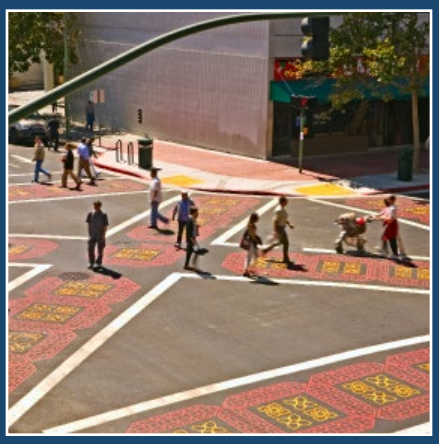

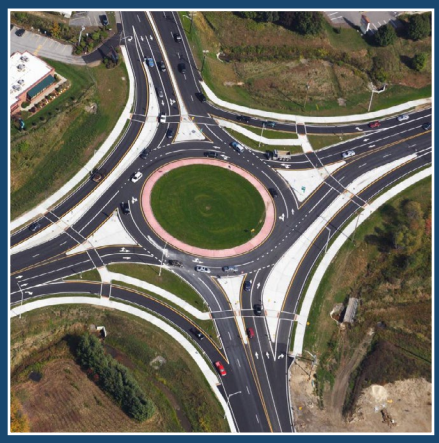

*prepared by:*


Institute of Transportation Engineers (ITE)
New England Section
Technical Committee


# TRAFFIC CALMING GUIDELINES

JUNE 2016

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Prepared by

INSTITUTE OF TRANSPORTATION ENGINEERS (ITE)
NEW ENGLAND SECTION
TECHNICAL COMMITTEE

June 2016

# ACKNOWLEDGEMENTS

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The above Technical Committee wishes to acknowledge the efforts conducted by those whom prepared the original November 2000 Manual.

## Disclaimer:

The design of traffic calming devices may be complex and the treatments and topics discussed in this guide must be tailored to individual contexts. NEITE encourages good engineering judgment in all cases and decisions made throughout the design process should be thoroughly documented.

# Contents

# BACKGROUND

This update of the New England Institute of Transportation Engineers (NEITE) "Traffic Calming Guide", originally prepared in the year 2000, is the first effort of the newly reorganized NEITE Technical Committee. The Committee has concluded an update is necessary as key aspects of traffic calming have been changed over time. Traffic calming purposes have shifted somewhat as aspects of traffic calming measures have been incorporated into the notion of "Complete Streets".

Source: Myescambia.com

"Complete Streets" promotes the notion of designing and implementing streets that are intended to accommodate the needs of all its users regardless of age or ability. In the original edition "Traffic Calming Guide" the fundamental purpose of the guide was to promote *keeping through traffic on arterial streets and local traffic on local streets*.

The Institute of Transportation Engineers' (ITE) publication ***Traffic Calming: State of the Practice (1999)*** defined traffic calming as "***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."***

The above ITE definition is rather broad. In fact, *any* traffic control device or feature that enhances pedestrian or bicycle safety (even traffic signals and sidewalks) could be considered by some people to represent traffic calming. A more specific definitive definition of traffic calming is:

> ***Traffic calming*** **involves the planning, design, and implementation of *self-enforcing* traffic control devices or geometric/landscape design features with features *on public ways* to reduce running travel speeds of motorized street users and make them more aware of the circulation needs of non-motorized street users. Traffic calming measures will encourage physical activity within a neighborhood or on a street in ways that enhance health, safety, and quality of life of neighborhood residents and visitors. Only in rare circumstances should traffic calming measures be used to divert traffic volumes and only where traffic volume diversions are broadly acceptable. Implemented traffic calming measures *must* comply with applicable Federal and State laws and regulations (e.g., ADA, AASHTO, MUTCD) and design guidelines.**

The above definition specifically rules out 'increased enforcement' as a primary traffic calming measure. This is because, by definition, increased enforcement is sporadic, not continuous, not self-enforcing, and is a very expensive and open-ended measure.

It is always good *to involve* a community's police department early on in a traffic calming initiative, or in *monitoring* to see how well a measure is working. Traffic calming speed signs, for example, are not

considered as increased enforcement but as a motorist feedback mechanism they may be used to provide data for determining when enforcement monitoring is needed. Also, while not legal in New England at this time, automated speed enforcement by camera has been used effectively to regulate speeds in residential neighborhoods.

The term 'on public ways' was added, as it is assumed this will be used by communities, primarily for budgeting purposes, which can control the level of traffic calming expenditures within public layouts, not necessarily private ways.

Source: ITE

The revised definition also indicates that the primary purpose of traffic calming is to *slow traffic and not necessarily divert* traffic. Diversions are generally adversely impactful and should only be acceptable where the diversionary routes are arterials or collectors and have the ability to absorb the additional volumes from both an operational and safety aspect, and where the 'cure' is not worse than the 'disease'. In situations where arterials or higher classified streets are being considered for traffic calming, the only reason should be to 'slow' not divert traffic. The revised definition assumes most roads where calming will be implemented are local or collectors.

However, it also specifically *does not limit the functional class where traffic calming can be implemented*. Not only can traffic calming be applicable to residential neighborhoods, but also to roads near or providing non-motorized access to activity centers such as schools and colleges, institutional and postal facilities, athletic fields, or downtown and neighborhood retail/commercial land uses. Any of these environments may be cited as places where traffic calming can be considered. This means 'traffic calming' may be applicable to specific segments of arterials and collectors, though the applicability of some features must not ignore the functions of roads that have regional or emergency access needs.

Many older New England communities have a lot of natural 'traffic calming' features already functioning very well in residential or downtown neighborhoods. Narrow streets, with historical dwellings or businesses close to the street, limited rights-of-way, and short blocks with short steep hills are perfect examples of roadways already to a large extent 'traffic-calmed'.

It is primarily relatively *straight and flat roadway alignments with land uses set back from the road* that may have a need to be calmed, whether because they are undesirable residential cut-through routes or whether they entice motorists to travel faster than warranted given multi-modal activity that is being encountered or encouraged. Two other terms directly related to traffic calming are widely being used today – 'Complete' and 'Green' Streets. Complete Streets employ traffic calming measures, in addition to other measures such as sidewalk, bicycle lanes and bus stop and bicycle facilities in an effort to provide streets that adequately address the needs of all their intended users. Green Streets are those designed to be environmentally-friendly. For example, adding green space and encouraging walking and biking on

streets are proven ways to help make streets more environmentally-friendly. Traffic calming features afford the opportunities to provide Green Street treatments and are fully consistent with Complete Streets principles.

The public is generally familiar with the term 'traffic calming', even if particular features are not well understood. It is common for residents in New England communities to request implementation of 'traffic calming' measures along either a street or within a neighborhood. However, problems arise when communities need to determine:

- How much money should we be spending on this?
- Should priority for traffic calming measures be assigned – e.g., besides political implications, are there technical or acceptability criteria that my Community can use to select one of more traffic calming devices for implementation?
- When does a New England State DOT need to get involved?
- Are potential 'side effects' of traffic calming fully addressed? For example, how are municipal services such as emergency vehicle access and response times, trash/recycling pick up, snow plowing, moving vans affected? What happens if traffic shifts to a nearby neighborhood street(s)?
- What is the street's primary function today?
- Does it have pedestrian and bicycle generators nearby?
- Does it serve as a major access corridor?
- What are applicable traffic calming measures for the street segment(s) in question?
- When are applicable traffic calming measures warranted?
- Can and should some traffic calming measures be tested first?

# 1.0 INTRODUCTION

Traffic calming, as a proactive action taken by a City or Town, can protect neighborhood roadways from traffic diverted from congested arterials. Except when necessary to slow traffic in a busy activity center, a purpose of Traffic Calming is to "Keep the Arterial Traffic on the Arterial Streets, and Keeping the Local Streets for Local Traffic." To achieve this purpose, traffic calming is a strategy to introduce ***self-enforcing*** capacity and speed reduction on the neighborhood roads. The objective is to make the arterial more appealing than the local road to the transient motorist. While there may be exceptions, traffic calming is intended for roadways functionally classified as local or collector. Traffic calming proposals for arterials may reduce effective capacity and may encourage diversion to lower classified road.

Source: ITE

Most motorists will stay on arterials until the level of congestion makes the arterial slower than local roads, even with their inherent narrower rights of way and on-street parking. Thus all traffic calming plans should attempt to identify the problem that causes arterial traffic to divert to neighborhood roads. Correcting the root cause of the congestion is often easier than correcting the symptom of excessive arterial traffic penetrating the neighborhoods. A traffic calming plan should address the surrounding neighborhood and transportation system, not just the affected street. Without an area wide comprehensive approach, traffic will simply move from one local street to another.

As important as determining the root cause of the congestion and taking a neighborhood approach to addressing transportation issues is the need to seek professional advice. The services of a qualified professional engineer (P.E.) are recommended well before the implementation of traffic calming devices, and preferably during the project planning stage. As with any transportation improvement plan, liability issues can arise, so it is advantageous to have a design by a professional engineer. Roadway drainage issues, for example, can result from ill-designed traffic calming devices that can cause ice in the winter and ponding in the summer.

Traffic calming should be viewed as the development of a final "plan" that would include such components as:

- Providing education and understanding of traffic calming (local awareness);
- Documenting problems/assessing needs;
- Developing preferences;
- Setting policies; and
- Organizing the process/plan


Source: NATCO

Traffic calming can be an excellent tool for enhancing the quality of life in neighborhoods by reducing traffic speeds, discouraging cut-through traffic, and improving safety.

## 1.1 Purpose of this Guideline

The purpose of this document is to provide an introduction to a wide array of traffic calming techniques to municipal officials. The Guidelines illustrate the applicability of these techniques to varying conditions. The Guidelines are not meant to replace the need for proper planning, design and construction. Rather, public officials should determine if the tools presented in these Guidelines are applicable, and then choose a proper course of action.

