

Section IV. Traffic Calming Measures

This section identifies and describes measures that can be implemented to calm traffic. The measures identified in this section are not meant to exclude other measures that may be available but rather provide a list of solutions that have been studied and identified as being effective in calming traffic.

Types of Traffic Calming Measures

The traffic calming measures identified here are divided into four categories: Non-Physical, Vertical, Horizontal, and Diversion. Of those categories, the measures in the Non-Physical category are generally ideas that do not alter the physical path of travel. Non-Physical measures also normally do not require significant construction or alteration of the roadway. These measures typically require low cost materials such as line striping or signing; however, some Non-Physical measures can be costly. These alternative measures should be considered and tried before implementing more complicated traffic calming measures. The following Non-Physical measures are included in this section:

1. Speed Enforcement
2. Radar Trailers Signs
3. Lane Striping
4. Signage
5. Pavement Marking Legends
6. High Visibility Crosswalks
7. On-Street Parking
8. Raised Pavement Markers
9. Streetscaping
10. Multi-Way Stops
11. Turn Prohibitions & Other Restrictions
12. Gateways / Entryways
13. Colored Pavements

Vertical traffic calming measures provide variations in pavement height and materials that typically cause discomfort to the occupants of vehicles operating in excess of the desired travel speed. These devices do not restrict traffic flow so they are not typically used to mitigate cut-through traffic issues; however, the inconvenience caused by these devices may cause some of the non-local traffic to avoid the area. **Most Vertical traffic calming measures are considered undesirable for primary emergency response routes and transit routes. City Council adopted a revision to the traffic calming policy December 2016 that limits the number of vertical devices that can be installed on a roadway if the average emergency response delay to any location increases by more than 60 seconds (Limit of 6 vertical devices on a roadway).** The following Vertical traffic calming measures are included in this section:

14. Textured Pavements
15. Speed Humps
16. Speed Lumps
17. Speed Tables
18. Raised Crosswalks
19. Raised Intersections

Horizontal traffic calming measures use items such as raised islands and traffic circles to eliminate straight-line travel thus forcing most drivers to reduce their speeds. Horizontal measures can also be used to reduce pavement widths to discourage speeding or to restrict passage to a single lane, thereby significantly reducing the capacity of the roadway. The following Horizontal traffic calming measures are included in this section:

20. Traffic Circles
21. Roundabouts
22. Curb Extensions
23. Chicanes

24. Lateral Shifts
25. Neckdowns
26. Realigned Intersections
27. Bulbouts
28. Two-Lane Chokers
29. One-Lane Chokers
30. Center Island Narrowing
31. Medians

Diversion measures change the flow of traffic and limit or eliminate certain movements. Diversion measures should only be used as a final option when any of the previously mentioned measures have not yielded the desired results. Even in these cases, Diversion measures should be implemented only with careful planning. Diversion measures should not be considered on primary emergency routes unless provisions can be made to maintain access for emergency vehicles. The following Diversion measures are included in this section:

- ~~32. Street Closures~~
33. Diagonal Diverters
34. Semi-diverters

Roadway Classification

The use of these measures is not only dependent on the issues to be addressed but also on the classification of the facility that the measure will be placed on. For the purposes of this policy, every street will fall into one of four (4) roadway classifications: Thoroughfare, Commercial, Residential Collector, or Local Residential.

Thoroughfares are those streets that are included in the Winston-Salem/Forsyth County Thoroughfare Plan. This includes both Major and Minor Thoroughfares. These are typically streets intended to move large volumes of traffic through the area or between major destinations, such as the CBD, shopping malls or the Convention Center. In general,

few traffic calming devices are permitted on thoroughfares. The measures that are allowed will typically be intended to improve safety for the non-motorized users of the facility, such as cyclists and pedestrians. **Measures to reduce volumes are not appropriate on thoroughfares. Measures to reduce speeds should be used with caution so the capacity of the facility is not impacted.**

Commercial roadways are primarily intended to provide access to adjacent properties in business districts. These streets are characterized by frequent commercial driveways, heavy peak period traffic volumes, and low pedestrian activity. Daily volumes and travel speeds are typically moderate. Traffic issues on these facilities are generally related to safety and travel speed. Many types of traffic calming measures are permitted on these facilities; however, care must be used to maintain adequate capacity and access for the traffic generated by adjacent land uses.

Residential Collectors are streets through residential areas that serve to connect the Local Residential streets with Thoroughfares. This street is typically characterized by frequent intersections with Local Residential streets. The adjacent land use for these facilities is primarily residential; however, some retail and institutional uses are not uncommon. These streets may have frequent residential driveways or may have no driveways at all (reverse frontage). Speeding and cut-through traffic are the typical primary concerns on Residential Collectors. Addressing cut-through traffic issues can be difficult because it is important to maintain adequate capacity and access to fully serve the Local Residential streets that intersect the facility.

Local Residential streets provide access to residential properties. Adjacent properties are typically single-family units but may also include multi-family developments. These are the types of streets where

traffic calming is typically most desired; especially if the street includes multiple intersections with other Local Residential streets and a Thoroughfare or Residential Collector. Nearly all traffic calming measures can be considered for this type of facility.

Roadway Uses

In addition to the roadway classification, consideration must be given to the uses of the roadway when selecting a traffic calming measure. Specifically, consideration must be given to the use of the facility by emergency response vehicles, transit vehicles (including school buses) and other heavy vehicles. **Consideration must also be given as to who owns the roadway – whether it is the City of Winston-Salem or the State of North Carolina.**

Many traffic calming measures can significantly impact emergency response times by forcing emergency vehicles to slow down or physically forcing them to use a less desirable route. Care should be taken to utilize only those measures that have little or no impact on emergency vehicles on primary emergency response routes. The Fire Department typically maintains maps of the primary response routes.

Transit vehicle routes through neighborhoods are often candidates for traffic calming measures due to the increased number of pedestrians and the frequent stopping of transit vehicles. Care must be taken in selecting measures for these streets so impacts to transit operations are minimized. Many traffic calming measures, particularly Vertical measures, can severely impact buses. Even at very low speeds, Vertical measures can cause significant discomfort for bus passengers. Measures that significantly reduce street capacity can cause schedule problems for transit. Also, long wheelbases make it difficult for these vehicles to navigate through some horizontal measures. The types of measures allowed on transit routes should be limited to those with little or no impact to transit bus safety or comfort. The same cannot be said about

school bus routes since this would preclude many measures from most streets and because school bus routes often change annually. Impacts to school buses should be considered on the major streets within neighborhoods where school buses have historically operated year after year.

