is visible to approaching traffic from all appropriate directions.

Section 5G.03 Channelization Devices

Standard:

01 **Channelization devices for nighttime use shall have the same retroreflective requirements as specified for higher-volume roadways.**

Option:

02 To alert, guide, and direct road users through temporary traffic control zones on low-volume roads, tapers may be used to move a road user out of the traffic lane and around the work space using the spacing of devices that is described in Section 6F.63.

Section 5G.04 Markings

Guidance:

01 *Pavement markings should be considered for temporary traffic control zones on paved low-volume roads, especially roads that had existing pavement markings or that have a surfaced detour or temporary roadway.*

Option:

02 Interim pavement markings may be omitted in a temporary traffic control zone if they are not needed based on the criteria for these markings in Section 6F.78.

Section 5G.05 Other Traffic Control Devices

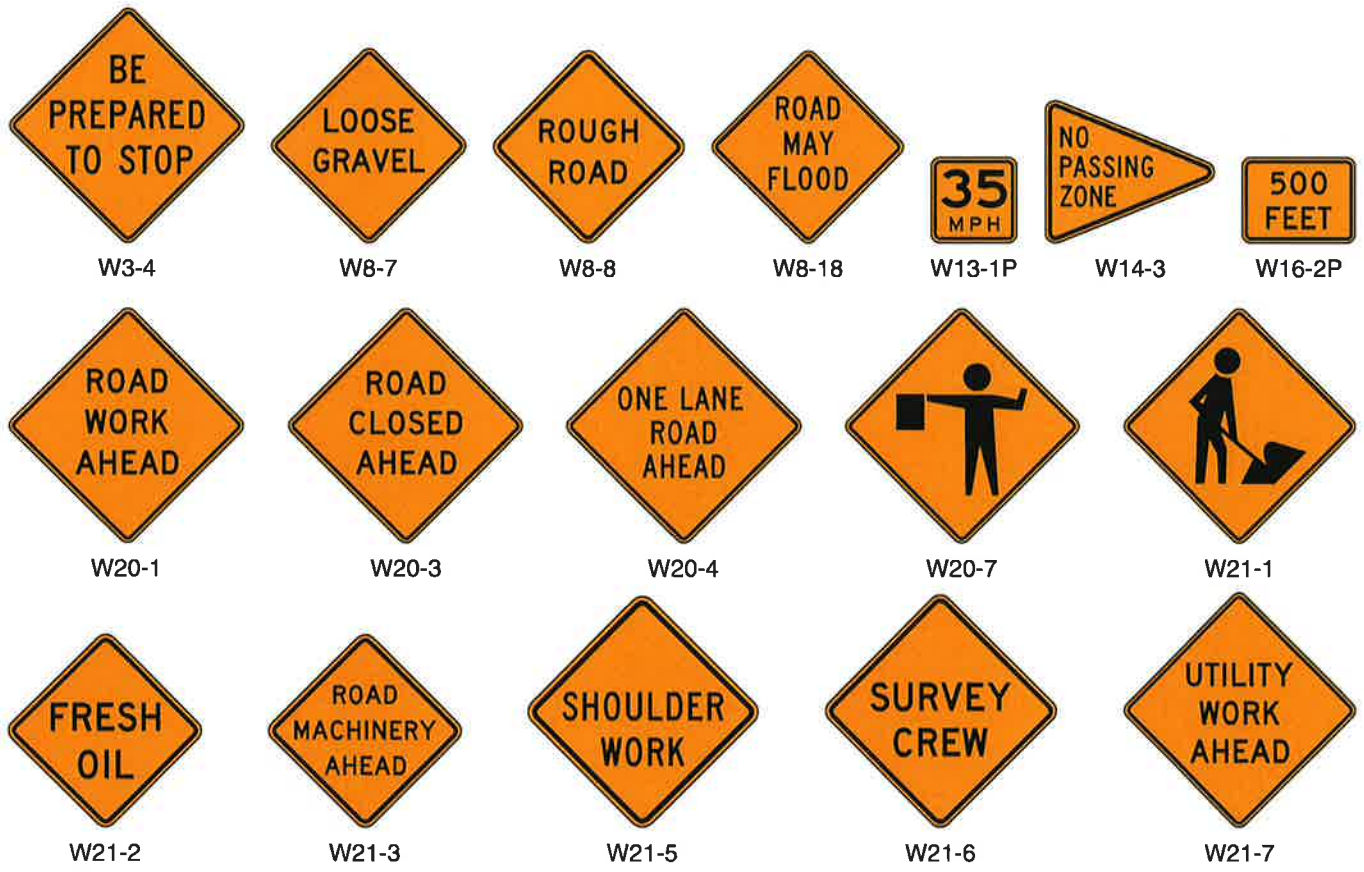
Standard:

01 **Other traffic control devices, such as other signs, signals, and illumination that are used on low-volume roads in temporary traffic control zones, but are not described in Part 5, shall comply with the provisions contained in other Parts of this Manual.**

Support:

02 Some of the signs that might be applicable in a temporary traffic control zone on a low-volume road are shown in Figure 5G-1.

Figure 5G-1. Temporary Traffic Control Signs and Plaques on Low-Volume Roads



CHAPTER 5H. TRAFFIC CONTROL FOR SCHOOL AREAS

Section 5H.01 Introduction

Support:

01 The provisions for school traffic control devices are contained in Part 7 of this Manual.

Standard:

02 **The sizes of school signs and plaques on low-volume roads shall be in accordance with Section 7B.01 and Table 7B-1.**

Traffic Calming Fact Sheets
May 2018 Update

A Community of Transportation Professionals

Introduction

Purpose:
The purpose of these fact sheets is to provide transportation practitioners, public agencies, and the general public general facts and information regarding the most popular traffic calming measures used today. ITE and the Federal Highway Administration (FHWA) recently produced a Traffic Calming ePrimer (web link shown below), which documents the results of several decades of traffic calming experience in the United States, presenting a thorough review of current traffic calming practices. These fact sheets summarize information presented in the ePrimer.

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Traffic Calming Measures Included:

A **horizontal deflection** hinders the ability of a motorist to drive in a straight path by creating a horizontal shift in the roadway. This shift reduces the ability of a motorist to maintain speed while comfortably navigating the measure.

- Lateral shift
- Chicane
- Realigned Intersection
- Traffic Circle
- Small Modern Roundabout/Mini-Roundabout
- Roundabout

A **vertical deflection** creates a change in the height of the roadway that typically forces a motorist to slow down to maintain an acceptable level of comfort.

- Speed Hump
- Speed Cushion
- Speed Table
- Raised Crosswalk
- Raised Intersection

A **street width reduction** narrows the width of a vehicle travel lane or roadway, so a motorist likely needs to slow the vehicle to maintain an acceptable level of comfort and safety. The measure can also reduce the distance required for pedestrian crossings, reducing exposure to vehicular conflicts.

- Corner Extension/Bulb-Out
- Choker
- Median Island
- On-Street Parking
- Road Diet

A **routing restriction** prevents particular vehicle movements at an intersection and is intended to eliminate some portions of cut-through traffic.

- Diagonal Diverter
- Closure
- Median Barrier/Forced Turn Island

Measures Not Included:

A variety of other measures have been part of traffic calming efforts in jurisdictions throughout the United States. These measures are not included in these fact sheets for a variety of reasons, including:

- The measure is a standard traffic control measure typically used for improving traffic flow and has a secondary benefit for non-motorist safety
- The measure produces only a temporary benefit
- The measure requires additional enforcement beyond typical activities
- The measure has minimal or no measurable effect on vehicle speed or non-motorist safety

The excluded measures include:

- Signs
- Pavement Markings
- Gateways
- Corner Radius Reductions
- Textured Pavements and/or Rumble Strips
- Streetscaping/Landscaping

Although these fact sheets focus on mostly physical measures to calm traffic, non-physical measures can also be effective as part of traffic calming efforts. For example, education and enforcement efforts have long been used as part of neighborhood traffic calming programs and should continue to be considered as either supplements to self-enforcing physical means or as precursors to physical measures.

Speed Hump

Description:

- Rounded (vertically along travel path) raised areas of pavement typically 12 to 14 feet in length
- Often placed in a series (typically spaced 260 to 500 feet apart)
- Sometimes called road humps or undulations

Applications:

- Appropriate for residential local streets and residential/neighborhood collectors
- Not typically used on major roads, bus routes, or primary emergency response routes
- Not appropriate for roads with 85th-percentile speeds of 45 mph or more
- Appropriate for mid-block placement, not at intersections
- Not recommended on grades greater than 8 percent
- Work well in combination with curb extensions
- Can be used on a one-lane one-way or two-lane two-way street

(Source: City of Boulder, Colorado)

(Source: PennDOT Local Technical Assistance Program)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- ITE recommended practice - "Guidelines for the Design and Application of Speed Humps"
- Typically 12 to 14 feet in length; other lengths (10, 22, and 30 feet) reported in practice in U.S.
- Speed hump shapes include parabolic, circular, and sinusoidal
- Typically spaced no more than 500 feet apart to achieve an 85th percentile speed between 25 and 35 mph
- Hump heights range between 3 and 4 inches, with trend toward 3 - 3 ½ inches maximum
- Often have associated signing (advance warning sign before first hump in series at each hump)
- Typically have pavement markings (zigzag, shark's tooth, chevron, zebra)
- Taper edge near curb to allow gap for drainage
- Some have speed advisories
- Need to design for drainage, without encouraging means for motorists to go around a hump

Potential Impacts:

- No impact on non-emergency access
- Average speeds between humps reduced between 20 and 25 percent
- Speeds typically increase approximately 0.5 to 1 mph midway between humps for each 100 feet Beyond the 200-foot approach and exit of consecutive humps
- Traffic volumes diversion estimated around 20 percent; average crash rates reduced by 13 percent

Emergency Response Issues:

- Impacts to ease of emergency-vehicle throughput
- Approximate delay between 3 and 5 seconds per hump for fire trucks and up to 10 seconds for ambulances with patients

Typical Cost (2017 dollars):

- Cost ranges between $2,000 and $4,000

Speed Table/Raised Crosswalks

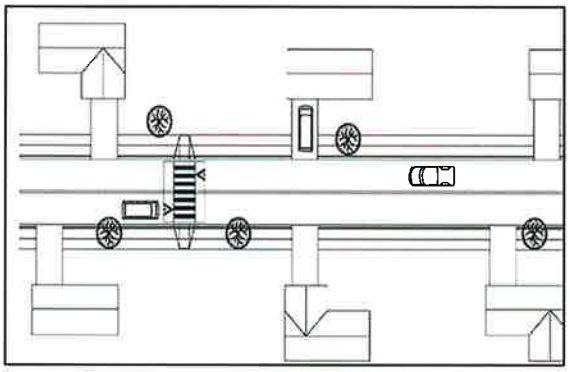
Description:

- Long, raised speed humps with a flat section in the middle and ramps on the ends; sometimes constructed with brick or other textured materials on the flat section
- If placed at a pedestrian crossing, it is referred to as a raised crosswalk
- If placed only in one direction on a road, it is called an offset speed table

Applications:

- Appropriate for local and collector streets; mid-block or at intersections, with/without crosswalks
- Can be used on a one-lane one-way or two-lane two-way street
- Not appropriate for roads with 85th percentile speeds of 45 mph or more
- Typically long enough for the entire wheelbase of a passenger car to rest on top or within limits of ramps
- Work well in combination with textured crosswalks, curb extensions, and curb radius reductions
- Can be applied both with and without sidewalks or dedicated bicycle facilities
- Typically installed along closed-section roads (i.e. curb and gutter) but feasible on open section

