4. TOOLBOX GUIDELINES

This section provides guidance on selecting the most appropriate neighborhood traffic management measure for a specific problem. This involves narrowing the toolbox of neighborhood traffic management measures to those that will most closely target the key traffic issue; are appropriate for the type of location concerned; and are compatible with the traffic volumes, geometrics, and adjacent land uses near the given location. When the list has been narrowed, devices should be considered that are likely supported by affected residents. Finally, the selected devices need to be placed in a manner that will produce the desired results.

GUIDELINES

Traffic Related Concern

The first task when selecting the most appropriate traffic calming device is to narrow the field of devices to those that address the primary traffic concern. The most common traffic related concerns are:

- Speeding – motor vehicle speeds are too high
- Traffic Volumes – motor vehicle usage levels (all trips or non-local trips only) are too high
- Vehicle Safety – motor vehicle speeds or volumes create an inordinate level of risk

Each device in the toolbox is appropriate to a different subset of the above traffic-related concerns. Table 1 summarizes the appropriateness of each device.

Non-Physical Measures – The first solutions to consider should be Non-Physical Measures, such as signs and markings, since these can devices increase driver awareness and are relatively inexpensive.

Speed Control Measures

Speed control measures can address any of the major problem types:

- ***Narrowing Measures*** – Narrowing devices, such as neckdowns, center island narrowings, or chokers, are less obtrusive than other devices and can be more aesthetically pleasing if residents opt to fund upgraded landscaping.
- ***Horizontal Measures*** – Horizontal deflection devices, such as chicanes and traffic circles, are more intrusive but also more effective than narrowings because they force vehicles to navigate horizontally around physical objects. Residents can also elect to fund upgraded landscaping.
- ***Vertical Measures*** – Vertical deflection devices provide the greatest speed reduction, and consequently have the greatest potential to slow emergency response vehicles, buses, and trucks. Therefore, the placement of these devices should be carefully considered, especially to limit any potential impact on emergency vehicles or transit access.

Volume Control Measures

If speed-control measures fail to produce desired results, then diversion measures, such as street closures or forced turns may be considered. These devices redirect traffic to an adjacent street, and, therefore, should be considered after all other measures fail to produce the desired results. Volume control measures limit through

traffic or turning movements at specific locations for both residents and non-residents. The full effect of the traffic diversion should be investigated before device implementation.

Location Type

The appropriate device for a given problem is a function of the location (midblock or at an intersection). Special consideration should be given to streets used by the Fire Department as primary response routes when responding to emergencies.

Table 2 indicates the location(s) where each type of traffic calming measure is applicable.

Street Classification, Location, and Other Constraints

The third step in determining the most appropriate device is to consider how each device is compatible with the street classification, traffic volumes, posted speeds, and special roadway users. Table 3 illustrates where each device is appropriate with certain constraints.

TABLE 1
APPLICABILITY OF TREATMENTS BY TRAFFIC RELATED CONCERN

Types of Measures		Type of Traffic Related Concern				
		Speeding	**Traffic Volume**	**Vehicle Collisions**	**Pedestrian Safety**	**Noise**
Non-Physical Control Measures						
	Targeted Speed Enforcement	●	○	◒	◒	◒
	Speed Radar Trailer	●	○	○	○	◒
	Speed Feedback Sign	●	○	○	○	◒
	Centerline/Edgeline Lane Striping	●	○	○	○	○
	Optical Speed Bars	◒	○	○	○	○
	Signage	●	◒	◒	○	○
	Speed Legend	●	○	○	○	○
	Centerline Botts Dots	○	○	●	◒	○
	High Visibility Cross Walks	◒	○	○	●	○
	Angled Parking	●	◒	○	○	○
Speed Control – Narrowing Measures						
	Neckdown/Bulbout	●	◒	○	●	○
	Center Island Narrowing/ Pedestrian Refuge	●	◒	◒	●	○
	Two-Lane Choker	●	◒	○	○	○
	One-Lane Choker	●	◒	○	○	○
Speed Control - Horizontal Measures						
	Traffic Circle	●	◒	●	◒	○
	Roundabout (Single-Lane)	◒	◒	●	○	●
	Chicane	●	◒	○	○	○
	Lateral Shift	◒	◒	○	○	○
	Realigned Intersection	◒	◒	●	○	○
Speed Control – Vertical Measures						
	Speed Hump	●	●	◒	◒	✕
	Speed Lump	●	●	◒	◒	✕
	Speed Cushion	●	●	◒	◒	✕
	Speed Table	●	◒	◒	◒	✕
	Raised Crosswalk	●	◒	◒	●	✕
	Raised Intersection	●	◒	◒	●	✕
	Textured Pavement	◒	○	○	◒	✕
	Rumble Strips	◒	○	○	○	✕
Volume Control Measures						
	Full Closure	●	●	○	○	○
	Partial Closure	●	●	○	○	○
	Diagonal Diverter	●	●	○	○	○
	Median Barrier	○	●	◒	○	○
	Forced Turn Island	○	●	◒	○	○
Key:	● = Strongly Appropriate ◒ = Moderately Appropriate		✕ = Inappropriate/Counterproductive ○ = Indifferent			