The North Carolina Department of Transportation (NCDOT) maintains many of the streets in Winston-Salem. These streets are primarily multi-lane thoroughfares or controlled access facilities and, therefore, will not generally be considered for traffic calming measures. However, it is not unusual for neighborhood traffic calming plans to include some measures on the adjacent or nearby thoroughfares that connect to the neighborhood; therefore, it is necessary for this policy to consider the requirements of the NCDOT. **All construction and maintenance activities on State system streets must be approved by the NCDOT and performed in accordance with State standards, policies and guidelines.** The NCDOT does not currently have a traffic calming policy and, generally, will not allow the construction of many types of traffic calming devices on State maintained rights-of-way. Lane widths, curb radii, pavement materials, clear zones, pavement striping and signing must all be compliant with NCDOT standards; therefore, there is little opportunity for traffic calming on State maintained streets. Standard devices that also serve a traffic calming function such as textured and colored pavements, pavement markings, turn prohibitions, signing and landscaping, are allowed on NCDOT rights-of-way, but will require approval from the NCDOT prior to implementation.

The following chart summarizes where the measures included in this section may be used and their effectiveness at resolving typical traffic calming issues. The second chart offers the same basic information as the first but is organized differently to make it easier for the user to identify which devices may solve a particular issue within the available project budget. Following these two charts are detailed descriptions of each measure.

	Allowable Uses				Roadway Uses			Speed Reduction			Volume Reduction			Noise & Pollution Increase			Implementation Cost			Enforcement Required
	Thoroughfare	Commercial Street	Residential Collector	Local Residential	Emergency Route	Transit Route	NCDOT Route	Low	Med.	High	Low	Med.	High	Low	Med.	High	Low	Med.	High	
Non-Physical Measures																				
1. Speed Enforcement	✓	✓	✓	✓	✓	✓	✓			✓	Negligible Impact			Negligible Impact					✓	✓
2. Radar Trailer	✓	✓	✓	✓	✓	✓	✓		✓		Negligible Impact			Negligible Impact				✓		
3. Lane Striping	✓	✓	✓	✓	✓	✓	Note 1	✓	✓		✓			✓			✓			
4. Signage	✓	✓	✓	✓	✓	✓	Note 1	✓			Negligible Impact			Negligible Impact			✓			
5. Pavement Marking Legends	✓	✓	✓	✓	✓	✓	Note 1	✓			Negligible Impact			✓			✓			
6. High Visibility Crosswalks	✓	✓	✓	✓	✓	✓	Note 1	✓			✓			✓			✓			
7. On-Street Parking	Note 1	✓	✓	✓	Note 1	Note 1	Note 1	✓	✓		✓	✓		✓			✓			
8. Raised Pavement Markers	✓	✓	✓	✓	✓	✓	✓	✓			Negligible Impact			✓			✓			
9. Streetscaping	✓	✓	✓	✓	✓	✓	Note 1	✓			✓			Negligible Impact				✓	✓	
10. Multi-way Stops	Note 2	Note 2	Note 1	✓	✓	✓	Note 2	✓				✓				✓	✓			✓
11. Turn Prohibitions/Restrictions	Note 1	Note 1	✓	✓	✓	✓	Note 1	✓				✓	✓	✓	Negligible Impact			✓		✓
12. Gateways/Entryways	✓	✓	✓	✓	✓	✓	Note 1	✓			✓			Negligible Impact			✓	✓		
13. Colored Pavements	✓	✓	✓	✓	✓	✓	Note 1	✓	✓		Negligible Impact			Negligible Impact			✓	✓		
Vertical Measures																				
14. Textured Pavements	✓	✓	✓	✓	✓	✓	Note 1	✓	✓		✓				✓	✓		✓	✓	
15. Speed Humps			✓	✓						✓	✓				✓		✓			
16. Speed Lumps			✓	✓	✓	✓				✓	✓				✓		✓			
17. Speed Tables			✓	✓						✓	✓				✓			✓		
18. Raised Crosswalks		Note 1	✓	✓						✓	✓				✓			✓		
19. Raised Intersections		Note 1	✓	✓						✓	✓				✓			✓	✓	
Horizontal Measures																				
20. Traffic Circles			✓	✓	Note 1	✓			✓			✓		Negligible Impact				✓		
21. Roundabouts	✓	✓	✓	✓	✓	✓	Note 1			✓	Negligible Impact			Negligible Impact				✓	✓	
22. Curb Extensions				✓	✓	✓				✓	Negligible Impact			Negligible Impact				✓		
23. Chicanes				✓						✓			✓		✓			✓	✓	
24. Lateral Shifts	Note 1	✓	✓	✓	✓	✓	Note 1			✓	✓			✓				✓		
25. Neckdowns			✓	✓						✓		✓		✓				✓		
26. Realigned Intersections				✓	✓	✓				✓		✓			✓			✓	✓	
27. Bulbouts	✓	✓	✓	✓	✓	✓	Note 1			✓	Negligible Impact			Negligible Impact				✓		
28. Two-Lane Chokers		✓	✓	✓	✓	✓				✓	Negligible Impact			Negligible Impact				✓		
29. One-Lane Chokers				✓		✓				✓			✓					✓		
30. Center Island Narrowing			✓	✓		✓	Note 1			✓	Negligible Impact			Negligible Impact				✓		
31. Medians	Note 1	Note 1	✓	✓	Note 1	✓	Note 1	✓					✓	Negligible Impact				✓		
Diversions																				
32. Street Closures				✓						✓			✓					✓	✓	
33. Diagonal Diverters				✓						Negligible Impact					✓			✓	✓	
34. Semi-Diverters				✓						Negligible Impact					✓			✓		

Note 1 – Use of this measure may be allowed on this type of facility under certain circumstances with approval of the appropriate review agencies.

Note 2 – Multi-way stops may be used on this type of facility only at intersections that meet the warrants of the Manual on Uniform Traffic Control Devices (MUTCD).

Note 3 – Roadways under 500 feet in length are not eligible for traffic calming measures.