(Source: Google Maps, Boulder, Colorado)



(Source: Delaware Department of Transportation)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- ITE recommended practice – "Guidelines for the Design and Application of Speed Humps"
- Most common height is between 3 and 4 inches (reported as high as 6 inches)
- Ramps are typically 6 feet long (reported up to 10 feet long) and are either parabolic or linear
- Careful design is needed for drainage
- Posted speed typically 30 mph or less

Potential Impacts:

- No impact on non-emergency access
- Speeds reductions typically less than for speed humps (typical traversing speeds between 25 and 27 miles per hour)
- Speeds typically decline approximately 0.5 to 1 mph midway between tables for each 100 feet beyond the 200-foot approach and exit points of consecutive speed tables
- Average traffic volumes diversions of 20 percent when a series of speed tables are implemented
- Average crash rate reduction of 45 percent on treated streets
- Increase pedestrian visibility and likelihood of driver yield compliance
- Generally not appropriate for BRT bus routes

Emergency Response Issues:

- Typically preferred by fire departments over speed humps, but not appropriate for primary emergency vehicle routes; typically less than 3 seconds of delay per table for fire trucks

Typical Cost (2017 dollars):

- Cost ranges between $2,500 and $8,000 for asphalt tables; higher for brickwork, stamped asphalt, concrete ramps, and other enhancements sometimes used at pedestrian crossings

Speed Cushion

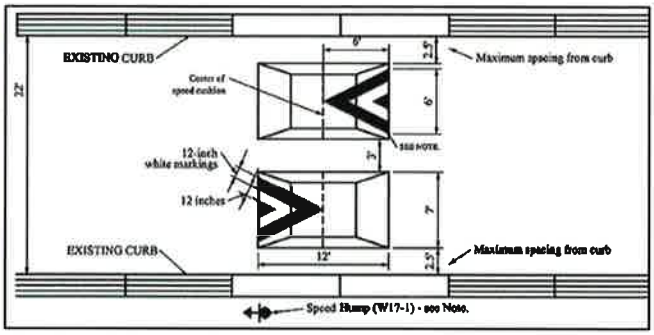
Description:

- Two or more raised areas placed laterally across a roadway with gaps between raised areas
- Height and length similar to a speed hump; spacing of gaps allow emergency vehicles to pass through at higher speeds
- Often placed in a series (typically spaced 260 to 500 feet apart)
- Sometimes called speed lump, speed slot, and speed pillow

Applications:

- Appropriate on local and collector streets
- Appropriate at mid-block locations only
- Not appropriate on grades greater than 8 percent

(Source: James Barrera, Horrocks, New Mexico)



(Source: Delaware Department of Transportation)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Two or more cushions at each location
- Typically 12 to 14 feet in length and 7 feet in width
- Cushion heights range between 3 and 4 inches, with trend toward 3 - 3 ½ inches maximum
- Speed cushion shapes include parabolic, circular, and sinusoidal
- Material can be asphalt or rubber
- Often have associated signing (advance-warning sign before first cushion at each cushion)
- Typically have pavement markings (zigzag, shark's tooth, chevron, zebra)
- Some have speed advisories

Potential Impacts:

- Limited-to-no impact on non-emergency access
- Speeds determined by height and spacing; speed reductions between cushions have been observed averaging 20 and 25 percent
- Speeds typically increase by 0.5 mph midway between cushions for each 100 feet of separation
- Studies indicate that average traffic volumes have reduced by 20 percent depending on alternative routes available
- Average collision rates have been reduced by 13 percent on treated streets

Emergency Response Issues:

- Speed cushions have minimal impact on emergency response times, with less than a 1 second delay experienced by most emergency vehicles

Typical Cost (2017 dollars):

- Cost ranges between $3,000 and $4,000 for a set of rubber cushions

Corner Extension/Bulb-Out

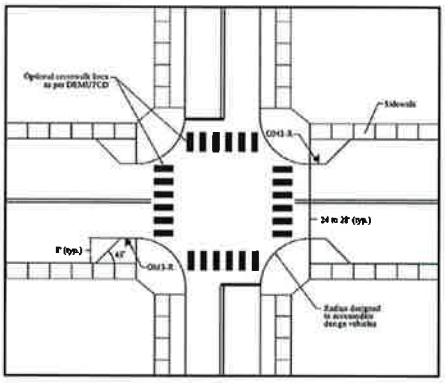
Description:

- Horizontal extension of the sidewalk into the street, resulting in a narrower roadway section
- If located at a mid-block location, it is typically called a choker

Applications:

- When combined with on-street parking, a corner extension can create protected parking bays
- Effective method for narrowing pedestrian crossing distances and increase pedestrian visibility
- Appropriate for arterials, collectors, or local streets
- Can be used on one-way and two-way streets
- Installed only on closed-section roads (i.e. curb and gutter)
- Appropriate for any speed, provided an adequate shy distance is provided between the extension and the travel lane
- Adequate turning radii must be provided to use on bus routes

(Source: James Barrera, Horrocks, New Mexico)



(Source: Delaware DOT)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Effects on vehicle speeds are limited due to lack of deflection
- Must check drainage due to possible gutter realignment
- Major utility relocation may be required, especially drainage inlets
- Typical width between 6 and 8 feet
- Typical offset from travel lane at least 1.5 feet
- Should not extend into bicycle lanes

Potential Impacts:

- Effects on vehicle speeds are limited due to lack of deflection
- Can achieve greater speed reduction if combined with vertical deflection
- Smaller curb radii can slow turning vehicles
- Shorter pedestrian crossing distances can improve pedestrian safety
- More pedestrian waiting areas may become available
- May require some parking removal adjacent to intersections

Emergency Response Issues:

- Retains sufficient width for ease of emergency-vehicle access
- Shortened curb radii may require large turning vehicles to cross centerlines

Typical Cost (2017 dollars):

- Cost between $1,500 and $20,000, depending on length and width of barriers

Road Diet

Description:

- Revision of lane use or widths to result in one travel lane per direction with minimum practical width, with goal of reducing cross-section; common application involves conversion of four-lane Two-way road to three-lane road – two through lanes and center two-way left-turn lane (TWLTL)
- Can also involve narrowing of existing travel lanes
- Alternate cross-section uses can include dedicated bicycle facilities, left-turn lanes, on-street parking, raised medians, pedestrian refuge islands, sidewalks, etc.

Applications:

- High likelihood of acceptability for nearly all roadway functional classifications
- Can be applied in urban, suburban, or rural settings
- Appropriate for most common urban speed limits
- Can be applied at/near intersections or along road segments
- Appropriate along bus routes

(Source: Chuck Huffine, Phoenix, AZ)

(Source: Chuck Huffine, Denver, CO)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Must consider transitions from adjacent roadway sections and through intersections
- AADT can be considered but is not the primary volume factor that needs to be evaluated

Potential Impacts:

- Usually reduces number of available travel lanes – impacts demand that can be accommodated; typical acceptable threshold of 1000 vehicles per direction during peak hour
- Reduction of through lanes tends to reduce speeds
- Can improve pedestrian crossing ease and safety
- Can improve bicycle accessibility if travel lanes can be used for shoulders/bike lanes instead

Emergency Response Issues:

- Generally accepted from emergency services; leaves available space for through flow of emergency vehicles

Typical Cost (2017 dollars):

- $6000 or less, depending on physical geometric changes and length of application
- The biggest impact to cost involves signal modifications, if applicable; other primary costs include pavement marking and signing revisions
- Costs can be much higher if outside portion of pavement is converted to other non-motorized uses (dedicated bicycle facilities, sidewalks, grass buffers)

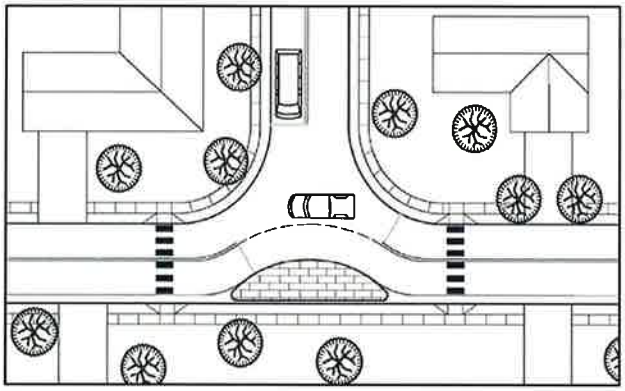
Realigned Intersection

Description:

- Reconfiguration of an intersection with perpendicular angles to have skewed approaches or travel paths through the intersection
- Also called modified intersection

Applications:

- Appropriate for collector or local streets
- Most applicable at T-intersections
- Can be used where on-street parking exists
- Applicable on one-way and two-way roadways
- Most commonly installed on closed-section roads (i.e. curb and gutter)
- Can be applied with and without a dedicated bicycle facility
- Can be applied with or without on-street parking



(Source: Delaware Department of Transportation)

(Source: Delaware DOT)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Need to avoid relocating drainage features such as catch basins, concrete channels, valley gutters, inlets, and trench drains
- Bicyclists and motorists may have separate lanes or may share lanes at intersections
- Be cognizant of pedestrian crossing needs (e.g., ADA, wheelchair ramps at T-intersections)
- Default design vehicle SU-30
- Typical maximum speed limit of 25 mph
- May be appropriate for buses if adequate turning radii can be provided

Potential Impacts:

- Limited-to-no impact on access
- Minimal anticipated diversion of traffic
- Can result in speed reductions between 5 and 13 mph within intersection limits
- Provides opportunity for landscaping
- Can improve pedestrian safety
- Consider additional intersection lighting

Emergency Response Issues:

- Appropriate along an emergency vehicle route or on a street with access to hospital/emergency medical services
- Little impact on response time

Typical Cost (2017 dollars):

- Costs range between $15,000 and $60,000

Traffic Circle

Description:

- Raised islands placed in unsignalized intersections around which traffic circulates
- Approaching motorists yield to motorists already in the intersection
- Require drivers to slow to a speed that allows them to comfortably maneuver around them
- Approaches not designed to modern roundabout principals - no deflection

Applications:

- Appropriate at intersections of local streets
- One lane each direction entering intersection
- Not typically used at intersections with high volumes of large trucks or buses turning left
- appropriate for both one-way and two-way streets in urban and suburban settings

(Source: Scott Batson)

(Source: Scott Batson)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Typically circular in shape but may be an oval shape
- Usually have landscaped center islands
- Recommend YIELD signs on all approaches
- Preferable for roadways to be closed-section (i.e. curb and gutter)
- Can be applied to roads with on-street parking
- Can be applied to roads both with and without dedicated bicycle facilities; bike lanes not striped in circulatory roadway
- Key design features include: offset distance (distance between projection of street curb and center island), lane width of circulatory roadway, circle diameter, and height of mountable apron for large vehicles

Potential Impacts:

- Minimal anticipated traffic diversion
- Bicyclist and motorists will share lanes at intersections because of narrowed roadway
- Large vehicles/buses usually not able to circulate around center island for left turns
- Landscaping needs to be designed to allow adequate sight distance, per AASHTO
- Minimize routing of vehicles through unmarked crosswalks on side-streets
- May require additional street lighting

Emergency Response Issues:

- Emergency vehicles maneuver intersections at slow speeds
- Constrained turning radii typically necessitates a left turn in front of the circle for large vehicles

Typical Cost (2017 dollars):

- Typical cost is $15,000, with a range between $10,000 and $25,000

Roundabout

Description:

- Raised islands placed in unsignalized intersections around which traffic circulates
- Approaching motorists yield to motorists already in the intersection
- Requires drivers to slow to a speed that allows them to comfortably maneuver around them
- Different from traffic circles or mini-roundabouts; possible substitute for traffic signal control

Applications:

- Intersections of arterial and/or collector streets
- One or more entering lanes
- Can be used at intersections with high volumes of large trucks and buses, depending on design

(Source: Grant Kaye)

(Source: PennDOT Local Technical Assistance Program)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation:

- See NCHRP Report 672 for design details
- Design vehicle is determined specifically for each site ranging from emergency vehicles to over size/overweight vehicles
- Typically circular in shape but may be an oval shape
- Key physical elements are center islands, truck aprons, and splitter islands
- Controlled by YIELD signs on all approaches with pedestrian crosswalks, if included, one car-length upstream of YIELD bar
- Key design features include: fastest paths, swept paths, and path alignment
- Large vehicles circulating around the center island for all movements may traverse the apron
- Landscaping needs to be designed to allow adequate sight distance per NCHRP 672
- Preferable to have a closed-section road (i.e. curb and gutter)
- Bicycle facilities, if provided, must be separate from the circulatory roadway with physical barriers; cyclists using the circulatory roadway must merge with vehicles. Bicycle facilities are prohibited in the circulatory roadway to prevent right-hook crashes.

