SECTION 1: TRAFFIC CALMING

Section 1.1: Definition

Traffic calming consists of physical changes, usually in the vertical or horizontal alignment, or cross section of the roadway, with the intent of altering drive behavior. The goal of traffic calming is typically to reduce traffic volume, vehicle speed or both.

Section 1.2: Purpose of Traffic Calming Devices

One of the most common concerns raised by residents is speeding on residential streets. 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 on residential streets.

Section 1.3: Common Types of Traffic

Calming Devices Section 1.3(A): Speed

Reduction Devices

Traffic Circles/Roundabouts – These devices are raised island, placed in intersections, around which traffic circulates. They can be controlled by yield signs, two-way stops, or all-way stops. Circles prevent drivers from speeding through an intersection by impeding the straight through movement. Drivers must first turn to the right, then to the left as they pass the circle, and then back to the right again after clearing the circle. The traffic circles would be made of pre-cast concrete, have a mountable curb, and can house landscaping in the center circle. Roundabouts require traffic to circulate counterclockwise around a center island. Unlike Traffic Circles, roundabouts are used on higher volume streets to allocate right-of-way between competing movements.

Semi-Circle Chicanes – The semi-circle chicane is very similar to a traffic circle. These would typically be placed at "T" intersections. In this application, a half circle is placed on the through street opposite the terminating leg of the intersection. Additional half circles are placed on the through street on either side of the terminating leg. Drivers must first turn left, then back to the right as they pass through the chicane. The semi- circle chicanes are made of pre-cast concrete, have a mountable curb, and have some space to hold landscaping.

Chicanes – a series of narrowings that alternate from one side of street to the other forming S-shaped curves. These S-shaped curves can be created by moving out the curb line or by other crashworthy devices such as flexible delineators.

Chokers – Chokers are curb extensions at midblock locations that narrow a street by widening the sidewalk or planting strip. If marked as crosswalks, they are also known as safe crosses. Two-lane chokers leave the street cross section with two lanes that are narrower than the normal cross section. One-lane chokers narrow the width to allow travel in only one direction at a time, operating similarly to one-lane bridges. They are good for areas with substantial speed problems and no on- street parking shortage.

Speed humps/Raised Crosswalks – Speed humps, speed tables, and raised crosswalks are rises in the pavement, usually constructed of asphalt. They consist of a rise, followed by a flat section, then slope back to original vertical alignment of the street. Drivers must slow down to travel over the speed hump.

Center Island Narrowings – A center island narrowing is a raised island located along the centerline of a street that narrow the travel lanes at that location. Center island narrowings are often landscaped to provide a visual amenity. Placed at the entrance to a neighborhood, and often combined with textured pavement, they are often called "gateway islands." Fitted with a gap to allow walks through at a crosswalk, they are often called "pedestrian refuges." Center Island Narrowings are good for entrances to residential areas and wide streets where pedestrians need to cross.

Rumble Strips – Rumble Strips, along with speed humps, raised crosswalks and speed tables, are designed to slow traffic to negotiate the device. Rumble Strips are normally placed at crosswalks.

Dynamic Message System – Driver Feedback Speed Sign alerts drivers and helps protect children at school crossings. The Driver Feedback Speed Sign combines fluorescent yellow green static school crossing signs with a fully self-contained dynamic vehicle speed sign.

Other Devices:

Raised Intersections – Raised intersections are flat raised areas covering an entire intersection, with ramps on all approaches and often with brick or other textured materials on the flat section. They usually raise to the level of the sidewalk, or slightly below to provide a "lip" that is detectable by the visually impaired. By modifying the level of the intersection, the crosswalks are more readily perceived by motorists to be "pedestrian territory".

Speed Dips –Are depressions in the pavement usually construction of concrete or asphalt with the intended purpose of reducing speeds on the roadway

Section 1.3(B): Volume Reduction Devices

Full Diverters – A full diverter is a barrier placed diagonally across an intersection, blocking the through movement. The barrier blocks the through movement in both

directions. This method of traffic calming should not be used unless all other options are not feasible or desirable.

Partial Diverters – A partial barrier is a barrier that blocks one-half of a street. The barrier blocks the through movement in one direction.

Section 1.4: Emergency Response

The Police and Emergency Services utilizes the City's streets as their main response routes for emergency services Traffic calming devices can lower vehicle speeds along local streets and they will have the same effect on emergency vehicles. Studies conducted by various municipalities have indicated that each traffic calming device can delay an emergency vehicle between 3 and 14 seconds, depending on the design of the device and the vehicle. Considering the impact on emergency vehicle response time, traffic calming devices other than the dynamic message speed indicator signs should not be used on collectors and shall not be used on arterial streets.