## 1.2 Traffic Calming Goals and Objectives

It is important to review the goals of the traffic calming plan as an initial step in this process. Well thought out goals, community participation and professional assistance are the key components to the traffic calming process. Some of these goals include:

- Improving the quality of life;
- Reducing impacts of motor vehicles on local and collector roads;
- Creating safe and attractive streets; and
- Creating a friendly environment for pedestrians and bicyclists.

The following are examples of some objectives that may be achieved by traffic calming:

- Increase the level of respect for non-motorists;
- Create a feeling of safety for all users and abutters;
- Improve safety and convenience for all users;
- Reduce crashes;
- Reduce noise;
- Provide space for non-traffic uses;
- Enhance street appearance;
- Reduce vehicular speed;
- Reduce the need for police enforcement;
- Eliminate/reduce cut-through traffic; and
- Reduce truck volumes

Some traffic calming techniques and plans will not achieve all of these objectives and some may contradict each other. The objectives should be assembled and evaluated as part of the goal setting agenda and the local awareness campaign.

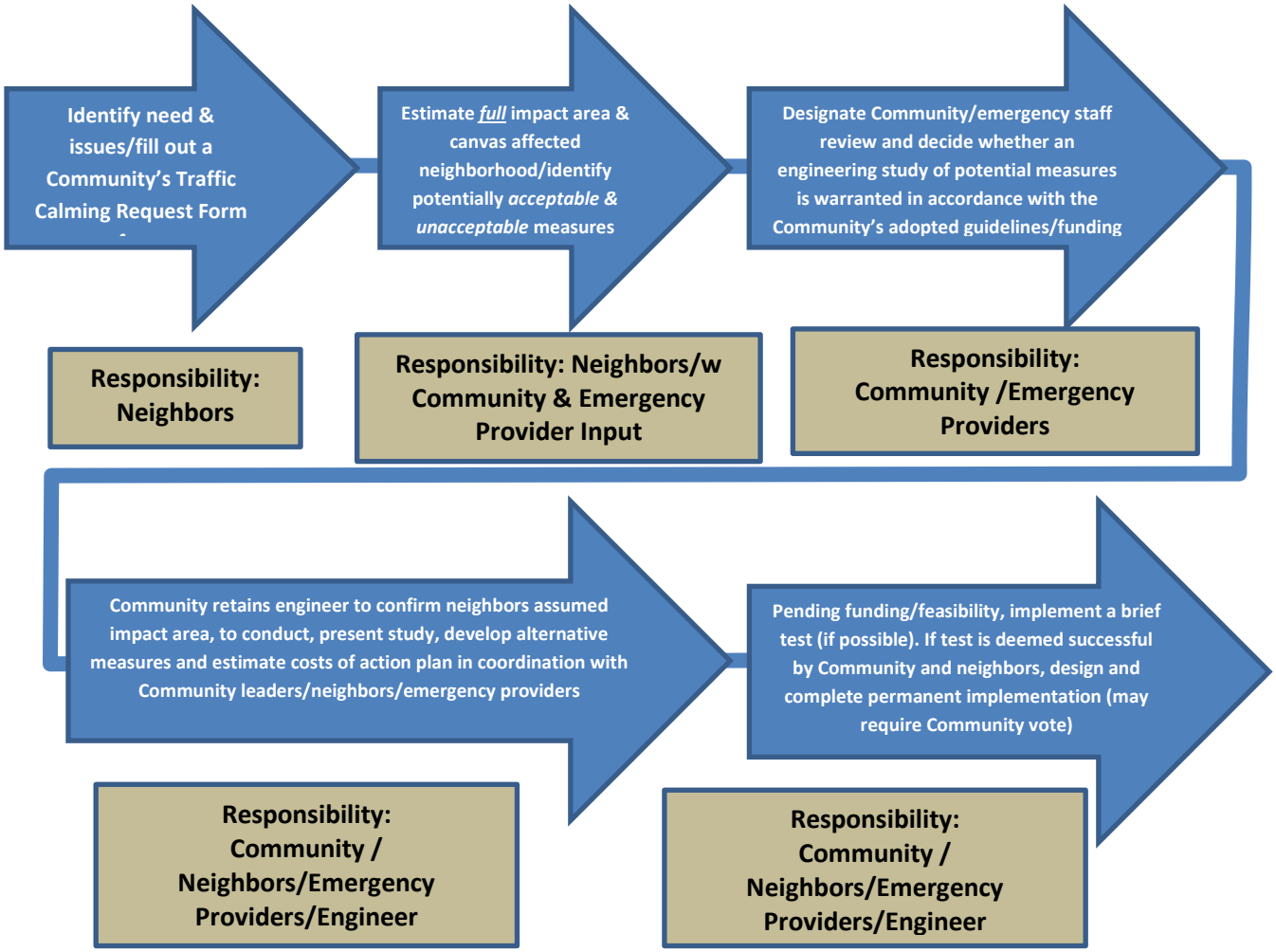
# 2.0 THE PLANNING PROCESS

## 2.1 DEVELOPING A PROCESS

It is recommended that Communities provide a fair and consistent methodology to address requests from neighbors who desire to implement traffic calming measures.

Source: NACTO

There is no such thing as a 'single' or 'standard' process for implementing traffic calming on a Community level. The flow chart below is an example of some of the elements that a Community might consider if traffic calming becomes a routine budget item driven by neighborhood or citizen group requests.




If a Community chooses to highlight traffic calming as a distinct issue to be addressed, the first order of business is for the Community to determine whether it needs a community-wide approach ('top down' approach). Because traffic calming requests are typically initiated by citizens seeking to address a specific issue at a specific location, a 'bottom-up approach' is far more common than a 'top-down' approach. If that's the case, each Community should set its potential funding levels and identify its process for traffic calming implementation. The above flow chart suggests a process for a community to consider.

A community-wide assessment of traffic calming features would simplify the analysis by looking at potential traffic calming measures community-wide and addressing them by need as funding becomes available. If taken, a community-wide approach does require retention of qualified planning and/or engineering professionals to help guide the process to a logical conclusuion. Renewal of a community-wide traffic calming plan will typically be needed about every 5 years. The drawbacks of this approach are: 1) Funding it would be very difficult, and 2) Circumstances for traffic calming measures tend to change over time, so a snap shot view for a community can be misleading. It may be more cost-effective to implement traffic calming as part of a planned maintenance of betterment project.

Tracking life-cycle 'traffic calming' costs is very important. Even though traffic calming measures typically involve relatively low implementation costs, initial costs can vary widely. Traffic calming measures may have recurring maintenance costs. Annual maintenance costs must be considered along with implementation costs, so each community can budget for them properly.

Each Community may wish to establish an annual *maximum* ceiling budget for installation and/or maintenance costs for new traffic calming projects or simply have approved neighborhood plans go through the Town Meeting/Town Council vote process. Having a maximum ceiling of funding will at least frame the applications for traffic calming measures on a competitive/need basis.

A traffic calming plan needs a structured planning process and consultation with all relevant authorities. The planning process for a traffic calming plan is complex and also requires significant public participation because the project is probably being undertaken in response to the needs of the community. Traffic calming is more than simply providing a technical solution to a specific traffic problem. It is an interaction between land use, transportation, and community needs. The following steps are provided as a guide for a traffic calming planning process. The planning process may consist of the following stages.

- Initiate the Study
- Identify Problems and Issues
- Develop a Plan
- Review the Process
- Implement the Plan

Source: tcrpc-pa.org

## 2.2 Initiate the Study

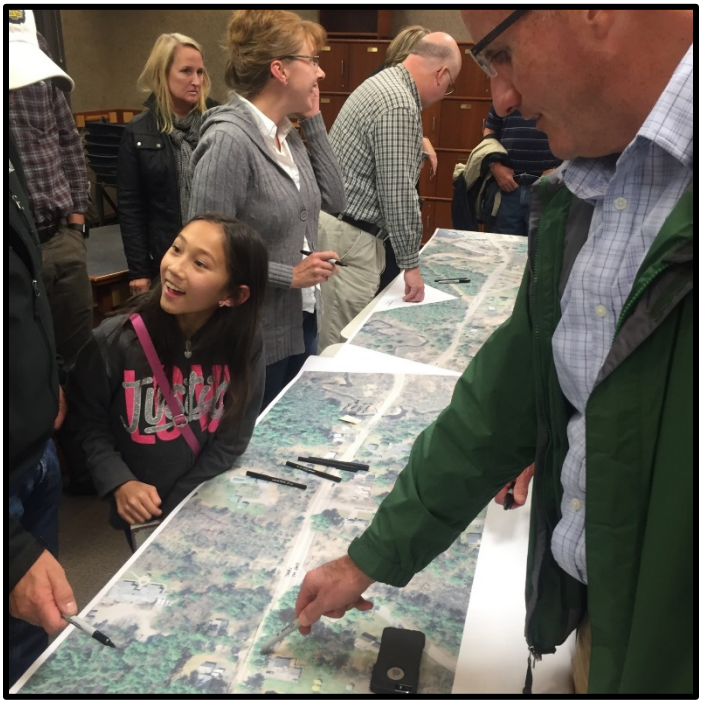
It is important that activities undertaken at the beginning of a traffic calming study determine whether or not the resulting plan will be successful. At study initiation the study team should:

- ***Identify the need for a traffic calming study.*** The need for study can be identified in a variety of ways. In many communities, neighborhood residents or organizations initiate studies by submitting requests. Where this is the case, a formal initiation policy and process is desirable to ensure that requests are addressed consistently and objectively. Some studies are initiated as a result of on-going monitoring efforts by municipal staff in communities where established traffic calming programs exist. As important as determining a real problem is the need to identify a perceived problem that should not be addressed through traffic calming techniques before advancing with the following steps. This is typically done with initial observations and review of travel speeds and crash history. A study may be necessary to determine if a real problem exists (versus a perceived problem). The study may assist the municipality in justifying why traffic calming measures are not necessary.

