

Upper Moreland Township Traffic Calming Policy Handbook



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TABLE OF CONTENTS

	Page
CHAPTER 1 – INTRODUCTION	1
<i>What is Traffic Calming</i>	1
<i>Multiple Purposes of Traffic Calming</i>	1
<i>An Integrated Approach to Traffic Calming</i>	2
CHAPTER 2 – TRAFFIC CALMING ISSUES	3
<i>Funding</i>	3
<i>Legal</i>	4
<i>Emergency Services</i>	4
<i>Landscaping</i>	4
<i>Snow Removal</i>	5
<i>Drainage</i>	5
<i>ADA Requirements</i>	5
CHAPTER 3 – TRAFFIC CALMING TOOLBOX	6
<i>Application of Tools</i>	6
<i>Level 1 Traffic Calming Tools</i>	7
<i>Level 2 Traffic Calming Tools</i>	7
<i>Combining Traffic Calming Measures</i>	8
<i>Use of Temporary Measures</i>	8
CHAPTER 4 – TRAFFIC CALMING IMPACTS	10
<i>Travel Speeds</i>	10
<i>Traffic Volumes</i>	11
<i>Collisions</i>	12
<i>Emergency Responsiveness</i>	12
CHAPTER 5 – IMPLEMENTATION PROCESS	15
<i>Step 1: Identification/Request for Study with Supporting Data</i>	15
<i>Step 2: Level 1 Traffic Calming Plan Development and Acceptance Process</i>	17
<i>Step 3: Level 2 Traffic Calming Plan Development</i>	17
<i>Step 4: Approval Process</i>	19
<i>Step 5: Installation and Evaluation</i>	20

LIST OF TABLES

Number		Page
3.1	Generalized Assessment of Traffic Calming Measures	9
4.1	Speed Impacts Downstream of Traffic Calming Measures	10
4.2	Volume Impacts of Traffic Calming Measures	11
4.3	Average Annual Collision Frequencies Before and After Traffic Calming	12
4.4	Emergency Response Time Study Results	13

LIST OF FIGURES

Number		Page
5.1	Neighborhood Traffic Calming Implementation Process	22

FORMS

Community Action Request Form	23
Neighborhood Traffic Calming Prioritization	24
Appendix A – Level 1 Measures	A1-A9
Appendix B – Level 2 Measures	B1-B20

CHAPTER 1 – INTRODUCTION

This Traffic Calming Policy is adopted by Upper Moreland Township to help address concerns and inquiries from Township residents regarding speeding and cut-through traffic in their neighborhoods. Neighborhood livability and sustainability are important qualities that the Township strives to maintain. Speeding and high cut-through traffic on neighborhood streets can create an atmosphere in which non-motorists feel intimidated, or even endangered. This comprehensive Traffic Calming Policy is intended to provide Township residents a process by which appropriate measures to deter such behavior could be evaluated and implemented.

What is Traffic Calming?

The term “traffic calming” is defined differently throughout the United States and the world. The Institute of Transportation Engineers (ITE), an international association of transportation professionals, defines traffic calming as follows:

“Traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users.”¹

Several resources have been written on the practice of traffic calming which highlight details on design policies and procedures, as well as effectiveness and implementation. This Traffic Calming Policy draws primarily upon two resources in developing Upper Moreland Township’s traffic calming program: “Traffic Calming–State of Practice” developed by ITE dated August, 1999 and PennDOT’s Publication No. 383 entitled “Pennsylvania’s Traffic Calming Handbook”, last dated January 2001. Both documents provide greater detail on Traffic Calming than what is presented in this handbook and should be used as supplemental resources.

Multiple Purposes of Traffic Calming

The immediate purpose of traffic calming is to reduce the speed and volume of traffic to “acceptable” levels. Reductions in traffic speed and volume, however, are just means to other ends such as traffic safety and active street life.² Traffic calming is undertaken for many different reasons, including, but not limited to:

- Reducing through traffic
- Reducing truck traffic
- Reducing the occurrence of excessive speeding
- Reducing noise, vibration and air pollution
- Reducing accidents
- Providing safer environment for pedestrians, children, and bicyclists
- Reducing crime
- Supporting redevelopment

¹ “ITE Traffic Calming Definition,” ITE Journal, Vol. 67, July 1997.

² “Traffic Calming, State of the Practice,” ITE, August 1999.

As is discussed later in this handbook, many different traffic calming tools or measures are available to achieve the above goals, and are also recognized by the Pennsylvania Department of Transportation.

An Integrated Approach to Traffic Calming

Upper Moreland Township’s Traffic Calming Program is intended to help address the “too many cars, going too fast by my house” syndrome by working closely with our residents to identify existing problems, define neighborhood goals, and garner community support. The program relies heavily on community participation and action, as well as the ability to fund and maintain implemented measures of traffic calming.

After the identification of a neighborhood problem, Township staff and residents will use an integrated approach to develop reasonable measures that consider the “4 Es”:

Education
Enforcement
Engineering
Enhancement

- **Education:** Residents are provided with information and tools necessary to make informed decisions about neighborhood traffic concerns.
- **Enforcement:** Community identified strategies can be put into effect through targeted traffic enforcement.
- **Engineering:** Through a Township staff and resident partnership, physical traffic calming strategies are developed based on accepted standard engineering principles, community input and acceptance, financial constraints for design, construction, and maintenance, and also legal implications.
- **Enhancement:** Design and landscaping features can be used to improve the aesthetics and livability of neighborhood and to enhance many physical measures.

Elements of one or more of the “4 Es” are incorporated into all of the traffic calming tools considered by the Township. After development of a community-driven, neighborhood traffic calming plan, actions may be implemented using a staged approach upon Township’s approval and prioritization through a systematic approach and selection process.

The Township’s integrated traffic calming approach includes an essential community involvement program. Community involvement and “buy-in” is a requisite. Because for every action there is an opposite reaction – be it diversion of traffic to another roadway, or neighborhood opposition to particular traffic calming devices – all Township traffic calming projects invite the need for considerable resident involvement.

CHAPTER 2 – TRAFFIC CALMING ISSUES

Funding

Funding for the installation and maintenance of traffic calming measures vary dependent upon the complexity, cost and other factors specific to the proposed project. To date, no revenue sources have been designated at the State or Federal levels to specifically fund the implementation of traffic calming projects. Therefore funding for most various traffic calming measures may require that neighborhood residents assume financial responsibility for part or all of the costs associated with the installation and maintenance of such measures. When applicable, the Upper Moreland Township Board of Commissioners will determine the extent of contribution required from the residents and the method by which it should be collected.

Liquid Fuel funds can be considered for a traffic calming projects. However Liquid Fuels funds that the Township currently receives are earmarked to the maintenance of the many local roads and additional funds specifically for implementation of traffic calming measures are not available. If the Township deems use of Liquid Fuels funds is appropriate, the Township will need to contact PennDOT's Municipal Services representative at PennDOT District 6-0. The Township recognizes that in order to utilize Liquid Fuels funds for traffic calming, the measure may not deprive the road of its public character by limiting its use, thus making it ineligible to use these funds.

Traffic calming measures may also be planned and budgeted into a following (future) year's capital improvement program or funded with general funds, or other available source, as determined by the Upper Moreland Board of Commissioners. Such sources may include an added property tax in a specific local improvement district, developing bond initiatives specific to traffic calming or seeking funds from grants that support traffic management programs such as a Community Development Block Grant (CDBG) from Montgomery County.

The specific type of funding to be utilized for a traffic calming measure is included as a question on the Community Action Request Form for the neighborhood requesting the potential implementation of a traffic calming measure in their neighborhood. The funding source should be greatly considered by those requesting traffic calming studies and/or measures due to the limited financial resources available to the Township. The Request Form question also asks the community what their financial commitment toward implementation of a traffic calming measure will be, should the request favorably make it through the process. Given that each Community Action Request for a traffic calming measure will also be subject to a ranking system to prioritize potential projects, the Upper Moreland Township Board of Commissioners, under advisement from its appointed local Traffic Calming Committee, will determine the appropriate source of funding for each traffic calming project.

Lastly, if traffic calming measures are proposed for installation on PennDOT's designated roadways, a written agreement, as outlined in Chapter 2 of "Pennsylvania's Traffic Calming Handbook" between Upper Moreland Township and PennDOT is necessary to outline funding responsibilities.

Legal

The legal issues outlined in Chapter 3 of “Pennsylvania’s Traffic Calming Handbook” are considered to also be part of this document, as well. Reference to these issues can be found in that resource. In summary, they provide general guidance to installation of traffic calming measures pursuant to the laws of Pennsylvania and the Vehicle Code (which should also be referenced). Changes in the law may affect the principles outlined in Pennsylvania’s Traffic Calming Handbook, and the laws should be checked prior to implementation during the planning stage when traffic calming devices are being sought for use in Upper Moreland Township.

Many local governments across the United States and overseas have successfully implemented traffic calming programs. Few have encountered liability issues by maintaining documentation that illustrates that their program is appropriate, and that installation of their traffic calming measures are based on objective data with procedures being followed when considering and installing such measures. Upper Moreland Township has thus adopted a traffic calming study and approval process (see Chapter 5) to accomplish the goal of also addressing liability issues.

Through its implementation process, Upper Moreland Township will design, implement, and maintain the accepted traffic calming measures so that drivers, pedestrians, and bicyclists acting reasonably and exercising ordinary care are able to perceive the intent of the measure and safely negotiate it. Acceptable traffic calming measures shall conform to standard engineering principles, as best as possible.

Emergency Services

Studies show traffic calming features may cause delay in emergency response times to residences in neighborhood areas where traffic calming projects have been installed. Property owners participating in the Traffic Calming Program will be provided information regarding the potential delay of emergency services due to traffic calming features. However, traffic calming features and reduced vehicular speeds may also reduce the number of incidents requiring emergency services, due to the increased safety on the roadways within a traffic calmed area.

Traffic calming on roads designated as "Arterials" will be limited to features that do not include vertical deflection. Vertical features may not be permitted on roadways designated as “Collectors” and "Primary Access for Emergency Services" unless agreed to by EMS. The Fire Marshal's Office determines those roads designated as "Primary Access Routes for Emergency Services". The Police Department and Fire Marshal's Office participate in the planning process and will be notified when and where the construction of traffic calming features occurs.

Landscaping

When deciding what types of landscaping to use for a traffic calming measure, one must always consider sight distance requirements and whether the landscaping will introduce “fixed objects” which may pose a potential hazard if struck by errant vehicles. In certain applications, large trees, rocks, and other similar objects could pose a potential hazard to motorists and pedestrians. In these situations, smaller shrubs and plants that do not pose a safety concern should be considered. Along with the safety concerns of introduced a “fixed object”, the landscaping may also become a sight distance

problem as the plants mature if they are improperly placed, not maintained, or if the wrong types of plantings are used. For this reason, it is important to consider plant type, growth, and location when landscaping is being considered.

Snow Removal

Many of the traffic calming measures identified in this Handbook may have an effect on the removal of snow and ice. Therefore, measures should be clearly identified and equipment operators made aware of the types of measures that are installed. Doing so will improve the snow removal operation and help prevent damage to the snow removal equipment or the measure itself.

