City of Spokane

Traffic Calming Toolbox

January 2015

What is Traffic Calming?

The Institute of Transportation Engineers (ITE) definition of traffic calming is:

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

By design, traffic calming is a self-enforcing traffic management approach that forces motorists to alter their speed or direction of travel. The purpose of traffic calming is to improve safety, especially for pedestrians and bicyclists, and to improve the environment or "livability" of streets for residents and visitors. By decreasing volume and/or reducing speed the number and severity of accidents can be greatly diminished.

Objectives of Traffic Calming

- Slow vehicular travel speeds
- Reduce the frequency and severity of collisions
- Reduce the need for police enforcement
- Enhance the street environment
- Reduce cut-through motor vehicle travel patterns
- Increase safety for non-motorized street users
- Increase access for all modes

Traffic Calming techniques may include education, enforcement, or engineering to shift traffic patterns and/or reduce speeds. Most traffic calming measures focus on engineering changes to alter driver behavior. Traffic calming techniques may include physical changes such as roadway narrowing, traffic circles, pavement markings, signage, and others. Education and enforcement efforts should be considered prior to engineering alternatives and as a complement to engineering efforts.

Toolbox:

The following pages describe and illustrate each of the traffic calming tools included in this resource guide. There is not a single tool to solve all traffic issues and one tool that may work well in one area for a particular issue may not be effective in another situation. Key to successful traffic calming is community acceptance and municipal support/maintenance.

Traffic calming measures can generally be separated into three groups based on the goal they are trying to achieve: speed control, volume control, and safety enhancement. These three categories are not as distinct as they may seem as speed reduction measures may divert traffic to other streets and efforts to control cut-through traffic may also increase the speeds of the traffic using the road. Safety enhancement measures are not implemented for the sole purpose of calming traffic rather they are installed to address a safety concern. However, certain safety enhancements have the additional benefit of raising driver awareness and slowing traffic. Effective traffic calming should be designed with a systematic approach with appropriate and frequent enough spacing of measures and consideration for secondary effects of the installations.

Speed/Safety Control Measures:

- Textured and Colored Pavement
- Landscaping/Street Trees
- Gateway
- Pavement Marking
- Stationary Radar Sign/ Speed Display Board
- Signage
- Modern Roundabout
- Traffic Island/Median
- Chicane
- Neckdown Bulb Out/Curb Extension
- Traffic Circle
- Reduced Corner Radii
- On-street Parking
- Narrowed Lane

Safety Enhancement Measures

- In-fill sidewalks
- Bike Lanes
- Crosswalk

Volume Control Measures

- Roadway Closures
- Diverter

Included in the toolbox:

In addition to describing the measures for traffic calming, a list of general pros and cons associated with each measure is also presented. The intent is to provide the reader with a quick indication of what might be expected if this measure is implemented. Remember, certain measures may or may not realize their full advantage or drawbacks depending on site specific conditions or circumstances.

Also included for each measure is a rough or relative cost. It is important to remember that costs can vary significantly depending on material, design requirements, etc. the costs as presented do not include maintenance of the measures after they are installed.

There is also a statement of whether a study needs to be done this could be a more complex traffic analysis for a roundabout to a warrant analysis such as for a crosswalk. This is important to acknowledge due to the fact that these can be very expensive and time consuming. When applying for traffic calming projects it is very important to take this into consideration.

There are three sections in the document, Speed Control Measures, Safety Measures, and Volume Control Measures. This will help the reader to identify the problem they are having with traffic in their neighborhood and help to find the correct solution.