- ***Establish an Advisory Committee.*** An Advisory Committee that includes community representatives, in addition to municipal staff, should be established to effectively represent the community. It is highly recommended that representatives of the local police, fire and public works departments be included on the Advisory Committee. The role and responsibilities of an Advisory Committee must be clearly defined. An Advisory Committee can effectively help to obtain feedback from a neighborhood regarding prospective traffic calming measures.

- ***Define the study scope and study area.*** A clearly defined study area should be established before the study team proceeds. This helps to ensure that key objectives, constraints, deliverables and points of public contact are identified and agreed upon in advance. Because certain traffic calming measures could divert traffic, it is important that any potential diversionary routes be included in the study area.

- ***Develop a Team.*** Depending on the extent and nature of the traffic calming study, it may be desirable to form a team. The team may consist of the municipality, the Advisory Committee and a qualified professional engineer with expertise in traffic calming to assist with the work.



Source: T.Y. Lin International

- ***Meet with the Team.*** A study initiation meeting among the team, the Advisory Committee and the municipal staff, should be held to ensure that all parties are satisfied with and aware of the issues and scope of work. All financial and organizational matters should be discussed and clarified before the project proceeds. Based on this meeting, the team should develop a detailed work program, schedule and budget for the overall project.

## 2.3 Identify Problems and Issues

It is important that any deficiencies be identified and documented through the Problems and Issues Identification Process. It is equally useful to determine that problems appropriate for traffic calming measures do not exist. In order for this process to be successful, the study team should:

- ***Hold community events.*** Community events are typically held at the outset of the study to identify and clarify the issues to be addressed and to explain the study process to the community. Early public involvement is critical to the success of the project.

- ***Collect data.*** Data should be collected to identify, confirm and quantify the extent of any problems. This information will be used to identify appropriate traffic calming measures, and to establish baseline ("before") conditions for subsequent monitoring of the implemented plan. The data required

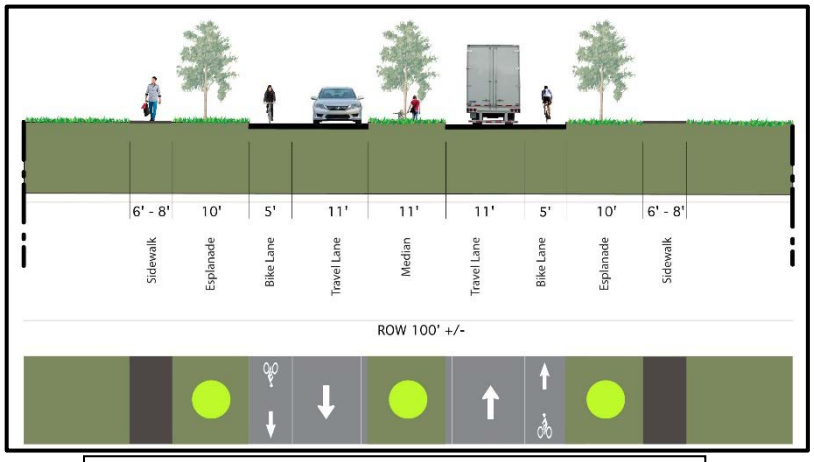
typically includes traffic (pedestrian, bicycle, motor vehicle) volumes, speed data, crash data and other material of this type. Basic roadway geometric information, such as roadway widths, the presence of sidewalks and other roadside features and adjacent land uses are also valuable data that will assist in defining and understanding the problems/issues.

- ***Quantify problems.*** Based on an analysis of the collected data, quantify the magnitude of reported problems (e.g. the number of vehicles per hour or per day), the duration of the problem (e.g. peak periods or all-day), the direction and route of traffic, and other key characteristics. This information will be used to identify potential traffic calming measures. If the problem extends into neighboring communities, contact and coordination must be made and maintained with that community.

## 2.4 Develop a Plan

Once the problems and issues have been identified and quantified, the next stage of the study involves developing the traffic calming plan. The exact manner of the Plan development will vary from town to town. The following steps present a framework for a successful plan:

- ***Examine arterial streets first.*** Prior to considering traffic calming, traffic operations on adjacent arterial streets should be examined to determine that there are no operational problems or deficiencies, which might be contributing to traffic concerns in the neighborhood. If there are any, identify possible modifications to the adjacent arterial street network to eliminate or reduce traffic problems on neighborhood streets. In this way, the traffic calming planning process can reach its objective by developing improvements on arterial streets that obviate the need for further neighborhood traffic calming treatments.




Source: T.Y. Lin International

- ***Examine neighborhood streets.*** Also consider the effects of traffic calming measures on adjacent streets to ensure that problems would be eliminated or minimized, and would not simply be shifted from one location to another. Confirm that all measures would work together to achieve the desired balance between safety, residential access, cost and acceptable traffic conditions. Traffic calming is least effective when residents of one street benefit, while neighbors located on another street experience increased traffic.

- ***Review and select potential traffic calming measures.*** Potential measures should be selected using the information presented in the Definition of Devices section. Use this section to identify all traffic calming measures that could achieve the desired result(s) in the study location. Then use **Tables 1-3** to assess the applicability of these traffic calming measures. The implications of a specific measure might be undesirable or inappropriate for a particular location, and consequently the measure should not be considered. For example, a full street closure would eliminate through traffic entirely, but

might also significantly restrict local access for residents, businesses and emergency vehicles, as well as having a negative Impact on surrounding roadways. If local access were considered important at this location, then a full closure would not likely be appropriate. The impact of implementing a specific measure at a specific location should also be reviewed at this stage, including impacts to roadway drainage and maintenance.

- ***Develop alternative traffic calming plans.*** It is important that more than one alternative traffic calming plan be developed for a project. Combining several traffic calming measures into one comprehensive traffic calming plan can be an effective way to solving transportation problems and help to provide improvements to multimodal transportation.

- ***Hold meetings with the affected study area neighborhood to discuss alternative traffic calming plans.*** Neighborhood specific meetings are an effective tool to present the alternative traffic calming plans and solicit input and comment from all affected and interested parties. If an entire community is affected, community-wide meetings should be considered. Groups to be consulted include local political representatives, directly affected residents and businesses, and emergency and maintenance service providers.

- ***Evaluate the alternatives and select the recommended traffic calming plan.*** Evaluate the alternative traffic calming plans based on the criteria identified in **Tables 1-3**. Based on this evaluation, select the preferred alternative for further design development.

- ***Present the recommended traffic calming plan.*** Upon completion of the technical and public review of the alternative plans, present the recommended plan to the public at an open house or other appropriate forum. The forum should provide the opportunity for the team to receive input and address questions/comments from the public about the features and impacts of the recommended traffic calming plan.

- ***Develop an implementation strategy.*** Once the draft final plan is confirmed, prepare cost estimates and identify priorities, timing and staging of implementation. Costs should be considered throughout the study process – not just at the end of the process.

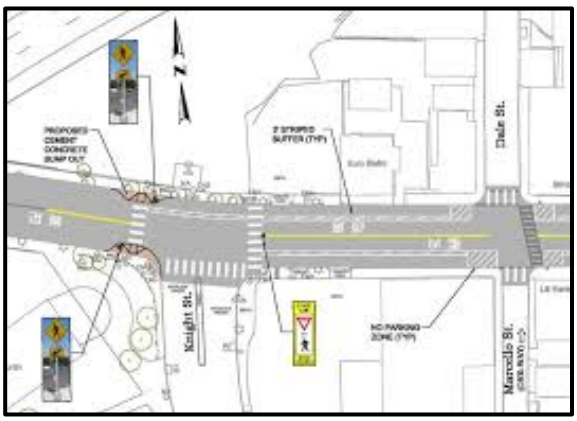
- ***Finalize report and submit the Final Plan for approval.*** Prepare the Draft version of the Plan, incorporate relevant comments from reviewing parties and then submit the Final Plan for approval to the respective authorities.

## 2.5 Plan Review Process

The review process will vary, depending on ownership of the roadway being considered for traffic calming. Town roads require review and approval by local government officials, as well as police, fire and maintenance departments. Strong abutter support is required. Some communities will implement only if 80% of abutters agree with the plan. If state funding is to be used for traffic calming on local roads, additional approval will likely be required from the State DOT's. Plans developed on all state roads will also require review and approval by State DOT's. Whatever the process, it is important to communicate with all relevant parties, particularly those who have direct jurisdiction over the affected roadway(s) before implementing the plan.

## 2.6 Implement the Plan

After the traffic calming plan has been reviewed and approved by the affected parties, the final stage involves design, implementation of traffic calming measures and monitoring. Implementation of the plan involves the following process:




Source: graengs.com

- ***Prepare designs.*** Design should be based on best available current engineering practices.

- ***Implement measures.*** Budget and construct the traffic calming measures. Where appropriate, implement measures on a **temporary or trial basis for a predetermined time,** to confirm that they are effective in addressing identified problems, prior to constructing the measures on a permanent basis. Using temporary measures provides an opportunity to modify the configuration or location of a device without incurring significant costs.

- ***Permanent Installation.*** Once the predetermined test period is over, the temporary measures should be permanently installed.

# 3.0 TRAFFIC CALMING TYPES AND DEFINITION

## 3.1 Vertical Alignment

- ***Raised Crosswalk:*** A flat-topped speed hump, marked as a crosswalk that extends from curb to curb with ADA compliant ramps.

Source: streetsblog.org

- ***Raised Intersection:*** A flat area covering the intersection of two or more streets, generally raised to an intermediate or sidewalk level with ramps on all approaches. (Also called a tabled, hump or plateaued intersection).

- ***Speed Hump:*** A rounded raised mound of pavement, typically 4 inches high and 12 feet wide, placed across a street.

- ***Speed Table:*** A speed table is a raised area placed across the roadway designed to physically limit the speed at which a vehicle can traverse it. Like a speed hump, it extends across the travel way. Unlike a speed hump, a speed table has a long enough flat top (typically, 10 feet) to accommodate the entire

wheelbase of most passenger cars. The longer longitudinal depth in the direction of travel enables comfortable and safe vehicle operating speeds that are faster than for a speed hump.