Potential Impacts:

- Limited impact on access, except for access points immediately adjacent to intersection
- Limited impact on roadways with on-street parking
- May draw additional traffic but with reduced delays and queues

Emergency Response:

- Appropriate for emergency vehicle routes or streets that provide access to hospitals
- Emergency vehicles may traverse the apron

Typical Cost

- Cost varies widely by site, but is usually comparable to a traffic signal

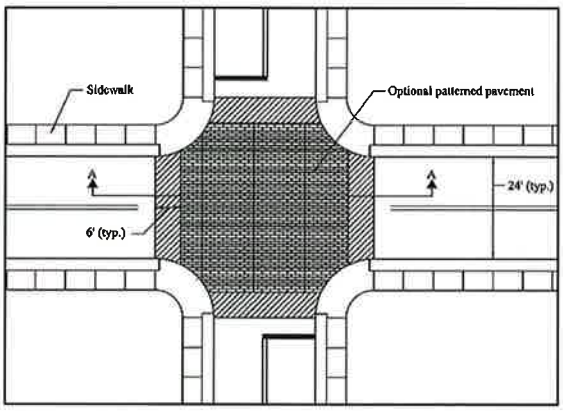
Raised Intersection

Description:

- Flat raised areas covering entire intersections, with ramps on all approaches and often with brick or other textured materials on the flat section and ramps
- Sometimes referred to as raised junctions, intersection humps, or plateaus

Applications:

- Intersections of collector, local, and residential streets
- Typically installed at signalized or all-way stop controlled intersections with high pedestrian crossing demand
- Works well with curb extensions and textured crosswalks
- Often part of an area-wide traffic calming scheme involving both intersecting streets in densely-developed urban areas



(Source: Delaware Department of Transportation)


(Source: Chuck Huffine, Phoenix AZ)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Used at intersections with a maximum speed limit of 35 mph
- Typically rise to sidewalk level; appropriate if crosswalks exist on all four legs
- Appropriate if a dedicated bicycle facility passes through the intersection
- Detectable warnings and/or color contrasts must be incorporated to differentiate the roadway and the sidewalk
- May require bollards to define edge of roadway
- Storm drainage/underground utility modifications are likely necessary
- Minimum pavement slope of 1 percent to facilitate drainage

Potential Impacts:

- Reduction in through movement speeds likely at intersection
- Reduction in mid-block speeds typically less than 10 percent
- No impact on access
- Can make entire intersections more pedestrian-friendly
- No data available on volume diversion or safety impacts

Emergency Response Issues:

- Slows emergency vehicles
- Appropriate for primary emergency vehicle routes and streets with access to a hospital or emergency medical services

Typical Cost (2017 dollars):

- Costs range between $15,000 and $60,000

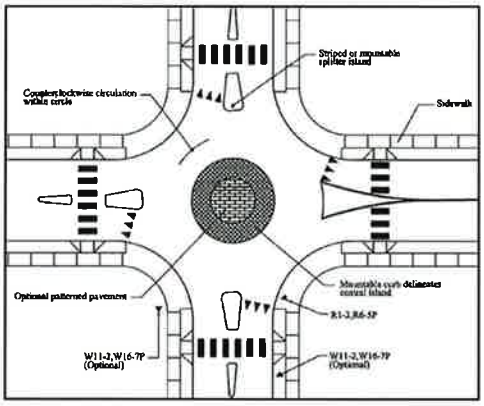
Mini Roundabout

Description:

- Raised islands, placed in unsignalized intersections, around which traffic circulates
- Motorists yield to motorists already in the intersection
- Require drivers to slow to a speed that allows them to comfortably maneuver around them
- Center island of mini roundabout is fully traversable, splitter islands may be fully traversable

Applications:

- Intersections of local and/or collector streets
- One lane each direction entering intersection
- Not typically used at intersections with high volume of large trucks or buses turning left
- Appropriate for low-speed settings



(Source: Delaware DOT)


(Source: Gary Schatz)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation:

- See NCHRP Report 672 for design details
- Typically circular in shape, but may be an oval shape
- Controlled by YIELD signs on all approaches with pedestrian crosswalks, if included, one car-length upstream of YIELD bar
- Preferable for roadway to have urban cross section (i.e., curb and gutter)
- Can be applied to road with on-street parking
- Can be applied to roads both with and without a bicycle facility. Bicycle facilities, if provided, must be separated from the circulatory roadway with physical barriers; cyclists using the circulatory roadway must merge with vehicles. Bicycle facilities are prohibited in the circulatory roadway to prevent right-hook crashes.
- Key design features are the fastest paths and path alignment.

Potential Impacts:

- Slight speed reduction
- Little diversion of traffic
- Bicycle and motorist will share lanes at intersections because of narrowed roadway
- Large vehicles/buses usually drive over the center island for left turns

Emergency Response:

- Emergency vehicles maneuver using the center island at slow speeds

Typical Cost

- Cost is similar to bulb-outs because pedestrian ramps and outside curb lines usually have to be relocated

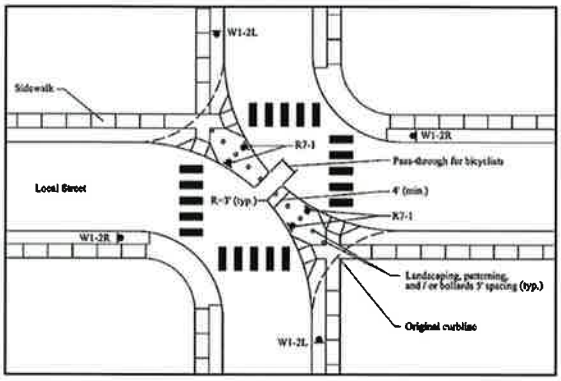
Diagonal Diverter

Description:

- Barriers placed diagonally across four-legged intersections, blocking through movements
- Sometimes called full diverters or diagonal road closures

Applications:

- Typically applied only after other measures are deemed ineffective or inappropriate
- Provisions are available to make diverters passable for pedestrians and bicyclists
- Often used in sets to make travel through neighborhoods more circuitous



(Source: Delaware Department of Transportation)

(Source: PennDOT Local Technical Assistance Program)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Possible legal issues associated with closing public streets (e.g., business and/or emergency access)
- Can only be placed at intersections
- Can be used on both one-way and two-way streets
- Typically found on closed-section roads (i.e. curb and gutter)
- Typical maximum appropriate speed limit is 25 mph
- Maintain drainage as necessary to mitigate potential flooding
- Corner radii should be designed to allow full-lane width for passing motor vehicle traffic
- SU-30 default design vehicle
- Appropriate signing and pavement markings needed on approaches
- Openings for pedestrians and bicyclists should allow movement between all intersection legs
- Barriers may consist of landscaped islands, walls, gates, side-by-side bollards, or any other obstruction that leave an opening smaller than the width of a typical passenger car

Potential Impacts:

- Concern regarding impacts to emergency response, street network connectivity, and capacity
- Should consider traffic diversion patterns and associated impacts
- No significant impacts on vehicle speeds beyond the approach to the diverter
- Not appropriate for bus transit routes
- Improved pedestrian and bicycle safety

Emergency Response Issues:

- Should not be used on roads that provide access to hospitals or primary emergency services
- Restricts emergency vehicle access through intersections
- Can be designed to allow emergency vehicle access with removable, or breakaway delineators or bollards, gates, mountable curbs, etc.

Typical Cost (2017 dollars):

- Typical cost of $6,000 for diverter with limited drainage modifications

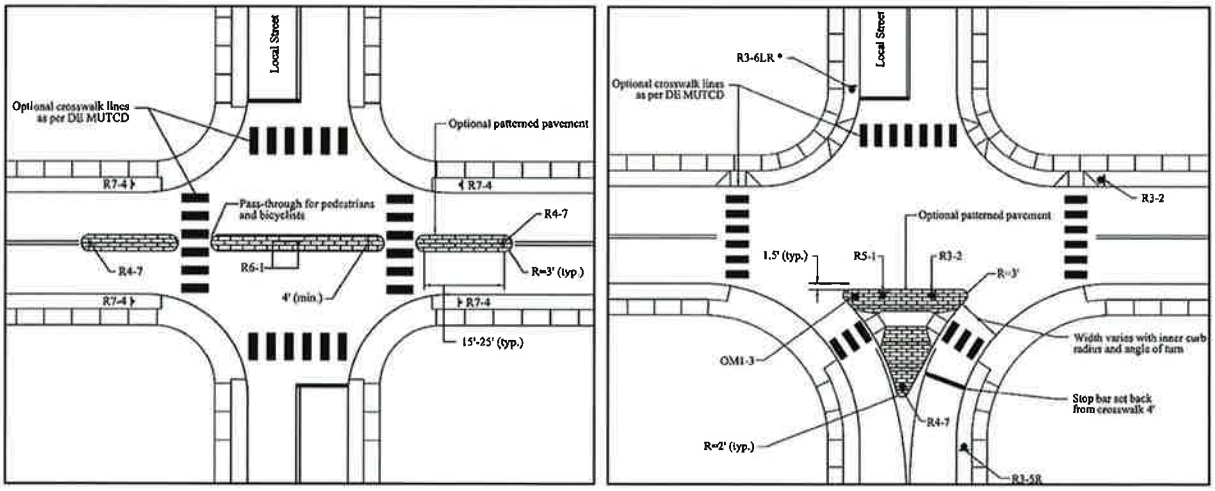
Median Barrier/Forced Turn Island

Description:

- Raised islands along the centerline of a street and continuing through an intersection that block the left-turn movement from all intersection approaches and the through movement from the cross street; also called median diverter, intersection barrier, intersection diverter, and island diverter
- Raised island that forces a right turn is called a forced turn island

Applications:

- For use on arterial or collector roadways to restrict access to minor roads or local streets and/or to narrow lane widths
- Typically applied only after other measures have failed or been deemed inappropriate/ineffective
- Barriers are made passable for pedestrians and bicyclists
- Often used in sets to make travel to/through neighborhoods more circuitous