SPEED CONTROL MEASURES

Speeding Issues:

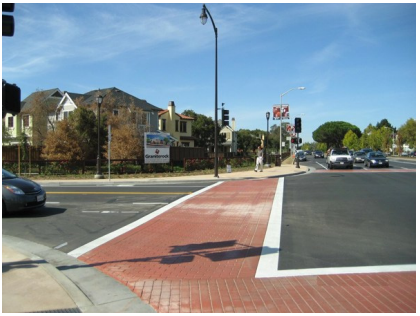
Speeding issues can be hard to identify, it is easy to perceive traffic as going faster than it is actually traveling. To verify speeds the City of Spokane must conduct studies to ensure that there is a legitimate speeding problem in the defined area.

As a guideline speeding is a problem when the 85th percentile speed is traveling 7 to 10mph over the posted speed. The 85th percentile speed is the speed at which vehicles are traveling that speed or less. This is important to remember when filling out the Traffic Calming application. Though the neighborhood may believe that speeding is a problem it is subject to actual data collected by City of Spokane staff.

Textured or Colored Pavement

Description:

Paving materials such as brick, cobbles, or concrete pavers can be used to identify a traffic-calmed area. The variety of color and texture signal to drivers that they are traveling in a pedestrian centric zone. Some projects include colored and textured pavement along the entire calmed roadway, while others limit the special pavement to the edges of calmed areas to announce entry into a new area where through traffic is not the priority.



Bricks or blocks are sometimes also used to provide the same traffic calming benefits as rumble strips, delineating crosswalks and pedestrian zones.

Pros:

Textured pavements attract the driver's attention visually, audibly, and physically and are ideal for residential and neighborhood shopping areas. They are permanent and effective and can add to the aesthetic identity of a neighborhood.

Cons:

Some material, particularly cobblestones, present a hazardous riding surface to bicyclists. Loose or uneven installations of paving stones pose a tripping hazard to pedestrians should be regularly inspected, increasing maintenance costs over ordinary asphalt or concrete pavement.

Costs:

- ~$35.00 a Square Yard
- Cost may vary depending on materials used

Study:

- Warrant Analysis

On-Street parking: Parallel & Angled Parking

Description:

On-street Parking, both parallel and angles helps to narrow roadways and calm traffic. The proximity of parked vehicles and necessity to watch for exiting vehicles and opening doors slows traffic. Angles parking can accommodate more cars per block than parallel parking.

Pros:

On-street parking creates a buffer between pedestrians and motorists, improving the walking environment. On-street parking in business districts is generally welcomed.

Cons:

On-street parking impedes traffic flow. Angle parking creates more right-of-way impacts. Drivers have reduced visibility backing out of angled parking spots, posing a greater risk to bicyclists.

Costs:

- $10.00 per linear foot
- Purchase for additional right-of-way could be very expensive.

Study:

- Traffic Study

Modern Roundabout

Description:

A modern roundabout is a raised island in the center of an intersection. Roundabouts are used on higher volume arterial streets to allocate right-of-way between competing movements and provide a cost-effective alternative to traffic signals.

Pros:

They can reduce vehicle queues and improve safety at intersections with high crash rates.

Cons:

Compared to traditional intersections, modern roundabouts require more right-of-way, increasing the crossing distance for pedestrians and possibly making it more difficult for large vehicles, such as fire trucks and transit buses, to negotiate. Converting an existing traditional intersection will require eliminating nearby on-street parking and, especially if landscaped, require more maintenance than traditional intersections.

Costs:

- ~$550,000.00 each, depending on diameter, right-of-way, number of lanes, landscaping.

Study:

- Extensive traffic study

Traffic Circles

Description:

Another variation of the modern roundabout usined in residential traffic calming is the traffic circle, which is used more to slow driving speeds approaching intersections with high crash rates than to improve traffic flow (as with a modern roundabout). Motorists must reduce speed to maneuver around the circle which helps reduce the frequency and severity of crashes.

Pros:

Permanent installation forces reduced speeds at subject intersection. Flexible installation allows retrofit to existing junction intersections, without costly roadway re-alignment. Can provide gateway or identity to a neighborhood.