Drainage

The installation of traffic calming measures may change the drainage patterns of the roadways on which they are located. It is very important to review drainage characteristics when determining which measures are most appropriate. Otherwise, problems such as ice/water accumulation on a pedestrian crossing or roadway could occur.

ADA Requirements

Traffic calming measures must be designed to accommodate all people in the community. To accomplish this goal, measures that are implemented to improve pedestrian safety, or have an effect on pedestrian travel, must be designed to meet the requirements set forth in the Americans with Disabilities Act (see Chapter 3, Part 6, Page 11). However, the diagrams of the traffic calming measures in Chapter 5 are not intended to represent actual site conditions or to depict the requirements set forth by the Americans with Disabilities Act.

CHAPTER 3 – TRAFFIC CALMING TOOLBOX

Before considering any traffic calming tool or a combination of tools, it is important to clearly understand residents' concerns and the factors or conditions that generated those concerns. Traffic calming tools come in all shapes and sizes, from the subtle to the very aggressive. Each tool has appropriate applications, limitations on its use, advantages, disadvantages, and costs associated with it. Sometimes all that may be needed to alleviate high speeds along a residential street is increased neighborhood awareness or police enforcement of speed limits. Physical devices, such as speed humps, may be often well-suited for speed control, but may create increased noise and possibly produce maintenance or safety concerns. Therefore, if residents are concerned with both speed and noise, the installation of speed humps may not be the best choice at particular locations. It is important to understand all of the issues associated with each tool to identify the most appropriate one for the circumstances.³

It is also important to recognize that if cut-through traffic is the problem (as determined by traffic counts in the traffic study phase of the Township process), it suggests one set of measures. If speeding is the problem (as determined by speed measurements), it suggests another set. High collision rates, crime, or urban blight may suggest a third set.⁴

In any case, this policy establishes a hierarchy and classification of the Township's roadways. Certain types of traffic calming tools may not be applicable or acceptable to place on roadways designated for their purposeful use. The Township will help to guide those decisions on their roadways, while PennDOT will need to approve any form of traffic calming measures on their highways.

Application of Tools

Traffic calming measures may be considered on the following Upper Moreland Township roadway types (local or State-owned) based on functional classification, land use patterns, and posted speed limits:

- Local residential access streets
- Residential collector streets with predominantly residential land uses and limited driveways/frontages
- Arterial roads within downtown districts or commercial areas (with posted speeds of 40 mph or less)

Whenever necessary, the Upper Moreland Planning & Development director, traffic consultant, and/or engineer may be required to provide assistance in identifying the functional classification of project area roadways. Only specific circumstances with documented and presented engineering evidence for the safety and benefit of use of traffic calming measures on other types of road classifications will be considered by the Township Commissioners.

³ "Traffic Calming Primer," Pat Noyes & Associates, 1998.

⁴ "Traffic Calming, State of the Practice," ITE, August 1999.

Although traffic calming measures may be appropriate in downtown districts and commercial areas, the applications are typically limited to less intrusive types of traffic calming measures, such as bulb-outs, mid-block islands and textured crosswalks. In locations where posted speed limits are 30 mph or less, a wider variety of measures may be appropriate, especially where pedestrian activity is high.

Many Pennsylvania and U.S. numbered traffic routes are intended to serve a large percentage of through traffic. On these routes, traffic calming measures may be inappropriate. State and U.S. routes where truck volumes are five (5) percent or greater may indicate that goods movement is an important function of the highway and traffic calming measures are likely undesirable.

As previously stated, if traffic calming is requested for a State road, or if State, Federal, or Liquid Fuels funds are used, approval from PennDOT District 6-0 is required. Preliminary discussions between Upper Moreland Township and PennDOT should occur prior to beginning the community involvement process identified in the Implementation Process of Chapter 5. This way major DOT concerns can be addressed before the community becomes involved.

Most traffic calming measures being used do not have “hard and fast” design criteria specified for them. PennDOT has its accepted measures in some cases to suit the State’s jurisdictional guidelines. Where specific design criteria are recommended by PennDOT, the specific design requirements are provided in this document, or should be as they are updated and amended in “Pennsylvania’s Traffic Calming Handbook.”

Table 3.1 provides a general assessment of traffic calming measures. Chapter 4 provides more specific detail on various measures’ effects on traffic speeds and volumes, vehicle collisions, and other quality of life measures.

Level 1 Traffic Calming Tools

Level 1 measures consist of easily implementable and low-cost tools, such as neighborhood traffic safety campaigns, radar speed display units, targeted police enforcement, sign installation, pavement marking changes, etc. Level 1 measures, as discussed in Chapter 4, will always be implemented and tested prior to consideration of more restrictive (Level 2) measures. Level 1 actions primarily consist of education and enforcement tools.

Appendix A provides a description to potential Level 1 traffic calming measures.

Level 2 Traffic Calming Tools

Level 2 actions alter the configuration of neighborhood streets, so they often require engineering, are higher-cost, and require community acceptance prior to installation. Level 2 measures are only used after Level 1 measures have been implemented and proven ineffective in addressing particular neighborhood traffic needs. Before Level 2 traffic calming actions are constructed, the neighborhood and Township staff must carefully evaluate the benefits and disadvantages of each action.

Appendix B provides a description of potential Level 2 traffic calming measures. It is often possible to combine elements of various Level 2 actions or to slightly modify treatments.

Combining Traffic Calming Measures

Often, the most effective traffic calming programs use a variety of traffic calming tools. Combinations of traffic calming measures can be used, and are often encouraged, in different neighborhoods and even along the same street. As shown in the toolbox of Level 1 and Level 2 applications, many of the measures complement each other. For instance, speed humps and chokers can be used effectively together, as can traffic circles and curb extensions. Center median islands and chokers are often installed as a set. Raised crosswalks and curb extensions work well together. Many other combinations of traffic calming tools can be effective.

Use of Temporary Measures

Whenever feasible, Upper Moreland Township will install temporary Level 2 traffic calming devices subject to an assessment of impacts and support of the residents. It should be noted that while the use of temporary devices help determine the resulting travel speed and traffic volume changes, temporary devices may usually not be aesthetic. Because of this, there is always the risk that residents will criticize the device's appearance instead of its effectiveness in traffic calming. However, the use of attractive materials, colors and composition can create acceptable temporary devices. For example, planters, which provide greenery as well as access control, can be used as temporary street closures.

Table 3.1 Generalized Assessment of Traffic Calming Measures

Measure	Reduces Speed	Reduces Traffic	Noise	Loss of Parking	Conflict Resolution	Restrict Access	Emrgny. Impacts	Main-tenance	Estimate of Cost
Level 1 Measures:									
Traffic Education Campaign	Maybe	Maybe	No change	None	No	None	None	No	Varies
Speed Display	Yes	No	No change	None	No	None	None	No	\$250/day
Neighborhood Signs/ Education Program	Maybe	Minimal	No change	None	No	None	None	No	\$200/sign
High Visibility Crosswalks	Maybe	No	No change	None	Some	None	None	Yes	\$50-\$150 /sq. yd.
Police Enforcement	Yes	Maybe	No change	None	No	None	None	No	\$75/hour
Narrowing Lanes	Yes	Minimal	No change	None	No	None	None	Yes	\$1K-\$3K
Defined On-Street Parking	Maybe	No	No change	None	No	None	Maybe	Yes	Varies
Speed Limit Signing	Maybe	No	No change	None	No	None	None	No	\$200/sign
Stop Signs (Multi-Way)	Maybe	No	Increase	None	Yes	None	Maybe	No	\$200/sign
Signing Restrictions/ Turn Prohibitions	No	Yes	No change	None	Yes	Yes	None	No	\$200/sign
Commercial Vehicle Prohibitions ⁽¹⁾	Maybe	Maybe	Decrease	None	Some	Yes	None	No	\$200/sign
Level 2 Measures:									
One-way Streets	No	Yes	No change	None	Some	Yes	Yes	No	\$5K
Median Island/ Pedestrian Refuge	Maybe	No	Decrease	Maybe	Some	Yes	None	No	\$5K-\$75K
Gateway	Yes	Yes	Decrease	Maybe	No	Yes	None	No	\$5K-\$20K
Curb Extension/ Bulb Out	Maybe	No	No change	Yes	Some	None	Some	Yes	\$5K-\$20K
Choker	Yes	Maybe	No change	Yes	Some	None	Some	No	\$15K
Speed Hump	Yes	Maybe	Increase	Maybe	Some	None	Yes	Yes*	\$1.5K-\$5K
Raised Crosswalk	Yes	Maybe	Increase	Yes	Some	None	Yes	Yes*	\$2K-\$10K
Raised Intersection	Yes	No	Increase	Yes	Some	None	Yes	Yes	\$15K-\$60K
Traffic Circle	Yes	Maybe	No change	Yes	Yes	None	Yes	Yes	\$18K-\$25K
Intersection Channelization	Yes	Maybe	No change	Yes	Some	None	None	Maybe	\$15K-\$20K
Chicane	Yes	Maybe	Maybe	Yes	No	None	Some	Maybe	\$6K-\$40K
Restricted Movement Barrier	Maybe	Yes	Decrease	None	Some	Yes	Yes	Yes	\$5K
Raised Median Through Intersection	No	Yes	No change	None	Yes	Yes	Yes	No	\$1.5K-20K
Right-in/Right-out Island	No	Yes	No change	None	Some	Yes	No	No	\$3.5K-\$7.5K
Diagonal Diverter	Yes	Yes	Decrease	Maybe	Some	Yes	Yes	No	\$7.5K-35K
Semi-Diverter	Maybe	Yes	No change	Maybe	Yes	Yes	Some	No	\$3K-\$20K
Street Closure	Yes	Yes	Decrease	Yes	Yes	Total	Yes	No	\$1.5K-35K

⁽¹⁾ Commercial vehicle restrictions on State highways may not be permissible.

*Speed humps and raised crosswalks must be reinstalled each time a street is resurfaced.

Sources: "Neighborhood Traffic Management & Calming Program," City of San Buenaventura, CA, 1997 and Parisi Associates.

CHAPTER 4 – TRAFFIC CALMING IMPACTS

This chapter describes some documented impacts of several types of traffic calming measures by the Institute of Transportation Engineers. Using qualitative and quantitative data available from before-and-after studies, the ability of various Level 2 devices to reduce travel speeds, cut-through traffic volumes, and collision potential are discussed. In addition, traffic calming measures' impact on emergency responsiveness is presented. Level 1 impacts are not discussed since very few before-and-after studies have been conducted on these types of traffic calming improvements.

As traffic calming measures are accepted from a “before” study and implemented within the Upper Moreland Township community, the Township officials and staff may often find it desirable to capture “after” implementation results for additional and more local data to monitor effectiveness. This “after” study is made part of the implementation process.

Travel Speeds

One of the primary goals of traffic calming is to reduce travel speeds on residential streets. In traffic engineering, speed distributions are typically represented by 85th percentile speeds since it is generally felt that at least 85 percent of the drivers operate at speeds which are reasonable and prudent for the conditions pertaining in each situation. Most of the speed data available from before-and-after studies of traffic calming are 85th percentile speeds.