TABLE 2
APPLICABILITY OF TREATMENTS BY LOCATION

Type of Measure	Mid-Block	Intersection	Study Perimeter	Collectors*	Transit Routes
Non-Physical Control Measures					
Targeted Speed Enforcement	●	●	●	●	●
Radar Trailer	●	●	●	●	●
Speed Feedback Sign	●	●	●	●	●
Centerline/Edgeline Lane Striping	●	×	×	●	●
Optical Speed Bars	●	×	×	●	●
Signage	●	●	●	●	●
Speed Legend	●	●	●	●	●
Centerline Botts Dots	**On Curves**	×	×	●	●
High Visibility Crosswalks	●	**Unsignalized Intersections**	**Unsignalized Intersections**	●	●
Angled Parking	●	×	×	●	○
Speed Control – Narrowing Measures					
Neckdown/Bulbout	×	●	●	●	●
Center Island Narrowing/ Pedestrian Refuge	●	●	●	●	●
Two-Lane Choker	●	×	×	×	●
One-Lane Choker	●	×	×	×	×
Speed Control – Horizontal Measures					
Traffic Circle	×	●	○	●	●
Roundabout (Single-Lane)	×	○	○	●	●
Chicane	●	×	×	●	●
Lateral Shift	●	×	×	●	●
Realigned Intersection	×	**Unsignalized Intersections**	**Unsignalized Intersections**	●	●
Speed Control – Vertical Measures					
Speed Hump	●	×	×	×	×
Speed Lump	●	×	×	○	●
Speed Cushion	●	×	×	○	●
Speed Table	●	×	×	○	○
Raised Crosswalk	●	○	○	○	○
Raised Intersection	×	●	●	○	○
Textured Pavement	●	●	●	●	●
Rumble Strips	●	●	○	●	●
Volume Control Measures					
Full Closure	×	●	●	×	×
Partial Closure	×	●	●	●	●
Diagonal Diverter	×	●	×	×	×
Median Barrier	×	○	●	×	×
Forced Turn Island	×	○	●	○	○

Key: * Due to Emergency Response Concerns

× = Never applicable. ○ = Seldom, except in some cases. ● = Generally applicable.

TABLE 3
APPLICABILITY BY STREET TYPE

Types of Measures	Roadway Classification		
	Local	**Collector**	**Other Considerations**
Non-Physical Control Measures			
Targeted Speed Enforcement	No Limitations with respect to ADT or Speed		None
Radar Trailer			
Speed Feedback Sign	No		
Centerline/Edgeline Lane Striping			
Optical Speed Bars			
Signage			
Speed Legend			
Centerline Botts Dots			Not applicable on snow removal routes above 2,000 feet
High Visibility Crosswalks			None
Angled Parking	ADT <4,000; Width ≥48 feet: Speed Limit ≤30 mph		
Speed Control – Narrowing Measures			
Neckdown/Bulbout	ADT ≤ 20,000; Speed Limit ≤ 35		Not applicable on snow removal routes above 2,000 feet
Center Island Narrowing/ Pedestrian Refuge			
Two-Lane Choker			Requires provisions on snow removal routes
One-Lane Choker	ADT ≤ 3,000; Speed Limit ≤ 30	No	DPW must review sight distance. Not applicable on snow removal routes above 2,000 feet
Speed Control – Horizontal Measures			
Traffic Circle	Daily Entering Volume <10,000; Speed Limit ≤ 35 mph		Grades ≤ 4% Requires provisions on snow removal routes
Roundabout (Single-Lane)	No	Daily Entering Volume <16,000; Speed Limit ≤ 45 mph	
Chicane	No	ADT ≤ 5,000; Speed Limit ≤ 35	• Grades ≤ 8% • Requires provisions on snow removal routes
Lateral Shift	No	ADT ≤ 20,000; Speed Limit ≤ 35	Not applicable on snow removal routes above 2,000 feet
Realigned Intersection	Daily Entering Volume <5,000; Speed Limit ≤ 35 mph		Requires provisions on snow removal routes
Speed Control – Vertical Measures			
Speed Hump	ADT<3,000; Speed Limit ≤ 30mph		• Grades ≤ 8% • Not applicable on snow removal routes above 2,000 feet
Speed Lump			
Speed Cushion			
Speed Table [1]	ADT<7,500: Speed Limit >25 mph and ≤ 35 mph		
Raised Crosswalk			
Raised Intersection	No		
Textured Pavement [2]	No	Yes	Noise impact to adjacent residential units
Rumble Strips [2]	Yes	Yes	Noise impact to adjacent residential units

