# Traffic Calming Guidebook

**Adopted**
**By City Council**
**November 14, 2006**

***Updated: January 13, 2009***

# Traffic Calming Guidebook
# Table of Contents

# Introduction

The City of Bentonville is taking a proactive approach to improving road safety by adopting ordinances that incorporate traffic calming into street design. One ordinance establishes a policy regarding retrofitting existing residential and local streets with traffic calming devices. The second ordinance requires the use of traffic calming techniques and devices in the design of new local and residential streets. This guidebook is designed to assist city officials as well as developers of new streets in incorporating traffic calming into their design. Each method of traffic calming carries its own advantages and disadvantages. This guidebook is designed to identify these so that the city official or developer can determine the device or technique that is most appropriate for the particular street or neighborhood.

**What is Traffic Calming?** The Institute of Transportation Engineers defines 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. Traffic calming measures are intended to be self-enforcing.

**What is a Traffic Calming Device?** A traffic calming device is a physical change or design of a street that causes a driver to slow down. Must be engineered and relies on physics.

**What are Traffic Calming Strategies?** Traffic calming strategies are techniques that are used to create a traveling environment that naturally causes a driver to slow down. These strategies require the driver to pay closer attention. This may include the layout of the streets in a curvilinear fashion, allowing parking along the street, a tree canopy, landscaping, streetscape and signage. Relies on human psychology.

**Why use traffic calming?** Traffic calming can reduce through traffic; reduce truck traffic; reduce occurrence of excessive speeding; reduce noise, vibration, and air pollution; reduce accidents; and provide a safer environment for pedestrians and children.

**How to Use This Guidebook**

The Residential Traffic Management Policy identifies three levels of traffic calming. The following sections identify the traffic calming techniques based on these identified levels. Level 1 is essentially getting the word out regarding speed and volume of traffic on local and residential streets. Level 2 and Level 3 include physical changes to the street that naturally disperses and slows down traffic.

Section 1100.5 Streets of the Subdivision Code requires speed control points. The Speed Control Traffic Calming devices described in Level 3 qualify as speed control points in new developments. These regulations also encourage traffic reducing techniques which are identified in the street layout and design section.

# Level 1: Education and Awareness

*Level 1 involves educational and informational techniques to increase public awareness of speed limits, traffic safety concerns and encourage reduced speeds. Below are the methods associated with Level 1.*

## Discussion:

Conversations, e-mails, meetings, letters and handouts to residents regarding neighborhood traffic safety. Staff helps provide informational materials and residents are responsible for getting the information to residents affected by the issue or concern. Cost is minimal.

**Advantages**

- Allows residents to express views.
- Identifies traffic issues.

**Disadvantages**

- Effectiveness may be minimal.
- Audience limited to those concerned.
- Potentially time consuming.

## Radar Trailer:


Placement of a portable radar trailer that displays the speed of passing vehicles. Cost is minimal.

**Advantages**

- Educates drivers of speeds.
- Can temporarily reduce speeds.

**Disadvantages**

- Does not enforce the speed limit.
- Effective only on single lane roadways.
- Limited effectiveness with higher volumes

## Enforcement:


Police Department selects times and locations to pro-actively enforce posted speed limits by issuing tickets/citations. Cost is minimal.

**Advantages**

- Visibility of enforcement.
- Temporarily reduces speeds.
- Increases awareness.

**Disadvantages**

- Temporary solution.
- Police resources must be available.

## Signage:


May include a variety of signage, including additional speed limit signs or specialty signs, such as “Children at Play” or “Keep Kids Alive, Drive 25.” Costs are associated with installation and maintenance of signs.

**Advantages**

- Clearly indicates the message.
- Helps reduce speeds.

**Disadvantages**

- Ineffective without other measures.
- Sign clutter / visual pollution.

# Level 2: Minor Street Changes

*Level 2 traffic calming measures include minor changes to the physical street condition that are of reasonable cost that can be applied to residential and local streets. Below are the methods associated with Level 2.*

---

## High Visibility Crosswalks:

Increasing visibility of crosswalks by painting a strip on the outer edges of the crosswalk and installation of appropriate signage.