Table 4.1 summarizes the speed impacts of various traffic calming measures. The data shown in the table is based on the results of hundreds of before-and-after studies.

Table 4.1 Speed Impacts Downstream of Traffic Calming Measures

Sample Measure	Sample Size	85 th Percentile Speed (mph)*			
		Avg. Before Calming	Avg. After Calming	Change After Calming	Percentage Change*
Speed hump	179	35.0	27.4 (4.0)	-7.6 (3.5)	-22 (9)
Raised crosswalk	58	36.7	30.1 (2.7)	-6.6 (3.2)	-18 (8)
Raised intersection	3	34.6	34.3 (6.0)	-0.3 (3.8)	-1 (10)
Traffic circle	45	34.2	30.3 (4.4)	-3.9 (3.2)	-11 (10)
Narrowing	7	34.9	32.3 (2.8)	-2.6 (5.5)	-4 (22)
Entrance barrier	16	32.3	26.3 (5.2)	-6.0 (5.2)	-19 (11)
Diagonal diverter	7	29.3	27.9 (5.2)	-1.4 (4.7)	-4 (17)

* Measures within parentheses represent the standard deviation from the average.
Source: “Traffic Calming, State of the Practice,” ITE, August 1999.

As shown in Table 4.1, speed humps have the greatest impact on 85th percentile speeds, reducing them by an average of more than seven miles per hour (mph), or 20 percent. Raised intersections and traffic circles have the least impact.

It should be noted that the speed impacts of traffic calming measures rely not only on the geometrics of the device, but the spacing between successive devices. Previous studies indicate that speeds increase about 0.5 to 1.0 mph for every 100 feet of separation for speed hump spaces up to 1,000 feet.

Traffic Volumes

Another primary goal of traffic calming is to reduce cut-through volumes on appropriate residential streets. Traffic volume impacts are much more complex and site-specific as compared to speed impacts because of the availability of alternative routes and the split of traffic between localized trips (that need to travel along the traffic calmed location) and through traffic (which can often take another route.)

Although traffic volume changes are difficult to assess, based on previous studies, two measures of impact are summarized in Table 4.2. The table provides information on average percentage change in daily traffic after treatment. The results shown in Table 4.2 should be viewed as representative only.

Table 4.2 Volume Impacts of Traffic Calming Measures

Sample Measure	Sample Size	Average Percent Change in Volume* (vehicles per day)
Speed hump	143	-18 (24)
Raised crosswalk	46	-12 (20)
Traffic circle	49	-5 (46)
Narrowing	11	-10 (51)
Entrance barrier	53	-42 (41)
Diagonal diverter	27	-35 (46)
Full closure	19	-44 (36)

* Measures within parentheses represent the standard deviation from the average.
Source: "Traffic Calming, State of the Practice," ITE, August 1999.

Traffic volume changes are usually the greatest when roadway closure devices are used, such as entrance barriers, diagonal diverters and cul-de-sacs. Of Level 2 measures, traffic circles typically have the least effect in reducing traffic volumes.

It should also be pointed out that while implementation of certain traffic calming devices can reduce traffic volumes along the intended route, they may also increase traffic volumes along nearby residential streets. This potential impact must be considered before deciding on which traffic calming tools are to be implemented.

Collisions

By slowing traffic, eliminating conflicting movements, and increasing drivers’ attention, traffic calming can result in fewer collisions. And, due to lower speeds, they are often less serious when collisions do occur.

Table 4.3 compares before-and-after collision frequencies for various Level 2 traffic calming measures. As shown, several traffic calming devices reduce the potential for collisions. Traffic circles are very effective, as they lower the number of potential vehicle conflict points (since no left-turn or straight-through movements are allowed).

Table 4.3 Average Annual Collision Frequencies Before and After Traffic Calming

Sample Measure	Sample Size	Average Annual Collisions		
		Before Calming	After Calming	Percentage Change
Speed hump	50	2.62	2.29	-13
Raised crosswalk	8	6.71	3.66	-45
Traffic circle	130	2.19	0.64	-71

Source: Unpublished documents supplied by traffic calming programs.

Many traffic calming measures not only reduce the potential for collisions between two or more vehicles, but also between vehicles and pedestrians or between vehicles and bicyclists. Several treatments improve the sign distance between these modes, and/or provide safe refuge areas for crossing non-motorized users. On the other hand, some measures that reduce travel lane widths could increase the potential for conflicts between vehicles and bicyclists.

Emergency Responsiveness

Any traffic calming tools that are effective due to their ability to physically control traffic could also negatively impact several classes of emergency vehicles. Upper Moreland Township and its residents place a very high priority on minimizing emergency response times.

Several localities have performed controlled tests of speed humps, raised crosswalks, and traffic circles to see how much delay they produce. Table 4.4 presents the test results.

Table 4.4 Emergency Response Time Study Results

Community	Measure	Delay at Slow Point (seconds)
Austin, TX	12-foot speed hump	2.8 (fire engine)
		3.0 (ladder truck)
		2.3 (ambulance w/out patient)
		9.7 (ambulance with patient)
Berkeley, CA	12 foot speed hump	10.7 (fire engine)
		9.2 (ladder truck)
	22-foot raised crosswalk	3.0 (fire engine)
		13.5 (ladder truck)
Boulder, CO	12-foot speed hump	2.8 (fire engine)
Montgomery Co., MD	25 foot traffic circle	7.5 (fire engine)
		12-foot speed hump
		2.8 (ladder truck)
		3.8 (ambulance)
	18-foot traffic circle	4.2 (fire truck)
		7.3 (pumper truck)
		5.4 (ladder truck)
		3.2 (ambulance)
Portland, OR*	14-foot speed hump	5.0 (fire truck)
		7.0 (pumper truck)
		5.2 (fire engine)
		2.9 (custom rescue vehicle)
	22-foot raised crosswalk	6.6 (ladder truck)
		3.0 (fire truck)
		0.3 (customer rescue vehicle)
		3.0 (ladder truck)
	16 to 24-foot traffic circle	6.1 (fire engine)
		3.1 (custom rescue vehicle)
		8.4 (ladder truck)
		9.5 (ambulance)
Sarasota, FL	12-foot speed hump	

* Assumes a 35-mph response cruising speed.

Source: "Traffic Calming, State of the Practice," ITE, August 1999

As shown in Table 4.4, regardless of the traffic calming measure or fire-rescue vehicle, the delay per traffic calming measure is nearly always under 10 seconds. Traffic circles appear to create longer delays than speed humps, but speed humps have a greater probability of damage to fire-rescue vehicles and injury to patients in ambulances. Finally, speed tables, because they are longer, create shorter delays than speed humps.

Consideration of traffic calming devices by Upper Moreland Township and its emergency services will always include a review of possible negative impacts, including emergency response times. On major designated emergency response routes, the Township, with input from its emergency service providers, may recommend that only traffic calming measures that will have little or no impact

on emergency response routes be permitted or provision of an acceptable altered design that improves emergency vehicle maneuvering and emergency access be completed.

Other items to be considered in selecting appropriate traffic calming measures are issues such as landscaping, snow removal, drainage, and ADA requirements to name a few. Detailed discussion of these potential issues can be found in PennDOT's "Traffic Calming Handbook."

CHAPTER 5 – IMPLEMENTATION PROCESS

The success to Upper Moreland Township’s Neighborhood Traffic Calming Program is support by the community and participation in the process. Because residents are primarily the initiators of traffic calming requests and must live day-to-day with the resulting actions, the Township includes neighborhood participation throughout the process. Development of successful traffic calming programs depends on strong interaction between the community, Township staff and consultants, and elected Township officials. A standing committee in Upper Moreland Township, known as the Traffic Calming Advisory Committee (TCAC), comprised of the Director of Planning & Development (Chairperson), the Township Traffic Consultant, the Police Chief, the Fire Marshall/Emergency Services, the Director of Public Works, and a representative from the Board of Commissioners will coordinate all requests for traffic calming measures.

One of the intents of the program is to provide a clear structure for addressing traffic concerns in the Township’s neighborhoods. Traffic concerns may exist throughout an entire neighborhood, or may be specific to a particular street, segment of roadway, or at a spot location. The Township’s implementation process consists of two levels, as shown in Figure 5.1. Both levels require, as a first step, community identification of existing problems. The process allows implementation of traffic calming tools in a timely manner in conditions where problems could be addressed with fairly routine solutions. The Township’s prioritization process provides the Township with clear guidelines on how to manage its limited resources effectively and appropriately when dealing with township-wide traffic calming needs. It also allows the Township to work with the neighborhoods that have the most pressing problems first. When a particular location reaches the top of the Township’s prioritization list, it may enter into the next phase of the traffic calming implementation process.

Step 1: Identification/Request for Study with Supporting Data

- A. The traffic calming process begins once the Township’s Director of Planning & Development receives a request from a neighborhood to initiate a study. Neighborhoods must complete a Community Action Request form. The form must include a discussion of the current traffic problem and the names and signatures of at least six other affected property owners supporting the request to initiate a study, the source of funding recommended, and the financial commitment of the neighborhood toward the traffic calming measure, if any. *A blank Community Action Request form is provided at the end of this section.*
- B. Upon receipt of the Community Action Request form, the Township’s Director of Planning & Development will pass along the request to the Traffic Calming Advisory Committee (TCAC) for review and will document the neighborhood concern. The Township will then gather preliminary information such as project area, street classification, and land use, as necessary, to determine if the project warrants further study. If it does NOT meet the preliminary requirements, then the group requesting the study will be sent a letter indicating that traffic calming is inappropriate.
- C. If the TCAC concludes that the preliminary requirements have been satisfied for further study, some essential base data will then be gathered by the Township’s traffic consultant or other qualified technical personnel, such as the traffic safety officer of the police department. All traffic studies conducted for a potential traffic calming program should be conducted in

accordance with the 67 PA Code, Chapter 201 (PennDOT Pub. 201 – Engineering and Traffic Studies), whenever applicable. To be considered for traffic calming measures, the following shall be considered as the minimum threshold requirements by the Township:

1. **Average Daily Traffic (ADT) volume:** The two-way ADT should exceed 1,000 vehicles per day OR the peak hour, two-way volume should exceed 100 vehicles.
 2. **Speed:** When speeding is a primary concern, the 85th percentile speed should exceed five (5) mph over the posted speed limit before traffic calming is considered. The 85th percentile speed should be obtained in the off-peak hours per Pub. 201. If the number of vehicles cannot be reasonably obtained for the 85th percentile speed, then average speed during off-peak hours can be used.
 3. **Cut-Through:** When cut-through traffic is a primary concern, the cut-through traffic on the residential collector or residential access street should be 40% or more of the total one-hour, single-direction volume. In addition, a minimum of 100 documented cut-through trips, through conduct of an origin-destination (license plate) study, in one hour, in a single direction will be the minimum requirement
 4. **Collision Data:** If collisions are a primary concern, accident records covering the most recent, past three years in their entirety should be retrieved through Township police and/or State records. The State’s definition of correctable accidents shall be applied when reviewing the data, although all accidents shall be considered in the review.
- D. If upon review of the preceding data, the TCAC concludes that the neighborhood’s identified problem can possibly be reduced or alleviated with a Level 1 action (e.g., easily implementable, low cost tools, primarily consisting of education and enforcement techniques), the TCAC will recommend those to the Board of Commissioners to program the implementation of the most appropriate Level 1 improvements as funding is available and as long as implementation is not controversial.
- E. If the TCAC determines that the identified neighborhood issue cannot be easily reduced or alleviated with a Level 1 action, or that the implementation of such an action may be controversial from an informal neighborhood survey, the Township will prioritize the level of the neighborhood traffic issue based on several factors, including traffic volumes, travel speeds, collision history, cut-through traffic levels, presence of schools and public facilities, and available/committed funding. The Township’s “Neighborhood Traffic Calming Priority Worksheet” will be used to accomplish this task. *A copy of this worksheet is also provided within this chapter.*
- F. To demonstrate Upper Moreland Township government support for traffic calming projects on residential/local roads which may then have an impact on State roads, or projects on State roads, the Township will pass a resolution approving further study. If the project for traffic calming is on a State road, the resolution must first be reviewed by PennDOT before proceeding.