Section 1.5: Advantages/ Benefits to Installing Traffic Calming Devices

Some advantages of installing traffic control devices have been identified by numerous agencies that have installed such devices. Typical advantages listed include:

- Citizens would have an additional option to consider when they feel traffic is traveling too fast along their street as opposed to installing unwarranted stop signs, or constant police surveillance.
- City Staff would have an additional option to offer citizens who feel vehicle speeds along their street are too fast.
- Traffic calming devices are physical changes to the street and therefore are self-enforcing.
- Traffic calming devices have been proven to be effective in reducing speeds and traffic volumes.
- Lower vehicle speeds increase available reaction time potentially reducing crashes and traffic volumes.
- Traffic calming devices would increase travel time along residential streets that they are installed along, making arterial and collector streets more attractive for cross-town traffic.
- Traffic calming can promote pedestrian, cycle, and transit use.
- Helps reduce the negative effects of motor vehicles on the environment (e.g., pollutions, sprawl).
- Incorporates the preferences and requirements of the people using the area (e.g., working, playing, residing) along the street(s), or at its intersection(s). Certain traffic calming measures can beautify the streetscape.

Section 1.6: Disadvantages to Installing Traffic Calming Devices

Some disadvantages of installing traffic control devices have been identified by numerous agencies that have installed such devices. Typical disadvantages listed include the following:

- Some residents will feel that the public's street is being altered for the benefit of a small group of citizens.
- Traffic calming devices will increase the response time of emergency vehicles such as fire engines and ambulances.
- Traffic calming devices are physical changes to the roadway and therefore are not easily installed or removed.
- Traffic may be diverted from one local street to another, merely moving the problem to another location.
- There might be an increase damage claims because of the traffic calming devices.

Section 1.7: Traffic Calming – New Developments

The City recognizes that traffic calming is a function of street design, street setbacks, parking, landscaping, and access. The City is committed to examining street design in overall subdivision planning.
As an alternate street design, reduced pavement widths may be provided with the approval of the Director of Building and Planning, Public Works Director and the Planning and Zoning Commission. Reduced pavement widths shall be considered along with a package of landscaping, enhanced pedestrian facilities and other community improvements. A traffic study that includes a parking analysis will be required for projects requesting reduced pavement widths.

Developers are required to address traffic calming measures through alternate street designs and/or by implementing the measures outlined in this section which include, but are not limited to raised intersections, neighborhood traffic circles, chicanes, neckdowns, center island narrowings and chokers as identified in the informational report entitled "Traffic Calming State of the Practice" by the Institute of Transportation Engineers (ITE) or as directed by the Director of Building and Planning or Public Works Director. See Section 1.3 for examples of Traffic Calming Devices. In the design of new subdivision streets, Collector and Arterial streets shown in the City's Comprehensive Plan shall be addressed as neighborhoods are developed that adjoin such streets with those streets not being required or recommended to have traffic calming measures included.
Subdivisions shall be designed to minimize or eliminate residential driveways from connecting directly to a system collector or arterial roadways. Residential streets shall be designed with the following standards with the intention of reducing the traveling speed of vehicles on residential streets.

At selected locations, such as sharp curves or school zones, design speed for residential streets shall be 20 mph and signed accordingly.

If spot Traffic Calming measures are used, they shall be spaced a maximum of 600 feet apart, unless otherwise approved by the Public Works Director.

Except for connections required for traffic flow, residential streets should be discontinuous and generally should be interrupted with jogs and offsets or curved. Four-way intersection shall be avoided.
Adequate Collector/Arterial streets shall be incorporated into projects, and efforts shall be made to minimize the number of homes fronting Collector and Arterial streets.

Local streets should not exceed 600-900 feet in length without design considerations for traffic calming. They may, however, extend to ¼ mile if the street is curved (100-200 feet radius) for an adequate length (minimum curve length equals the curve radius) and the cut-through traffic potential is minimal.

The Type of Traffic Calming measures including street design alternatives for new developments shall be selected by the developer and presented to the Planning & Zoning Commission for approval with the Preliminary Plat.

TRAFFIC CALMING

Section *2*.1 Traffic Calming Policy – Existing Developments

To begin the process, a group of citizens representing fifteen (15) or more separate households from a given traffic neighborhood (subdivision) submits a letter to the City expressing their interest in improving traffic conditions in their neighborhood. The petitioner's letter should describe, as completely as possible, the location and details of the types of traffic problems perceived. This letter must also be sent to the Councilperson representing the ward in which this subdivision/traffic neighborhood is located.