Cons:

A single traffic circle used in isolation will not significantly calm traffic. A coordinated system of multiple traffic circles or other calming measures is required. Motorists may ignore painted traffic circles, and drive right over them. Raised traffic circles may interfere with snow plowing operations.

Costs:

- ~$15,000.00-$25,000 depending on location

Study:

- Traffic Study

Narrowed Lanes

Description:

Drivers naturally go more slowly when navigating narrow travel lanes, providing a more subtle calming effect than other physical calming methods. However, narrow lanes also slow emergency vehicle reponse times. One solution is to visually narrow lanes using paint while leaving a several foot shoulder that emergency vehicles can utilize-effectively providing a narrow lane for motorists and a wider lane for emergency vehicles. Lanes can also be physically narrowed by providing on street parking on one, or both sides or by adding bollards, planters or bike lanes. Narrowing traffic lanes differs from other road treatments by making slower speeds seem more natural to drivers and less of an artificial imposition, as opposed to other physical treatments that compel lower speeds or restrict route choice.

Pros:

Travel speeds are typically higher on four-lane roadways than on two-lane roads. Excess right-of-way can be shifted to providing wider sidewalks, bicycle lanes, or on-street parking. Narrowing the number of travel lanes also facilitates additional calming methods such as neck downs and mid-block bulb outs. Simple roadway restriping to achieve roadway narrowing is inexpensive.

Cons:

Reducing the number of travel lanes reduces the overall capacity of the roadway possibly increasing congestion and reducing the vehicular level of service (LOS).

Costs:

- ~$10.00 Linear Foot

Study:

- Traffic Study
- Warrant analysis

Neckdown/Bulb Out/Curb Extention

Desciption:

Neckdowns or bulb outs narrow the roadway by extending the curb at key intersections and mid-block locations.

Pros:

Neckdowns and bulb outs slow traffic, reduce turning speeds, and increase pedestrian safety by reducing crossing distance. They shift the focus of the street towards creating a walkable environment.

Cons:

- Relatively high initial costs
- Loss of on-street parking
- Increased maintenance costs
- Complicates plowing and street sweeping operations
- Can hinder drainage

Costs:

- ~$15,000 per bump out

Study:

- Traffic Study

Chicanes

Description:

Chicanes are a set of two or more alternating curb bulbs or extensions that narrow and realign the roadway for short segments. Since the street is no longer straight, drivers must slow down to negotiate the roadway. Two-way traffic and full access for larger vehicles and emergency can be maintained. A chicane effect can be created using various methods, including concrete curbs, landscaped areas or alternating diagonal and parallel parking.

Pros:

By creating a slalom effect, chicanes reduce vehicle speeds and discourage cut-through traffic. These methods can improve the appearance and function of the street and provide opportunity for parking.

Cons:

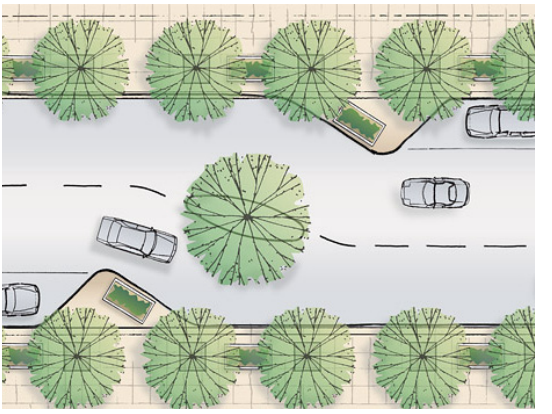
Concrete chicanes complicate street maintenance and storm water drainage and can hinder emergency vehicle and bus operations. They may require additional right of way to construct as well and if designed incorrectly could encourage motorists to attempt to navigate them at high rates of speed.

Costs:

- ~$15,000 or more depending on existing conditions

Study:

- Traffic Study



Traffic Islands & Medians

Description:

Concrete or landscaped islands typically located down the center of a roadway or at a roadway entrance.