	TYPE \ COST	Thoroughfare			Commercial			Residential Collector			Local Residential		
		Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Speed Reduction	Non-physical	3-6, 8, 12, 13	2, 9, 12, 13	1, 9	3-8, 11-13	2, 9, 12, 13	1, 9	3-8, 11-13	2, 9, 12, 13	1, 9	3-8, 10-13	2, 9, 12, 13	1, 9
	Vertical		14	14		14, 18, 19	14, 19	15, 16	14, 17-19	14, 19	15, 16	14, 17-19	14, 19
	Horizontal		21, 27, 31	21		21, 22, 24, 25, 27, 28, 31	21		20-22, 24, 25, 27, 28, 30, 31	21		20-31	21, 23, 25, 26
	Diversion											32	32
Volume Reduction	Non-physical	3, 6, 12	9, 12	9	3, 6, 7, 9, 11, 12	9, 12	9	3, 6, 7, 11, 12	9, 12	9	3, 6, 7, 10-12	9, 12	9
	Vertical					14, 18, 19	14, 19	15, 16	14, 17-19	14, 19	15, 16	14, 17-19	14, 19
	Horizontal					24, 31			20, 24, 25, 31			20, 23-26, 29, 31	23, 26
	Diversion											32-34	32, 33
Aesthetics	Non-physical	12, 13	9, 12, 13	9	12, 13	9, 12, 13	9	12, 13	9, 12, 13	9	12, 13	9, 12, 13	9
	Vertical		14	14		14	14		14	14		14	14
	Horizontal		21, 27, 31	21		21, 22, 27, 28, 31	21		20-22, 27, 28, 30, 31	21		20-24, 27-31	21, 23
	Diversion											32-34	32, 33
Safety	Non-physical	3-6, 8		1	3-6, 8		1	3-6, 8		1	3-6, 8		1
	Vertical					14, 18, 19	14, 19		14, 18, 19	14, 19		14, 18, 19	14, 19
	Horizontal		21, 27, 31	21		21, 22, 27, 31	21		21, 22, 27, 30, 31	21		21, 22, 26, 27, 30, 31	21, 26
	Diversion											32-34	32, 33

Non-Physical Traffic Calming Measures

Non-Physical measures are generally ideas that do not alter the physical path of travel. Non-Physical measures also normally do not require significant construction or alteration of the roadway. These measures typically require low cost materials such as line striping or signing; however, some Non-Physical measures can be costly. These measures can usually be implemented by City staff with Operating Budget funds. The following Non-Physical measures are included in this section:

1. Speed Enforcement
2. Radar Trailers Signs
3. Lane Striping
4. Signage
5. Pavement Marking Legends
6. High Visibility Crosswalks
7. On-Street Parking
8. Raised Pavement Markers
9. Streetscaping
10. Multi-Way Stops
11. Turn Prohibitions & Other Restrictions
12. Gateways / Entryways
13. Colored Pavements

1. Speed Enforcement

Description: Temporary targeted speed limit enforcement in areas where residents are concerned.



Advantages	Disadvantages
<ul style="list-style-type: none">• May be implemented immediately with little planning• No impact to emergency response times• Effective for reducing speeds in a short span• Secondary benefits include reduced crime and a higher sense of security	<ul style="list-style-type: none">• Expensive to maintain for an extended period of time• May only be effective for a short time• May only be effective for short distances

Cost: Varies

2. Radar Trailers Signs

Description: A radar trailer can be placed adjacent to a roadway to measure and display a passing vehicles speed. Providing the posted speed limit on the device reminds drivers to slow down if they are traveling too fast.



Advantages	Disadvantages
<ul style="list-style-type: none">• In the long-term, less expensive than police enforcement• May be implemented immediately with little planning• No impact to emergency response times• Effective for reducing speeds in a short span	<ul style="list-style-type: none">• Only effective for one direction of travel at a time• May only be effective for a short time• May only be effective for short distances

Cost: Varies

3. Lane Striping

Description: Lane striping can be used to visually narrow travel lanes in a given area. By using highly visible stripes, vehicles are encouraged to slow down.



Advantages	Disadvantages
<ul style="list-style-type: none">• Inexpensive• May be implemented quickly with little planning• No impact to emergency response times	<ul style="list-style-type: none">• Increases maintenance costs

Cost: \$0.15 - \$1.00 per linear foot (paint)
\$1 - \$5 per linear foot (plastic)

4. Signage

Description: Placing appropriate warning and information signs and additional regulatory signs reminds motorists of the various roadway conditions and hazards of the area.



Advantages	Disadvantages
<ul style="list-style-type: none">• Inexpensive• No impact to emergency response times	<ul style="list-style-type: none">• Increases maintenance costs• Signs typically considered unsightly – most people do not want them in their yard

Cost: \$50 - \$100 per sign

5. Pavement Marking Legends

Description: The speed limit or other driver information can be painted onto the street to remind drivers of the speed limit or other area conditions that warrant special attention.



Advantage	Disadvantages
<ul style="list-style-type: none">• Inexpensive• May be implemented immediately with little planning• No impact to emergency response times	<ul style="list-style-type: none">• Increased maintenance costs• Has not been proven to reduce speeds

Cost: \$25 - \$50 per letter or number
\$100 - \$200 per symbol

6. High Visibility Crosswalk

Description: High intensity paint or plastic can be used in a dense pattern to clearly delineate a crosswalk. Should be accompanied by appropriate signage.



Advantages	Disadvantages
<ul style="list-style-type: none">• Inexpensive• No impact to emergency response times• Helps collect and distribute pedestrians at one point along the street• Increases visibility of pedestrian	<ul style="list-style-type: none">• Requires more maintenance than normal crosswalk• May provide pedestrian with false sense of security, especially when used at mid-block locations or uncontrolled approaches to an intersection

Cost: ~~\$200~~ \$500 per crosswalk per lane

7. On-Street Parking

Description: Designates area along a street to store vehicles. May be used along one or both sides of the street. May also be a revenue generator through permit, meter, or other methods.



Advantages	Disadvantages
<ul style="list-style-type: none">• Provides more vehicle storage• Narrows street width to encourage slower vehicle traffic• Shortens pedestrian crossing distance• Encourages pedestrian activity in an area	<ul style="list-style-type: none">• May be ineffective if parking not adequately utilized• May reduce sight distance for both drivers and pedestrians• May increase certain types of vehicular crashes• May restrict bicycle movements• Traffic volumes may increase, especially in areas with high demand and low availability of off-street parking• May impede emergency response vehicles and solid waste collection

Cost: Dependent on frequency of spaces; enforcement costs, etc.