(Source: Delaware Department of Transportation)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Potential legal issues associated with blocking a public street (e.g., business/emergency access)
- Placed on major roads on approaches to and across intersections with minor roads
- Should extend beyond the intersection to discourage improper/illegal turn movements
- Barriers may consist of landscaped islands, mountable features, walls, gates, side-by-side bollards, or any other obstruction that leave an opening smaller than the width of a passenger car

Potential Impacts:

- May divert traffic volumes to other parallel and/or crossing streets
- May require removal or shortening of on-street parking zones on approaches/departures
- May impact access to properties adjacent to intersection
- No significant impacts on vehicle speeds beyond the approaches to intersection

Emergency Response Issues:

- Restricts emergency vehicle access using minor street
- Can be designed to allow emergency vehicle access

Typical Cost (2017 dollars):

- Cost between $1,500 and $20,000, depending on length and width of barriers

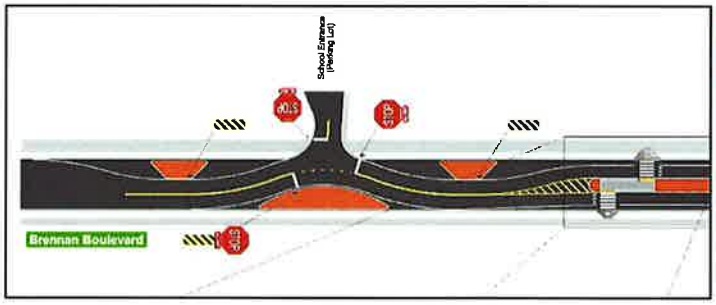
Chicane

Description:

- A series of alternating curves or lane shifts that force a motorist to steer back and forth instead of traveling a straight path
- Also called deviations, serpentines, reversing curves, or twists

Applications:

- Appropriate for mid-block locations but can be an entire block if it is relatively short
- Most effective with equivalent low volumes on both approaches
- Appropriate speed limit is typically 35 mph or less
- Typically, a series of at least three landscaped curb extensions
- Can use alternating on-street parking from one side of a street to the other
- Applicable on one-lane one-way and two-lane two-way roadways
- Can be used with either open or closed (i.e. curb and gutter) cross-section
- Can be used with or without a bicycle facility



(Source: Delaware Department of Transportation)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Chicanes may still permit speeding by drivers cutting straight paths across the center line
- Minimize relocation of drainage features
- May force bicyclists to share travel lanes with motor vehicles
- Maintain sufficient width for ease of emergency vehicles and truck throughput

Potential Impacts:

- No effect on access, although heavy trucks may experience challenges when negotiating
- Limited data available on impacts to speed and crash risk
- Street sweeping may need to be done manually
- Minimal anticipated volume diversion from street
- May require removal of some on-street parking
- Provides opportunity for landscaping
- Unlikely to require utility relocation
- Not a preferred crosswalk location
- Bus passengers may experience discomfort due to quick successive lateral movements

Emergency Response Issues:

- Appropriate along primary emergency vehicle routes

Typical Cost (2017 dollars):

- Reported costs range between $8,000 and $25,000

On-Street Parking

Description:

- Allocation of paved space to parking
- Narrows road travel lanes and increases side friction to traffic flow
- Can apply on one or both sides of roadway
- Can be either parallel or angled, but parallel is generally preferred for maximized speed reduction

Applications:

- High likelihood of acceptability for nearly all roadway functional classifications and street functions
- More appropriate in urban or suburban settings
- Can be combined with other traffic calming measures
- Can apply alternating sides of street for chicane effect
- Can combine with curb extensions for protected parking, including landscaping for beautification
- Can apply using time-of-day restrictions to maximize throughput during peak periods
- Can be used on one-way or two-way streets
- Preferable to have a closed-section road (i.e. curb and gutter)
- Appropriate along bus transit routes

(Source: PennDOT Local Technical Assistance Program)

(Source: Google Earth, Fort Collins, CO)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Appropriate distance needed between travel lane and parking lane
- Impact is directly affected by demand; must have parked vehicles present to be effective
- If used for chicane effect, must verify parking demand to ensure that majority of spaces are occupied when effect is desired most during the day; can use parallel, angled, or combination
- Should not be considered near traffic circles nor roundabouts
- Should not be applied along median island curbs
- For lower-demand locations, can counteract negligible impact with curb extensions or other road-narrowing features

Potential Impacts:

- Can be blocked in by snow during plowing operations; required vehicle removal
- May limit road user visibility and sight distance at driveways/alleys/intersections
- Can put bicyclists at risk of colliding with car doors
- May be impacted if other traffic calming measures are considered or implemented
- Provides buffer between moving vehicles and pedestrian facilities

Emergency Response Issues:

- Preferred by emergency responders to most other traffic calming measures
- Requires consideration of design of parking lanes near hydrants and other emergency features

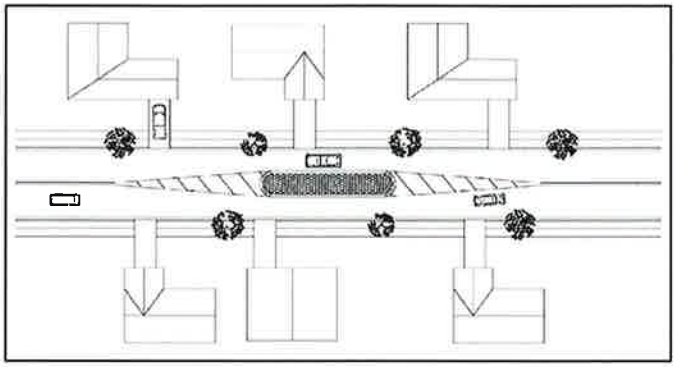
Median Island

Description:

- Raised island located along the street centerline that narrows the travel lanes at that location
- Also called median diverter, intersection barrier, intersection diverter, and island diverter

Applications:

- For use on arterial, collector, or local roads
- Can often double as a pedestrian/bicycle refuge islands if a cut in the island is provided along a marked crosswalk, bike facility, or shared-use trail crossing
- If placed through an intersection, considered a median barrier



(Source: Delaware Department of Transportation)

(Source: James Barrera, Horrocks, New Mexico)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Potential legal issues associated with blocking a public street (e.g., business or emergency access)
- Barriers may consist of landscaped islands, mountable facilities, walls, gates, side-by-side bollards, or any other obstruction that leave an opening smaller than the width of a passenger car
- Can be placed mid-block or on the approach to an intersection
- Typically installed on a closed-section roadway (i.e. curb and gutter)
- Can be applied on roads with or without sidewalks and/or dedicated bicycle facilities
- Maximum appropriate speed limits vary by locale
- Typically not appropriate near sites that attract large combination trucks

Potential Impacts:

- May impact access to properties adjacent to islands
- No significant impact on vehicle speeds beyond the island
- Little impact on traffic volume diversion
- Safety can be improved without substantially increasing delay
- Shortens pedestrian crossing distances
- Bicyclists may have to share vehicular travel lanes near the island
- May require removal of some on-street parking
- May require relocation of drainage features and utilities

Emergency Response Issues:

- Appropriate along primary emergency vehicle roads or street that provides access to hospitals/emergency medical services

Typical Cost (2017 dollars):

- Cost between $1,500 and $10,000, depending on length and width of island

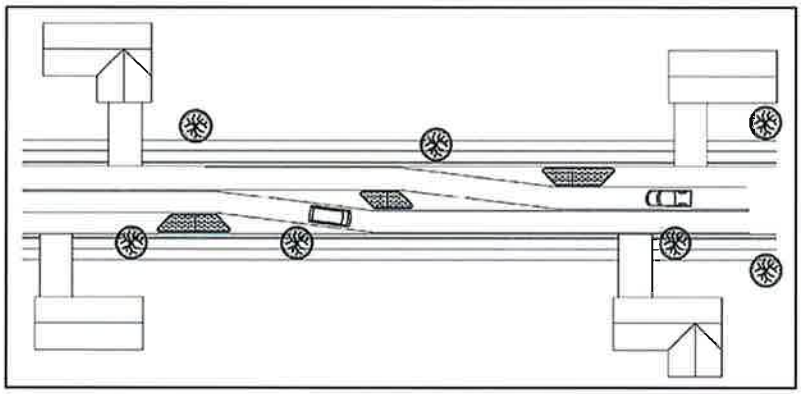
Lateral Shift

Description:

- Realignment of an otherwise straight street that causes travel lanes to shift in at least one direction
- A chicane is a variation of a lateral shift that shifts alignments more than once

Applications:

- Appropriate for local, collector, or arterial roadways
- Appropriate for one-lane one-way and two-lane two-way streets
- Appropriate on roads with or without dedicated bicycle facilities
- Maximum appropriate speed limit is typically 35 mph
- Appropriate along bus transit routes



(Source: Delaware Department of Transportation)

(Source: Google Street View)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Typically separates opposing traffic through the shift with the aid of a raised median
- Applicable only to mid-block locations
- Can be installed on either open- or closed-section (i.e. curb and gutter) roads
- Location near streetlights preferred
- May require drainage feature relocation
- Should not require utility relocation

Potential Impacts:

- Without islands, motorists could cross the centerline to drive the straightest path possible
- No impact on access
- May require removal of some on-street parking
- Limited data available on impacts on speed, volume diversions, and crash risk
- Provides opportunities for landscaping
- Can provide locations for pedestrian crosswalks

Emergency Response Issues:

- Appropriate along primary emergency vehicle routes or on streets with access to hospitals/emergency medical services, provided vehicles can straddle the street centerline

Typical Cost (2017 dollars):

- Reported costs range between $8,000 and $25,000

Closure

Description:

- **Half closures** are barriers that block travel in one direction (creates a one-way street) for a short distance on otherwise two-way streets; sometimes called partial closures or one-way closures
- **Full-street closures** are barriers placed across a street to completely close the street to through-traffic, usually leaving open space for pedestrians and bicyclists; they are sometimes called cul-de-sacs, dead-ends, or mini-parks

Applications:

- Appropriate for local streets (half and full), at intersection (half and full), or mid-block (full closure only)
- Typically applied only after other measures have failed or are deemed inappropriate or ineffective
- Typically found on closed-section roadways (i.e. curb and gutter)
- Can be applied with and without dedicated bicycle facilities and on roads with on-street parking
- Often used in sets to make travel through neighborhoods more circuitous
- Not appropriate along bus transit routes
- Can be used to assist crime prevention

(Source: James R. Barrera, Horrocks, New Mexico)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Potential legal concerns
- Can be placed at intersections or mid-block locations
- Barriers may consist of landscaped islands, walls, gates, side-by-side bollards, or other obstructions that result in openings smaller than the width of a typical passenger car
- Appropriate signing needed at entrances to full-closure street blocks
- May require modifications to maintain surface drainage capacity
- Should consider traffic diversion patterns and associated impacts
- Possible to make diverters passable for pedestrians and bicyclists

Potential Impacts:

- Concerns regarding street network connectivity and capacity
- May result in traffic diverting to other local streets (should be used in groups/clusters)
- No significant impact on vehicle speeds beyond the closed block
- Can improve pedestrian crossing safety

Emergency Response Issues:

- Full or half closures can increase response times and should not be used on roads/streets that provide access to hospitals or emergency medical services; half closures allow for a higher degree of emergency vehicle access than full closures
- Both closure types can be designed to allow emergency vehicle access with removable, or breakaway delineators or bollards, gates, mountable curbs, etc.