Section *2*.1(A): Traffic Calming Information

Upon receiving the request by the fifteen (15) residents, staff will verify the names and addresses on the petitioners. Once verified, City Staff will mail a Traffic Calming pamphlet to the petitioning residents to explain the Traffic Calming (TC) Process with the residents in the area.

Section *2*.1(B): Staff Evaluation, Preliminary Data Collection and Analysis

After the initial contact with the residents, Staff will perform preliminary data collection and analysis (speed study) to determine the speeds and volumes of motorists on the roadway of concern.

Section *2*.1(C): Eligibility

At a minimum, the speed study will need to demonstrate that the average speed is greater than 25 mph or the traffic volume must exceed 600 ADT (average daily traffic) for the roadway of concern. If one of these minimum criteria is not met, the roadway will not qualify for traffic calming.

Traffic calming devices other than the dynamic message speed indicator signs should not be used on collector streets and shall not be used on arterial streets.

Stop signs are not labeled as a traffic calming device and will not be listed in the available traffic calming devices. Stop signs are intended to help drivers and pedestrians at an intersection decide who had the right-of-way, not to reduce speed. Trends show that unwarranted stop signs will have a higher non-compliance rate (rolling stop) and at a higher risk of an intersection crash. An unwarranted stop sign installation reduces speed only immediately adjacent to the sign. Aggressive drivers will

accelerate as soon as possible, to a speed faster than before the stop sign was installed. The aggressive drivers do this apparently to make up for time lost at the stop sign. Additional stops increase vehicle fuel consumption and emissions to the environment. Unwarranted stop signs might increase the number of rear-ends and severity of the crashes. To properly install a stop sign, the intersection should be studied through a warrant analysis.

Section *2*.1(D) Education

If roadway does qualify per section l.1(B) the first step will be to educate motorists for a period and re-evaluate to determine if further intervention measures are needed.

Examples of education techniques are: Dynamic message boards, indicators, signage, speed trailers, etc.

Section *2*.1(E) Enforcement

If education step is not successful, then enforcement intervention will be requested of the Police Department along with continued education techniques.

Section *2*.1(F) Ranking System

If the desired results have not been achieved by education and enforcement, the next step will be to rank the project using the below criteria that has been established:

Section *2*.1(G): Eligibility Criteria for Traffic Calming

The following criteria are used to produce a numerical score for each traffic calming request.

Crashes– The last 3 full years of available crash data for the section of street for which traffic calming is being requested will be examined. l0 points will be awarded for each crash that is susceptible to correction by traffic calming devices. (30 points maximum)

Speed Violation Rate – Percentage of vehicles traveling over the speed limit on the subject street. One point is awarded for each percentage point of vehicles traveling over the speed limit. (30 points

maximum)

Traffic Volume – Average Daily Traffic (ADT) on the busiest section of the subject street divided by 300 (l0 points maximum)

Increase in Traffic Volume – The current ADT will be compared to the ADT from previous ADT data. The intent is to measure increases in traffic volumes related to factors outside the neighborhood, not increases in traffic volumes due to the development of the subdivision in which the subject street is located. If the difference between the current traffic volumes and the previous traffic volumes indicate an increase in ADT, then l point will be assigned for every20 ADT increase. If the current traffic volumes have decreased, a score of 0 is assigned. If there is no previous ADT data, then a score of 5 is given. (20 points maximum)

Schools – Ten points for each private or public elementary school on the subject street or within project area.

Other Pedestrian areas – Five points for each individual pedestrian-oriented facility, such as a park, on the subject street.

Driveway Density – Density is expressed in terms of the number of driveways per mile. Driveways are defined as private accesses to the public roadway, serving up to 8 lots. Public roads and private roads are not considered driveways. One point per l0 driveways per mile rate. For example, a density of 50 driveways per mile would receive a score of 5 points. (l0 points maximum)

Other – Five points will be awarded for the absence of sidewalks and 5 points will be awarded for the absence of streetlights. Also, five points if street is utilized by high school age kids, driving to and from school which makes for a noticeable increase in traffic during times before and after school by inexperienced drivers.

Alleys – Deduct 5 points for alleys due to low traffic volumes and low speeds.

A score of greater than fifty-five (55) points is required for the location to be eligible for physical traffic calming. The scores will be used to prioritize traffic calming requests. Those that rank the highest will be acted upon first as funds are available**.**

Section *2*.1(H) Neighborhood Information Gathering

Based on the ranking and if the traffic study shows that traffic calming measures can be implemented safely, a mail-back survey of all affected residential dwelling units will then be conducted by the City. A proposal for traffic calming must be supported by 51% of the residential dwelling units responding to the questionnaire to be considered for implementation. A 50% minimum number of responses to the mail back survey are required. A low response rate will be considered by the City Council as a no action.