Pros:

Landscaped or concrete traffic islands and medians can reduce speeds by narrowing drivable travel lane widths. They can improve pedestrian accommodation by providing a mid-block pedestrian refuge at crossings. They complement improved crosswalks and reduce pedestrian crossing width. They can be used to provide a visual enhancement or gateway to promote neighborhood identity.

Cons:

Traffic islands and medians may reduce parking and driveway access, and also narrower road may increase motor vehicle/bicycle conflicts.

Costs:

- ~$100 per linear foot (concrete)

Study

- Traffic Study

Landscaping:

Description:

Landscaping is used in conjunction with other traffic calming measures such as roadway narrowing, traffic islands, and sidewalk improvements to improve the pedestrian environment, define pedestrian and vehicle areas, and provide separation between motor vehicles and pedestrians.

Pros:

Landscaping increases motorists' awareness and can help define a neighborhood identity. Its installation is long term and increases the quality of life of a community.

Cons:

Depending on the design, the installation and maintenance costs can be high. Right-of-way impacts may be significant as well.

Costs:

- Trees: ~$300.00 each
- Shrubs (5 gal.):~$55.00 each
- Sod: ~$10.00 Square Yard

Study:

- None needed unless impeding right-of-way

Gateways

Description:

A signing and/or landscaping treatment to alert motorists they are entering a special area can be used at entrances to neighborhoods, commercial areas, town centers, or busy places of activity. Gateways are typically supplemented with other traffic calming measures.

Pros:

- Can be visually aesthetic and heighten awareness

Cons:

- Generally expensive and can require routine maintenance

Costs:

- Varies on size, material and maintenance

Study:

- None needed unless impeding right of way

Speed Feedback Signs

Description:

Radar signs are interactive sign that draw motorists' attention to their speed and the road's legal speed limit. They work by altering motorists when they're exceeding the speed limit. They can be used in residential areas, school zones, construction zones, or other safety zones.

Radars can be permanently mounted on signposts or temporary installations using self contained trailers.

Pros:

Radar signs have proven to slow down traffic, even years after their initial installation. They are particularly effective on high volume arterials and highways, where physical measures would restrict traffic flow.

Cons:

Radar signs do not slow traffic as much as physical measures. Motorists' compliance is voluntary. Enforcement is necessary.

Costs:

- ~$5,300 for solar powered installed
- ~$7,500-$12,500 for mobile signs

Study:

- Warrant Analysis

Pavement Markings/Stencils

Description:

Pavement markings are another means to alert or inform a motorist of a condition or a potential situation. Painted lines and symbols need to be selected and placed according to MUTCD. Some examples include: The word "SLOW" can be painted on a travel lane to encourage motorists to drive slowly and painted white edge lines can be used to visually narrow streets. Crosswalks can be used to alert motorists of pedestrian activity. Pavement markings are used in conjunction with other vertical signage which increases the cost.

Pros:

- Low cost and easy to install
- Can increase awareness

Cons:

- Low initial cost but requires regular maintenance and may not be considered visually aesthetic
- Signs not visible on snow covered roads
- They can be ignored by motorists

Costs:

- ~$175 per sign
- ~$300 per vertical sign

Study:

- Warrant Analysis

Signage

Description:

Traffic signs can be used to alert or inform motorists of a condition or a potiential situation. Signs need to be selected and place in accordance with the Manual of Uniform Traffic Control Devices (MUTCD). Pedestrian/bicycles/school crossing signs*, and in-street pedestrian crossing signs have been used by municipalities to warn motorists of high pedestrain activity, and help to reduce speeds. Signs are also used in conjunction with other measures such as pavement markings.