Step 2: Level 1 Traffic Calming Plan Development and Acceptance Process

- A. Once the neighborhood traffic calming program priority process is reviewed by the TCAC and presented and accepted by the Commissioners, which will typically occur only twice per year (early Spring and early Fall), and a specific neighborhood(s) is/are approved and budgeted by the Commissioners for further study, the Director of Planning & Development will arrange a kick-off neighborhood meeting with the assistance of those residents that signed the original Community Action Request form. At the meeting, representatives of the TCAC will present findings from the initial field investigation and data collection phase, and provide an overview presentation of Upper Moreland Township's Neighborhood Traffic Calming Program.
Note: If Level 1 measures have general concurrence by the residents and are approved by the Commissioners for implementation (See 1D), then Step 2 is not necessary.
- B. A volunteer group of residents will form the project's Neighborhood Traffic Calming Committee (NTCC). A goal is to have members that represent the various geographical areas and interests within the neighborhood.
- C. The NTCC will work with at least three representatives of the TCAC and will meet to review existing problems, determine community goals, confirm the neighborhood study boundaries, discuss and evaluate the various Level 1 measures, and gain community acceptance on which Level 1 measures to implement as means of first addressing the problems. The group will also determine how long to implement the recommended Level 1 improvements, although a minimum testing period of three months will be required, with a minimum preferred of six months.
- D. Upon recommendation of the TCAC and approval by the Upper Moreland Board of Commissioners, the appropriate Level 1 improvements will then be installed. Following the pre-established implementation period, the Director of Planning & Development for the Township will have new data collected by its traffic consultant or other qualified technical personnel to determine the effectiveness of the measures put into place. The NTCC will then meet to discuss if their goals have been met.
- E. If the prescribed Level 1 actions have proven effective in addressing the goals, the improvements will stay in place, or more permanent devices will be installed. If the actions are ineffective, the NTCC may consider reapplying for a traffic calming plan (in three years) or pursue potential implementation of Level 2 measures. The Level 2 process is provided as the next step.

Step 3: Level 2 Traffic Calming Plan Development

- A. Level 2 traffic calming improvements will only be considered if Level 1 measures do not meet the goals established by the Neighborhood Traffic Calming Committee (NTCC), as previously discussed. The prioritization process will be used for any implementation of Level 2 measures. In special circumstances, the TCAC or Board of Commissioners may determine from documented past history, or complexity of the situation, that Level 1 measures cannot achieve the desired outcomes, and may then recommend consideration of Level 2 measures from the

outset. Projects that move into Level 2 consider physical condition, travel speed, and traffic volume reduction measures; and therefore, require increased neighborhood consensus.

- B. Utilizing the main project area boundaries identified and/or verified by the TCAC, the requesting neighborhood will be asked to compile, with some assistance from the Township, a list of all residents and businesses in the project area. Representatives of the NTCC shall then conduct either a mail or door-to-door inquiry to obtain documented/signed interest in the Level 2 traffic calming project. A 30 percent disapproval response (with all non-responses being recorded as favorable), will be the maximum allowable basis for continuing with traffic calming studies and implementation process. The traffic calming process for Level 2 action should not move forward unless there is a minimum 70 percent approval for traffic calming.
- C. If the vote supports consideration of Level 2 measures, the NTCC will be re-established. It may be necessary to expand or otherwise alter the composition of the group due to the likely greater impacts that could result under a Level 2 traffic calming plan.
- D. In addition, all members of the Traffic Calming Advisory Committee (TCAC) should be part of the process, as well as appointed additional technical members when needed. The stakeholders in this group include Township officials and staff, police, fire, and emergency service providers, the Township traffic consultant, and others such as local schools, transit agencies, County or State planners and engineers, etc., that may be directly impacted by any changes to neighborhood streets. Their perspective is essential for developing a plan that effectively addresses existing concerns without creating new problems that cannot be mitigated or that keep the ultimate plan from being implemented. A resolution shall be passed stating the representatives of the TCAC and necessary appointed outside technical personnel per Level 2 plan development selection.
- E. The NTCC and full TCAC will meet to review the results from the Level 1 program (when applicable), revisit existing problems and community goals, and identify the appropriateness of various Level 2 measures in addressing the existing problems. The Director of Planning & Development, upon approval from the Commissioners, will engage the Township's traffic consultant or appropriate technical personnel, sometimes with neighborhood (NTCC) support, to collect additional data to support the process, as follows:
1. **Collect and Analyze Data:** The following data may be helpful when determining appropriate solutions to the traffic problems at a particular location:
 - Speed – average speed and 85th percentile speed (previously discussed).
 - Volume – daily and peak hour volumes on the project street and other streets within the project area. If cut-through traffic volumes are believed to be excessive, a license plate survey could be conducted along with turning movement counts.
 - Adjacent arterial roads – determine if problems on area streets are majorly related to poor traffic conditions on adjacent arterial roads. In this case, deficiencies on the arterial streets should be addressed through the Township's Act 209 Capital Improvement Program, possibly before implementing traffic calming.
 - Crashes – crash data, by type, for the most recent three years.
 - Parking – location, capacity, and use.

- Pedestrian and bicycle activity – identify vulnerable groups like children and the elderly.
 - Emergency service routes.
 - Transit routes.
 - Locations of schools, parks, and other such facilities.
2. **Identify Appropriate Traffic Calming Measures:** After the traffic data has been compiled, appropriate traffic calming measures can then be identified. Chapter 3 provided information about a number of different traffic calming measures to assist in this effort. Identifying appropriate measures includes the following:

- Identification of which traffic calming measures are designed to solve the documented problems.
 - Appropriateness of a particular traffic calming measure to the location where it will be installed.
- F. Next, the Township’s Traffic Consultant and Police Safety Officer will present the findings of the data analysis to the NTCC and TCAC. Also, the traffic engineer will describe which traffic calming measures may best be able to address the problems identified, and discuss neighborhood opinions about traffic calming. Upper Moreland Township officials, the NTCC, and the TCAC will work towards a consensus on the most appropriate traffic calming measures, their design, and specific locations through a series of meetings before taking it to a larger forum, such as a public meeting or open house.

Step 4: Approval Process

- A. Once consensus has been reached by Upper Moreland Township and the traffic calming committees, the preliminary and final traffic calming plans will then be presented at a single open house or public meeting. A “special” public meeting outside a regularly scheduled Township meeting may work best. Notices for these meetings may be distributed door-to-door, mailed, or announced via a press release, along with a description and schematic of the plan whenever possible. The Township will assist in mailings or written press releases with the guidelines for notification of public meetings per the Municipal Planning Code. It is recommended that the community typically be presented with a single plan, with options for specific locations. Then, if necessary, plans may be modified before they are submitted to the community for final approval.
- B. Following the public review, any necessary modifications are made to analyze the traffic calming plan. Additional public meetings can be held at the discretion of the Commissioners if the changes are very substantial. Otherwise, the plan is ready for a vote on community approval.
- C. After the Neighborhood Open House or Public Meeting and final modifications completed on the plan, residents and property owners will vote on whether or not to conduct a temporary test of the proposed Level 2 traffic calming plan. A minimum of 70 percent of the residents and property owners (household locations will be determined by Township staff) that could be

affected by the proposed changes in traffic flow must favor implementation of Level 2 measures in order to proceed. In addition, a minimum of 80 percent of the residents and property owners immediately adjacent to each proposed device must favor implementation. One vote will be granted to each residence and/or property owner. The voting period will last up to four weeks and be specified clearly in the mailing. **A non-response will be considered an affirmative vote for the plan at the end of the specified voting period.**

Note: In some cases, neighborhood participation in funding a proposed Level 2 plan may be necessary. If a financial commitment is required from the neighborhood, this stipulation will be included in the ballot/ mailing.

- D. After conclusion of the voting process, Township staff will notify residents and property owners about the ballot results. If the Level 2 traffic calming plan does not receive enough votes for testing, the proposed devices will not be installed. The community may re-apply for a traffic calming plan in three years or sooner if special circumstances indicate that further review should be considered.
- E. After the appropriate community approval is obtained, the traffic calming plan must be officially approved by the local government. At this point, the funding source should be clearly identified and money set aside for implementation and maintenance. If the project involves a State road, or if State, Federal, or Liquid Fuels funds are requested, PennDOT approval is also required. This approval will include the issuance of a highway occupancy permit. When a State road is involved, a legal agreement between PennDOT and the local municipality identifying the installation and maintenance responsibilities must be established.

