APPENDIX A – DESIGN GUIDELINES

This section describes the guiding design principles relating to various physical traffic calming devices. The design guidelines are based on recommended designs published in Traffic Calming State-of-the Practice3 and Canadian Guide to Traffic Calming4. Appendix B contains standard engineering design templates for the most common traffic calming devices.

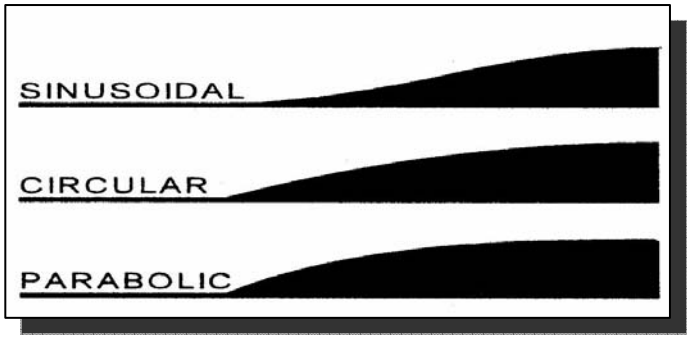
SPEED CONTROL – VERTICAL MEASURES

Ramp Profiles

Ramp profile describes the angle or approach of the vertical measure that a vehicle would traverse. Vertical measures (e.g., speed humps) should use Parabolic profiles on the approach and departure ramps to the device. Parabolic profiles have consistently been used in other programs around the nation and are a recommended design according to Institute of Transportation Engineers: Guidelines for the Design & Application of Speed Humps (ITE, 1993). Figure A-1 shows three commonly used profiles, and a description of each follows below:

- Sinusoidal profiles have slightly less reduction effects on speed than circular and parabolic profiles but higher comfort levels for vehicles and bicyclists and are typically more difficult and expensive to construct due to the slope of the profile.
- Circular profiles have moderate reduction effects on speeds (compared to the two other profiles) and comfort levels for vehicles and bicyclists.
- Parabolic profiles have the greatest reduction effects on speeds but have the lowest comfort levels for vehicles and bicyclists due to the greater rise in the slope of the profile.

Figure A-1 Vertical Measure Ramp Profiles



[3] Ewing, R. (1999). *Traffic Calming: State of the Practice*. Washington, DC: Institute of Transportation Engineers/Federal Highway Administration.

[4] *Canadian Guide to Neighbourhood Traffic Calming,* (1998) Ottawa, Canada: Transportation Association of Canada.

Edge Tapers

The edge taper refers to the transition area between a vertical measure at its full height and the edge of the device. Edge tapers on vertical measures (e.g., speed humps and excluding raised crosswalks) should extend to the edge of the pavement (i.e., not into the gutter) to prevent blocking the gutter drainage.

On streets without vertical curbs, the edge taper should extend the full length of the pavement width to discourage drivers from straddling or driving around the vertical measure. In addition, an advisory sign (or other barrier) should be placed on either approach of the vertical device to prevent drivers from driving around the device.

Example: Bollards and advisory sign encourage drivers to travel over speed hump.

Edge Tapers – Parking and Bikeways

Vertical devices should extend across any parking or bike lane to prevent drivers from veering into the bike lane. Consequently, bicyclists will traverse the even section (as opposed to the tapered portion) of the device. In addition, vehicles parking on the street will have the option to park on a portion of the device or avoid the device entirely.

Example: Speed lump extends to the edge of pavement across bike lane.

Raised Crosswalk Tapers

Raised crosswalks should always be designed to a height equal to the curb height, but not fully extend to the curb, as this will impede drainage. To bridge the gap between the sidewalk and raised crosswalk, a metal connector plate or other approved device may be used to allow unimpeded flow of the gutter. The design should also include truncated dome plates to indicate the entrance to the crosswalk from the sidewalk. Raised crosswalks may not be appropriate where curbs do not exist.

Example: Unimpeded drainage.