8. Raised Pavement Markers

Description: Raised pavement markers are plastic reflectors installed in the pavement that, when installed in series, alert the driver when they are deviating from the travel lane. They can be installed on the centerline and edgeline of a roadway or across a roadway to function as a rumble strip. They are often used on curves.



Advantages	Disadvantages
<ul style="list-style-type: none">• Inexpensive• May be implemented immediately with little planning• No impact to emergency response times• Secondary benefits include increased delineation and roadway safety	<ul style="list-style-type: none">• Noise• May be unintentionally removed during snow removal• Increased maintenance cost

Cost: ~~\$2 - \$7~~ \$7 - \$25 per marker

9. Streetscaping

Description: Streetscaping can incorporate many different ideas and approaches. Typically, streetscaping includes planting street trees and other landscaping along the roadway. Streetscaping also usually involves establishing a planting area between the street and the sidewalk.



Advantages	Disadvantages
<ul style="list-style-type: none">• May reduce speeds and volumes• Positive aesthetic effect• Good Functionality• Increases pedestrian safety• Improves quality of life for neighborhood• No impact to emergency response times	<ul style="list-style-type: none">• Can create vehicular hazards• Can create poor visibility conditions if installed too dense• High cost• Possibly increased maintenance costs

Cost: Varies depending on materials, length and width of application area, and availability of right-of-way

10. Multi-Way Stops

Description: Multi-way stops involve placing stop signs on all approaches to an intersection. Considerations for Multi-way stops should follow the guidelines as described in the Manual on Uniform Traffic Control Devices (MUTCD).

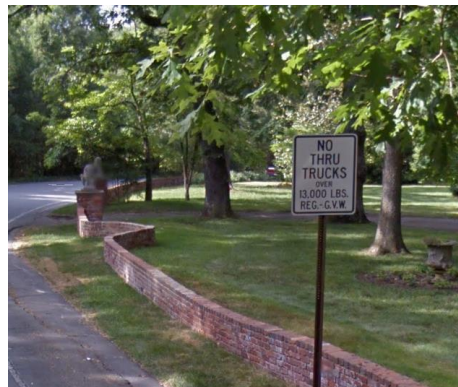


Advantages	Disadvantages
<ul style="list-style-type: none">• If traffic signals are warranted, can be used as a temporary measure• Can reduce intersection collisions• Little impact to emergency response times• May be implemented quickly with little planning• May provide a safer crossing for pedestrians	<ul style="list-style-type: none">• Speeds between intersections often increase• Increases noise and air pollution• Can cause rear-end accidents• Requires enforcement• If stop signs are not warranted, disregard for the measure can create dangerous situations

Cost: \$300-\$600 per intersection

11. Turn Prohibitions and Other Restrictions

Description: Turn prohibition signs are posted to restrict movement through a given area and to limit travel in certain directions. Other restrictions, such as “No Trucks,” can also help reduce cut-through traffic. Speed limit reductions can be used in areas where existing speed limits are higher than desired; however, speed limit changes alone are generally not effective in significantly reducing travel speeds on local residential streets.



Advantages	Disadvantages
<ul style="list-style-type: none"> • Inexpensive to install • No impact to emergency response times • May increase pedestrian safety • Transit and school buses can be exempted • Restriction can be “part time” 	<ul style="list-style-type: none"> • Deliberate violation could create a hazard • May divert problem onto another street • Requires enforcement • Requires approval of an enabling ordinance • Not effective for reducing speeds

Cost: \$100 - \$200 per sign + enforcement costs

12. Gateways / Entryways

Description: Gateways include decorative signing and/or landscaping to visually identify the entrance to a neighborhood or commercial district. This measure helps to make the area appear more as a destination rather than a connection to another area.



Gateways are often incorporated into a median island.



Advantages	Disadvantages
<ul style="list-style-type: none">• May reduce volumes• Positive aesthetic effect• Good Functionality• Improves quality of life for neighborhood• No impact to emergency response times	<ul style="list-style-type: none">• Can create vehicular hazards• Can create poor visibility conditions• Can be expensive

Cost: Varies depending on materials, length and width of application area

13. Colored Pavements

Description: Pavement can be installed with many different colors and patterns. These unique properties can slow drivers by forcing them to process different patterns as they approach an area. Colored pavement can also help delineate the separation between a travel lane and lanes that accommodate other modes of transportation.



Advantages	Disadvantages
<ul style="list-style-type: none">• May reduce speeds and volumes• Positive aesthetic effect• Good Functionality• Increases pedestrian safety• Improves quality of life for neighborhood• No impact to emergency response times	<ul style="list-style-type: none">• Can create vehicular hazards• Can make roadway features difficult to see if installed too densely• Increased maintenance• Surface can be slick – hazardous to pedestrians and cyclists

Cost: Varies depending on materials, length and width of application area

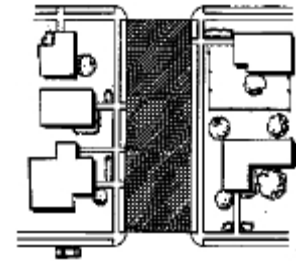
Vertical Traffic Calming Measures

Vertical traffic calming measures provide variations in pavement height and materials to cause discomfort to vehicles operating in an unsafe manner. The following vertical traffic calming measures are included in this section:

14. Textured Pavements
15. Speed Humps
16. Speed Lumps
17. Speed Tables
18. Raised Crosswalks
19. Raised Intersections

14. Textured Pavement

Description: Textured pavements can alert motorists to special conditions through sound and/or vibration. Rumble strips are typical example of how textured pavement can produce a sound to warn a driver approaching a hazardous condition. Textured pavements combined with colored pavements to delineate a special area, such as a historic district. Brick pavers are a form of textured pavement.