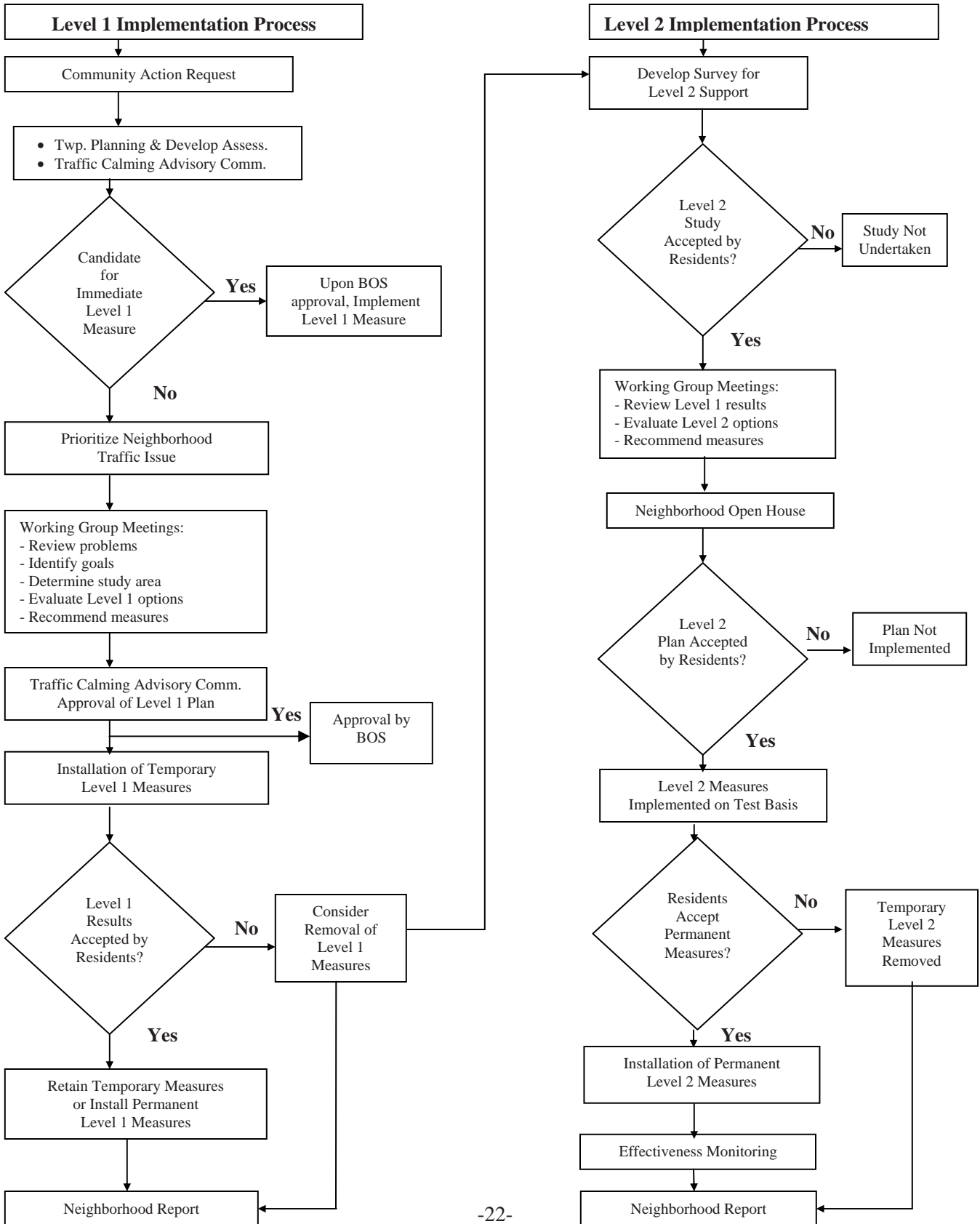
Step 5: Installation and Evaluation

- A. Once approved by all agencies required, the proposed Level 2 traffic calming plan will be implemented on a test basis using temporary control devices, where possible, for a period determined by the Township's Director of Planning & Development, municipal engineering, Township traffic consultant, Director of Public Works, police chief, and Commissioners' representative to the TCAC. In most cases, the test program for Level 2 measures will last six to twelve months – with the ultimate duration agreed to by the NTCC and full TCAC.
- B. Following the test period, Township staff will collect new data (e.g., traffic volume counts, speed surveys, etc.) to determine the effectiveness of the measures put into place. These results will be available for review by all of the neighborhood's residents and property owners. Then, residents and property owners will again vote, using the same process as described previously, to determine whether permanent traffic calming devices should be installed, the temporary devices removed, or if a slight modification to the traffic calming plan is needed. Again, Township staff will notify residents and property owners about the ballot results. If permanent measures are voted in, the Level 2 traffic calming plan will be fully implemented with permanent devices and notification will be given by Township staff prior to construction.
- C. After construction of the permanent Level 2 measures, the Township's Director of Planning & Development, Director of Public Works, and engineering consultants will continue monitoring the effectiveness of the plan for up to one year. Depending on the particular traffic calming

measures and objectives of the project, Upper Moreland Township may monitor traffic speeds, traffic volumes, crashes, or diversions to other routes. The Township may choose to use the following parameters in determining the benefits derived from the installation of traffic calming measures, which may aid in the decision process on these measures in other parts of the Township, and be valuable in supporting the future expenditures for these types of traffic calming:

- Before and after crash statistics for motor vehicle crashes, motor vehicle/bicycle crashes, and motor vehicle/pedestrian crashes. The crash studies should indicate how crash trends in the project area have been affected and should cover a length of time sufficient to identify long-term effects.
 - Before and after speed studies to determine the 85th percentile speed. Ideally, speed studies should be performed upstream of, at, and downstream of the traffic calming measure to identify its effect on vehicle speeds.
 - Before and after user volume, including peak hour volumes, the average daily traffic (ADT), and the directional design hourly volume (DDHV). Traffic counts should be made on the street where traffic calming will be installed and on the streets to which traffic is expected to divert. The “after” counts should be made when traffic patterns have stabilized.
- D. Modify design or remove measure if needed. As previously indicated, the removal of traffic calming measures should only be considered after they have been in place and monitored for six months to a year, and then only with the same level of support of the neighborhood that was required to install the measure, unless a safety problem has developed. If a safety problem develops, Upper Moreland Township will take steps to modify the traffic calming measure or remove it. PennDOT may also remove a traffic calming measure installed on a State road if a safety problem has developed. If PennDOT removes a measure from a State road due to safety concerns caused by improper installation or maintenance, the cost for removal must be reimbursed by our municipality.

**Figure 5.1
Neighborhood Traffic Calming
Implementation Process**



Today's Date: _____

COMMUNITY ACTION REQUEST FORM

The purpose of this form is to enable neighborhood to request the possible initiation of a traffic study in accordance with Upper Moreland Township's Neighborhood Traffic Calming Program. The form must be filled out in its entirety, including a short description of current problems, and names of residents and/or property owners from at least six different residences within the affected area. Use back or additional sheets, as necessary.

After completing this form, please submit it to:

Upper Moreland Township
Attn: Office of the Township Manager
117 Park Avenue, Willow Grove, PA 19090
Phone: (215) 659-3100 / Fax: (215) 659-7363

1. Name of Neighborhood or organized group name: _____

2. Please describe any traffic or safety issues that concern residents in your neighborhood. Use the back side of this sheet or additional sheets, if necessary.

3. Please describe the specific location of concern, as well as the limits of your neighborhood and/or area of concern. Feel free to provide a sketch and attach to this sheet as well as identify your thoughts for specific traffic calming measures and their locations in accordance with the Township's Traffic Calming Toolbox.

4. Please provide the names and signatures of at least six residents and/or property owners from six separate properties who are requesting that this neighborhood and location be considered in the Township's Neighborhood Traffic Calming Program. Additional names can be placed on the back of this sheet. Place a check mark by the main contact person.

Signature	Printed Name	Address	Phone No. (Optional)
1.			
2.			
3.			
4.			
5.			
6.			

5. Source of funding recommended for Traffic Calming Measure (i.e., Liquid Fuels, Township General Funds, Grant, Private/Neighborhood funded, etc.).

6. Discuss financial commitment (\$) of neighborhood, if any, toward implementing the measure, if selected.

For Township Use

Date Received: _____

Date given to TCAC _____

Date Community Action Request Received: _____

NEIGHBORHOOD TRAFFIC CALMING PRIORITIZATION WORKSHEET

This worksheet will be completed by Upper Moreland Township Traffic Calming Advisory Committee (TCAC) in accordance with Upper Moreland Township's Neighborhood Traffic Calming Program. It will be used to prioritize the potential initiation of specific neighborhood traffic calming processes for controversial Level 1 measures, or for Level 2 measures.

Name of Neighborhood (as applicable): _____

1. Traffic Volumes

- Greater than 2000 vehicles per day = 5 points
- 1,500 to 2,000 vehicles per day = 4 points
- 1,000 to 1,500 vehicles per day = 3 points

2. Travel Speeds

- 80% - 100% of traffic exceeds speed limit = 5 points
- 60% - 80% of traffic exceeds speed limit = 4 points
- 40% - 60% of traffic exceeds speed limit = 3 points
- 30% - 40% of traffic exceeds speed limit = 2 points
- 20% - 30% of traffic exceeds speed limit = 1 point

3. Cut-through Traffic Levels

- Greater than 25% of vehicles are cut-through = 5 points
- 20% to 25% of vehicles are cut-through = 4 points
- 15% to 20% of vehicles are cut-through = 2 points

4. Collision History (most recent, past 3 years)

- More than 5 collisions in a one year period = 8 points
- 2 to 4 collisions I a one year period = 4 points

5. Schools and Public Facilities (Pedestrian Generators)

- Each school and public facility (i.e., park, community center, neighborhood commercial use) adjacent to street = 1 point

6. Neighborhood Impact

- Each 500 linear feet of street experiencing above problems = 1 point

7. Source of Funding

- Full funding by neighborhood = 10 points
- Partial funding by neighborhood = 3 points
- Balance of partial funding "committed" by other sources/funds = 7 points

Total Score:

Date Preliminary Information Completed by Township: _____

Completed by: (Print Name) _____ (Sign Name) _____

APPENDIX A
LEVEL 1 MEASURES

NEIGHBORHOOD TRAFFIC EDUCATION CAMPAIGN

Level 1

Description: Neighborhood traffic safety campaigns include: personalized letters, neighborhood flyers, meetings, workshops, specific school programs, and neighborhood speed awareness signs or banners.

Application: The intended benefit of conducting neighborhood traffic safety campaigns is usually to make residents aware of local speed limits and other traffic and safety concerns.



Advantages:

- + Allows residents to discuss views.
- + Identifies issues of concern.
- + Enables staff to see concerns.
- + Reduces speeds temporarily.

Disadvantages:

- Effectiveness may be limited.
- Meetings need to stay focused.
- Potentially time consuming.
- Enforcement still likely required.

Special Considerations:

- Neighborhood traffic safety campaigns can consist of letters and/or flyers.
- Often, neighborhood meetings or workshops are conducted.
- Any meetings or workshops need to stay focused on specific traffic issues.
- Neighborhood speed awareness signs or banners are sometimes used.
- Sometimes only effective over a short duration

Cost:

- Varies.

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SPEED DISPLAY UNIT

Level 1

Description: The most common form of radar speed display unit is a portable trailer equipped with a radar unit that detects the speed of passing vehicles and displays it on a reader board, often with a speed limit sign next to the display.

Application: The primary benefit of speed display units is to discourage speeding along neighborhood streets.



Advantages:

- + Effective educational tool.
- + Good public relations tool.
- + Encourages speed compliance.
- + Can reduce speeds temporarily.

Disadvantages:

- Not an enforcement tool.
- Ineffective on multi-lane roadways.
- Less effective on high volume streets.
- Subject to vandalism.

Special Considerations:

- Used throughout the Township on an ongoing basis.
- The purpose of the units is to remind drivers that they are speeding.
- Encourage compliance with the posted speed limit.
- Usually only effective in reducing speeds when actually being used.
- In longer term (30 days), speeds can decrease by 6% on low volume roads.
- Effect usually negligible on higher volume streets serving through traffic.
- Some motorists may speed up to try to register a high speed.
- Should not be used in remote areas.

Cost:

- \$250 per day.

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HIGHER VISIBILITY CROSSWALKS

Level 1

Description: Higher visibility crosswalks can be created by using paving blocks or contrasting color concrete, or painting “zebra” stripes in lieu of or between the crosswalk’s outer boundary stripes.

Application: The primary benefit of higher visibility crosswalks is to increase crosswalk visibility to drivers.



Advantages:

- + More visible than traditional x-walks.
- + Indicates preferred crossing location.
- + Can slow travel speeds.
- + Can be aesthetically pleasing.