Typical Cost (2017 dollars):

- **Full Closure** - <$10,000 for simple closures, to $100,000 for complex closures with drainage mods.
- **Half Closure** - $3,000 for simple closure, to $40,000 for complex closures with drainage mods.

Choker

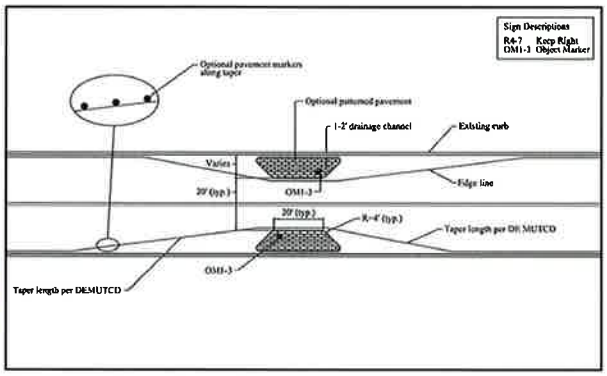
Description:

- Curb extension is a lateral horizontal extension of the sidewalk into the street, resulting in a narrower roadway section
- If located at an intersection, it is called a corner extension or a bulb-out
- If located midblock, it is referred to as a choker
- Narrowing of a roadway through the use of curb extensions or roadside islands

Applications:

- Can be created by a pair of curb extensions, often landscaped
- Encourages lower travel speeds by reducing motorist margin of error
- One-lane choker forces two-way traffic to take turns going through the pinch point
- If the pinch point is angled relative to the roadway, it is called an angled choker
- Can be located at any spacing desired
- May be suitable for a mid-block crosswalk
- Appropriate for arterials, collectors, or local streets

(Source: City of An Arbor, Michigan)



(Source: Delaware DOT)

ITE/FHWA Traffic Calming EPrimer: https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Design/Installation Issues:

- Only applicable for mid-block locations
- Can be used on a one-lane one-way and two-lane two-way street
- Most easily installed on a closed-section road (i.e. curb and gutter)
- Applicable with or without dedicated bicycle facilities
- Applicable on streets with, and can protect, on-street parking
- Appropriate for any speed limit
- Appropriate along bus routes
- Typical width of 6 to 8 feet; offset from through traffic by approximately 1.5 feet
- Locations near streetlights are preferable
- Length of choker island should be at least 20 feet

Potential Impacts:

- Encourages lower speeds by funneling it through the pinch point
- Can result in shorter pedestrian crossing distances if a mid-block crossing is provided
- May force bicyclists and motor vehicles to share the travel lane
- May require some parking removal
- May require relocation of drainage features and utilities

Emergency Response Issues:

- Retains sufficient width for ease of use for emergency vehicles

Typical Cost (2017 dollars):

- Between $1,500 and $20,000, depending on length and width of barriers

NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM

N.T.M.P.

HARFORD COUNTY
DEPARTMENT OF PUBLIC WOKS
212 S. BOND STREET
BEL AIR, MD 21014
PHONE: (410) 638-3546

Revised: March 1, 2019

INTRODUCTION

The Neighborhood Traffic Management Program (NTMP) for residential streets represents the commitment by Harford County and the Department of Public Works to promote and maintain the safety and livability of the County's residential neighborhoods. In an effort to reduce the impact of traffic on our neighborhoods, NTMP provides a process for identifying, evaluating, and addressing undesirable traffic conditions related to speeding and excessive volumes in residential subdivisions. By conducting the appropriate traffic engineering studies and by soliciting the input of a community's residents, DPW's staff can determine the type and severity of traffic problems occurring on a particular residential street. With NTMP's point assignment system (see page 9), requested streets can be evaluated and rated according to their individual point scores, which reflect the prevailing traffic conditions on the street. If a street is found eligible (according to its point score and other factors) and if the required approval of the residents has been obtained and the necessary funding is available, DPW will install traffic management devices such as speed humps, islands or diverters. NTMP will also consider traffic diversion measures, such as: one-way street patterns or turn prohibitions and will include educational measures such as the Speed Awareness Program.

GOALS

The overall goals of the Neighborhood Traffic Management Program are as follows:

1. Improve neighborhood livability by reducing the speeds and impact of vehicular traffic on residential streets, while providing for the safe, efficient and economical movement of persons and goods throughout the County.

2. Promote safe and pleasant conditions for residents, pedestrians, bicyclists, and motorists on neighborhood streets, while preserving access for emergency-vehicles, buses and other users.

3. Encourage and promote citizen involvement in all phases of NTMP.

4. Make efficient use of County resources by ranking requested streets according to their NTMP point assignment scores and other factors.

TRAFFIC MANAGEMENT MEASURES

All County streets qualify for traffic control devices in accordance with the Manual on Uniform Traffic Control Devices (the use of which is mandated by State Law). This manual, prepared by a national joint committee of municipal, county, and state officials, describes conditions or warrants which should be present prior to the installation of traffic control devices, including the multi-way stop control. One of the most requested traffic control devices, the multi-way stop control has many negative side effects:

1. Increased speeds, above the original speeds, due to the motorists' desire to make up for the "lost" time suffered at the stop sign.

2. Increased accidents caused by lack of respect for unwarranted stop sign and frequent violations of the stop condition - "California" (rolling) stop - As well as an increased disrespect for all stop signs.

3. Increased noise, pollution and energy use associated with stopping and starting a vehicle, at a location where they otherwise would not be required to stop, is another detriment to the multi-way stop installation.

The multi-way stop has been shown to be ineffective in providing the desired state of reasonable and consistent speeds throughout the roadway, and is, therefore, not included as an option in the Neighborhood Traffic Management Program.

The following NTMP traffic management measures have been classified in two levels, each progressively more restrictive to motorists using the street.

LEVEL 1

Level 1 measures are passive in nature and include educational methods and special pavement markings. For these measures to be implemented, they must be approved by a civic association. Residents may also be required to participate in implementation. The NTMP Points assigned must be greater than **25** to be eligible for this level of implementation.

SPEED AWARENESS PROGRAM

The Speed Awareness Program is an educational measure intended to increase motorists' perception of the speed at which they travel on neighborhood streets and to provide residents a positive outlet to show their concerns regarding speeding in their neighborhood. It consists of a radar activated speed notification sign board (either manned or un-manned) positioned in a problem area. The digital display board shows motorists the speed at which they are traveling. Frequently, motorists drive at speeds that they feel comfortable at and are unaware that they are traveling well in excess of the posted speed limit.

The speed board shows greatest improvement when it is used in conjunction with a "community out" day - in which the community appears along the street to re-enforce the idea

that it is a residential neighborhood, not a high speed through street. This action tends to place guilt upon the offending driver by catching him or her in the "act" and usually causes a reduction in speed for a longer period of time.

LINE STRIPING PROGRAMS

This program involves the installation of pavement markings that constrict the driver's available lane width - from 18' down to 10'. This also creates an additional lane on the road for parking or bike riding that is separate from the travel lane.

Reactions to these stripes have been mixed. While some citizens believe the speeds have been reduced and feel safer with the through traffic confined to the center of the road, others do not like the appearance of the stripes and believe they give the street an "urban" look. Installation of the stripes must be officially requested, on behalf of the Community, by a Home Owners Association or a Community Association and a petition must be signed by at least 75% of the homeowners fronting the affected street.

LEVEL 2

Level II measures include traffic control devices and physical measures which control access to neighborhoods, change travel patterns, and regulate the flow of traffic through the neighborhood. The NTMP Points assigned must be greater than **50** to be eligible for this level of implementation. It is the requestor's responsibility to obtain these signatures.

SPEED HUMPS

Speed humps, often referred to as "sleeping policemen", are gently sloping pavement protuberances, with cross sections that provide for a smooth ride at reduced speeds. Conventional speed bumps are more abrupt than speed humps. Speed bumps are typically less than three feet in length and vary in heights up to six inches. The conventional bumps pose a potential for vehicle damage or loss of control, and therefore will not be considered as a method of traffic calming. If a particular street is approved for speed humps, a petition must be signed by at least 75% of the homeowners who must cross over a hump to get access to their home (whether or not they actually front the subject street).

Two types of speed humps are available for use on Harford County roads. The Watts profile hump is three inches high with a six-foot parabolic curve approach on each side. This type of hump may only be utilized in areas where the recommended roadway speed is below 20 mph. Because they reduce speeds to approximately 15 MPH, installation of the Watts type hump must be carefully scrutinized, and in all but the most unusual circumstances, will not be installed.

The second form of speed hump is the Flat top profile. This design consists of a six-foot parabolic approach (similar to the Watts type), however a ten-foot-long plateau is centered between the two approaches: resulting in a total length of 22'. When required, this will be the

primary form of speed hump utilized in Harford County. Studies have shown that the speeds are reduced to approximately 25 MPH at the hump. The one location in Harford County in which a substantial amount of information is available is the East Ring Factory Road installation. The 85th percentile and average speeds dropped six and five mph, respectively, (and have remained there) following installation of the humps. No accidents have occurred as a direct result of their presence and the response from the community has been positive - concerning lower speeds and fewer vehicles.

In general, automobiles, motorcycles and bicycles do not experience any problems or loss of control when traversing the humps. However, long wheelbase vehicles may experience some discomfort when crossing the hump. Therefore, the humps should not be used along roads that carry a significant amount of truck traffic, on streets where the majority of the drivers travel at relatively fast speeds (45 - 50 mph), bus routes, or on routes commonly used by emergency vehicles. Additionally, speed humps will generally not be considered on roads designated as "Collector" by the Department of Planning & Zoning's Transportation Plan.

ROUNDABOUTS

A roundabout is an intersection with a central island, in which traffic circulates in a counter clockwise direction. Traffic must yield to circulating vehicles. The roundabout is multi-functional in that it can reduce speeds and volumes on residential streets, and control the uniform flow of traffic and reduce accidents at higher volume intersections. Research has shown that, unless the roundabout is correctly designed with the proper deflection angles for vehicles entering the roundabout, and with splitter islands to deflect traffic to travel in a counter-clockwise direction; it will not effectively and safely reduce vehicular speeds or volumes. In most existing communities, the available right of way and paving surface limits the possibility of their installation. In particular, this device will not be installed in existing communities at "T" intersections. However, at major intersections within new developments, and in conjunction with other traffic calming devices, they can have dramatic effects on the overall safety. Additionally, because the center of the roundabouts may be landscaped, residents have viewed them as attractive enhancements to their communities.

CHOKERS

Chokers are the narrowing of streets, either at an intersection or midblock, to reduce the width of the traveled way. Chokers can be designed to widen the sidewalk (bulb design), or an island may be constructed, which would force the traffic toward the curb (island choker). Either way, chokers appear to have the greatest effect in the area of pedestrian safety. By reducing the roadway width, the choker dramatically reduces the "exposure time" of a pedestrian (the amount of time that a pedestrian is susceptible to a vehicle while that pedestrian is crossing a street. Additionally, both chokers break up the appearance of the roadway and may be landscaped to increase the appearance of a residential neighborhood. Each type of choker has its own advantages and disadvantages.

The bulb design increases the width between the pavement and the normal pedestrian path, while simultaneously reducing the amount of time that a pedestrian is in the roadway. It

also better defines the pedestrian crossing locations for motorists. Disadvantages include no lateral deflection - which results in little if any speed and volume reductions. Additionally, pedestrians must cross both directions of traffic at the same time.