- ***Speed Pillows, Lumps and Speed Cushion:*** Similar to a traditional speed hump, speed pillows, lumps and cushions are used in locations where communities would like to have the effects of a speed hump without slowing the speed of emergency vehicles or adversely affecting drainage and bicycling. The lumps are commonly made out of prefabricated rubber shapes and bolted into place - leaving gaps for the tires of wide vehicles by evenly spacing them three or four across a street.

## 3.2 Horizontal Alignment

- ***Roundabout:*** A circular island and associated approach treatments located at the intersection of two or higher volume streets that will assign right-of-way among competing traffic movements. Those in the roundabout have right-of-way over the entering traffic.

Source: tompkinscountyny.gov

- ***Mini-Roundabout:*** As defined by FHWA, "a mini-roundabout is a type of intersection that can be used at physically-constrained locations in place of stop-controlled or signalized intersections to help improve safety problems and reduce excessive delays at minor approaches. Mini-roundabouts generally have an inscribed circle that is small enough to stay within the existing right-of-way (or within the existing curb lines if adequate space is available). Mini-roundabouts operate in the same manner as larger roundabouts, with yield control on all entries and counterclockwise circulation around a mountable (traversable) central island."

- ***Traffic Circle:*** A traffic circle is a raised island, placed within an unsignalized intersection, around which traffic circulates. A circle forces a motorist to use reduced speed when entering and passing through an intersection, whether the vehicle path is straight through or involves a turn onto an intersecting street. When yield signs are used on each approach, traffic yields to vehicles within the circle, as is the case for a mini-roundabout. The primary benefit of a traffic circle is an expected reduction in the number of angle and turning collisions. An additional benefit is that it can slow high-speed traffic at the intersection. A typical traffic circle has a horizontal clearance that is too small for a left-turning truck, emergency vehicle, or bus to circulate counterclockwise even with a partially mountable center island. If the local jurisdiction permits the movement, the large vehicle can make a left turn in front of the island. However, some jurisdictions prohibit turn in front of the island.

- ***Median:*** A median island narrowing is a raised island located along the street centerline that narrows the travel lanes at that location. The visual appearance of narrowed lanes encourages a motorist to slow. A median island is physically different from and serves a different purpose as a standard median

on a 4-or-more-lane roadway. The latter median provides separation between opposing vehicle travel lanes, an opportunity for landscaping or visual enhancements to a roadway corridor, and a place of refuge for a pedestrian crossing a multi-lane street – all in support of improved and safe traffic flow. A median island may simply be a painted area that is designated for non-automobile use. But a median island is most effective when it is defined by a raised curb and landscaped to further reduce the open feel of a street. Median islands often incorporate textured pavement on the island itself, particularly for a median island without a raised concrete curb. A median island can often double as a pedestrian refuge island if a cut in the island is provided along a marked crosswalk. Where there is an existing midblock crosswalk, it is desirable to locate the median island at the crosswalk.

- ***Lateral Shift:*** A lateral shift is a realignment of an otherwise straight street that causes travel lanes to shift in one direction. The primary purpose of a lateral shift is to reduce motor vehicle speed along the street. A typical lateral shift separates opposing traffic through the shift with the aid of a median island. Without the island, a motorist could cross the centerline in order to drive the straightest path possible, thereby reducing the speed reduction effectiveness of the lateral shift. In addition, a median island reduces the likelihood a motorist will veer into the path of opposing traffic, further improving the safety of the roadway for motorists.

- ***Offset Intersection:*** Offset intersections feature an offset distance between the centerlines of the intersecting minor road legs of an intersection. Through the offsetting of the legs of an intersection, the appearance is given that the minor roadway is not a through roadway. The additional turning movements required for through traffic has the effect of discouraging cut-through traffic. Offset intersections also have fewer potential conflict points than a traditional intersection and have been demonstrated to have lower crash rates.

- ***Road Narrowing:*** reducing the pavement width of a road to create a narrowing of the roadway cross-section, which often results in reduced vehicle speeds The space may be re-allocated to other modes of travel (such as increased sidewalk widths and bicycle lanes)

- ***Curb Extension (or Bump Out):*** Curb extensions visually and physically narrow the roadway, creating safer and shorter crossings for pedestrians while increasing the available space for street furniture, benches, plantings, and street trees. They may be implemented on downtown, neighborhood, and residential streets, large and small. Curb extensions have multiple applications and may be segmented into various sub-categories, ranging from traffic calming to bus bulbs and midblock crossings.

- ***Road Diet:*** A typical road diet technique is to reduce the number of lanes on a roadway cross-section. One of the most common applications of a road diet is to improve safety or provide space for other modes of travel. For example, a two-way, four lane road might be reduced to one travel lane in each direction.

- ***Transverse Markings:*** These can be used to provide a visual reduction in the width of a travel lane to encourage motorists to increase separation from the roadway edge (a sheet has not been provided).

- ***Chicane:*** A chicane is a series of alternating curves or lane shifts that are located in a position to force a motorist to steer back and forth out of a straight travel path. The curvilinear path is intended to

reduce the speed at which a motorist is comfortable travelling through the feature. The lower speed could in turn result in a traffic volume reduction.

- ***Choker:*** A narrowing of a street at an intersection, mid-block, or on a segment of a street in order to reduce the width of the traveled way (to either two narrow lanes or a single lane) by construction of a sidewalk or landscape buffer. (Also called mid-block narrowing, pinch point, bulb out, or constriction.)

Source: City of Seattle

- ***Lane Narrowing:*** Pavement markings or reduced pavement used to create lanes whose width is uniform, but less than typical.

- ***Neck-Down:*** Narrowing of a street at an intersection to reduce the width of the traveled way by widening of a sidewalk or landscape buffer. (Also called curb extension, knuckle or intersection narrowing.)

- ***On-Street Parking:*** On-street parking can effectively narrow the roadway travel lanes by adding side friction to the traffic flow. On-street parking can be allowed on one or both sides of a roadway. Or parking zones can be strategically located on alternate sides of a roadway to create a chicane effect. Whether on-street parking can be an appropriate traffic calming measure is a direct function of its actual or potential usage (i.e., parking demand). In order for the presence of on-street parking to be an effective and safe traffic calming measure, it must be occupied with parked vehicles during the time when traffic calming is desired. The different types of on-street parking (parallel and both front-in and back-in angled) have different horizontal width effects and operational effects.

- ***Center Island Narrowing:*** A physical device located on a segment of a street in order to reduce the width of the traveled way and provide a refuge for pedestrians. (Also called median slow point or median choker.)

## 3.3 Vehicle Use Restriction

Source: uctcsrts.com

- ***Signed Versus Physical Obstructions*:** This can include using regulatory signs to restrict motorist actions.

- ***Forced Turn Island*:** A noted in the graphic to the right, raised islands restrict movements at an intersection.

- ***Truck Use Restriction*:** This requires an alternative arterial truck route and state approval may be required.

- ***Full Street Closure:*** A street closure which includes construction of a turn-around area.

- ***Diagonal Diverter:*** A barrier placed between opposite corners of an intersection, prohibiting through traffic. (Also called full diverter or diagonal road closure.)

- ***Median Barrier:*** A physical barrier along the center of a street through an intersection which prohibits left turns and through traffic from the intersecting street. (Also called median diverter or island diverter.)

- ***One-Way Street:*** A street designated for travel in a single direction only.

- ***Semi Diverter:*** A physical barrier which prohibits one or more traffic movements at an intersection or on a street, while not completely closing the street.


Source: centennialco.gov

## 3.4 Other

- ***Speed Feedback Signs:*** These draw attention to motorist behavior and can provided data for police monitoring (a cut sheet has not been provided).

- ***On-Road Bike Facilities:*** Numerous types of on-road bike facilities are available to provide bike users with a higher visibility profile on public ways, whether as separate lanes or simply a notice to motorists that indicates bike lanes may be present. They can serve as an effective way to slow traffic, especially at critical intersections, but are usually considered more of "complete streets" than "traffic calming" measures.

- ***Gateway:*** A median island or other vertical treatment located at the entrance to a neighborhood, often combined with textured pavement and landscape features.

Source: NACTO

# 4.0 DESIGN CONSIDERATIONS

## 4.1 Safety

Perhaps the most controversial aspect of Traffic Calming is safety. Some of the key principles of traffic engineering (wider roads, straighter alignments, and improved slight distances) seem to be incongruous with the techniques prescribed by traffic calming advocates. Often the neighborhoods desire to enhance safety by implementing a traffic calming plan are in conflict with municipal services, such as fire or police department's response times. To date, collision data on traffic calming devices are positive but not comprehensive.

Most transportation professionals will agree that slower traffic, with less conflicts and attentive drivers may result in fewer and less severe crashes. Safety for all street users likely can be improved when traffic calming measures are appropriately located and designed to address identified problems. Where a traffic calming measure would unreasonably compromise safety for any segment of the travelling public, the measure should not be used, even if it might provide some benefits. In these cases, a more appropriate solution can often be used which would not result in potential safety problems.

## 4.2 Maintenance

Some traffic calming measures result in increased maintenance activities for a community or neighborhood and should be addressed on a site specific basis. For example, devices which require landscaping treatments, or changes to the roadway pavement (e.g. speed humps, raised intersections and textured pavements) have been cited as requiring an increased maintenance activity. Specific maintenance concerns include snow removal and storage; street sweeping; drainage; debris build-up; water ponding and ice formation and potential damage to roadway surfaces or curbing.

## 4.3 Emergency Vehicles

Emergency response times should be a major concern of any traffic calming proposal. Unfortunately, traffic calming devices that reduce overall vehicular speeds can impact emergency vehicles by increasing response times. At a minimum, traffic calming measures that are aimed at speed reduction should not be installed on primary emergency routes or adjacent to key emergency response facilities such as fire stations, hospitals, etc. or selected and designed in a manner that will not inhibit emergency response. The key ingredient to a successful traffic management program is communication. Key members of the local emergency response teams should be part of the planning process for all traffic calming proposals.