Notes: [1] Not appropriate for streets without curbs, gutter, or sidewalks.
[2] Use of this device should be limited to locations where noise impacts would be minimal.

Table 3 (continued) Applicability by Street Type			
Types of Measures	**Roadway Classification**		
	Local	**Collector**	**Other Considerations**
Volume Control Measures			
Full Closure	≥ 25% non-local traffic. Evaluation should be conducted to determine effects of diverted traffic to alternate routes	No	Requires provisions on snow removal routes
Partial Closure			Not applicable on snow removal routes above 2,000 feet
Diagonal Diverter			
Median Barrier			
Forced Turn Island			

EFFECTIVENESS COMPARISON

When more than one traffic calming device is available, it is helpful to understand the levels of effectiveness for each device to better determine which device will have the greatest effect in meeting the specified objective(s). Table 4 summarizes the effectiveness data (including excluded devices) that has been compiled for each of the neighborhood traffic management measures in the toolbox. These data are averages and the actual effectiveness will vary based on site-specific circumstances, such as proximity to major roads and the availability of alternate routes.

PLACING THE NEIGHBORHOOD TRAFFIC MANAGEMENT MEASURES

Strategies for the specific placement of devices differ depending on whether the concern is speed-control, volume-control, or safety related. The placement of devices is described below.

Placing Speed-Control Measures

Where feasible, neighborhood traffic management measures should be spaced in such a way to achieve the following two design speeds:

- **Slow-Point 85th Percentile Design Speed**: the speed that 85 percent of vehicles are traveling less than, when they are crossing a neighborhood traffic management device; the target slow-point speed is defined as 5 mph below the posted speed limit.

- **Midpoint 85th Percentile Design Speed**: the speed that 85 percent of vehicles are traveling less than, when they are halfway between a traffic calming device or other roadway feature that requires significant slowing (e.g., stop sign or curve). The target midpoint speed is defined as 5 mph above the posted speed limit.

Figure 3 illustrates how to estimate the midpoint speed.

TABLE 4
QUANTITATIVE IMPACTS OF NEIGHBORHOOD TRAFFIC MANAGEMENT MEASURES

Types of Measures		Effectiveness									
		85th Percentile Change				Vehicles Per Day		Average Annual Collisions			
		Before	After	Change	Percent Change	Change	Percent Change	Before	After	Change	Percent Change
Non-Physical Measures											
	All Non-Physical Measures	Limited Effectiveness as stand alone device									
Speed Control – Vertical Measures											
	Entry Feature	I/D				I/D		I/D			
	Speed Hump	35.0	27.4	-7.6	-22%	-355	-18%	2.62	2.29	-0.33	-13%
	Speed Lump	Comparable to speed hump but I/D									
	Speed Cushion[1]	Comparable to speed hump but I/D			-14%	Comparable to speed hump but I/D					
	Split Speed Hump	37	32	-5	-14%	I/D		I/D			
	Speed Table Raised Crosswalk	36.7	30.1	-6.6	-18%	-415	-12%	6.71	3.66	-3.05	-45%
	Raised Intersection	34.6	34.3	-0.3	-1%	Ineffective					
	Rumble Strips	I/D and Limited Effectiveness									
	Textured Pavement	Limited Effectiveness as stand alone device									
Speed Control – Narrowing Measures											
	Neckdown/Bulbout Center Island Narrowing Two-Lane Choker	34.9	32.3	-2.6	-7%	-293	-10%	I/D			
	One-Lane Choker	I/D			-14%	I/D	-20%				
Speed Control – Horizontal Measures											
	Traffic Circle	34.2	30.3	-3.9	-11%	-293	-5%	2.19	0.64	-1.55	-71%
	Roundabout (Single-Lane)	Insignificant Speed Effects				Insignificant Volume Effects		Not Recorded			-15% to -33%
	Chicane	I/D and Limited Effectiveness									
	Lateral Shift	Ineffective									
	Realigned Intersection	I/D				I/D		I/D			
Volume Control Measures											
	Full Closure	I/D	I/D	I/D	I/D	-671	-44%	I/D			
	Partial Closure	32.3	26.3	-6.0	-19%	-1,611	-42%	I/D			
	Diagonal Diverter	29.3	27.9	-1.4	-4%	-501	-35%	I/D			
	Median Barrier Forced Turn Island Turn-Movement Restrictions	I/D				I/D		I/D			
Stop Signs											
	Stop Signs	I/D				I/D		I/D			