HORIZONTAL DEFLECTION MEASURES

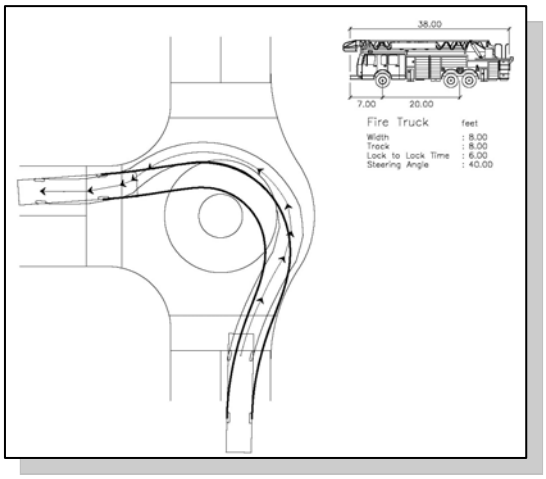
Traffic Circle Center Island Profile

Traffic circles should be designed with both a vertical inner curb and a mountable apron. The vertical inner curb prevents vehicles from driving over the circle. The apron is a shallow-sloped curb extending out from the bottom of a vertical curb; the apron has a low lip at its pavement-side edge. This apron effectively reduces the diameter of the center island for large vehicles, facilitating easier turns. The lip at the apron's edge discourages vehicles from using it unnecessarily.

Example: Vertical inner curb and mountable apron.

Traffic Circle Turn Operations

All vehicles should circulate around the center island on left-turns. However, an exception can be made for large trucks and buses in some cases if geometric constraints require it. If a specific intersection has a high proportion of trucks and/or bus traffic, alternative treatments may provide similar results without impact to trucks or busses. All traffic circles should be designed using the appropriate truck turning templates from Caltrans Highway Design Manual (Caltrans, 2006). Software packages such as AutoCAD or AutoTURN may also be used to identify whether emergency response vehicles and buses can maneuver around the circle.

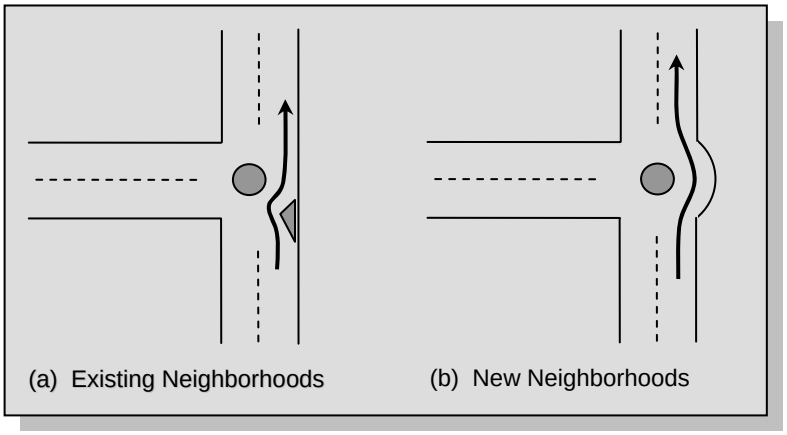


Example: Truck turning radius using mountable apron.

Traffic Circles at T-Intersections

Traffic circles should have deflection on all approaches if implemented at a T-intersection. This can be implemented in both existing neighborhoods in retrofit situations and in new neighborhood. First, a raised island can be placed at the right side of the un-deflected approach to the traffic circle to artificially introduce deflection, as shown in Figure A-2 (a). In new neighborhoods, the street curbs can be modified to allow the center island to be located at the center of the intersection, as shown in Figure A-2 (b).

Figure A-2 Traffic circles at T-Intersections



NARROWING MEASURES

Drainage

Narrowing measures, such as chokers, should be constructed to minimize or avoid blocking gutter flow, as illustrated in the photo. Modifying the drainage can be cost prohibitive and could require regular maintenance to clear debris from the modified gutter.

Example: Retrofit design with unimpeded drainage.

Neckdowns/Bulbouts

Narrowing measures, such as neckdowns or chokers, should not be constructed wider than the approximate width of a parked vehicle. Extension of these devices any further than the width of a parked vehicle could present potential safety issues to other drivers.

Example: Neckdown at intersection.