The island choker reduces the amount of pavement required for a pedestrian crossing, but also creates a "refuge" island in the center of the road. This eliminates the requirement that both directions be clear prior to crossing. A pedestrian may first look to the left, cross half of the street, wait on the refuge island; then look to the right and cross the rest of the street. Thereby, essentially crossing two, one-way roads. An additional advantage is that this creates a deflection in the roadway, which will result in reduced speeds. A disadvantage is that the through traffic will be relocated closer to the normal pedestrian path (sidewalk).

SEMI-DIVERTERS

Semi-diverters are the narrowing of street approaches to intersections. In conjunction with Do Not Enter signs they are used to prevent access into a neighborhood. Semi-diverters are installed to address through traffic problems by modifying traffic patterns in the same manner as one-way streets while still allowing two-way traffic beyond their prohibition. Because they block only half of the street section, semi-diverters are easily violated, particularly on low volume streets. At the same time, they provide a minimal impediment to emergency vehicles. The primary purpose of a semi-diverter is to reduce traffic volume - they have little effect on vehicle speeds. However, if they divert drivers who formerly used the street as a speedy through route or shortcut, the actual change in speed experienced after installation may be substantial.

Semi-diverters are best located at the end of a block to prevent entrance and permit exit. Diverters located in a way such as to prevent exit are easily and frequently violated.

NTMP Point Assignment System

Neighborhood traffic calming measures will be considered for residential subdivision roads only. (Collector roads, through residential areas, will not be considered for speed humps; however, other forms of traffic calming may be applicable). The subject road must be at least 2,000 feet in length and have a lot density of at least 65 housing units per mile (or 1 every 81') fronting the street. The following information is used to develop a numerical score for each requested residential street. A high score, available funding and other factors are used to determine which roads will proceed to the next NTMP phase, which shall involve direct community participation in educational measures such as the Speed Awareness Program. If warranted, the community may be required to obtain a minimum of 75% community approval for the installation of speed humps or chokers. There are three exceptions where installation of Level II measures will be installed when the road does not meet the aforementioned criteria. The exceptions are:

1. Roads adjacent to an elementary school access where the majority of the students walk to school.

2. Roads that meet all of the following criteria:

- Non-local traffic is greater than 30%,
- The maximum average lot frontage is 175 feet,
- Minimum length of road of 1500 feet.

3. Roads that meet all of the following criteria:

- Peak hour volume (PHV) exceeds 100
- 85% speed is 7mph or greater than the posted speed limit
- Maximum average lot frontage is 88 feet

Point System Criteria

The following point system criteria are used to determine its point score:

1. **Traffic Volume**

   Points are assigned according to the street's Peak Hourly Volume (PHV). Peak hourly volumes are normally registered between the hours of 4:00 - 6:00 PM, on an average weekday. Points are given on a graduated scale from 100 to >299. The minimum required volume for Level 2 Traffic Management is 100. Speed humps will not be installed if the PHV exceeds 500 vehicles.

   25 points maximum score

2. **Speed**

Points are assigned according to how many miles per hour the measured 85th percentile speed on the requested street is over the posted speed limit. The 85th percentile speed indicates that 85 percent of vehicles on a particular street are traveling at this speed, or lower, and is a nationally recognized standard. Points are awarded on a graduated scale ranging up to values of > 15 MPH above the posted speed limit. However, if the 85% speed is less than 5 mph over the posted speed limit, the motorists are considered to be in general compliance with the posted speed limit and Level II traffic calming devices will not be warranted.

20 point maximum score.

3. **Elementary school or playground adjacent to the street**

Ten (10) points are assigned to a street on which an elementary school or community playground is located on the street.

10 point score.

4. **Major pedestrian generators**

Five (5) points are assigned to a street that has one or more major pedestrian generators within one-quarter mile of the street. Major pedestrian generators include schools, libraries, parks, playgrounds, major bus stops, and stores. (If points were awarded under item # 3, they should also be awarded under this item.)

5 point score.

5. **Sidewalk**

Points are assigned according to how much (by percentage) of the street does not have sidewalk. The points are calculated by dividing the percentage of the street without sidewalk by 10. For example, 80% (without sidewalk) x 10 = 8 points. If the majority of the street's section(s) without sidewalk has adequate walking areas, 5 points are subtracted from the tabulated points. To continue the above example, 8 points - 5 points = 3 points. An adequate walking area is defined as a gravel, paved, or grassy area at least five (5) feet wide and which is unobstructed and reasonably level.

10 point maximum score.

6. **On street parking**

On street parking can create sight distance problems for pedestrians and motorists and can create safety problems with speeding vehicles. Five points are assigned

to a street with greater than 30 vehicles parked on the roadway per mile. These counts will be taken at the conclusion of the through traffic analysis around 6:00 PM.

5 point score.

7. **Non-local traffic**

A maximum of thirty-five (35) points are assigned to a street on which a majority of the current peak hour traffic volume is comprised of motorists who do not reside within the requesting community, but use the street as an access to a higher priority roadway. It is expected that non-local motorists (typically commuters) may not be as sensitive to a neighborhood's safety needs as the neighborhood's residents. In addition, non-local motorists may be less receptive to neighborhood-sponsored educational measures such as the Speed Awareness Program.

5% - 9%	-	5 points
10% - 14%	-	10 points
15% - 20%	-	15 points
20% - 24%	-	20 points
25% - 29%	-	25 points
30% - 34%	-	30 points
> 35%	-	35 points

NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM
POINT ASSIGNMENT WORKSHEET

STREET NAME_____
FROM _____ **TO** _____
EVALUATOR _____ **DATE** _____

1) DESIGNATED COLLECTOR: YES _____ **NO** _____

2) NUMBER OF UNITS FRONTING ROADWAY: A = _____
LENGTH OF ROADWAY: B = _____

=> FEET PER HOUSE (B/A) _____

NOTE: If #2 is greater than 80, minimum requirements for LEVEL II are not met, recommend LEVEL I Traffic Calming, only

3) VOLUME (PHV) _____ _____**POINTS (MAX 25)**
Minimum (100 VPH)

5 points	10 points	15 points	20 points	25 points
100-149	150 - 174	175 - 199	200 - 249	> 250

NOTE: If #3 is less than 100, minimum requirements for LEVEL II are not met, recommend LEVEL I Traffic Calming, only

4) 85th PERCENTILE SPEED _____ _____**POINTS (MAX 20)**
POSTED SPEED LIMIT _____

MPH OVER POSTED SPEED LIMIT
(>5 mph Level II requirements are not met)

5 - 7 MPH	8 - 11 MPH	12 – 15 MPH	>15 MPH
5 Pts.	10 Pts.	15 Pts.	20 Pts.

5) ELEMENTARY SCHOOL OR PLAYGROUND ADJACENT TO SUBJECT ROAD _____**POINTS (10)**

YES _____ **NO** _____

STREET NAME _____
DATE _____

6) MAJOR PEDESTRIAN GENERATOR _____**POINTS (5)**

(Schools, libraries, parks, playgrounds, major bus stops, stores, etc., within 1/4 mile radius of subject road). **YES** _____ **NO** _____

7) SIDEWALK _____**POINTS (MAX 10)**
(% OF ROAD W/OUT SIDEWALK _____ **X 10)**

(% of roadway without sidewalk on at least one side multiplied by 10. Example: 80% X 10 = 8 pts.) (Subtract 5 points if majority of the road without sidewalk as adequate walking areas.) Adequate Walking Area: A gravel, paved, or grassy area at least 4' wide which is un-obstructed and level.

8) PARKED VEHICLES _____**POINTS (5)**
(N) NUMBER OF VEHICLES PARKED ON THE STREET: _____
(L) LENGTH OF SEGMENT (FT): _____
(N * 5280)/L = VEHICLES PER MILE: _____

Parked vehicles on the street can limit sight distance for motorists and pedestrians. If, an average of at least 30 vehicles per mile is parking on the street during after work hours, the section will qualify for 5 points.

9) NON-LOCAL TRAFFIC _____**POINTS (MAX 35)**
% NON-LOCAL TRAFFIC: _____

5 - 9%	10 - 14%	15 - 19%	20 - 24%	25% - 29%	30% - 34%	≥35%
5 pts.	10 pts.	15 pts.	20 pts.	25 pts.	30 pts.	35 pts.

SHEET 1: _____**POINTS**

\+ **SHEET 2:** _____**POINTS**

TOTAL: _____ **POINTS**

THE NEIGHBORHOOD TRAFFIC MANAGEMENT PROCESS

TRAFFIC MANAGEMENT REQUESTS AND TRAFFIC STUDY

Requests for neighborhood traffic management can be made by individual citizens, elected officials, or by neighborhood associations.

Upon receipt of a request, DPW (Traffic Division) staff will conduct a traffic study of the requested street in order to obtain traffic volume, speed, and physical geometry of the road section. The Traffic Division will review this information and assign points to the studied street, as described in a preceding section, NTMP's Point Assignment System.

According to the street's point score and the study's overall findings, the staff will recommend the appropriate level of NTMP measures to address the street's prevailing conditions. (A minimum point score of 25 is required for first level traffic calming and a minimum score of 50 is required for second level traffic calming). If the street is eligible for the second level traffic calming, further review will be made to determine whether the street's physical conditions (horizontal curvature, grade, drainage, etc.) will allow the safe installation of physical traffic management devices and to ensure that the road is not a primary response route for emergency-vehicle and/or MTA buses.

If a street is found not to be eligible for any level of NTMP measures, the staff will always review such a street to ensure that all of the appropriate traffic control devices are in place in accordance with the **MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.**

RESPONSE TO REQUESTOR AND NEIGHBORHOOD MEETING

The original requestor will be informed in writing of the study's results and the staff's recommendations. If the requested street is eligible for the first level of traffic management, the staff will advise the requester of this, in writing, and will program the Speed Awareness Board for the community. If the requestor would like to have the line striping installed, it will be up to them to obtain approval of such, from at least 75% of the residents directly fronting the affected roadway.

If the requested street is eligible for level two traffic management, the requestor will be informed regarding the next step in the process, which involves scheduling a meeting between the neighborhood residents and the Traffic Division's staff. At this meeting, the results from the study will be reviewed and details about the various physical traffic management devices (speed humps, chokers, etc.) will be discussed. A sub-committee will be formed from that community meeting to discuss the specific calming measures and locations. It will be the responsibility of that sub-committee, if necessary, to obtain the required 75% approval from the affected residents.

Sec. 100-7

This article shall be known as the "Harford County Road Construction Code" and is hereinafter referred to as the "Code."

Sec. 100-8. Definitions.

As used in this Code:

(a) Road includes street, highway, avenue, lane, alley and viaduct, or any segment or part of the length thereof.

(b) Construction and constructed includes reconstruction and reconstructed, but shall not include maintenance.

(c) Subdivision means any division of land in which the owner or owners shall create streets, roads, avenues, lanes, alleys with or without lots or building sites. In addition, the term subdivision shall include any division of lands, by plat or by deeds containing metes and bounds descriptions, in which new streets, roads, avenues, lanes, alleys are created to serve interior building lots not fronting on a public highway. The term subdivision shall include the conveyance of building lots along a public highway for the purpose of developments by a series of three or more deeds in which metes and bounds descriptions are employed, unless each lot is two (2) or more acres in area and with two hundred (200) feet or more of road frontage. This definition is not intended to include a testamentary division of land; a division of land upon dissolution of a bona fide partnership in existence for two or more years; a division of land among the immediate members of a family for personal use, and not for development; or a division of land for agricultural purposes.