## 4.4 Diversions to Other Residential Streets

Traffic Calming measures aimed at reducing the volume of through traffic or non-essential traffic within a neighborhood should be evaluated on an area-wide basis. Estimates of the percentage of local and through trips should be obtained before any traffic calming measure is implemented to aid in the evaluation of diversion potential.

## 4.5 Self Enforcement

Standard traffic control devices rely primarily on voluntary compliance or enforcement by law enforcement officials. By contrast, traffic calming devices rely on laws of physics and are primarily intended to be self-enforcing.

## 4.6 Roadway Drainage

When introducing any changes to profile or alignments such as recommending medians, raised islands, and horizontal or vertical shifts (speed bumps, humps, etc.) to provide traffic calming, care should be taken to not disrupt runoff paths to roadway drainage structures (such as catch basins). When this disruption cannot be avoided, additional drainage structures should be provided and integrated into the existing drainage system. Otherwise, ponding of water and ice formation will occur, creating hazardous driving and walking conditions. A qualified professional engineer should review plans that would impact highway drainage.

## 4.7 Costs/Financing

Installation (i.e., construction) of a traffic calming plan is the most obvious cost. There are, however, several other costs to be considered, including maintenance of traffic during construction, ongoing maintenance, user/travel costs, replacement and restoration costs. These additional costs should be considered and estimated before going forward with a new traffic calming project.

Responsible authorities should consider the length of time the planned layout will be effective and desirable when choosing the materials and methods of installation used. They should also make it clear who should share the burden of initial and ongoing costs.

Prior to commitment of all financial resources to the final traffic calming plan, many projects have been implemented on a trial basis to confirm that the intended results actually occur and that there are no unforeseen adverse consequences. Sometimes plans fail to achieve their intended results and have to be abandoned. Thus most plans are tested with temporary devices, minimizing any expenses to restore the roadway to its previous condition. During the trial period, low cost, movable and easily disposable substitute materials and features can be used rather than the permanent features. Examples of this approach include: barrels, sandbags and bituminous curbs that are used rather than granite and concrete curbs; signs that are placed in moveable buckets rather than in their final placement sites; paper or painted lines that are used rather than thermoplastic lines; and deferral of landscaping effort – all to save costs should the plan not gain public acceptance. Temporary measures should be designed with consideration to the appearance of such devices to avoid an unsightly environment.

# 5.0 APPLICABILITY OF TRAFFIC CALMING DEVICES

While a generic understanding of traffic calming is useful, it is also important to understand the proper application of each calming device to achieve the desired effect. **Tables 1-3** provide a summary of each device and an index of the appropriate use for to effect reductions in speed, volume and truck traffic, respectively. An index is assigned for arterial, collector and local roadway classifications. CAUTION: the index is provided as a guide, but **engineering judgement and specific conditions require that each case be evaluated individually.** Descriptions of the type of service provided by each roadway classification, as contained in the American Association of State Highway and Transportation Officials (AASHTO) Publication, A Policy on Geometric Design of Highways and Streets, are provided for additional guidance. These roadway classifications are:

- *Arterial* – Provides the highest level of service at the greatest vehicle speed for the longest uninterrupted distance.

- *Collector* – Provides a less highly developed service at a lower speed for shorter distances and collects traffic from local roads and funnels it to arterials.

- *Local* – Provides access to abutting land with little or no through movement. Consists of all roads not defined as arterials or collectors. Functional classification designations for roads are available from each state.

The Federal Highway Administration (FHWA) requires that public roads be functionally classified. The classification is not based upon abutting land uses, rather on how the roadway serves the motoring public. Every public road in Massachusetts has been functionally classified. The Massachusetts Highway Bureau of Transportation Planning and Development can provide this information to any city of town requesting it. Traffic calming plans on roads with a functional classification of arterial or higher will meet resistance in the MassDOT review process.

Traffic calming is a technique used to impact driver behavior on behalf of neighborhood residents. While this technique provides many options for local officials to implement, public consensus must be gained and maintained before any plan is implemented. Using a comprehensive planning process, design completed by a qualified professional engineer, and careful consideration of potential negative impacts of traffic calming devices, officials can improve the quality of life in a neighborhood and encourage use of non-motorized transportation modes.

# APPENDIX

# TRAFFIC CALMING STRATEGIES

# Diagonal Diverter

A barrier placed between opposite corners of an intersection, prohibiting through traffic. (Also called full diverter or diagonal road closure.)

## Improvement Type

☑ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

## Problem-Area Target

☐ Speed
☑ Cut-Through Volume
☑ Truck Traffic
☐ Safety
☐ Multi-Modal Accommodations

Source: www.pedbikesafe.org

## Design Considerations

- Does not close street, but does redirect traffic;
- Can maintain pedestrian and bicycle movements;
- Reduces traffic volumes by creating a less attractive cut-through route;
- Drainage is a consideration;
- Reduces traffic volumes by creating a less attractive cut-through route;

## Typical Context

☐ Central Business District
☐ Village/Town Center
☐ High Density Suburban
☐ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☐ Arterial
☐ Collector
☑ Local Roads and Street

## Additional Resources

1. http://trafficcalming.org

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# Forced Turn Island

Implementation of features, like raised islands, that restrict movements at an intersection.

## Improvement Type

☑ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

## Problem-Area Target

☐ Speed
☑ Cut-Through Volume
☐ Truck Traffic
☐ Safety
☐ Multi-Modal Accommodations

Source: www.sacdot.com

## Design Considerations

- Prevent traffic from making certain movements;
- Can improve safety by prohibiting certain movements;
- May divert traffic to another route;
- Design properly to ensure compliance with prohibitions;
- Minimize lane width to slow vehicle speeds;
- Minimize vehicle speeds by tightening the angle of deflection;
- Consider accessibility;
- Drainage is a consideration;

## Typical Context

☐ Central Business District
☐ Village/Town Center
☐ High Density Suburban
☐ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☐ Arterial
☑ Collector
☑ Local Roads and Streets

## Additional Resources

1. https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/sidewalk2/sidewalks209.cfm
2. http://www.sacdot.com/Pages/NTMP-ForcedTurnIsland.aspx

June 2016

# Truck Use Restriction

Installation of signs that prohibit trucks from using a designated streets. This action requires an alternative arterial truck route and state approval may be required.

## Improvement Type

☐ Geometric
☑ Signage
☐ Pavement Markings
☐ ITS Device

Source: www.ct.gov/dot

## Problem-Area Target

☐ Speed
☑ Cut-Through Volume
☑ Truck Traffic
☐ Safety
☐ Multi-Modal Accommodations

## Design Considerations

- Prohibits trucks per signs;
- Safety issues or crash history could indicate a need;
- Trucks could divert to alternate routes;
- Alternate route should be appropriate;
- Laws, regulations and policies may apply.

## Typical Context

☐ Central Business District
☐ Village/Town Center
☐ High Density Suburban
☐ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☐ Arterial
☐ Collector
☑ Local Roads and Streets

## Additional Resources

1. http://www.fairfaxcounty.gov/fcdot/rtap.htm#truck

June 2016

# Chicanes

Chicanes are alternating pavement markings, raised curbs or landscape island used to provide horizontal deflection and curved path through an otherwise straight section of roadway. The photo below shows a method pf using pavement marking and on-street parking to achieve the chicane effect.

## Improvement Type

☑ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

*Source: MassDOT*

## Problem-Area Target

☑ Speed
☑ Cut-Through Volume
☐ Truck Traffic
☐ Safety
☐ Multi-Modal Accommodations

## Design Considerations

- Drainage and street maintenance should be considered.
- Operation of emergency vehicles and buses is a consideration.
- Chicanes may be designed with cut-through or bypass lane for bicycles.
- Enhance visibility of chicanes with landscaping and signage.

## Typical Context

☐ Central Business District
☐ Village/Town Center
☐ High Density Suburban
☐ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☐ Arterial
☐ Collector
☑ Local Roads and Street

## Additional Resources


1. National Association of City Transportation Officials, Urban Street Design Guide, 2013
2. Safe Routes To School Guide http://guide.saferoutesinfo.org/engineering/chokers_and_chicanes.cfm
3. Ewing, Reid and Brown, Steven J., US Traffic Calming Manual, American Planning Association, 2009

# One-Way/Full Closure Restrictions

Implementation of geometric and signage strategies that restrict movements at an intersection. The photo below notes a street that prohibits movements onto the side street.

## Improvement Type

☑ Geometric
☑ Signage
☐ Pavement Markings
☐ ITS Device

## Problem-Area Target

☐ Speed
☑ Cut-Through Volume
☐ Truck Traffic
☐ Safety
☐ Multi-Modal Accommodations


Photo Source: City of Cambridge, MA

## Design Considerations

- May inconvenience access for local residents and businesses.
- Extensive coordination required with affected residents and businesses prior to implementation.
- Can create circuitous traffic patterns and increase traffic on nearby streets.
- Generally requires a one-way couplet and will shift traffic volumes other adjacent streets.
- Midblock vehicle speeds could increase if physical measures are not implemented.

## Typical Context

☑ Central Business District
☑ Village/Town Center
☑ High Density Suburban
☑ Low Density Suburban
☐ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☑ Arterial
☑ Collector
☑ Local Roads and Street

## Additional Resources

1. Federal Highway Administration, *Manual on Uniform Traffic Control Devices (MUTCD)*, Washington, DC, 2009, as amended.
2. Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE), *(pedbikesafe.org)*

June 2016

# Curb Extension (or Bump Outs)

A curb extension of sidewalk or planting strip into corners of intersections or at a midblock location, narrowing the traveled way. Frequently used at pedestrian crossings to not only calm traffic but to provide pedestrians with improved visibility of on-coming traffic and reduce the pedestrian exposure by minimizing crossing distance. It can also be used to reduce illegal parking at corners and bus stops and to provide additional space for pedestrian amenities. Curb Extensions (at intersections) are sometimes called bulb-outs, knuckles or corner bulges.