LANDSCAPING

The standard treatment for all neighborhood traffic management devices will be hardscape (i.e., grouted cobblestone). Residents may fund aesthetic upgrades to neighborhood traffic calming devices such as landscaping or stamped and colored concrete (i.e., simulated brick work). Aesthetics upgrades not only improve the aesthetic quality of the device but increase the visual presence of the device. Landscaping should be limited to low-lying shrubs and plants. Trees planted on center islands must allow adequate sight distances for motorists.

Example: Standard treatment

Example: Upgraded aesthetics

SIGNAGE AND STRIPING

Signage

Signage should be provided at or near traffic calming devices advising motorists of the device. Signage should be visible to both motorists and bicyclists. The signs should be comprised mostly of symbols and be easily understandable to motorists. Figure A-3 illustrates examples of several common warning signs.

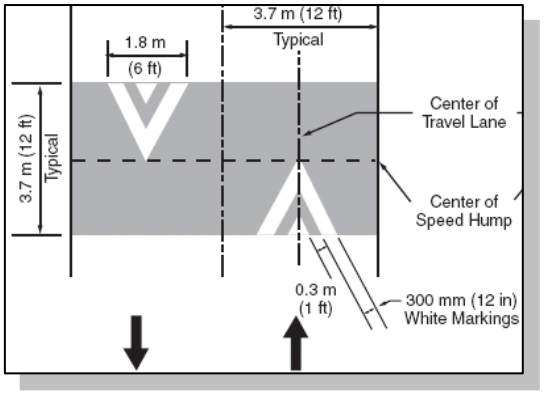
The warning sign for a traffic circle or roundabout shown on Figure A-3 should be the standard used at such intersections. The warning sign is clear and concise, showing drivers the route around and turning options of the upcoming traffic circle or roundabout.

Special signing specific to bicyclists may be used as determined by Public Works staff. Examples of this signing include advising motorists not to pass bicyclists through narrow traffic calming devices or informing bicyclists of proper maneuvering of devices. This signage should be used when the travel rights of bicyclists warrant emphasis.

Striping

Pavement markings assist in warning motorists and bicyclists of traffic calming devices in the roadway. Vertical devices should always include pavement markings on the device and may also include advanced warning legends (see Figure C-6). In certain situations, vertical devices may be unmarked, such as revitalization or beautification plans in a given area. In such cases, the device must be designed to provide a clear contrast with the surrounding environment.

The example image to the right illustrates the preferred striping option for vertical devices, such as speed lumps. This marking option is compliant with the Manual on Uniform Traffic Control Devices (FHWA, 2003).

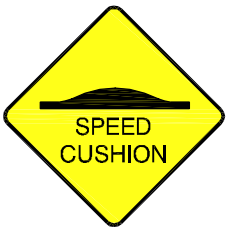


Example: Recommended striping.

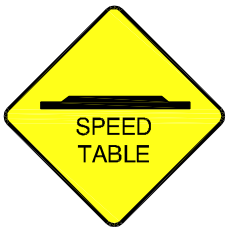
COMBINED MEASURES

Some measures from the toolbox can be combined to increase the combined effect on traffic volumes and speeds. For example, a raised crosswalk may be combined with neckdowns, the effect being a crosswalk that is both shortened and raised above the level of the roadway. Motorists must then react to both a vertical deflection and a narrowing. In assessing the suitability of combined measures, the guidelines in Tables 1, 2, and 3 should be applied for both devices.

Sign Dimensions	Color Code		
	Background	Message	Border
30" x 30"	Flourescent Yellow or Yellow-Green	Black	Black

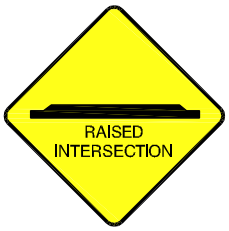


SPEED CUSHION

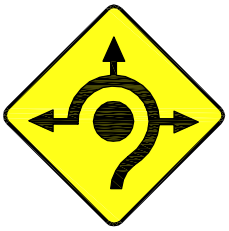


SPEED TABLE

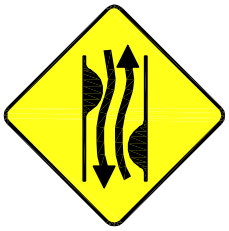
RAISED CROSSWALK



RAISED INTERSECTION



TRAFFIC CIRCLE OR ROUNDABOUT



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COMMON WARNING SIGNS

FIGURE A-3