(d) Drainage structure includes culvert, bridge, storm sewer, catch basin, canal, ditch, subsurface drain and any structure or water-course designed to carry off surface or other waters.

(e) Person includes individual, association, firm, partnership, corporation but does not include governmental agency, whether County, Federal, State or Municipal.

(f) Director means the Director of the County Department of Public Works and his duly authorized agents.

(g) Dedication plat means any plat conforming to law, duly recorded among the land records of the County, which has the legal effect of dedicating one or more rights-of-way to public use.

(h) Permittee means a person, firm or corporation who has applied for and holds a valid permit in full force and effect, issued by the Director of the Department of Public Works, authorizing construction in a public

right-of-way.

Sec. 100-9. Applicability of Code.

This Code shall apply to all roads within the county other than: (1) Roads lying within the limits of any incorporated city, town, or village of the county or which may hereafter be created, insofar as the city, town, village or taxing area has the authority to enact or adopt regulations on the subject matter of this Code; (2) state roads; (3) federal roads; and (4) roads on a private right-of-way.

Sec. 100-10. Standards and specifications.

Except as otherwise provided, the construction of all roads shall conform to the minimum requirements, standards and specifications hereinafter provided. Whenever used in this Code, the word "standards" means Harford County Design Standards, and the word "specifications" means Harford County Standard Specifications. The Administrative Assistant to the County Commissioners shall keep among his official records the standards and specifications, as adopted by the Commission, together with any amendments thereto, signed by the Chairman of the Commission and attested by the Administrative Assistant thereof. The Director of Public Works shall also prepare and make available to the public printed copies of this Code and of such standards and specifications, and they shall be given such free distribution or sold for such price as the Commissioners may by resolution determine.

Sec. 100-11. Classification and minimum requirements.

Roads not specifically classified in any zoning or master highway plans approved by the Harford County Planning and Zoning Commission shall be classified as provided in this section by the Planning and Zoning Commission after first receiving the recommendations of the Subdivision Review Committee.

All roads shall be classified as provided in this section and minimum requirements for each class are hereby established as follows:

(A) "Arterial Road" means a major road primarily serving mobility functions (through traffic movements) rather than access functions. The arterial serves trips of moderate length, and interconnects with other arterials and/or county collector roads to move traffic between local and regional generators such as schools, shopping centers and large residential developments.

(1) Width. The right-of-way for all arterial roads shall be at least sixty (60) feet wide. Arterial sections are depicted on standards R-3 and R-4.

(2) Construction. Order of construction shall consist of grading of the entire right-of-way, installing drainage structures, paving, and installing curbs

and gutters, all to comply with standards R-3 and R-4. Sidewalks shall be constructed on both sides of the road where the average width of the lots is less than one hundred (100) feet at the building line, unless the Planning and Zoning Commission shall decide that, due to the rural character or location of a particular subdivision, or for other just reasons sidewalks need not be built therein or in a specific portion therein.

(3) Standards and Specifications:
   (a) Grading. All grading shall be done in accordance with plans and profiles approved by the Director, Standards R-3 and R-4, and Section 200 of the Specifications.
   (b) Drainage structures. See subsection (f) of Section 100-12 of this Code.
   (c) Paving. Paving width shall conform to Standards R-3 or R-4. Paving thickness shall be designed and is subject to approval by the Director.
   (d) Curbs and gutters. Curbs and gutters shall be installed in closed-section arterial roads according to Standard S-2 and Section 806 of the Specifications.
   (e) Sidewalks. When required, sidewalks shall be constructed in accordance with Standards S-9 and R-3 and with Section 805 of the Specifications.

(B) "Business District Road" means any road which lies within or is contiguous to any area which has been recommended or approved for any class of commercial or industrial use in any zoning or master highway plan approved by the Harford County Planning and Zoning Commission. Business district roads shall be constructed in conformity with the following minimum requirements:

(1) Width. The right-of-way shall be at least seventy feet wide. Paving shall be at least forty feet wide.
(2) Construction. The entire right-of-way shall be graded and there shall be installed paving, drainage structures, concrete curbs, and gutters and sidewalks.
(3) Standards and Specifications:
   (a) Grading. All grading shall be done in accordance with plans and profiles approved by the director, Standard R-20 and Section 200 of the Specifications.
   (b) Drainage structures. See subsection (f) of Section 100-12 of this Code.
   (c) Paving. Paving shall be of the required width and in accordance with Standard Detail R-20, and the applicable specifications

indicated thereon.

(d) Curbs and gutters. Curbs and gutters shall be built in accordance with Standard S-1 and Section 806 of the Specifications.

(e) Sidewalks. Sidewalks shall be built in accordance with Standards S-9, and R-20 and Section 805 of the Specifications.

C. "Collector" means a road serving both mobility and access functions that collects traffic and distributes it to other collector and arterial systems and to local activity centers. " Major collectors", as opposed to "minor collectors", provide less direct access points and thus greater mobility.

(1) Width. The right-of-way for all collector roads shall be at least sixty (60) feet wide. Collector sections are depicted on Standards R-3, R-4 and R-6.

(2) Construction. Order of construction shall consist of grading of the entire right-of-way, installing drainage structures, paving, and curb and gutter, all to comply with Standards R-3, R-4, and R-6. Sidewalks shall be constructed on both sides of the road where the average width of the lots is less than one hundred (100) feet at the building line, unless the Planning and Zoning Commission shall decide that, due to the rural character or location of a particular subdivision, or for other just reasons, sidewalks need not be built therein or in a specific portion therein.

(3) Standards and specifications:

(a) Grading. All grading shall be done in accordance with plans and profiles approved by the Director, Standards R-3, R-4 and R-6 and Section 200 of the Specifications.

(b) Drainage structures. See subsection (f) of Section 100-12 of this Code.

(c) Paving. Paving shall be of the required width as shown on Standards R-3, R-4, or R-6, and in accordance with Standard Detail R-1 and the applicable specifications indicated thereon.

(d) Curbs and gutters. Curbs and gutters shall be built in closed-section collectors in accordance with Standard S-1 and Section 806 of the Specifications.

(e) Sidewalks. When required, sidewalks shall be built in accordance with Standards S-9, R-3, R-6 and Section 805 of the Specifications.

(D) "Residential Road" or "Minor Road" means a road serving local traffic and providing access to individual properties. A "Primary Residential Road" as opposed to a "Minor Residential Road" serves more dense

developments and/or larger traffic volumes. Such roads shall be constructed according to the following minimum requirements:

(1) Width. Right-of-way widths, road widths, and cross-sections shall comply with Standards R-3, R-4, R-7 and R-8.

(2) Construction. Residential and Minor roads shall be graded to the full width of the right-of-way, drainage structures shall be installed, and paving and curbs installed. Sidewalks shall be constructed on both sides of the road where the average width of the lots is less than one hundred (100) feet at the building line, unless the Planning and Zoning Commission shall decide that, due to the rural character or locations of a particular subdivision, or for other just reasons, sidewalks need not be built therein or in a specific portion therein.
Extruded concrete curb is allowed in temporary installations and in subdivisions of 1 1/2 acre or greater lot size. In cul-de-sacs and subdivisions of lot width less than 150 feet, mountable curb shall be used. Seven inch (7") combination curb and gutter shall be used if no units front the road.

(3) Standards and specifications:
   (a) Grading. All grading shall be done in accordance with plans and profiles approved by the Director, Standards R-4, R-7 and R-8 and Section 200 of the Specifications.
   (b) Drainage structures. See subsection (f) of Section 100-12 of this Code.
   (c) Paving. Paving shall be of the required width and in accordance with Standard R-1 and applicable specifications indicated thereon.
   (d) Curbs and gutters. Curbs and gutters shall be in accordance with Standards S-1 through S-2 or S-3 and Section 806 of the Specifications.
   (e) Sidewalks. When required, sidewalks shall be built in accordance with Standards S-9, R-7, R-8 and Section 805 of the Specifications.

(E) "Dual Lane Road" means any road which has two separate roadways divided by an island or grass plot, and designed for one-way traffic in each roadway. (A dual lane road shall be classified as a business district road, or collector road.)

Whenever a dual lane road is constructed pursuant to a zoning or highway plan approved by the Harford County Planning and Zoning Commission, it shall conform to the following minimum requirements:

(1) Width. The right-of-way shall be at least eighty-four (84) feet. The width of pavement of each roadway shall be twenty (20) feet.

(2) Construction. The entire right-of-way shall be graded and drainage structures, paving, and seven inch (7") combination curb and gutters shall be installed. Wherever required by this Code for the particular class in which a dual road is placed, sidewalks shall be installed.

(3) Standards and specifications:

(a) Grading. All grading shall be done in accordance with plans and profiles approved by the Director, Standard R-2 and Section 200 of the Specifications.

(b) Drainage structures. See subsection (f) of Section 100-12 of this Code.

(c) Paving. Paving shall be of the required width and conform to standards and specifications for business district, collector or minor roads according to the particular class in which the road has been placed.

(d) Curbs and gutters. Curbs and gutters shall be built on both sides of each roadway of a dual lane road in accordance with Standard S-1 and specifications applicable to the particular classification in which such dual lane road has been placed.

(e) Sidewalks. When required, sidewalks shall be built on each side of a dual lane road on the side of the respective roadway upon which the building lots abut, and in accordance with Design Standards S-9 and R-20 as determined by the particular classification of the road, and in accordance with Section 805 of the Specifications.

F. "Townhouse Subdivision Road" means a county-maintained access road to a fee-simple townhouse subdivision. Perpendicular parking pads may access directly from either or both sides; parking pads which are within county right-of-way but are maintained by the homeowners' association.

(1) Width. Right-of-way, homeowners' maintenance and roadway widths are specified on Standards R-9, R-10, R-11 and R-12.

(2) Construction. The entire right-of-way shall be graded and drainage structures, paving, curb and gutter, and sidewalks installed.

(3) Standards and specifications:

(a) Grading. All grading shall be done in accordance with plans and profiles approved by the Director, Standards R-9 through R-12, and Section 200 of the Specifications.

(b) Drainage structures. See subsection (f) of Section 100-12 of this Code.

(c) Paving. Paving shall be of the required width and conform to Standards R-9 through R-12.

(d) Curbs and gutters. Seven inch (7") combination curb-and-gutter shall be installed within all county-maintained areas. Extruded curb may be installed around the parking pads, which are not to be maintained by the County.

(e) Sidewalks. Sidewalks shall be constructed in accordance with Standards S-9 and R-9 through R-12.

G. "Parkway" means an arterial road with special access and characteristics appropriate to major new development. Desired characteristics incorporate the concept of interesting and scenic travel experience.

(1) Width. The right-of-way for all parkways shall be at least eighty (80) feet wide. The parkway section is depicted on Standard R-5.

(2) Construction. The entire right-of-way shall be graded and paving installed.

(3) Standards and specifications.

(a) Grading. Grading shall comply with Standard R-5 and shall be done in accordance with plans and profiles approved by the Director.

(b) Paving. Paving width shall comply with Standard R-5. Pavement cross-sections shall be designed subject to approval by the Director.

Sec. 100-12. General Provisions.

(a) Wherever alternative standards and specifications are provided for in the preceding section, any one alternative may be chosen at the option of the person applying for a permit.

(b) The County Commissioners shall erect name signs at all road intersections at the expense of the developer.

(c) Temporary turnarounds or cul-de-sacs shall be required wherever the paving of a road ends otherwise than at a paved road intersection. Such turnaround or cul-de-sacs shall be graded, paved and appropriate drainage structures including temporary curbs installed as the County Commissioners find necessary.