## Improvement Type

- ☑ Geometric
- ☐ Signage
- ☐ Pavement Markings
- ☐ ITS Device

*Photo Credit: CSTNE Project*

## Problem-Area Target

- ☑ Speed
- ☐ Cut-Through Volume
- ☐ Truck Traffic
- ☑ Safety
- ☑ Multi-Modal Accommodations

## Design Considerations

- May be used in combination with other traffic calming measures such as raised intersections and textured crosswalks
- Design must still accommodate vehicular turns
- Adjustments in drainage may be required
- Driveway and parking location may be a consideration in determining design
- Consider bicyclists during design process.

## Typical Context

- ☑ Central Business District
- ☑ Village/Town Center
- ☑ High Density Suburban
- ☑ Low Density Suburban
- ☑ Residential
- ☐ Natural/Rural Open Space

## Typical Roadway Type

- ☑ Arterial
- ☑ Collector
- ☑ Local Roads and Street

### Additional Resources


1. Federal Highway Administration: *Designing Sidewalks and Trails for Access*, Updated February 2014 http://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/sidewalk2/sidewalks207.cfm
2. Federal Highway Administration: *Curb Extensions / Neckdowns* http://contextsensitivesolutions.org/content/topics/css_design/design-examples/flexible-design-elements/curb-extensions-m/


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# Raised Intersection

## Improvement Type

☑ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

## Problem-Area Target

☑ Speed
☑ Cut-Through Volume
☐ Truck Traffic
☐ Safety
☐ Multi-Modal Accommodations


*Source: NACTO*

## Design Considerations

- Traffic generators: Not recommended for high-volume roadways.
- Right-of-way: Can be constructed within existing limits of roadway.
- Warning signs may be placed in advance of tables. Tables should be painted with warning indicators to heighten visibility.

## Typical Context

☑ Central Business District
☑ Village/Town Center
☑ High Density Suburban
☐ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☐ Arterial
☐ Collector
☑ Local Roads and Street

## Additional Resources

1. National Association of City Transportation Officials (NACTO), *Urban Street Design Guide*
2. Institute of Transportation Engineers (ITE), Traffic Calming Measures

# Road Diet

A reduction in the number of through travel lanes within the existing roadway width in order to calm traffic, mitigate safety issues and obtain space to accommodate other modes of transportation. A road diet often consists of replacing two unnecessary through travel lanes (along a four lane two-directional roadway) with one center turn lane.

## Improvement Type

☑ Geometric
☑ Signage
☑ Pavement Markings
☐ ITS Device

## Problem-Area Target

☑ Speed
☐ Cut-Through Volume
☐ Truck Traffic
☑ Safety
☑ Multi-Modal Accommodations

*Before*

*After*

*Source: Rochester Cycling Alliance*

## Design Considerations

- A traffic evaluation is required for each location being considered for a road diet to verify feasibility, to accommodate traffic demand and to effectively address crash patterns.
- Typically, a two-way left turn lane is provided at appropriate locations.
- Slow moving and frequently stopping vehicles are another considerations in identifying road diet candidates.
- Provisions to maintain transit service are required.
- Education and public outreach play a critical role in road diets. Temporary striping can be used as a trial basis in such projects.

## Typical Context

☑ Central Business District
☑ Village/Town Center
☑ High Density Suburban
☑ Low Density Suburban
☐ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☑ Arterial
☑ Collector
☐ Local Roads and Street

**Additional Resources**


1. Federal Highway Administration: *Evaluation of Lane Reduction "Road Diet" Measures and Their Effects on Crashes and Injuries*, March 2004 http://www.fhwa.dot.gov/publications/research/safety/humanfac/04082/index.cfm
2. Federal Highway Administration: *Road Diet Information Guide*, November 2014 http://safety.fhwa.dot.gov/road_diets/info_guide/ch3.cfm

# Speed Cushion

Similar to a traditional speed hump, speed cushions are used in locations where communities would like to have the effects of a speed hump without slowing the speed of emergency vehicles or adversely affecting drainage and bicycling. They are commonly made out of prefabricated rubber shapes and bolted into place - leaving gaps for the tires of wide vehicles by evenly spacing them three or four across a street.

## Improvement Type

☑ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

## Problem-Area Target

☑ Speed
☑ Cut-Through Volume
☐ Truck Traffic
☐ Safety
☐ Multi-Modal Accommodations

***Photo Credit: National Association of City Transportation Officials (NACTO)***

## Design Considerations

- Traffic generators: Not recommended for high-volume roadways.
- Multimodal: Space between allows bicycles to circumvent cushions.
- Right-of-way: Can be constructed within existing limits of roadway.
- Geometry and Necessary Equipment: Warning signs should be placed in advance of cushions. Cushions should be painted to heighten visibility.

## Typical Context

☐ Central Business District
☐ Village/Town Center
☑ High Density Suburban
☑ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☐ Arterial
☐ Collector
☑ Local Roads and Street

## Additional Resources

1. National Association of City Transportation Officials (NACTO), *Urban Street Design Guide*
2. Institute of Transportation Engineers (ITE), Traffic Calming Measures

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# Speed Hump

A rounded raised mound of pavement, typically 4 inches high and 12 feet wide, placed across a street.

## Improvement Type

☑ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

## Problem-Area Target

☑ Speed
☑ Cut-Through Volume
☐ Truck Traffic
☐ Safety
☐ Multi-Modal Accommodations

***Source:*** **City of Surrey, CA**

## Design Considerations

- Traffic generators: Not recommended for high-volume roadways.
- Bicycle modes shall be considered.
- Right-of-way: Can be constructed within existing limits of roadway.
- Geometry and Necessary Equipment: Warning signs should be placed in advance of hump. Pavement markings should be placed in advance of and/or on the hump.

## Typical Context

☐ Central Business District
☐ Village/Town Center
☐ High Density Suburban
☑ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☐ Arterial
☑ Collector
☑ Local Roads and Street

## Additional Resources

1. National Association of City Transportation Officials (NACTO), *Urban Street Design Guide*
2. Institute of Transportation Engineers (ITE), Traffic Calming Measures

# Speed Table/Raised Crosswalk

A flat-topped speed hump, marked as a crosswalk that extends from curb to curb with ADA compliant ramps.

## Improvement Type

☑ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

*Photo Credit: City of Minneapolis, MN*

## Problem-Area Target

☑ Speed
☑ Cut-Through Volume
☐ Truck Traffic
☐ Safety
☑ Multi-Modal Accommodations

## Design Considerations

- Traffic generators: Not recommended for high-volume roadways.
- Multimodal: Bicycle accommodations shall be considered. Raised plateau allows table to be placed at location of crosswalk.
- Right-of-way: Can be constructed within existing limits of roadway.
- Geometry and Necessary Equipment: Tables are designed as a long speed hump with a flat middle section. Tables are generally long enough for the entire wheelbase of a passenger car to rest on top. Warning signs should be placed in advance of tables. Tables should be painted with warning indicators to heighten visibility.

## Typical Context

☐ Central Business District
☑ Village/Town Center
☑ High Density Suburban
☐ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☐ Arterial
☑ Collector
☑ Local Roads and Street

## Additional Resources

1. National Association of City Transportation Officials (NACTO), *Urban Street Design Guide*
2. Institute of Transportation Engineers (ITE), Traffic Calming Measures

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# Lane Narrowing

Pavement markings or reduced pavement used to create lanes whose width is uniform, but less than typical.

## Improvement Type

☐ Geometric
☐ Signage
☑ Pavement Markings
☐ ITS Device

## Problem-Area Target

☑ Speed
☐ Cut-Through Volume
☐ Truck Traffic
☑ Safety
☑ Multi-Modal Accommodations

Photo by RP Campbell

## Design Considerations

- Effect is enhanced by proximity of physical elements such as close to buildings, street trees, street furniture, parked cars, bike lanes, channelization devices;
- Bike lanes may be feasible with narrow travel lanes and improve multi-modal use of corridor;
- Effective by making slower speeds seem natural to drivers, but most effective with physical encroachment rather than markings-only.

## Typical Context

☑ Central Business District
☑ Village/Town Center
☑ High Density Suburban
☑ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☑ ☐ Arterial
☑ Collector
☑ Local Roads and Street

## Additional Resources

1. www.fhwa.dot.gov/publications/research/safety/08067/
2. www.library.ite.org/pub/e21de8d7-2354-d714-51a2-8c9fab1ec8d1

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# Lateral Shifts

Lateral shifts are curb extensions that cause travel lanes to be deflected one way and then back the other way.

## Improvement Type

☑ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

## Problem-Area Target

☑ Speed
☑ Cut-Through Volume
☐ Truck Traffic
☐ Safety
☐ Multi-Modal Accommodations

*Photo Credit: FHWA*

## Design Considerations

- Lateral shifts are appropriate for mid-block road segments.
- Consider installing center island to minimize drivers crossing the centerline.
- Drainage must be addressed.
- Visibility of curb extensions and center islands is a consideration.

## Typical Context

☐ Central Business District
☑ Village/Town Center
☑ High Density Suburban
☑ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☐ Arterial
☑ Collector
☑ Local Roads and Street

## Additional Resources


1. National Association of City Transportation Officials, Urban Street Design Guide, 2013
2. Ewing, Reid and Brown, Steven J., US Traffic Calming Manual, American Planning Association, 2009

# Medians

A median is a raised island at the centerline of a street, at an intersection or midblock that narrows the travel lanes at that location. The median can act as a narrowing device in the roadway in order to narrow the adjacent travel lanes.