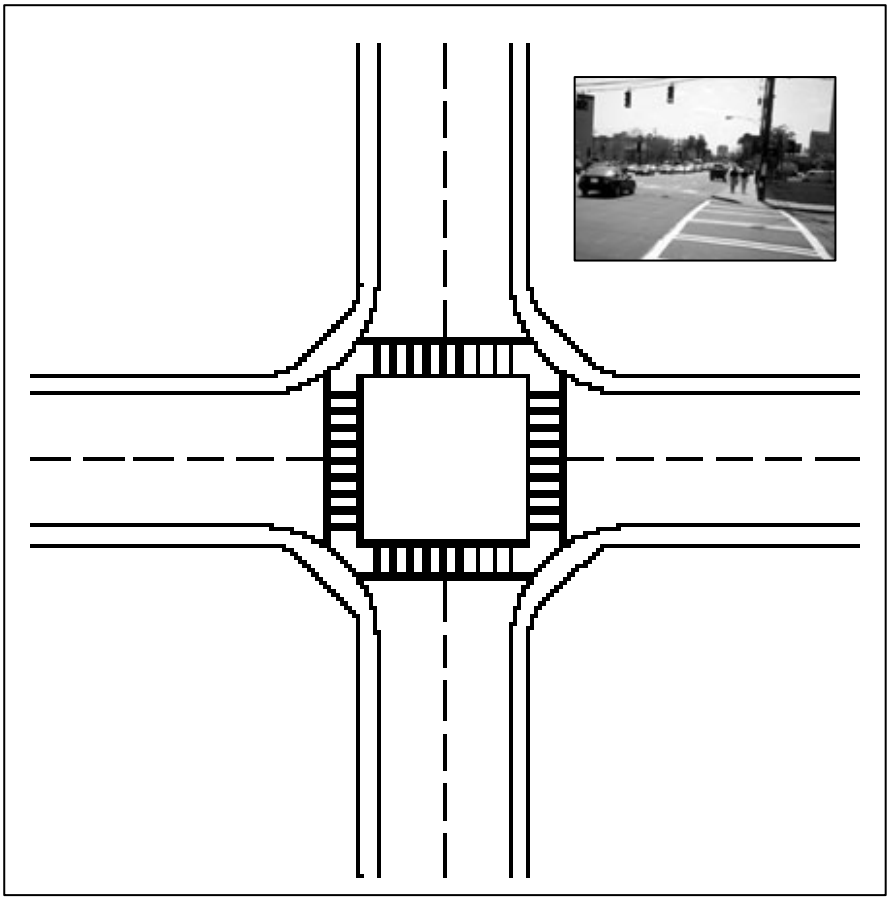
**Advantages**

- Increases visibility.

**Disadvantages**

- False sense of security for pedestrians.
- High maintenance costs.
- Increases cost of resurfacing.

---



# Level 2: Minor Street Changes

## Narrowing Lanes:

Narrowing lanes can be accomplished by striping the lanes to create a smaller lane. Narrow lanes tend to cause drivers to slow down.

| Advantages | Disadvantages |
|---|---|
| • Can be implemented quickly.<br>• Can reduce speeds and improve safety. | • Residents may oppose striping neighborhood streets.<br>• Increases maintenance and resurfacing costs. |

# Level 2: Minor Street Changes

## In-Street Pedestrian Crossing Sign:


Used to remind motorists to yield the right-of-way to a pedestrian crossing the roadway within a marked crosswalk. The following policies should be followed to ensure this technique is not overused.

- Sign shall not be used at intersections whose approaches are controlled either by stop signs or traffic control signals.
- Use only at key locations such as high pedestrian volume crosswalks.
- Use sign only at existing crosswalk locations.
- The sign shall only be used as an in-street sign, not on the outside shoulder or parking lane. When installed, the sign shall not impede or obstruct any traffic movement including through turn movements.
- When the sign is used at or in advance of a school crossing to supplement the ground mounted school warning signs, the sign shall include the SCHOOL plaque.
- The sign shall be used on streets with vehicle traffic volumes that exceed 1,500 vehicles per day.
- Use only in 35 mph or lower speed zones.
- The following supplemental conditions may warrant the signs installation:
    - Locations adjacent to and along established pedestrian routes to and from a school.
    - Locations adjacent to community centers, libraries, and other high use public facilities.
    - Locations adjacent to public parks.
    - Locations where accident records, sight obstructions and/or pedestrian volume warrants the installation.
    - Locations where significant numbers of handicapped persons cross a street.
    - Locations where significant numbers of senior citizens cross a street.

| Advantages | Disadvantages |
|---|---|
| • Can be implemented quickly.<br>• Can reduce speeds and improve safety. | • Gives pedestrians a false sense of security. |