Disadvantages:

- Pedestrians may ignore traffic more.
- Only used at uncontrolled crosswalks.
- Usually require more maintenance than traditional crosswalks.
- Virtually no effect on reducing traffic speeds or volumes.
- Extra noise may be produced from vehicles passing over the textured surface.
- Heavily textured surface may present a traction problem for bicyclists, wheelchairs, or disabled persons.

Special Considerations:

- Higher visibility crosswalks indicate preferred crossing location to pedestrians.
- Pedestrians may place too high a reliance on ability to control driver behavior.
- Specially paved types require more maintenance than traditional crosswalks.
- Should only be used at uncontrolled crosswalks.
- Less expensive, but not as effective as raised crosswalks (Level 2).
- Textured crosswalks are generally flush with the surrounding street. Jurisdictions that have used slightly raised surfaces – ½ to ¾ inch above street level – have seen no added benefit in reducing vehicle speeds.

Cost:

- \$50 to \$150 per square yard.

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TARGETED POLICE ENFORCEMENT

Level 1

Description: The Police Department deploys motorcycle or automobile officers to perform targeted enforcement on residential streets for at least an hour a day.

Application: The intended benefit of targeted police enforcement is to make drivers aware of local speed limits and to reduce speeds.

Advantages:

- + Visible enforcement very effective.
- + Driver awareness increased.
- + Can be used on short notice.
- + Can reduce speeds temporarily.

Special Considerations:

- Police enforcement is continually in effect throughout the Township.
- Usually used only on neighborhood streets with documented speeding problems.
- Typically only effective while officer is actually monitoring speeds.
- Often helpful in school zones.
- May be used during “learning period” when new devices first implemented.
- Long-term benefits unsubstantiated without regular periodic enforcement.
- Expensive.

Cost:

- About \$75 per hour for officer and equipment.

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Disadvantages:

- Temporary measure.
- Requires long-term use to be effective.
- Fines lower than enforcement cost.
- Disrupts traffic on high volume streets.

NARROWING LANES

Level 1

Description: On this Level 1 type of measure, striping is usually used to create narrow lanes – often about 10 feet wide. The “unused” pavement can be used to stripe bicycle and/or parking lanes.

Application: The primary benefit of narrowing lanes through striping is to slow vehicle speeds.



Advantages:

- + Can be quickly implemented.
- + Slows travel speeds.
- + Improves safety.
- + Can be easily modified.
- + If parking lanes are striped, a buffer is provided between traffic and pedestrians on sidewalks.

Disadvantages:

- Increases regular maintenance.
- Not always perceived as effective tool.
- Adds striping to neighborhood streets.
- Increases resurfacing costs.
- On-street parking can reduce the visibility of pedestrians and vehicles to each other.

Special Considerations:

- Narrowed travel lanes provide “friction” and can slow vehicle speeds.
- Can be installed quickly and easily revised over time.
- Designated bicycle lanes and/or parking lanes can be created.
- Adds centerline and edgeline striping to neighborhood streets.
- Can be used around curves to “force” vehicles to stay within lanes.
- On curves, raised dots are usually most effective in centerline.

Cost:

- \$1,000 to \$3,000 each.

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SPEED LIMIT SIGNING

Level 1

Description: 25 miles per hour speed limit signs are installed along neighborhood streets.

Application: The primary benefit of installing speed limit signing is to encourage slower vehicle speeds along residential streets. Signs are only installed along streets where speeding is a problem.



Advantages:

- + Clearly defines legal speed limit.
- + Can reduce speeds if enforced.
- + Usually popular with neighborhood.
- + Low cost installation.

Disadvantages:

- Requires on-going police enforcement.
- Not effective solely by themselves.
- Low speed limits may be unreasonable.
- Adds additional signs in neighborhood.

Special Considerations:

- Should only be used on streets where speeding is a documented problem.
- Requires police enforcement to remain effective.
- Speed limits lower than 25 mph can only be set by engineering analysis.
- Unrealistically low speed limits tend to be disregarded.
- Increases cost of sign maintenance.
- Should be posted at the beginning and end of each speed zone and at intervals not greater than one-half mile.

Cost:

- \$200 per sign.

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STOP SIGNS

Level 1

Description: Stop signs are either installed on the “side street” where no signs currently exist – or on the “main street” at an intersection where the “side street” already has stop signs.

Application: Stop signs should only be considered when warranted based on established criteria. PennDOT Publication 201 and the Vehicle Code reference these procedures.

Advantages:

- + Requires traffic to stop.
- + Assists pedestrian crossings.
- + May slightly reduce cut-thru traffic.
- + Lowers speeds at stop sign.

Special Considerations:

- Stop signs should only be installed if warranted based on established and acceptable criteria (see PennDOT Pub. 201 and PA Vehicle Code).
- Drivers may not comply with stop signs if installation is unwarranted.
- Mid-block speeds can increase to make up for “lost” time.
- At low volume, unwarranted locations, many drivers will “roll” through.
- Can create safety problems for pedestrians when compliance is poor.
- Stop signs may increase certain types of collisions, e.g., rear-ends.
- Stop signs may reduce other types of collisions, e.g., broadsides.
- May increase emergency response times.
- Increases noise near intersection due to vehicle deceleration and acceleration.

Cost:

- \$200 per sign.

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Disadvantages:

- May lead to increased mid-block speeds.
- Increases noise and air pollution.
- Can create problems if unwarranted.
- May increase emergency response time.

RESTRICTED MOVEMENT SIGNING

Level 1

Description: Turn prohibition signs involve the use of standard “No Left Turn,” “No Right Turn,” or “Do Not Enter” signs to prevent undesired turning movements onto residential streets. They may include peak period limitations.

Application: The primary benefit of restricted movement signing is to reduce cut-through traffic volumes along residential streets.



Advantages:

- + Redirects traffic to main streets.
- + Reduces cut-through traffic.
- + Can address time-of-day problems.
- + Low cost.

Disadvantages:

- May divert traffic to other streets.
- Require enforcement.
- Adds more signs to neighborhood.
- Usually not effective all day.

Special Considerations:

- Restricted movement signing is best used on major or collector streets.
- Most effective at periphery of a neighborhood to prevent entering traffic.
- Has little or no effect on speeds for through vehicles.
- Turn prohibitions can be used on a trial basis.
- Violation rates are about 50% without enforcement.
- With active enforcement, violation rates are reduced to about 20%.
- Turn restrictions are most effective when limited to peak hours.
- Less effective when applied around-the-clock.
- 24-hour turn restrictions better served with closures than with signing.

Cost:

- \$200 per sign.

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APPENDIX B
LEVEL 2 MEASURES

ONE-WAY STREETS

Level 2

Description: This measure converts a segment of a two-way street to one-way operations.

Application: The primary benefit of two-way to one-way street conversions is reduction in cut-through traffic.



Advantages:

- + Redirects traffic to other streets.
- + Reduces cut-through traffic.
- + Improved safety with one-way.
- + Emergency services can bypass.

Disadvantages:

- Can encourage increased speeds.
- Redirects traffic to other streets.
- Will increase trip lengths.
- Requires signage.

Special Considerations:

- Restrict movements into street while allowing resident access within block.
- Potential use must consider how residents will gain access.
- Bicycles are typically permitted to travel through in both directions.
- In effect at all times, even when cut-through volumes may be low.
- Can be accomplished with just signing and pavement markings.
- Possible to landscape channelizing islands, but maintenance required.
- Often used in combination with other one-way street conversions.

Cost:

- \$5,000 each.

Education
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Enhancement

MEDIAN ISLAND

Level 2

Description: Median islands are raised islands in the center of a street that can be used to narrow lanes for speed control and/or to create a barrier to prohibit left-turns into or from a side street. They can also be used for pedestrian refuges in the middle of a crosswalk.

Application: Median islands are used on wide streets to lower travel speeds and/or or prohibit left-turning movements. They are also often used to provide a mid-point refuge area for crossing pedestrians.

Advantages:

- + Effectively reduces vehicle speeds.
- + Can reduce collision potential.
- + Reduces pedestrian crossing.
- + Opportunity for landscaping.
- + Can be used on curves to prevent vehicles from swinging wide at excessive speeds.

Special Considerations:

- Median islands, when used to block side street access, may divert traffic.
- In this condition, they may impact emergency response times.
- Median islands may visually enhance the street through landscaping.
- Median islands used for lane narrowing should result in at least 12' lanes.
- Fire departments usually prefer median islands to some other measures.
- Bicyclists prefer not to have travel way narrowed.
- Median islands should be 6 to 8 feet wide to comfortably accommodate pedestrians.
- Islands should be at least 12 feet, and preferably 20 feet, in length.
- Lighting should be provided for islands, along with landscaping, trees and reflectors to ensure motorists can see it.

Cost:

- \$5,000 to \$75,000 each (depending on size).

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Disadvantages:

- Could require parking removal.
- May reduce driveway access.
- Could impact emergency vehicles.
- May divert traffic volumes.

GATEWAY

Level 2

Description: Gateway entrance treatments consist of physical and textural changes to streets and are located at key entryways into a neighborhood. They often consist of features, like chokers, that narrow a street in order to reduce the width of the street's right-of-way.

Application: The primary benefit of gateway treatments is speed reduction. They provide visual cues that tell drivers they are entering a local residential area or that the surrounding land uses are changing.



Advantages:

- + Can reduce vehicle speeds.
- + Creates identity for neighborhood.
- + Can discourage cut-through traffic.
- + Opportunity for landscaping.
- + Can discourage truck entry, depending on the extent of narrowing and inclusion of median islands at the intersection.

Disadvantages:

- Maintenance and irrigation needs.
- May require removal of parking.
- Can impede truck movements.
- Creates physical obstruction.

Special Considerations:

- Gateways have minimal influence on driver's routine behavior.
- Overall speeds and volumes are usually only minimally influenced.
- Gateway treatments make drivers more aware of neighborhood environment.
- Can incorporate neighborhood identification signing and monumentation.
- Care should be taken not to restrict pedestrian visibility at adjacent crosswalk.
- Textured pavements could introduce some new noise.
- A number of traffic calming measures such as bulb-outs at the intersection, textured pavement treatments and median islands may be included in a gateway design.

Cost:

- \$5,000 to \$20,000 each.

Education
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CURB EXTENSION

Level 2

Description: Curb extensions narrow the street by extending the curbs toward the center of the roadway or by building detached raised islands to allow for drainage and bike lanes passage.

Application: Curb extensions are used to narrow the roadway and to create shorter pedestrian crossings. They also improve sight distance and influence driver behavior by changing the appearance of the street. May also be used at mid-block locations with significant pedestrian activity, school children or senior citizens, or where speed humps are not permitted.



Advantages:

- + Better pedestrian visibility.
- + Shorter pedestrian crossing.
- + Can decrease vehicle speeds.
- + May encourage pedestrians to cross at designated locations.
- + Can improve neighborhood appearance with landscaping and/or textured treatments.
- + Increase pedestrian sight distance
- + Prevent illegal parking close to intersections.

Disadvantages:

- Can require removal of parking.
- May create hazard for bicyclists.
- Can create drainage issues.
- Difficult for truck turns to right.