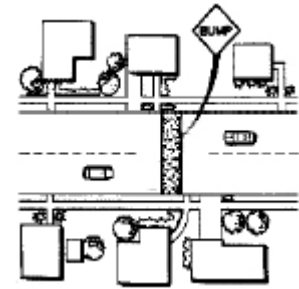


Advantages	Disadvantages
<ul style="list-style-type: none"> • May reduce vehicle speeds • May add aesthetic value • If used at an intersection, can calm two streets at once • Little or no impact to emergency response times 	<ul style="list-style-type: none"> • Textured materials are expensive • Increased noise • Difficult for physically challenged individuals to maneuver • Increased maintenance costs

Cost: Varies with material and area of installation

15. Speed Humps

Description: Raised hump (pavement undulation) in the roadway with a parabolic top which extends across the road at right angles to the direction of traffic flow. Most effective if used in a series; spaced 300'-500' apart



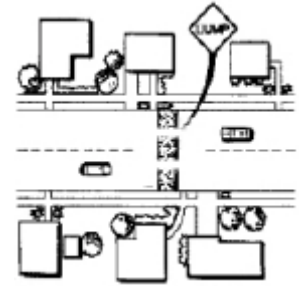
Advantages	Disadvantages
<ul style="list-style-type: none"> • Effective in reducing speeds • Compatible with pedestrian and bicycle movements • May also decrease cut-through traffic by increasing travel time • Inexpensive 	<ul style="list-style-type: none"> • Increased noise when vehicles travel over them • Increased maintenance costs • Slows emergency vehicles and buses • Aesthetics • Can be very uncomfortable to vehicle occupants with certain disabilities

Cost: \$1,500-\$2,000

STREETS WITH SPEED HUMPS WILL NOT BE ELIGIBLE FOR SNOW PLOWING

16. Speed Lumps

Description: Speed lumps are a variation of speed humps that add two cut-outs for tires of larger vehicles. The cut-outs are designed so that wider vehicles, such as emergency vehicles, can fit through with little slowing but a standard vehicle must pass at least one side of its wheels over the hump.



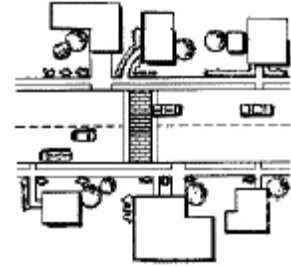
Advantages	Disadvantages
<ul style="list-style-type: none"> • Effective in reducing speeds • Maintains rapid emergency response time • Inexpensive • Relatively easy for bicyclists to cross if installed correctly 	<ul style="list-style-type: none"> • Aesthetics • Private vehicles with large wheel bases can avoid the humps • Increased noise • Increased maintenance costs • Can be very uncomfortable to vehicle occupants with certain disabilities

Cost: \$1,800 - \$2,500

STREETS WITH SPEED LUMPS WILL NOT BE ELIGIBLE FOR SNOW PLOWING

17. Speed Tables

Description: Speed tables are elongated speed humps with flat tops that usually allow for the entire wheel base of a standard vehicle to be on the top flat part. Usually, a textured pavement or alternate design is used to distinguish the speed table from the rest of the roadway.



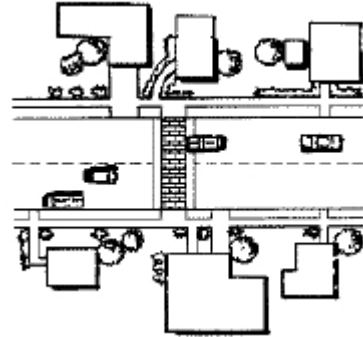
Advantages	Disadvantages
<ul style="list-style-type: none"> • Smoother than humps for larger vehicles • Effective in reducing speeds • Compatible with pedestrian and bicycle movements • May also decrease cut-through traffic by increasing travel time 	<ul style="list-style-type: none"> • Aesthetics, if decorative surface material is not used • Decorative materials are expensive • Increased noise • Increased maintenance costs • Slows emergency vehicles and buses • Can be very uncomfortable to vehicle occupants with certain disabilities

Cost: \$1,500 - \$4,000 each (depending on materials)

STREETS WITH SPEED TABLES WILL NOT BE ELIGIBLE FOR SNOW PLOWING

18. Raised Crosswalks

Description: Raised crosswalks are equivalent to speed tables with crosswalk markings. Should be accompanied by appropriate signage.

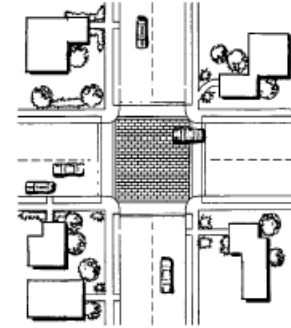


Advantages	Disadvantages
<ul style="list-style-type: none"> • Smoother than humps for larger vehicles • Effective in reducing speeds • Increases visibility for pedestrians • Slows vehicular traffic at conflict point with pedestrians • Better than a simple crosswalk for visually impaired pedestrians • May also decrease cut-through traffic by increasing travel time 	<ul style="list-style-type: none"> • Aesthetics, if decorative surface material is not used • Decorative materials are expensive • Increased noise • Increased maintenance costs • Slows emergency vehicles and buses • Can be very uncomfortable to vehicle occupants with certain disabilities

Cost: \$1,800 - \$4,500 (depending on materials)

19. Raised Intersections

Description: Raised intersections are equivalent to speed tables, only they are applied over the entire intersection with ramps on all sides. They are normally at or near the same elevation as the sidewalk. Often include textured and/or colored pavements.



Advantages	Disadvantages
<ul style="list-style-type: none"> • Smoother than humps for larger vehicles • Effective in reducing speeds • Increases visibility for pedestrians • Slows vehicular traffic at conflict point with pedestrians • May also decrease cut-through traffic by increasing travel time 	<ul style="list-style-type: none"> • Aesthetics, if decorative surface material is not used • Decorative materials are expensive • Increased noise • Increased maintenance costs • Slows emergency vehicles and buses • Can be very uncomfortable to vehicle occupants with certain disabilities

Cost: Varies by material used and intersection size

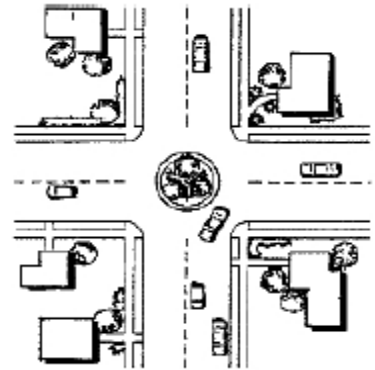
Horizontal Traffic Calming Measures

Horizontal traffic calming measures use items such as raised islands and traffic circles to eliminate straight-line travel that allows high speeds. These horizontal traffic control measures are included in this section:

20. Traffic Circles
21. Roundabouts
22. Curb Extensions
23. Chicanes
24. Lateral Shifts
25. Neckdowns
26. Realigned Intersections
27. Bulbouts
28. Two-Lane Chokers
29. One-Lane Chokers
30. Center Island Narrowing
31. Medians

20. Traffic Circles

Description: Provides circular, counter-clockwise operations at intersections by placing a raised island in the middle of the intersection. Vehicles on the ‘thru’ street must change their travel path to maneuver around the circle. Entry into the intersection is often controlled by Yield signs on all approaches.