## Improvement Type

☑ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

## Problem-Area Target

☑ Speed
☑ Cut-Through Volume
☐ Truck Traffic
☑ Safety
☑ Multi-Modal Accommodations

*Photo Credit: ITE*

## Design Considerations

- May reduce or prevent access to driveways
- May provide a cut-through for pedestrian accessibility and pedestrian refuge and reducing pedestrian crossing distance
- Drainage and stormwater runoff needs consideration
- Emergency/Large vehicles may be impacted if traffic volume is heavy.
- Bicycle lanes and parking shall be considered
- Landscape islands, object markers, and pavement markings improve visibility.

## Typical Context

☑ Central Business District
☑ Village/Town Center
☑ High Density Suburban
☑ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☑ Arterial
☑ Collector
☑ Local Roads and Street

**Additional Resources**


1. National Association of City Transportation Officials, Urban Street Design Guide, 2013
2. Safe Routes To School Guide http://guide.saferoutesinfo.org/engineering/chokers_and_chicanes.cfm
3. Ewing, Reid and Brown, Steven J., US Traffic Calming Manual, American Planning Association, 2009

# On-Street Parking

On-street parking can effectively narrow the roadway travel lanes by adding side friction to the traffic flow. On-street parking can be allowed on one or both sides of a roadway. Or parking zones can be strategically located on alternate sides of a roadway to create a chicane effect.

## Improvement Type

☐ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

Source: TYLI .

## Problem-Area Target

☑ Speed
☐ Cut-Through Volume
☐ Truck Traffic
☐ Safety
☐ Multi-Modal Accommodations

## Design Considerations

- On-Street Parking introduces a physical element in close proximity to moving traffic;
- Can be applied on both sides, one side, or alternating from one side to the other;
- Adversely affects on-street cycling unless bike lane can also be added;
- Sight distance at intersections and crosswalks / pedestrian crossing areas shall be reviewed;
- Adversely affects snow storage and mechanical curbside trash collection;

## Typical Context

☑ Central Business District
☑ Village/Town Center
☑ High Density Suburban
☑ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☑ Arterial
☑ Collector
☑ Local Roads and Street

## Additional Resources


1. www.library.ite.org/pub/e21de8d7-2354-d714-51a2-8c9fab1ec8d1
2. Wesley E. Marshall, Norman W. Garrick, Gilbert Hansen, "Reassessing On-Street Parking", Transportation Research Record No. 2046, pp. 45-52, Washington D.C., 2008

# Mini-Roundabouts

Mini-roundabouts are a type of roundabouts characterized by a small diameter and traversable islands (central island and painted splitter islands), best suited for environments with low speeds, where Modern Roundabouts are not feasible.

## Improvement Type

☑ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

*Photo Credit: FHWA*

## Problem-Area Target

☑ Speed
☑ Cut-Through Volume
☑ Truck Traffic
☑ Safety
☑ Multi-Modal Accommodations

## Design Considerations

- Right-of-way: Mini-Roundabouts require significantly less area than a traditional roundabout, but may need more than a traditional stop-controlled intersection.
- Optimal solution for a safety or operational issue at an existing stop-controlled or signalized intersection.
- Truck volumes: Large truck volumes may increase delays.
- Close proximity to large traffic generators may affect mini-roundabout operations.
- Suitable for low speed urban environments with average operating speeds of 30mph or less.

## Typical Context

☑ Central Business District
☑ Village/Town Center
☐ Urban
☑ High Density Suburban
☑ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☐ Arterial
☑ Collector
☑ Local Roads and Street

**Additional Resources**


1. Federal Highway Administration, *Mini-Roundabouts (FHWA-SA-10-007)*, FHWA, Washington, DC, 2010.
2. Rodegerdts, Lee A., et al, *Roundabouts: An Informational Guide, Second Edition (NCHRP Report 672)*, National Cooperative Highway Research Program, Washington, DC, 2010.
3. Zhang, Wei, et al, "They're Small But Powerful," *Public Roads (FHWA-HRT-13-001)*, Volume 76, No. 3, November/December 2012.


June 2016

# Roundabouts

Modern roundabout is a form of circular intersection in which traffic travels counter-clockwise around a central non-traversable island with splitter islands at entries/exits and in which entering traffic must yield to circulating traffic.

## Improvement Type

☑ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

## Problem-Area Target

☑ Speed
☐ Cut-Through Volume
☐ Truck Traffic
☑ Safety
☑ Multi-Modal Accommodations

*Braintree, MA*
*Photo Credit: Tetra Tech*

## Design Considerations

- Optimal solution for a safety or operational issue at an existing stop-controlled or signalized intersection.
- Allows higher speeds at entry, on the circulatory roadway and at the exit when compared with mini-roundabouts.
- Right-of-way: Require larger area due to larger inscribed circle diameter.
- Roundabouts can accommodate truck turning radii by providing a traversable apron around the perimeter of the central island.
- Multi-lane roundabouts needs to consider bicycle and pedestrian use.

## Typical Context

☑ Central Business District
☑ Village/Town Center
☑ High Density Suburban
☑ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☑ Arterial
☑ Collector
☑ Local Roads and Street

**Additional Resources**


1. Rodegerdts, Lee A., et al, *Roundabouts: An Informational Guide, Second Edition (NCHRP Report 672)*, National Cooperative Highway Research Program, Washington, DC, 2010.
2. Safe Routes to School, http://guide.saferoutesinfo.org/engineering/roundabouts.cfm


June 2016

# On-Street Bicycle Facilities

Numerous types of on-road bike facilities are available to provide bike users with a higher visibility profile on public ways, whether as separate lanes or simply a notice to motorists that indicates bike lanes may be present. They can serve as an effective way to slow traffic, especially at critical intersections, but are usually considered more of "complete streets" than "traffic calming" measures.

## Improvement Type

☑ Geometric
☑ Signage
☑ Pavement Markings
☐ ITS Device

## Problem-Area Target

☑ Speed
☐ Cut-Through Volume
☐ Truck Traffic
☑ Safety
☑ Multi-Modal Accommodations

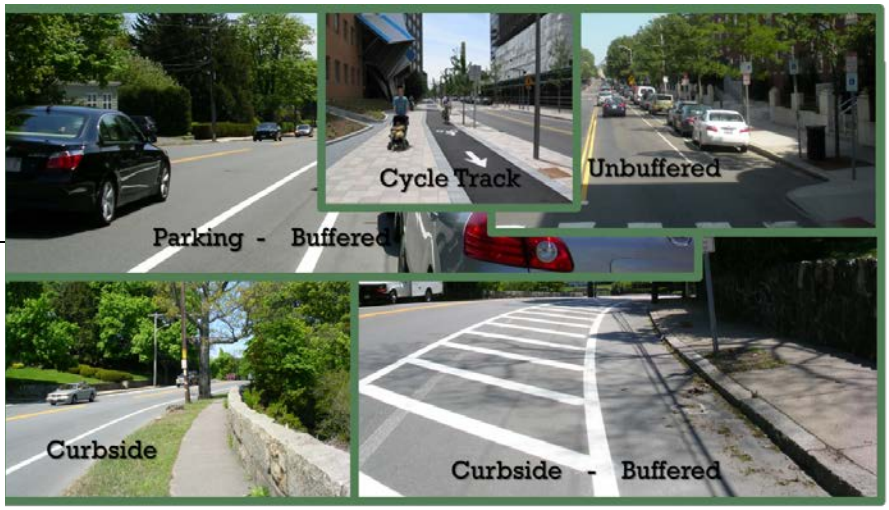

Photo Source: Gary Hebert, FST

## Design Considerations

- Type: high-end with protected elements requiring wide layouts to shared lane markings with tight layouts.
- Truck volumes: space must recognize on-street loading, provide acceptable through lane width and driveway densities

## Typical Context

☑ Central Business District
☑ Village/Town Center
☑ High Density Suburban
☑ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☑ Arterial
☑ Collector
☑ Local Roads and Street

### Additional Resources


1. Federal Highway Administration, *Manual on Uniform Traffic Control Devices (MUTCD)*, Washington, DC, 2009, as amended.
2. National Association of City Transportation Officials, "*Urban Bikeway Design Guide", 2nd Edition*," March 2014.
3. American Association of State Highway and Transportation Official "*Guide for the Development of Bicycle Facilities* , 4th Edition, "2012.


June 2016

# Gateway Treatment

A median island or other vertical treatment located at the entrance to a neighborhood, often combined with textured pavement and landscape features.

## Improvement Type

☑ Geometric
☑ Signage
☑ Pavement Markings
☐ ITS Device

## Problem-Area Target

☑ Speed
☐ Cut-Through Volume
☐ Truck Traffic
☑ Safety
☐ Multi-Modal Accommodations

*Dublin Oval Arterial Gateway, Dublin, NH*
*Source: Stantec*

## Design Considerations

- Gateways come in all sizes and shapes but must be designed to accommodate largest vehicles for roadway type. Residential gateways are most common.
- Impacts on drainage and emergency vehicle access must be addressed.

## Typical Context

☑ Central Business District
☑ Village/Town Center
☑ High Density Suburban
☑ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☑ Arterial
☑ Collector
☑ Local Roads and Street

### Additional Resources


1. New Jersey Department of Transportation, *State of New Jersey Roadway Design Guide* Chapter 15, Traffic Calming, 2014.
2. *Project Development and Design Guide*, Chapter 16.5.10, Massachusetts DOT, Boston, MA, 2006.
3. Buckhurst, Fish & Jacquemart, *Traffic Calming Study and Approval Process for State Highways*" Vermont Agency of Transportation, September, 2003.

# Offset Intersection

Offset intersections feature an offset distance between the centerlines of the intersecting minor road legs of an intersection. Through the offsetting of the legs of an intersection, the appearance is given that the minor roadway is not a through roadway. The additional turning movements required for through traffic has the effect of discouraging cut-through traffic. Offset intersections also have fewer potential conflict points than a traditional intersection and have been demonstrated to have lower crash rates.