Special Considerations:

- Curb extensions can be installed at intersections or mid-block (see chokers).
- Mid-block chokers are often used with pedestrian crossing treatments.
- Curb extensions should not extend into bicycle lanes, where present.
- Curb extensions at transit stops enhance service.
- No noise or emergency service impacts.
- May require landscape maintenance to preserve sight distances.

Cost:

- \$5,000 to \$20,000 each.

Education
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CHOKER

Level 2

Description: Chokers are mid-block curb extensions that narrow a street by extending the sidewalk or widening the planting strip. The remaining cross-section can consist of one lane or two narrow lanes.

Application: Chokers are intended to reduce traffic volumes by making the roadway narrow so that only one car at a time can pass through it, or two cars can pass very slowly in opposite directions.

Advantages:

- + Effectively reduces vehicle speeds.
- + Shorter pedestrian crossing.
- + Provides improved sight distance.
- + Opportunity for landscaping.

Special Considerations:

- Chokers can be designed with protected bike lane next to original curb.
- Chokers with exclusive bike lanes can collect debris in bike lane.
- Can impact driveway access.
- Also reduce travel speeds when cross-section reduced substantially.
- Preferred by many emergency response agencies to other measures.
- Provide excellent opportunities for landscaping.

Cost:

- \$10,000 each.

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Disadvantages:

- Can require removal of parking.
- May create hazard for bicyclists.
- Can create drainage issues.
- May impede truck movements.

SPEED HUMPS

Level 2

Description: Speed humps are asphalt mounds constructed on residential streets. They are usually placed in a series and spaced 300 to 600 feet apart. Speed humps are typically 14 feet long and 3 to 6 inches high. Their vertical deflection encourages motorists to reduce speed.

Application: The primary benefit of speed humps is speed control. They work well in conjunction with curb extensions.



Advantages:

- + Effectively reduces vehicle speeds.
- + Does not require parking removal.
- + Can reduce vehicular volumes.
- + Easily tested on temporary basis.
- + Relatively inexpensive to install and maintain.
- + Does not pose problems for bicyclists or motorcyclists, except at high speeds.

Disadvantages:

- Slows emergency vehicles.
- Increases noise near speed humps.
- May divert traffic to parallel streets.
- Not aesthetically pleasing.
- Should be avoided on major transit routes.
- Drainage could be a concern.

Special Considerations:

- Vehicle speeds between humps have been shown to decrease by up to 25%.
- Volumes may decrease if parallel route, without measures, is available.
- Possible increase in traffic noise from braking and accelerating.
- Highest noise increase from buses and trucks.
- Speed humps reduce emergency vehicle response times.
- 3-5 second delay per hump for fire trucks, 10 seconds for ambulances.
- Speed humps require advance warning signs and object marker at hump.
- Difficult to construct precisely, unless pre-fabricated.
- Two most popular designs are the Watts speed hump and the Seminole County speed hump; Watts speed hump is recommended only for local streets while Seminole County speed hump can be used on local roads as well as collector roads.
- Similar designs can be used as raised pedestrian crosswalks.
- Primarily used at mid-block locations.
- Normally, no hump should be placed within 150 feet of an unsignalized intersection or 250 feet of a signalized intersection.

SPEED HUMPS (continued)

Level 2

- Speed humps should not be used on curves unless the radius is greater than 300 feet.
- Humps should not be installed on streets with a grade exceeding 8%.
- Humps should not be installed on streets without curbing unless obstructions such as signing, flexible delineator posts, or bollards prevent drivers from driving around the hump. Rocks, boulders, and other objects of this nature should not be used for this application.
- Ideally, speed humps should extend across the roadway from curb to curb. This design is generally preferred by bicyclists, and it prevents motorists from driving with one wheel in the gutter (this may happen with tapered edges). If drainage cannot be accommodated under curb-to-curb conditions, it is recommended that humps end before bike lanes or continue across the bike lane without tapering off.
- Humps usually have a parabolic cross section. A sinusoidal cross section is harder to construct but may better facilitate snow removal.
- Although speed humps may create noise from vehicles passing over them, the overall noise levels on the street may be reduced due to lower vehicle speeds.
- Traffic may divert to other parallel streets that are not traffic calmed.
- In areas with snow removal problems, a measure such as a flexible delineator post may be needed at each hump to alert snowplow operators to lift their blades.
- Has minimal effect on trucks and sport utility vehicles and may worsen speeding with problem drivers.
- Can be used as a series of two humps to impact all vehicle types.

Cost:

- \$1,500 to \$5,000 each.

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RAISED CROSSWALK

Level 2

Description: Raised crosswalks are crosswalks constructed 3 to 6 inches above the elevation of the street. They are usually about 22 feet long, with a flat section in the middle and ramps on the ends. Sometimes the flat portion is constructed with brick or other textured materials.

Application: Raised crosswalks are intended to reduce vehicle speeds specifically where a high amount of pedestrians cross the street.



Advantages:

- + Effectively reduces vehicle speeds.
- + Good pedestrian safety treatment.
- + Does not affect access.
- + Flat portion can be textured.
- + Improves visibility of pedestrians.
- + May reduce volumes.

Disadvantages:

- May generate increased noise and emissions.
- Can require drainage modifications.
- Only 3 seconds delay for fire trucks.
- Often require signage and markings.
- Require more maintenance than traditional crosswalks.
- Icing can be a problem if snow is not properly removed.

Special Considerations:

- Raised crosswalks are usually 22 feet long, with a 10-foot wide flat section.
- Usually a lower elevation than sidewalk to alert visually impaired it's a crosswalk.
- Careful design is needed due to potential drainage issues.
- Usually preferred by Fire Departments over standard speed hump.
- Work well in combination with curb extensions and curb radius reductions.
- Do not affect access.
- Increases pedestrian visibility and likelihood that driver yields to pedestrian.
- Often referred to as speed tables or speed platforms.
- If the raised pedestrian crossing is the same height as the curb, the edge of the raised crosswalk should be differentiated with a tactile measure to warn visually impaired people.
- Most appropriately used at areas with significant pedestrian crossing activity.
- Effectiveness of the measure is increased when used with textured crosswalks or curb extensions.
- A catch basin should be installed for drainage on the uphill side of the raised crosswalk.
- All ADA requirements must be met.
- In areas with snow removal problems, a measure such as a flexible delineator post may be needed at each hump to alert snowplow operators to lift their blades.

Cost:

- \$2,000 to \$10,000 each.

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RAISED INTERSECTION

Level 2

Description: A raised intersection is a flat, raised area covering an entire intersection. There are ramps on all approaches. The plateau is usually about 4" high. Usually, the raised intersection is finished in brick or other textured materials.

Application: Raised intersections are used to reduce through movement speeds and provide safer street crossings to pedestrians.



Advantages:

- + Effectively reduces vehicle speeds.
- + Good pedestrian safety treatment.
- + Can be aesthetically pleasing.
- + Does not affect access.
- + Reduces vehicle-pedestrian conflicts by providing better visibility for pedestrians.

Special Considerations:

- Raised intersections usually used in urban areas.
- Make entire intersections more pedestrian-friendly.
- Work well with curb extensions and textured crosswalks.
- Often part of an area-wide traffic calming scheme involving both streets.
- Expensive.
- Special signing often required.
- If raised intersections are the same height as the surrounding curb, a slight lip or other tactile measure should be used as a warning to visually impaired people.
- In areas with snow removal problems, a measure such as a flexible delineator post may be needed at each hump to alert snowplow operators to lift their blades.

Cost:

- \$15,000 to \$60,000 each.

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Disadvantages:

- Expensive to construct and maintain.
- Requires drainage modifications.
- Affects emergency vehicle response.
- May require bollards to define corners.

TRAFFIC CIRCLE

Level 2

Description: Traffic circles are raised circular islands in an intersection. They are typically landscaped with ground cover and/or street trees. Traffic circles require drivers to slow down to a speed that allows them to comfortably maneuver around the circle in a counterclockwise direction.

Application: The primary benefit of traffic circles is speed control and reduction in angle and turning collisions.



Advantages:

- + Effectively reduces vehicle speeds.
- + Reduces collision potential, particularly right-angle conflicts.
- + Provides better side-street access.
- + Opportunity for landscaping.
- + Reduces the number of potential conflict points at an intersection.

Disadvantages:

- Parking removal required.
- Can increase bike/auto conflicts.
- Can impede emergency vehicles.
- Can restrict large vehicle access.

Special Considerations:

- Traffic circles are best used in a series or with other devices.
- About 30 feet of curbside parking must be prohibited in advance of circle.
- Buses and trucks maneuver around traffic circles at slow speeds.
- Noise impacts are minimal.
- If well maintained, traffic circles can be attractive.
- However, there are also a lot of signs and pavement markings required.
- Traffic circles are less effective at T-intersections and offset intersections.
- Turning analysis should be completed to ensure that the design vehicle can negotiate the circle.
- May require additional street lighting.
- Drainage works best if the cross-section slopes away from the circle, despite the fact that this creates a reverse superelevation.
- It may be necessary to move crosswalks further away from the traffic circle to prevent vehicles from encroaching on the crosswalk.

Cost:

- \$8,000 to \$25,000 each.

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TRAFFIC CIRCLE (continued)

Level 2

ROUNDABOUTS

Description:

Roundabouts are measures similar to traffic circles, but they must have all of the following characteristics:

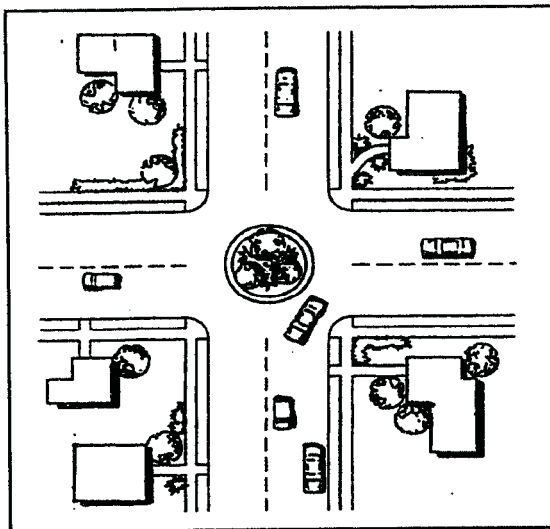
- Yield control is used on all entries and the circulatory roadway has no control.
- Circulating vehicles have the right-of-way.
- Pedestrian access is allowed only across the legs of the roundabout, behind the yield line.
- No parking is allowed within the circulatory roadway or at the entries.
- All vehicles circulate counter-clockwise and pass to the right of the central island.

If any of the roundabout characteristics are not met, the circular intersection is considered a traffic circle.

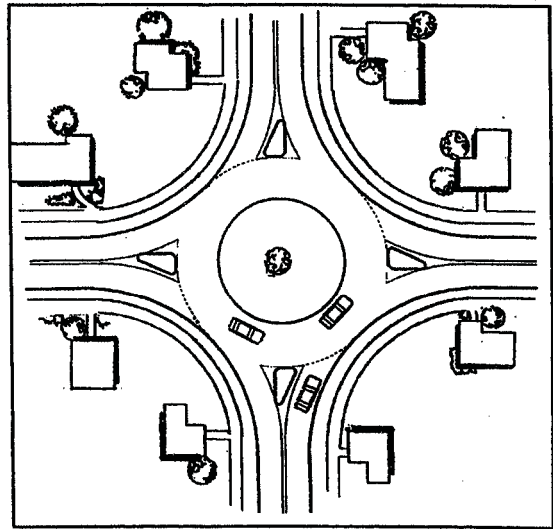
In the near future, PennDOT will be developing standards for roundabouts. Additional information concerning the use of roundabouts can also be found in the Federal Highway Administration (FHWA) publication "Roundabouts: An Informational Guide" (FHWA-RD-00-067).