Pros:

- Low cost
- Increases awareness

Cons:

- Can be considered to clutter the roadway especially on residential streets
- In-street signs may get hit or may need to be removed at night and placed back during the day
- Overall effectiveness can vary

Costs:

- Varies, depending on type and amount of signage, vertical signs typically are ~$300 per sign
- *Any school crossing signs must be endorsed by the school

Study:

- Depends on type of sign and placement

Reduced Corner Radii

Description:

This calming method is used at intersections to make turning movements tighter. It typically is used in conjunction with other calming techniques like neck downs and raised crosswalks. This effectively slows turning vehicles and increases pedestrian safety. The reduced radius, however, also can limit truck and bus turning- negatively impacting both emergency vehicles and transit operations.

Pros:

- Slow turning vehicles
- Promotes pedestrian safety
- Improves motor vehicle and pedestrian sight distances
- Shortens crossing distance

Cons:

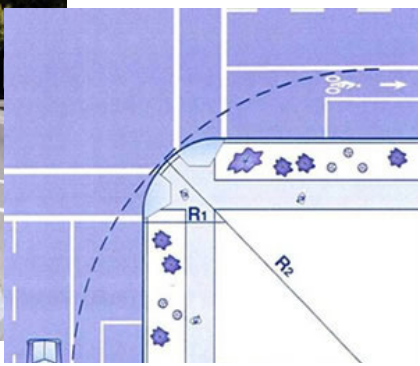
- Impacts truck/bus turning
- Slows emergency vehicles and large transit vehicles

Costs:

- ~$6,500.00-$15,000 or more depending on existing conditions

Study:

- Traffic Study



SAFETY ENHANCEMENT MEASURES

Safety Issues:

Safety issues are defined as issues with traffic that may impede the safety of pedestrians or vehicles. Safety issues include such things as pedestrians having to use the roadway because there are no sidewalks. Safety issues will be defined as a high occurence of vehicle and pedestrian crashes in the area of the proposed project.

In-fill Sidewalks

Description:

Sidewalks are not generally seen as a traffic calming mechanism, they do improve pedestrian safety but they do not generally calm traffic on a stretch of road.

Pros:

- Increases pedestrian safety

Cons:

- Does not calm or slow traffic

Costs:

- ~$50.00 linear foot
- ~$160.00 linear foot for separated sidewalks
- ~$1,600 each driveway
- ~$1,700.00 each ADA ramp

Study:

- Warrant Analysis

Bike Lanes

Description:

Designing a portion of the existing roadway cross-section exclusively for bicycle use. Bike lanes are used only on arterial streets.

Pros:

- Help to slow speed of vehicles
- Provides for bicycle access

Cons:

- Reduces roadway capacity
- If not designed well, they can create safety concerns

Costs:

- ~$12 Linear Foot for thermoplastic (heat applied)
- ~$300 per sign (2 min. per block, 8 blocks per mile)

Study:

- Must be in the City of Spokane Master Bike Plan

Crosswalks

Description:

Marked, crosswalks are an essential tool for helping pedestrians move safely, conveniently and predictably across roadways. Marked crosswalks alert drivers to expect crossing pedestrians and to direct pedestrians to desirable crossing locations – marking crosswalks at every intersection is not necessary or desirable. Although many motorists are unaware of their precise legal obligations at crosswalks, it is required that drivers yield to pedestrians in any crosswalk, whether marked or unmarked.

Streetscape design should emphasize crosswalks as a fundamental part of the pedestrian realm, not as an intrusion into the roadway reserved for vehicles only. Crosswalks are only used on arterial streets.