Advantages	Disadvantages
<ul style="list-style-type: none"> • May significantly reduce speeds on the ‘thru’ street • Reduces intersection collisions • Provides additional street aesthetics • May be used as a volume control device without limiting access 	<ul style="list-style-type: none"> • May require the removal of parking near intersection • May cause sight distance problems for vehicles • Depending on size and location, may have high installation costs • May impact emergency response times • May impede large vehicles

Cost: ~~\$5,000~~ ~~\$10,000~~ \$10,000 = \$20,000

21. Roundabouts

Description: Similar to traffic circles but larger and with “splitter” islands on each approach that flare entry into the circle. They are more typically used as a substitute for a traffic signal. Traffic on the approaches must yield to vehicles within the circle.



Advantages	Disadvantages
<ul style="list-style-type: none"> • Reduces vehicle speeds • Eliminates typical left-turn conflicts • In the long run, more economical to maintain than a traffic signal • Adds to street aesthetics • Reduces crash severity at intersections 	<ul style="list-style-type: none"> • Often requires a large amount of right of way • May require additional lighting to lessen driver confusion at night • Not a typical traffic calming measure for local streets (used more for collectors and minor thoroughfares) • Initial costs are high

Cost: Single lane roundabout \$20,000-\$120,000 (Varies depending on Right-of-Way requirements)

22. Curb Extensions

Description: Used to make pedestrian crossing movements shorter and easier. Used to narrow the roadway cross-section at particular points (intersection, mid-block, etc.) but still maintains separate lanes for opposing traffic flows. Often used in combination with a raised crosswalk.

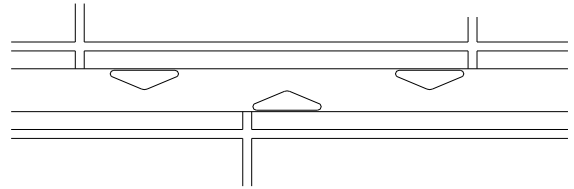


Advantages	Disadvantages
<ul style="list-style-type: none">• Narrows street width to encourage slower vehicle traffic at specific points• Shortens pedestrian crossing distance and makes pedestrians more visible• May facilitate more on-street parking spaces• Intended to reduce vehicle speeds	<ul style="list-style-type: none">• Conflicts with flow of bicycle lanes• Requires removal of some on-street parking

Cost: \$7,000-\$10,000/pair

23. Chicanes

Description: Physical constriction built at the curbside of the roadway to create bends in a formerly straight road. Vehicles are forced to negotiate the narrowed street in a serpentine fashion. Retrofitting an existing street typically allows only one lane through the chicane so that opposing traffic must alternate passage through the constraints.

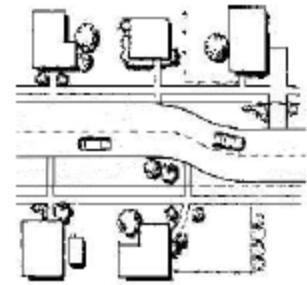


Advantages	Disadvantages
<ul style="list-style-type: none"> • Typically results in lower speeds • One lane chicanes can significantly reduce cut-through traffic • Can be aesthetically pleasing 	<ul style="list-style-type: none"> • May lead to an increase in head-on collisions • Higher maintenance costs • Can severely impact emergency response times • Should not be used in areas with frequent driveways • Loss of on-street parking

Cost: \$4,000 - \$8,000 (depends on length of road affected)

24. Lateral Shifts

Description: A lateral shift is a curb extension which shifts the roadway horizontally. A second shift downstream may move the roadway back to the original alignment. These are also frequently called two-lane chicanes.



Advantages	Disadvantages
<ul style="list-style-type: none"> • Is an effective tool for slowing traffic on high volume streets • Easy functionality for large vehicles 	<ul style="list-style-type: none"> • Less effective for reducing speeds than a one lane chicane • Proper design is crucial to avoid lane changing by vehicles • Loss of on street parking • May require additional right-of-way

Cost: Varies by length, width and shift distance

25. Neckdowns

Description: Neckdowns like the one pictured below, are used to make streets more pedestrian-friendly by shortening the crossing distance and reduce speed by narrowing the travel lanes.

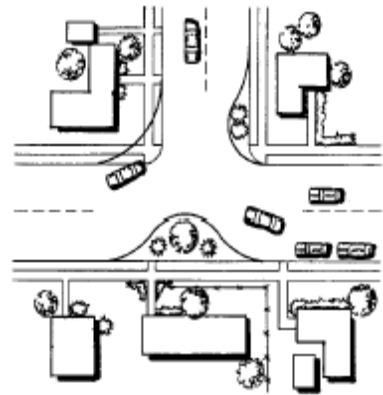


Advantages	Disadvantages
<ul style="list-style-type: none">• Increased pedestrian safety and range• Reduces speeds	<ul style="list-style-type: none">• May require bicyclists to merge with traffic• May slow emergency vehicles• Loss of on-street parking

Cost: \$4,000 - \$6,000

26. Realigned Intersections

Description: Realigned intersections are changes in alignment that convert T-intersections with straight approaches into curving streets that meet at right angles. A former “straight-through” movement along the top of the T becomes a turning movement. This is one of the few traffic calming measures available for T-intersections.

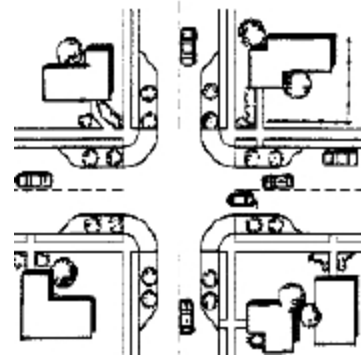


Advantages	Disadvantages
<ul style="list-style-type: none"> • Reduces speeds at T-intersections • Can reduce cut-through traffic by reassigning right of way at an intersection 	<ul style="list-style-type: none"> • Typically requires additional right-of-way on one corner • Construction can be costly • May have minor impacts on emergency response times

Cost: Varies with the magnitude of the project

27. Bulbouts

Description: Similar to curb extensions at intersections. Used to narrow the street width to help facilitate pedestrian movements and reduce speeds on one or more approaches.