(d) Where a preliminary drainage study indicates that a minimum right-of-way width as established in this Code is inadequate for proper drainage of a particular road, the County Commissioners may require such additional right-of-way as is found necessary for such drainage purposes; provided, that such requirement is made prior to the final approval and recording of a dedication plat among the Land Records of the County.

(e) The construction of half roads or any road of less than the minimum width as required by this Code is hereby prohibited; provided, that construction of such portions of roads shall be

permitted where the dedicated portion of the road established by a dedication plat and recorded among the Land Records of the County prior to the adoption of this Code is of sufficient width to permit the grading and construction of paving eighteen feet in width with curbs and gutters and sidewalks as are required by the design standards in those section of this Code applicable to the particular classification of the road under construction. No road shall be constructed unless it connects with an existing road at one end thereof, and no road shall be constructed short of an intersection except where it connects with an existing road or where the dedication of the right-of-way ends short of an intersection. Where any road construction ends at or goes through an intersection, the intersection shall be completed, and if it ends at other than an intersection or a point of connection with an existing road, then turnarounds or cul-de-sacs shall be provided.

(f) Whenever drainage structures are required for any particular class of road, such drainage structures shall be installed or constructed as are found by the County Commissioners to be necessary or appropriate after a preliminary drainage study has been approved by the Department of Public Works in accordance with design standards and all applicable specifications.

(g) Driveway entrances to individual lots shall be required upon a finding by the Planning and Zoning Commission that off street parking facilities are necessary and practicable in accordance with Standards S-12 through S-16.

Sec. 100-13. Applications for grading and construction permits.

(a) No person shall construct any road, sidewalk, curb and gutter or drainage structure, or begin any of such construction, without first obtaining a permit therefor. Applications for such permits shall be made to the Director on such forms as he shall prescribe, and shall be accompanied, in each case, by detailed plans and specifications and locations and right-of-way plats bearing the tentative approval of the Planning and Zoning Commission, the Harford County Metropolitan Commission and the approval by the State Highway Administration shall also be required as to matters within its jurisdiction.

(b No person, including any utility corporation or governmental agency, shall cut any road without first obtaining a permit from the Director. All backfilling and repaving of such utility trenches shall be under the supervision of the Director according to Standards R-22 and R-23 and all applicable specifications.

(c) No person shall construct sidewalks, driveway entrances, retaining walls, steps, cut curbs or construct or place any temporary or permanent structure within a County right-of-way without first obtaining a permit therefor from the Director.

(d) In the case of a subdivision, the signature of the Director of Public Works on the approved construction plans shall constitute a permit to perform all items appearing on these plans.

Sec. 100-14. Conditions of Permits.

Construction permits shall be issued upon the following conditions, which shall be specified therein:

(a) Irrespective of the plans and specifications accompanying the application, the actual construction shall conform to law and to the minimum requirements for a road of its class.

(b) Such permit shall be transferable upon application to the Department of Public Works by the successor in title.

(c) Such permit shall automatically expire one (1) year after its issuance unless extended in writing by the County Commissioners stating the reasons for the extension. No extension shall be granted unless the bond filed with the permit by its term continues in full force and effect or a new bond is filed or the consent of the surety to the extension is obtained.

(d) The permittee and his agents, servants and subcontractors shall comply with all written requirements of the Department of Public Works directed to the permittee, which are deemed necessary in the interest of public safety or for the avoidance of unnecessary inconvenience to the public during such grading or construction, either before or during the course of grading or construction.

(e) The construction work, materials, plans and specifications shall at all times be open to and available for inspection by duly authorized officials and employees of the County. Permittees shall give notice to the Department of Public Works at least forty-eight hours in advance prior to commending any construction for which the permit is issued.

(f) No permit for paving shall be issued unless there has been a final inspection and approval of grading by the Director.

(g) The permittee shall have available at all times on each project a copy of the permit for inspection by the representative of the Department of Public Works. If such permit is lost or destroyed, the permittee shall cause such permit to be replaced within twenty-four hours, excluding Saturdays and Sundays. The Department of Public Works shall issue new permits upon request to replace any which are damaged, lost or destroyed.

(h) No permit shall be issued for construction unless the right-of-way has been acquired by the County or shown on an approved plat.

(i) Whenever, in the opinion of the Director, the conditions of any permit are being violated, the Director may order, by certified mail, the permittee to stop construction and to show cause within 10 days why the permit should not be revoked. The willful refusal of any permittee to stop construction after receiving notice of a stop work order shall be deemed a violation of this Code.

(j) Upon a finding that the standards and specifications

are not feasible or practicable for a particular project, the Director may require such alternate or additional standards and specifications in accordance with good engineering principles, as may be deemed necessary, and such alternate or additional requirements shall be part of and a condition of the permit.

(k) Whenever in the opinion of the Director, the work is being performed improperly or the work performed is faulty, he may cause the permit to be revoked, or order that portion of the work performed to be corrected.

Sec. 100-15. Performance bond.

The minimum improvements which a permittee will be required to make or enter into agreement to make, in a subdivision prior to the approval of the final plat thereof by the Planning and Zoning Commission, shall be completed in full compliance with the requirements, standards and specifications for each of the various units of work as contained in the Road Code adopted by the Harford County Commissioners.

All of the improvements required shall be completed prior to filing with the Planning and Zoning Commission the Final Plat of the Subdivision for approval, in accordance with the standards and specifications and under the supervision of the Department of Public Works.

If a subdivider desires approval of a Final Plat for the recording thereof prior to the completion of, or acceptance by the County of the required improvements, a Subdivision Agreement shall be executed by the Subdivider, as provided in paragraph 6.08 of the Subdivision Regulations.

In lieu of completing the improvements as required, the Subdivider may:

(a) Deliver to the County a corporate bond in such amount as is estimated to be the total cost of the project. Such corporate bond shall run to the County, and be conditioned as follows:
    (1) That the permittee, his agents and servants will comply with all the applicable terms, conditions, provisions, requirements, standards, and specifications of this Code.
    (2) That the permittee, his agents and servants, will faithfully complete the work for which the permit is issued.
    (3) That the permittee, his agents and servants, will save harmless the County from any expense incurred through the failure of the permittee, his agents and servants, to complete the work as required by this Code, or from any damages growing out of the negligence of the permittee or his agents or servants.

(b) Before acceptance, the bond shall be approved by the

County Commissioners and the County Attorney. The bond shall be executed by a surety or guaranty company qualified to transact business in the State. All corporate bonds filed hereunder shall be released upon, but not before, acceptance of the completed road by the County in accordance with the following section.

(c) In lieu of filing a corporate bond as required by subsections (a) and (b) of this section, any person may enter into an agreement with the County, to be approved and executed on behalf of the County by the County Commissioners, providing that the permittee shall deposit with the County Commissioners such sum of money as is estimated by the Department of Public Works to be the total cost of the project. The Agreement shall itemize the several phases of work or construction in sequence, with an amount opposite each phase representing the value of the work and materials of that particular step or phase in the work or construction. Upon completion of each step or phase, the permittee shall notify the Department of Public Works that he is ready for an inspection. The County Commissioners is hereby authorized to refund to the permittee upon receipt of a certificate, signed by the Director, certifying that the work has been performed by the permittee according to standards, specifications and minimum requirements of this Code and any waiver granted pursuant to Section 100-17 of this Code, and that the permittee is entitled to the installment due for completion of such work. Such certificate shall also be signed by the permittee, certifying that an inspection has been made by a named inspector for the particular step or phase of work or construction involved for which the installment is due. Upon final completion of all work for which the permit is issued, a final inspection certificate shall be issued and, upon acceptance of the road by the County Commissioners, the final payment shall be made to the permittee. The final draw or payment under the terms of this agreement shall in no event be less than fifteen per cent of the total cost of the project.

(d) The County Commissioners may, in their discretion, in lieu of filing a corporate bond or cash equivalent to the total cost of the project as provided for in subsections (a), (b) and (c) of this section, approve the deposit of such sum of money as is estimated by the Department of Public Works to be one-half the total cost of the project. The agreement shall itemize the several phases of work or construction in sequence, with an amount opposite each phase representing the value of the work and materials of that particular step or phase in the work or construction. Upon completion of each step or phase, the permittee shall notify the Department of Public Works that he is ready for an inspection. The County Commissioners are hereby authorized to refund to the permittee upon receipt of a

certificate, signed by the Director, certifying that the work has been performed by the permittee according to standards, specifications, and minimum requirements of this Code, and any waiver granted pursuant to Section 100-17 of this Code, and that the permittee is entitled to the installment due for completion of such work, providing, however, that the balance of cash remaining on deposit is sufficient to complete the remaining uncompleted phases of construction as estimated in the public works agreement. Such certificate shall also be signed by the permittee, certifying that an inspection has been made by a named inspector of the Department of Public Works for the particular step or phase of work or construction involved for which the installment is due. Upon final completion of all work for which the permit is issued, a final inspection certificate shall be issued by the Director and, upon acceptance of the road by the County Commissioners, the final payment shall be made to the permittee.

Sec. 100-16. Acceptance by County.

All permittees and their agents and servants shall comply with all applicable provisions of this Code, and until a road constructed under the provisions of this Code is accepted for maintenance by the County, the permittees, their agents and servants, and the bond given under this Code shall remain liable for the faithful performance of the provisions. After completion and upon receipt of a written request of the permittee a final inspection shall be made of the road within fifteen (15) days, and the County Commissioners shall either accept such road upon a finding that the construction of same has complied with this Code, and release the bond or they shall reject the road by written notification to the permittee and his surety, where a corporate bond has been posted, specifying the reasons for such rejection by reference to the particular provision of this Code which has been violated, and allow a reasonable time, to be specified therein, for such permittee or his surety or comply with the provisions of this Code. If the permittee or his surety does not thereafter, within the time specified, complete the construction according to the provisions of this Code, then the County Commissioners shall forthwith proceed to do whatever is necessary to cause the construction to comply with this Code and the permittee and his bond shall thereupon be liable for any expense incurred thereby. Any acceptance of a road by the County Commissioners shall be on behalf of the County by their written order, fully identifying the road. Thereafter, the road shall be maintained at County expense. Where cash has been deposited pursuant to subsections (c) and (d) of the preceding section and a road is not accepted, the County may withhold any funds remaining in the cash deposit account until compliance by the permittee with the provisions of this Code. If the permittee does not comply, the County Council may declare forfeit such amount as is required to effect compliance.

Sec. 100-17. Waiver.

(a) The requirements of this Code for grade percentages may be waived pursuant to the standards herein contained by the County Commissioners after receiving recommendations thereon from the Director of the Department of Public works and the Planning and Zoning Commission.

(b) Grade percentages. A waiver may be granted when the proposed road connects with an existing road in such manner that the grade percentages required by the Code cannot be provided. A waiver may also be granted whenever it is found that adherence to the grade-percentage requirements of the Code would result in a substantial depreciation in the value of the houses or buildings previously constructed on the lots abutting the proposed street.

Sec. 100-18. Penalty.

Any person, firm or corporation intentionally violating any provisions of this Code shall be guilty of a misdemeanor and upon conviction thereof shall be liable to a fine not exceeding $100.00 or imprisonment for a period not exceeding thirty (30) days in the Harford County jail or to both fine and imprisonment for each offense; and it shall be the duty of the States Attorney of this County to prosecute all persons accused of violating the provisions of this Code.