The limits of the boundaries of the subdivision to which will be allowed to vote on the proposed traffic calming proposal will be determined by the Director of Public Works or his or her designee and may include adjacent subdivisions on which their sole access will be impacted by the traffic calming
proposals.

Section *2*.1(I): Preliminary Design

For local street projects where there is generally an agreement regarding the problems and strategies, staff will prepare a preliminary design.

Preliminary design will include not only the street in question, but also the surrounding area and how it may be affected by the implementation of traffic calming measures. During this phase, potential traffic calming measures and locations will be identified as well as construction cost estimates. Input will be sought from emergency services with regards to the proposed preliminary design.

Section *2*.1(J): Presentation of Preliminary Design to Neighborhood

The Public Works Department staff will schedule and attend a neighborhood meeting to report the results of the design process and attempt to reach a consensus from the neighborhood regarding any proposed actions.

A representative from the Fire Department and the Police Department, if available, will present effects that traffic calming measures will have on emergency response time.

Section *2*.1(K): Neighborhood Approval of the Design

Once the final design of the traffic calming improvements is determined, the neighborhood in which the traffic calming device is to be placed is asked to vote on whether they approve of the proposed traffic calming proposal. A 65% vote in favor of final design for all ballots issued to the property owners is needed to continue to next phase.

TRAFFIC CALMING REFERENCES

Traffic Calming References

Federal Highway Administration
https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Institute of Transportation Engineers – New England Section Technical Committee
https://braintreema.gov/DocumentCenter/View/2901/New-England-ITE-Final-Traffic-Calming-Guidelines-PDF

City of St. Charles – Traffic Calming Intro and Devices
https://www.stcharlescitymo.gov/654/Traffic-Calming

City of St. Charles – Traffic Calming Policy
https://www.stcharlescitymo.gov/DocumentCenter/View/6570/Traffic-Calming-Policy-8-16

City of Columbia, MO – Traffic Calming Guidebook
https://www.como.gov/publicworks/wp-content/uploads/sites/28/2016/09/TrafficCalmingGuidebook2.pdf

https://www.como.gov/publicworks/wp-content/uploads/sites/28/2016/09/Neighborhood-Traffic-Management-Program-2016-Revisions.pdf

TRAFFIC CALMING DEVICES – ILLUSTRATIONS

TRAFFIC CALMING DEVICES

Speed Reduction Devices:

Traffic Circles / Roundabouts –These devices are a raised island, placed in intersections, around which traffic circulates. They can be controlled by yield signs, two-way stops, or all-way stops. Circles prevent drivers from speeding through an intersection by impeding the straight through movement. Drivers must first merge / turn to the right, then to the left as they pass the circle, and then back to the right again after clearing the circle.


Traffic Circle


Roundabout

Chicanes – a series of narrowings that alternate from one side of street to the other forming S-shaped curves. These S-shaped curves can be created by moving out the curb line or by other crashworthy devices such as flexible delineators. Also, the semi-circle chicane is very similar to a traffic circle. These would typically be placed at "T" intersections. In this application, a half circle is placed on the through street opposite the terminating leg of the intersection. Additional half circles are placed on the through street on either side of the terminating leg. Drivers must first turn to the left, then back to the right as they pass through the chicane.


Chicane

Permanently Mounted Driver Feedback Signs – also known as radar speed signs, use speed awareness to slow traffic, ultimately making roadways safer.

Traffic Chokers – reduction of the width of the roadway by moving in the curbline, islands and/or by other crashworthy devices such as flexible delineators. Parking spaces could be lost with this option.

Raised Intersections – create a safe, slow-speed crossing and public space at minor intersections. Similar to speed tables and other vertical speed control elements, they reinforce slow speeds and encourage motorists to yield to pedestrians at the crosswalk. Speed tables can be installed at midblock crossing to improve driver's compliance to pedestrians.

Center Island Narrowing – are raised islands located along the centerline of a street that narrow the travel lanes at that location. These are sometimes referred to as midblock medians, median slow points, or median chokers.

Pavement Markings – There are variety of uses for pavement markings. For traffic calming, we are referencing transverse / optical markings, lane narrowing with edgelines, converging chevrons, and painting the speed limit legend in the middle of the lane on the roadway.

Curb Extension – 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.