Pros:

- Enhances safety of pedestrian
- Makes drivers aware of pedestrian presence

Cons:

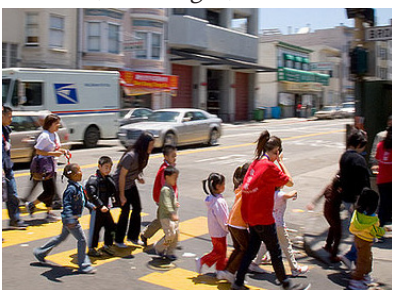
- Does not accomplish traffic calming
- May give pedestrians false sense of safety

Costs:

- ~$300 for painted parallel bars
- ~$750 for painted piano style bars
- ~$1,000 for thermoplastic parallel bars (last longer)
- ~$2,500 for thermoplastic piano style bars (last longer)
- ~$1,700 each ADA ramp installed

Study:

- Warrant analysis



VOLUME CONTROL MEASURES

Volume Control Issues:

Volume control issues must be verified by the City staff taking an actual traffic count. Typically, a residential street should experience volume less than 1,000 ADT (Average Daily Traffic) in a 24 hour period. Residential streets above 1,000 ADT will be candidates for further study.

It is important to remember that aggressive traffic calming options, such as full or partial street closures require significant and detailed approval from multiple departments within the city. These types of closures significantly affect adjoining streets and the residents on those adjacent streets must also approve of the closure.

Roadway Closure

Description:

Full street closures retroactively installed to previously open streets are often reserved for locations where all other calming attempts have failed. They may be located adjacent to intersections, creating cul-de-sacs and dead ends, or located mid block, creating two stub streets. These closures completely close the street to through-traffic, usually leaving only pathways open for bicyclists and pedestrians.

Closure methods include landscaped islands, decorative walls, steel posts, bollards or planters, or any other means that leave an opening narrower than an automobile. The barrier can be designed to maintain emergency vehicle access.

Within a grid of neighborhood streets, a series of closures are often used to make vehicular travel through neighborhoods more circuitous to discourage cut-through patterns.

In some high crime areas, full streets closures have also been implemented to prevent "cruisin" or illegal activities.

Pros:

Closures eliminate cut-through traffic from neighborhoods and effectively convert through streets into extremely low volume dead end roads. Their installation can also be used as an opportunity to introduce additional landscaping and aesthetic improvements to public right of way within a neighborhood.

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Cons:

Street closures require strong community support since they restrict access for neighborhood residents. Any nearby land owners opposed to the closure could initiate a protracted legal fight.

Closing a few streets within a neighborhood network may divert a significant amount of traffic to nearby parallel streets or to adjacent neighborhoods.

Street closures only reduce vehicle speeds in the immediate vicinity of the closed block. Parallel roadways without closures can suffer both higher travel speeds and increased traffic volumes.

Costs:

- ~$15,000.00-$25,000.00 depending on location

Study:

- Significant traffic study

Diverters

Description:

Several types of diverters can be used to channelize or restrict traffic flow at intersections. They are used to prevent through movements and interrupt the traffic grid. Diagonal diverters prevent through movements from two of the approaches and left turn movements from the other two approaches. Star diverters prevent through movements, while allowing right turns from all four intersection approaches. Island diverters prevent through movements from two approaches, while allowing cross-traffic to proceed straight. And semi-diverters can either prevent in or out traffic for a single approach, changing a two-way road to one way.

Pros:

Diverters limit access and reduce through traffic without preventing pedestrian access. They can also be designed to favor bicycle travel, creating quiet, efficient bicycle boulevards through neighborhoods.

Cons:

Diverters may create frustration for motorists confused by the irregular traffic pattern. They may impede transit and emergency vehicle operations, though certain design features can be included to maintain access for authorized vehicles. The shift in traffic patterns can have unintended consequences, sending more traffic to other nearby residential streets.

Costs:

- ~$15,000 or more depending on size.

Study:

- Significant Traffic Study

Turn Restrictions

Description:

Restricting certain turns at intersections to influence travel patterns.

Pro:

- Low Cost
- Reduces cut-through traffic

Cons:

- Inconveniences residents on streets
- Can create circuitous traffic patterns
- Can be hard to enforce
- May cause cut through traffic in other parts of neighborhood

Cost:

- ~$300.00 each sign
- Expensive to do traffic study

Study:

- Significant traffic study