## Improvement Type

☑ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

## Problem-Area Target

☐ Speed
☑ Cut-Through Volume
☐ Truck Traffic
☐ Safety
☐ Multi-Modal Accommodations

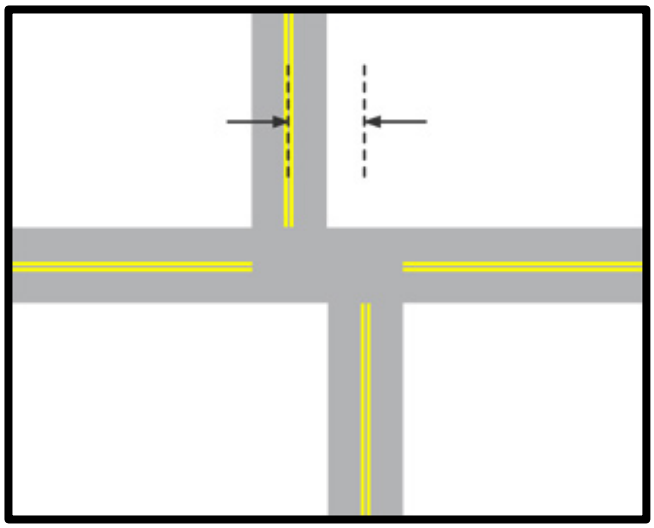

Photo Credit: FHWA

## Design Considerations

- Typical offset distance – 120 feet – 150 feet (centerline measurement)
- Use of offset and offset distance should account for left turn volumes. A high volume of left turns may block the offset legs and mainline road. In some cases queues from left turns in each direction can block left turns from the opposing direction.
- Bicycle routes located on the offset roadway may be forced onto a short segment of a major roadway in order to continue on the offset roadway. Ensure that the major roadway can accommodate bicycles.

## Typical Context

☐ Central Business District
☐ Village/Town Center
☐ High Density Suburban
☐ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☐ Arterial
☐ Collector
☑ Local Roads and Street

# Road Narrowing

Road narrowing is the concept of providing a narrow roadway width, which may result in lower travel speeds. Narrowing roadways may be accomplished by reallocating the space to other modes, for example, allocating roadway space to bicyclists by providing bicycles lanes, or widening sidewalks. Allowing on-street parking on both or one side of the roadway can also have the effect of narrowing the effective travel width of the roadway (i.e. the usable width of the roadway for motor vehicles). Other methods may include the use of vertical devices to reduce the travel width on a roadway.

## Improvement Type

☑ Geometric
☐ Signage
☑ Pavement Markings
☐ ITS Device

## Problem-Area Target

☑ Speed
☐ Cut-Through Volume
☐ Truck Traffic
☐ Safety
☑ Multi-Modal Accommodations

Source: Stantec, Inc.

## Design Considerations

- Typically applied on low volume residential streets
- When using curbside parking to narrow the roadway width, the effective travel width of the roadway to be provided is dependent on traffic volumes, the density of parking and the density of driveways. For two way travel, low density parking or high density of driveways both provide a space for drivers to pull over to allow for opposing traffic to travel through.
- When determining reductions in travel widths, careful consideration should be given to emergency vehicles, in particular, fire trucks. The travel width should be able to accommodate the width of a fire truck.

## Typical Context

☐ Central Business District
☐ Village/Town Center
☐ High Density Suburban
☐ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☐ Arterial
☐ Collector
☑ Local Roads and Street

### Additional Resources

1. Daisa, James M., & Peers, John B. *Narrow Residential Streets: Do They Really Slow Down Speeds?*

# Neighborhood Traffic Circle

The Neighborhood Traffic Circle is a raised island, landscaped with ground cover and street trees placed at an intersection, around which traffic circulates. It is intended to reduce motor vehicle speeds. These are not same as Mini-roundabouts and Roundabouts.

## Improvement Type

☑ Geometric
☐ Signage
☐ Pavement Markings
☐ ITS Device

## Problem-Area Target

☑ Speed
☑ Cut-Through Volume
☐ Truck Traffic
☐ Safety
☑ Multi-Modal Accommodations

*Photo Credit: Tetra Tech*

## Design Considerations

- Optimal solution to slow vehicular traffic in residential neighborhoods and add aesthetics to the street.
- Less effective at T intersections and difficult to design for offset intersections.
- Can operate as two-way or all-way stop-controlled intersections and frequently do not include raised channelization to guide approaching traffic into the circulatory roadway.
- Tolerable for low traffic volumes

## Typical Context

☐ Central Business District
☐ Village/Town Center
☐ High Density Suburban
☐ Low Density Suburban
☑ Residential
☐ Natural/Rural Open Space

## Typical Roadway Type

☐ Arterial
☐ Collector
☑ Local Roads and Street

**Additional Resources**


1. Institute of Transportation Engineers, Traffic Calming Measures-Neighborhood Traffic Circle
2. Portland Bureau of Transportation, Traffic Circles.
3. Safe Routes to School, http://guide.saferoutesinfo.org/engineering/neighborhood_traffic_circles.cfm
4. ITE/FHWA, Traffic Calming: State of the Practice, August 1999


June 2016

**TABLE 1**
APPLICABILITY OF TRAFFIC CALMING DEVICES
SPEED REDUCTION

| **DEVICE** | ***ROADWAY CLASSIFICATION*** | | |
|---|---|---|---|
| | ***Arterial*** | ***Collector*** | ***Local*** |
| ***Vertical Alignment*** | | | |
| Raised Crosswalks / Speed Table | N/A | MOD | HIGH |
| Raised Intersections | N/A | MOD | HIGH |
| Speed Hump/Cushion | N/A | LOW | HIGH |
| **Horizontal Alignment** | | | |
| Roundabouts | MOD | MOD | HIGH |
| Mini-Roundabout | N/A | N/A | HIGH |
| Traffic Circle | N/A | MOD | HIGH |
| Median | N/A | LOW | LOW |
| Lateral Shift | N/A | MOD | MOD |
| Offset Intersection | MOD | MOD | MOD |
| Road Narrowing | MOD | HIGH | HIGH |
| Curb Extension /Choker /Neckdown | LOW | MOD | MOD |
| Road Diet | HIGH | HIGH | HIGH |
| Chicane | N/A | LOW | MOD |
| Lane Narrowing | N/A | LOW | MOD |
| On-Street Parking | LOW | LOW | MOD |
| **Vehicle Use Restriction** | | | |
| Forced Turn island | N/A | MOD | MOD |
| Truck Use Restriction | N/A | LOW | LOW |
| One-Way / Full Street Closure | N/A | N/A | HIGH |
| Diagonal /Semi Diverter | N/A | N/A | N/A |
| **Other** | | | |
| On-Street Bike Facilities | LOW | MOD | LOW |
| Gateway Treatment | MOD | LOW | LOW |

**TABLE 2**

APPLICABILITY OF TRAFFIC CALMING DEVICES
- VOLUME REDUCTION

| **DEVICE** | ***ROADWAY CLASSIFICATION*** | | |
|---|---|---|---|
| | ***Arterial*** | ***Collector*** | ***Local*** |
| ***Vertical Alignment*** | | | |
| Raised Crosswalks / Speed Table | N/A | MOD | HIGH |
| Raised Intersections | N/A | MOD | HIGH |
| Speed Hump/Cushion | N/A | LOW | HIGH |
| **Horizontal Alignment** | | | |
| Roundabouts | MOD | MOD | HIGH |
| Mini-Roundabout | N/A | N/A | HIGH |
| Traffic Circle | N/A | MOD | HIGH |
| Median | N/A | LOW | LOW |
| Lateral Shift | N/A | MOD | MOD |
| Offset Intersection | MOD | MOD | MOD |
| Road Narrowing | MOD | HIGH | HIGH |
| Curb Extension /Choker /Neckdown | N/A | MOD | MOD |
| Road Diet | HIGH | HIGH | HIGH |
| Chicane | N/A | MOD | MOD |
| Lane Narrowing | N/A | LOW | MOD |
| On-Street Parking | LOW | LOW | MOD |
| **Vehicle Use Restriction** | | | |
| Forced Turn island | N/A | MOD | MOD |
| Truck Use Restriction | N/A | LOW | LOW |
| One-Way / Full Street Closure | N/A | N/A | HIGH |
| Diagonal /Semi Diverter | N/A | N/A | N/A |
| **Other** | | | |
| On-Street Bike Facilities | LOW | LOW | LOW |
| Gateway Treatment | N/A | LOW | LOW |

**TABLE 3**
APPLICABILITY OF TRAFFIC CALMING DEVICES

- TRUCK TRAFFIC REDUCTION

| **DEVICE** | ***ROADWAY CLASSIFICATION*** | | |
|---|---|---|---|
| | ***Arterial*** | ***Collector*** | ***Local*** |
| ***Vertical Alignment*** | | | |
| Raised Crosswalks / Speed Table | N/A | MOD | LOW |
| Raised Intersections | N/A | MOD | LOW |
| Speed Hump/Cushion | N/A | LOW | LOW |
| **Horizontal Alignment** | | | |
| Roundabouts | MOD | MOD | HIGH |
| Mini-Roundabout | N/A | N/A | HIGH |
| Traffic Circle | N/A | MOD | HIGH |
| Median | N/A | LOW | LOW |
| Lateral Shift | N/A | MOD | MOD |
| Offset Intersection | MOD | MOD | MOD |
| Road Narrowing | MOD | HIGH | HIGH |
| Curb Extension /Choker /Neckdown | N/A | LOW | LOW |
| Road Diet | HIGH | HIGH | HIGH |
| Chicane | N/A | LOW | MOD |
| Lane Narrowing | N/A | LOW | MOD |
| On-Street Parking | LOW | LOW | MOD |
| **Vehicle Use Restriction** | | | |
| Forced Turn island | N/A | MOD | MOD |
| Truck Use Restriction | N/A | LOW | LOW |
| One-Way / Full Street Closure | N/A | N/A | HIGH |
| Diagonal /Semi Diverter | N/A | N/A | N/A |
| **Other** | | | |
| On-Street Bike Facilities | LOW | LOW | LOW |
| Gateway Treatment | N/A | LOW | LOW |