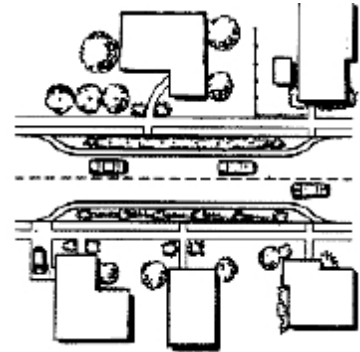


Advantages	Disadvantages
<ul style="list-style-type: none"> • Reduces vehicle speeds near intersection • Makes pedestrian crossing safer and easier • Improve sight line between vehicle and pedestrians • May help accommodate pedestrians with disabilities • May facilitate more on-street parking 	<ul style="list-style-type: none"> • Does not accommodate bicycle paths • May affect turning movements (especially for larger trucks)

Cost: ~~\$4,000 - \$5,000~~ \$5,000 - \$10,000 per corner

28. Two-Lane Chokers

Description: Two-lane chokers are used at mid-block points to reduce the overall cross section of the street providing a natural slow down point.

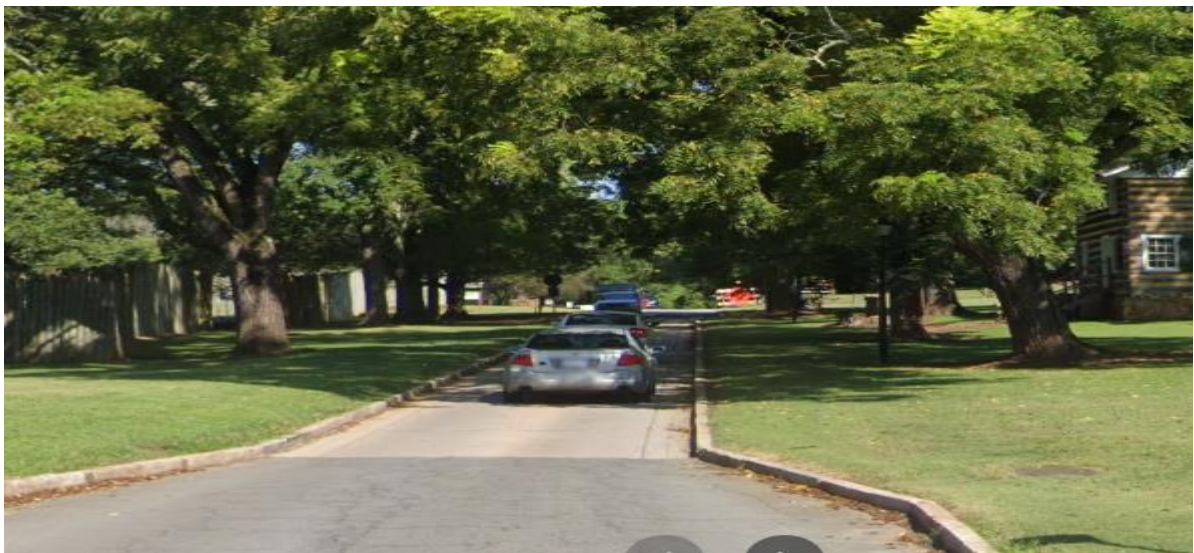
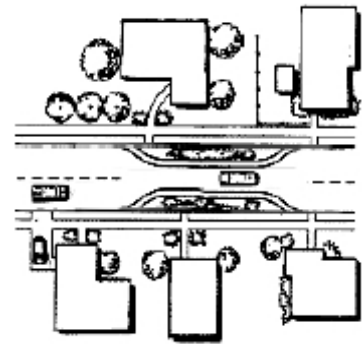


Advantages	Disadvantages
<ul style="list-style-type: none"> • May reduce speeds • May reduce volumes • Positive aesthetic effect • Good functionality • Provides safer pedestrian crossings • May encourage more use of on-street parking • No impact to emergency response times 	<ul style="list-style-type: none"> • No vertical and little or no horizontal deflection • Loss of on-street parking • Bicyclists may have to merge with traffic

Cost: \$7,000 - \$10,000

29. One-Lane Chokers

Description: Curb extensions toward the center of the roadway that reduce the street from two lanes to one lane. This requires vehicles to come to a stop and yield to on coming traffic.

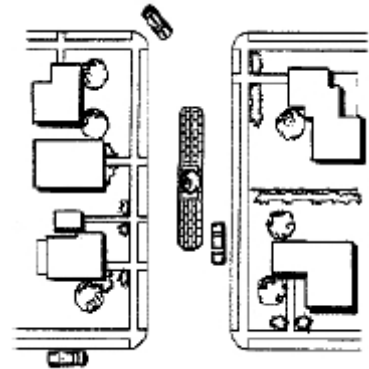


Advantages	Disadvantages
<ul style="list-style-type: none"> • Reduces speeds and volumes • Positive aesthetic effect • Good functionality • Safer pedestrian crossings 	<ul style="list-style-type: none"> • Loss of on-street parking • Bicyclists may have to merge with traffic • Opposing vehicles trying to use same space • Can significantly delay emergency vehicles

Cost: \$7,000 - \$10,000

30. Center Island Narrowing

Description: Narrowing of the roadway with a raised center island, typically planted, between the travel lanes. They also provide a pedestrian refuge thereby allowing pedestrians to cross one travel lane at a time.