The following pictures depict the difference between a traffic circle and a roundabout.

Traffic Circle



Roundabout



INTERSECTION CHANNELIZATION

Level 2

Description: Providing channelization at three-legged intersections forces previous straight-through movements to make slower turning maneuvers. Channelization is usually raised.

Application: The primary benefit of realigning intersections is to slow traffic down. Can also be used to redirect to another facility or to provide neighborhood gateway.



Advantages:

- + Effectively reduces vehicle speeds.
- + Low impact to emergency services.
- + Can discourage through traffic.
- + Opportunity for landscaping.

Disadvantages:

- Parking removal required.
- May direct traffic to other street(s).
- Maintenance responsibility.
- Fairly expensive.

Special Considerations:

- Intersection channelization slows traffic down near the intersection.
- Improvement may also discourage some cut-through traffic.
- No significant impedance to fire and transit service.
- Provide landscaping opportunities and potential gateway treatments.
- Can require drainage modifications.
- Possible to vary traffic control with stop signs on one or all three legs.
- Works best for low to moderate traffic volumes (up to 1,200 ADT).

Cost:

- \$15,000 to \$20,000 each.

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CHICANE

Level 2

Description: A chicane is a series of two or more staggered curb extensions on alternating sides of a roadway. Horizontal deflection influences motorists to reduce speed through the serpentine roadway.

Application: The primary benefit of chicanes is speed control without a significant impact to emergency vehicle mobility.



Advantages:

- + Effectively reduces vehicle speeds.
- + Low impact on emergency vehicles.
- + Does not restrict resident access.
- + Opportunity for landscaping.
- + May reduce traffic noise due to lower speeds and volume.
- + Reduces traffic volumes.
- + May reduce collisions.

Disadvantages:

- Significant parking loss.
- Increased maintenance.
- May require right-of-way.
- Expensive.
- May cause an increased number of motorists to cross the centerline in order to maintain a straight line of travel.

Special Considerations:

- Chicanes cannot usually be used where right-of-way is limited.
- May require removal of substantial amounts of on-street parking.
- Alternatively, on-street parking can be used to create a chicane.
- Most effective with equivalent traffic volumes along both approaches.
- May increase conflicts with pedestrians and bicyclists.
- Chicanes provide landscaping opportunities.
- Most residents would have their driveways affected by type of installation.
- No expected noise impacts.
- May not be appropriate in areas with high truck traffic.
- Avoid locations where grades exceed 8 percent.
- Devices used to construct chicanes typically include curb extensions, planters, trees, barrels, fences, or barricades. Care must be taken to ensure that these devices do not create a safety hazard through the introduction of fixed objects on or along the roadway.
- Intended for use only on residential streets or quiet portions of a downtown with low traffic volumes (under 1,500 cars per day).

Cost:

- \$6,000 to \$40,000 each.

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RESTRICTED MOVEMENT BARRIER

Level 2

Description: Restricted movement barriers are raised islands that prevent certain movements at an intersection. They are often landscaped.

Application: The primary benefit of restricted movement barriers is to reduce cut-through traffic levels. They also provide pedestrian refuge areas for street crossings.



Advantages:

- + Redirects traffic to other streets.
- + Reduces cut-through traffic.
- + Provides pedestrian refuge area.
- + Opportunity for landscaping.

Disadvantages:

- Redirects traffic to other streets.
- Will increase trip lengths.
- May impact emergency response.
- Creates physical obstruction.

Special Considerations:

- Barriers have little or no effect on speeds for through vehicles.
- Should not be used on critical emergency response routes.
- Reduces number of potential conflict points for turning vehicles.
- Possibility for landscaping.
- Many variations are possible, including prohibiting turns to/from main street.
- Design needs to consider drainage needs.
- Usually require signing.

Cost:

- \$5,000 each.

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RAISED MEDIAN THROUGH INTERSECTION

Level 2

Description: A raised median through an intersection is a barrier which prevents left turns and through movements to and from a local street at an intersection with a major street.

Application: These measures are typically used to prohibit through traffic in a residential area.



Advantages:

- + Reduce traffic volumes on the local street.
- + Improves intersection safety by removing conflicting movements.
- + When landscaped, can improve appearance of the street.

Disadvantages:

- May shift traffic to other locations where left-turn opportunities remain.
- May affect emergency vehicle access and response.
- Increases trip length for motorists, including neighborhood residents.

Special Considerations:

- Median barriers can be constructed in various ways, including a closely spaced row of flexible delineator posts, a series of pre-cast curb sections, and a barrier constructed on a curbed island with landscaping.
- Given access restrictions, this measure is not recommended for use on a primary fire response route.
- To avoid shifting traffic from one local street to another, intersection medians should be installed at all local street intersections potentially impacted along the major street.
- Designs should incorporate gaps that permit access by bicyclists and pedestrians.

Cost:

- \$1,500 to \$20,000 each.

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RIGHT-IN / RIGHT-OUT ISLAND

Level 2

Description: Right-in/right-out islands are a form of intersection channelization that prevents left turns and through movements to and from a side street at an intersection with a major street.

Application: Many jurisdictions employ them as a less intrusive (and less expensive) version of a median barrier through an intersection. The primary purpose of this type of channelization is to reduce cut-through traffic on local streets.

Advantages:

- + Reduce through traffic on local streets.
- + Can improve pedestrian safety by reducing crossing distances and providing refuge areas.

Special Considerations:

- Designs can include depressed or mountable curbs to accommodate oversized vehicles.
- The island's effectiveness in reducing cut-through traffic will improve when used in combination with other measures on an area-wide-basis.

Cost:

- \$3,500 to \$7,500 each.

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Disadvantages:

- Restrict resident access.
- May divert traffic to parallel streets without traffic calming measures.

DIAGONAL DIVERTER

Level 2

Description: Diagonal diverters are raised areas placed diagonally across a four-legged intersection. They prohibit through movements by creating two “L” shaped intersections.

Application: The primary benefit of diagonal diverters is reduction in traffic volumes. These types of diverters also minimally decrease speeds near the intersection.



Advantages:

- + Reduces cut-through traffic.
- + Self-enforcing.
- + Reduces collision potential by eliminating conflicting traffic movements
- + Opportunity for landscaping.
- + May reduce speeds.
- + Lesser impact on traffic circulation when compared to a street closure.

Disadvantages:

- Redirects traffic to other streets.
- May increase trip lengths.
- Can impede emergency vehicles.
- Always in effect.

Special Considerations:

- Diagonal diverters can be designed to allow emergency vehicle access using gates, bollards or mountable curbs.
- Can be designed to allow pedestrian and bicycle access.
- They may shift problems elsewhere unless strategic program developed.
- Provide advantage over complete street closure as circulation less impacted.
- Can be attractively landscaped.
- Has little or no effect on speeds for local traffic.
- Because of their impact on traffic patterns, diagonal diverters can be controversial and should receive strong support before their installation.
- The radius of the diagonal diverter should reflect the posted speed of the street or the speed should be appropriately modified.
- Temporary installations and monitoring are recommended prior to construction of permanent measures.
- Unless the neighborhood is confined to a limited area, installing a single diverter may merely shift through traffic to other local streets. As a result, diagonal diverters generally need to be installed in a group or cluster to effectively route traffic to collector and arterial roadways.

Cost:

- \$7,500 to \$35,000 each.

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SEMI-DIVERTERS

Level 2

Description: Sometimes referred to as half-closures or partial diverters, semi-diverters prevent travel in one direction on a street by blocking half the street with a physical barrier. Semi-diverters, normally 16 to 23 feet in length, create a one-way roadway at the point of construction while two-way traffic is maintained on the remaining portions of the roadway.

Application: By eliminating movements, semi-diverters serve to reduce through traffic.



Advantages:

- + Reduce cut-through traffic without restricting bicycle and pedestrian access.
- + May lower travel speeds.
- + Semi-diverters permit emergency vehicles to go around them in the wrong direction (provided there is adequate sight distance), thus allowing a higher degree of emergency access than street closures or diagonal diverters.
- + Can visually enhance a neighborhood if landscaping is included.

Disadvantages:

- Could be violated, especially in the late evening, and particularly on low volume streets.
- May require loss of on-street parking opposite the measure to permit emergency vehicle access.
- Reduce access for residents.

Special Considerations:

- Traffic barricades can be used to test the effectiveness of a temporary installation.
- On a permanent basis, semi-diverters can be constructed with curb and gutter or sidewalks and landscaping.
- A safe bypass for bicycles and wheelchairs should be incorporated in the design.
- Semi-diverters intended to prevent exit are more readily violated.
- Semi-diverters at mid-block locations are more frequently violated than end of block measures.
- A six to twelve-month trial period is recommended before a measure is made permanent.
- Enforcement may be necessary to keep traffic from violating the directional closure.
- Semi-diverters should not be used on transit routes or major emergency response routes.
- Violations may be reduced by extending the length of the semi-diverter.

Cost:

- \$3,000 to \$20,000.

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Enforcement
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STREET CLOSURE

Level 2

Description: Full street closures are barriers placed across a street to completely close the street to through-traffic, usually leaving only sidewalks open. They are sometimes called cul-de-sacs or dead-ends.

Application: Cul-de-sacs and street closures are intended to change traffic patterns. They are very effective at reducing cut-through and general traffic volumes.



Advantages:

- + Reduces cut-through traffic.
- + Reduces speeding near device.
- + Self-enforcing.
- + Opportunity for landscaping.

Disadvantages:

- Directs traffic to other streets.
- Increases trip lengths for motorists, including neighborhood residents.
- Affects emergency response time.
- May lose some on-street parking.
- May require acquisition of property to provide a turnaround area of sufficient diameter.

Special Considerations:

- Cul-de-sacs/street closures typically used after other measures have failed.
- Often used in sets to make travel circuitous – typically staggered.
- Require strategic pattern of devices to not shift problem elsewhere.
- Can be placed at an intersection or mid-block.
- Not used on major emergency response routes or transit routes.
- May be designed to allow emergency vehicle access.
- Usually designed with small opening to allow bicyclists and pedestrians.
- Often consist of landscaping.
- When converting an existing residential street, consider the design criteria for cul-de-sacs and dead-end streets in the AASHTO “Green Book” (“A Policy on Geometric Design of Highways and Streets”).
- Parking bans on approaches to the turning area can also help facilitate turning movements.
- The barrier closing the street should be placed at an intersecting through street rather than in the interior of a neighborhood.
- Temporary measures can be created with barricades or other devices and are recommended to test the closure before it is permanently installed.
- Road closures can serve to deprive the road of its public character by limiting its use, rendering the road ineligible for assistance from the Liquid Fuels fund.

Cost:

- \$1,500 to \$35,000 each.

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