Road Diet – generally described as removing travel lanes from a roadway and utilizing the space for other uses and travel modes such as reducing an undivided four lane roadway to an undivided three lane with two thru lanes and a shared center turn lane.

Pedestrian Refuge Island – median island installed on the middle of the roadway for pedestrians to safely pause before crossing the rest of the street. The island brings awareness to the drivers for the potential of a pedestrian crossing the roadway.

Volume Reduction Devices:

Full Diverters - A full diverter is a barrier placed diagonally across an intersection blocking the through movement in both directions. This method of traffic calming should not be used unless no other options are feasible or desirable.

Partial Diverters – A partial barrier is a barrier that blocks one-half of a street. The barrier blocks the through movement in one direction.

Closures - generally on residential streets, these prohibit through-traffic movement or prevent undesirable turns. Street closures may be appropriate where large volumes of through-traffic or "short-cut" maneuvers create unsafe conditions in a residential environment.

Other Traffic Management Strategies:

Selective Traffic Enforcement Patrol – combines intensive enforcement of specific traffic safety laws with extensive communication, education, and outreach informing the public about the enforcement activity.

Traffic Safety Trailer – a portable radar trailer that will display the posted speed and a changeable message board with the driver's speed. The trailer will be deployed where applicable given clear sight distance and vegetation free shoulder. The trailer helps remind drivers what the posted speed limit and that he or she should abide by.

Decoy Vehicle – uses unoccupied marked police vehicles to give a perception of being present everywhere.

TRAFFIC CALMING DEVICES
ILLUSTRATIONS/PROS-CONS/APPROXIMATE COSTS

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

June 2016

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/

June 2016

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

June 2016

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

Problem-Area Target

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

Photo Credit: City of Minneapolis, MN

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

Photo Credit: ITE

Problem-Area Target

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

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.

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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

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

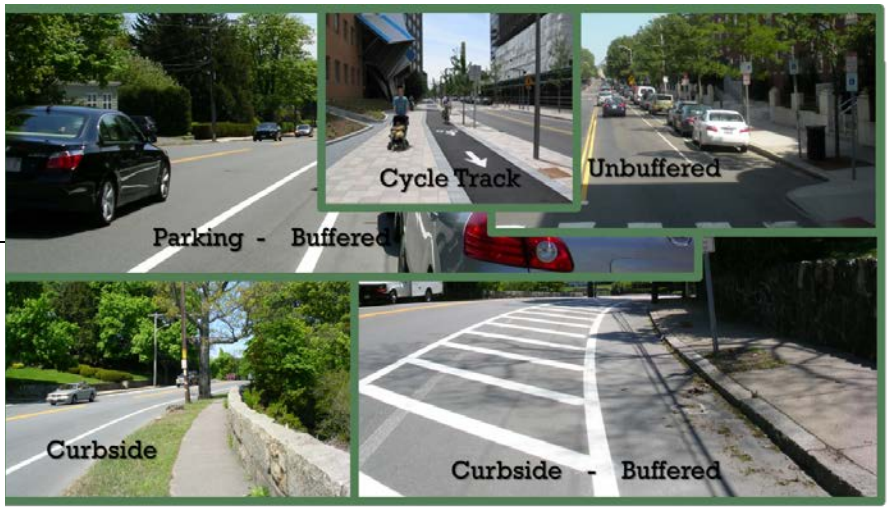

Photo Source: Gary Hebert, FST

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.

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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

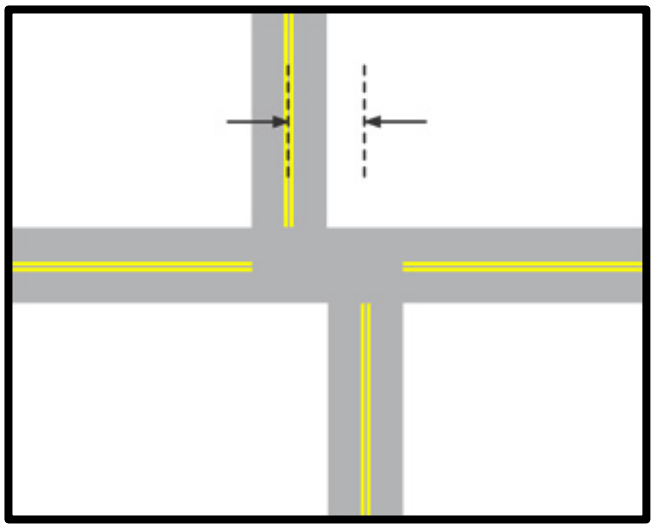

Photo Credit: FHWA

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

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