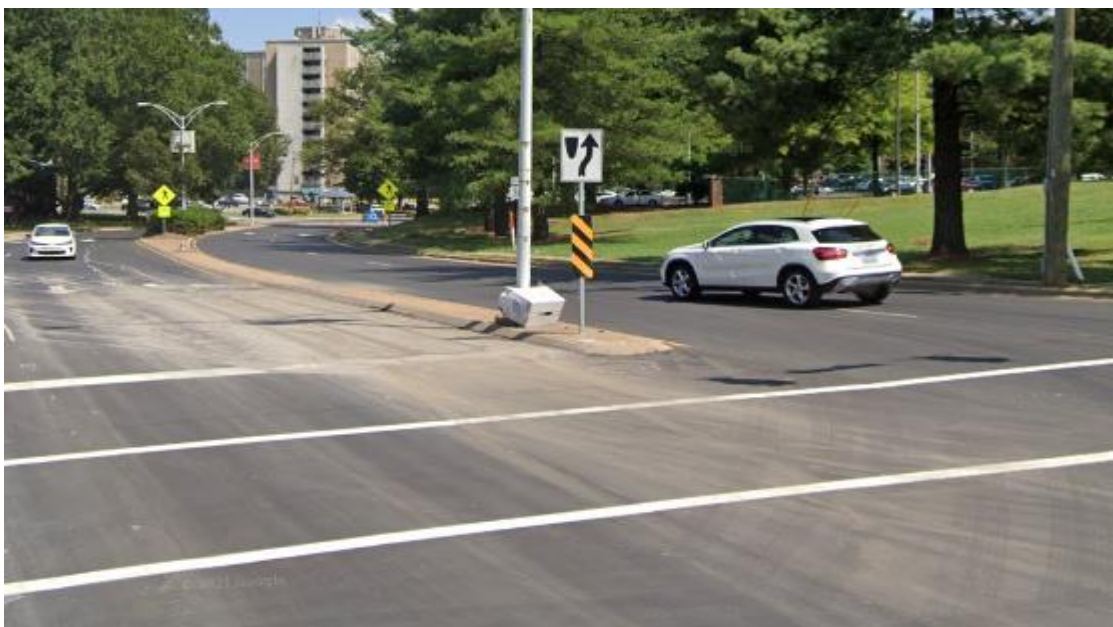
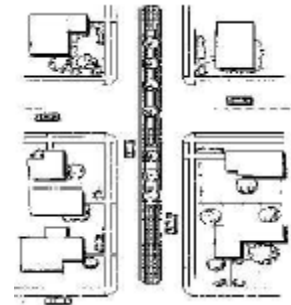


Advantages	Disadvantages
<ul style="list-style-type: none"> • May reduce speeds and volumes • Positive aesthetic effect • Good functionality • Increases pedestrian safety 	<ul style="list-style-type: none"> • Loss of on-street parking • Can impact emergency response vehicles if lanes made too narrow • Should not be used in areas with frequent driveways

Cost: Varies depending on size and material

31. Medians

Description: Used to separate lane movements and provide a visual cue along the roadway. Medians can be especially effective along curves. Medians can also be used as a diversion device by restricting access at intersections and to adjacent properties.



Advantages	Disadvantages
<ul style="list-style-type: none"> • Prevents any passing maneuvers along roadway • Provide area for street landscaping • Reduces vehicle speeds, along a curve • Provides pedestrian refuge area and aids crossing maneuvers • Can be used to restrict movements at intersections 	<ul style="list-style-type: none"> • May require parking removal • Can be costly • May limit access depending on length of median section • May reduce sight distance depending on roadway alignment, size of median • May impact emergency response times

Cost: Varies depending on size and material

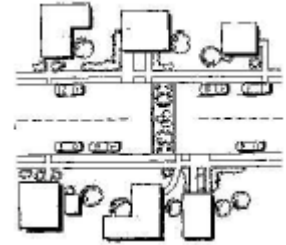
Diversion Traffic Calming Measures

Diversion measures change the flow of traffic and limit or eliminate certain movements. Diversion measures should only be used as a final option when any of the previously mentioned measures have not yielded the desired results. Even in these cases, Diversion measures should be implemented only with careful planning. Diversion measures should not be considered on primary emergency routes unless provisions can be made to maintain access for emergency vehicles. The following Diversion measures are included in this section:

- 32. ~~Street Closures~~
- 33. Diagonal Diverters
- 34. Semi-diverters

32. Street Closures

~~**Description:** Barrier or pavement removal intended to block all vehicle access on a street. Pedestrian and bicycle access is typically maintained. Often designed to allow emergency vehicles to ‘break-through’ the closure. Cul de sacs are a common form of this measure.~~

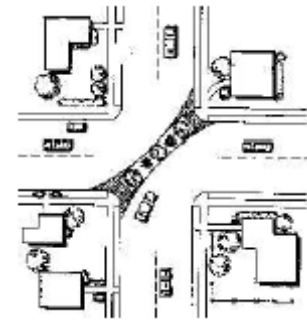


Advantages	Disadvantages
<ul style="list-style-type: none"> • Eliminates through traffic • Reduces speeds • Improves safety for all modes of transportation 	<ul style="list-style-type: none"> • Limits access • Creates problems for emergency vehicles • Often need to construct turn-arounds or cul-de-sacs near the closure point

~~**Cost:** ~\$20,000 (Dependent on Size)~~

33 32. Diagonal Diverters

Description: Diagonal diverters bisect an intersection diagonally, disconnecting the legs of the intersection and creating two separate roadways. This can be accomplished with a simple barrier such as guardrail or through pavement removal and landscaping. Pedestrian and bicycle access is typically maintained. Can be designed to allow emergency vehicles to ‘break-through’ the barrier.

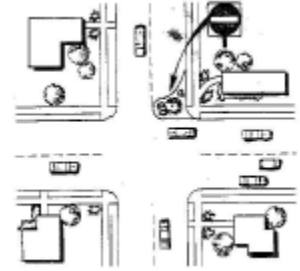


Advantages	Disadvantages
<ul style="list-style-type: none"> • Reduces speeds and volumes • Can be an aesthetic enhancement • Good Functionality • Increases pedestrian safety • Improves quality of life for neighborhood 	<ul style="list-style-type: none"> • Can create vehicular hazards • Can create poor visibility conditions • Can be expensive • Potentially severe impacts on emergency response times

Cost: Varies depending on size and materials

34-33. Semi-diverters

Description: A semi-diverter is a barrier, usually a landscaped island, on one side of a street at an intersection that permits traffic on the opposite direction to pass through; thereby creating a one-way street at the intersection but maintaining two-way traffic for the rest of the block.



Advantages	Disadvantages
<ul style="list-style-type: none"> • Reduces volumes • Positive aesthetic effect • Good Functionality • Increases pedestrian safety • Improves quality of life for neighborhood • Limits cut-through traffic 	<ul style="list-style-type: none"> • Can create vehicular hazards • Restricts access at all times - not just during peak periods • Can create poor visibility conditions • Can be expensive • Does not control speed • May impact emergency response times

Cost: Varies with application size.