Notes: I/D = Insufficient Data
Source: Traffic Calming State-of-the Practice (Ewing, 1999)
[1]City of Portland, Rubber Speed Bump Research, 1995

Figure 3 Estimating Midpoint Speed

In mathematical terms, the following exponential function gives the relationship between midpoint speed and spacing of slow points:

$$85^{th}_{midpoint\ (mph)} = 85^{th}_{slow\ point\ (mph)} + (85^{th}_{street\ (mph)} - 85^{th}_{slow\ point\ (mph)}) * 0.56 * (1 - e^{-0.004\ *\ spacing\ (ft.)})$$

where;

$85^{th}_{midpoint}$ = resulting 85th percentile speed at midpoint after treatment;
$85^{th}_{slow\ point}$ = estimated 85th percentile speed at the slow point after treatment;
85^{th}_{street} = 85th percentile speed of street before treatment;
spacing = distance in feet between two devices.

When placing speed-control measures, use the above formula to test proposed spacings to determine whether the estimated midpoint speeds would meet the targeted midpoint speed.

Example (speed humps on street with starting speed of 32 mph):

Where spacing is 350 feet:

$$85^{th}_{midpoint\ (mph)} = 15\ mph + ((32\ mph - 15\ mph) * 0.56 * (1 - e^{-0.004\ *}\ 350\ feet))$$

$$85^{th}_{midpoint\ (mph)} = \underline{22\ mph}$$

Where spacing is 750 feet:

$$85^{th}_{midpoint\ (mph)} = 15\ mph + ((32\ mph - 15\ mph) * 0.56 * (1 - e^{-0.004\ *}\ 750\ feet))$$

$$85^{th}_{midpoint\ (mph)} = \underline{24\ mph}$$

The spacing of neighborhood traffic management measures directly affects the midpoint speeds: the farther apart they are, the higher the midpoint speed. In general, speed control measures placed 350 to 750 feet from another slow-point can result in speed reductions similar to those indicated in Table 4. Measures placed at intervals of less that 350 feet can become a nuisance to drivers, and measures placed greater than 750 feet apart decrease the ability to slow speeds to the target midpoint speed. In addition, vertical measures should be place a minimum of 250 feet from an adjacent intersection.

Placing Volume-Control Measures

Neighborhood traffic management devices intended to divert traffic can be located either external or internal to the neighborhood.

- Gateway Measures – Volume-control measures placed at entrances or gateways to neighborhoods can be more effective in reducing volumes because drivers encounter these devices upon entering a neighborhood, which may deter future use. However, these measures can also cause local traffic to take more circuitous paths than internal measures would.

- Internal Measures – When placed within a neighborhood, measures have a less direct effect on non-local traffic. First-time attempts to travel through the neighborhood will occur more frequently, and drivers will seek alternative routes within the neighborhood. However, this type of placement can cause less of an inconvenience to local traffic.

Placing Safety Measures

The placement of safety-oriented neighborhood traffic management devices is dependent on the particulars of the traffic-related concern and on the characteristics of the selected neighborhood traffic management device. For example, if the traffic related concern involves pedestrian safety, then the solution—a raised crosswalk, for example—should be placed at a location where it is likely to be heavily used by pedestrians.