# Level 3: Major Street Changes
# Speed Control Measures

*Level 3 traffic calming measures are those that result in a major change to the physical character of the street and are typically associated with higher costs. Below are the methods associated with Level 3, categorized by those designed to control speed and those designed to control volume.*

---

**Speed Hump:** Speed humps are rounded raised humps placed across the roadway. They are generally 10 to 14 feet long, 3 to 4 inches high in a parabolic shape. *Cost Estimate: $8,000 to $9,000*

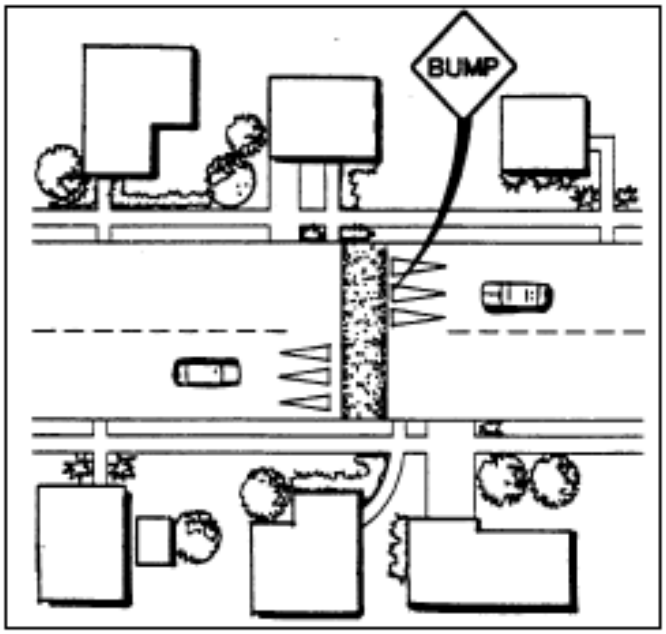
**Advantages**

- Relatively inexpensive.
- Relatively easy for other road users.
- Effective in slowing speeds.

**Disadvantages**

- Can cause a rough ride.
- May increase noise pollution
- Unattractive.
- Can cause drainage issues.

---



# Level 3: Major Street Changes
# Speed Control Measures

## Speed Table:

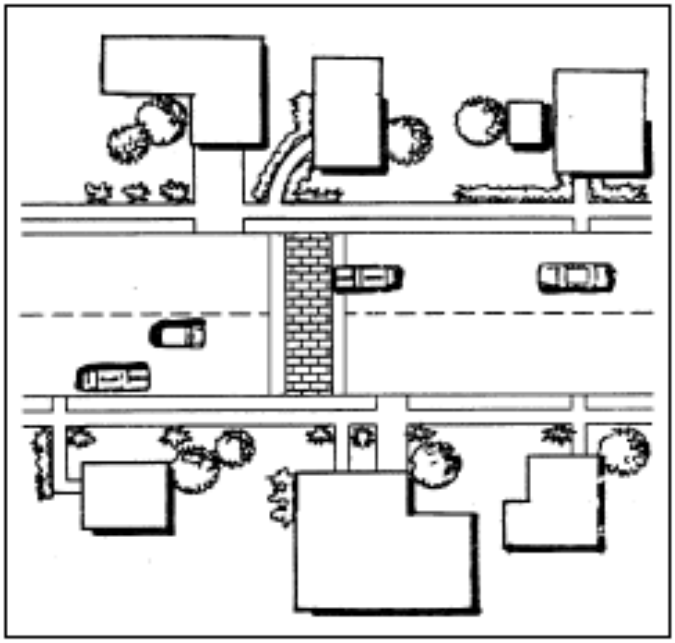
Speed tables are flat-topped speed humps often constructed with brick or other textured materials on the flat section. Speed tables are typically long enough for the entire wheelbase of a passenger car to rest on the flat section. The brick or other textured materials improve the appearance of speed tables and draw attention to them. Speed tables are good for locations where low speeds are desired but a somewhat smooth ride is needed for larger vehicles. *Cost Estimate: $2,000 to $5,000*

**Advantages**

- Easier on large vehicles (such as fire trucks) than Speed Humps.
- Effective in reducing speeds, but not as well as Speed Humps.
- Enhance safety.

**Disadvantages**

- Unattractive without textured pavement.
- Textured materials, if used, can be expensive.
- May increase noise and air pollution.
- Can cause drainage issues.



# Level 3: Major Street Changes
# Speed Control Measures

**Raised Crosswalk:**

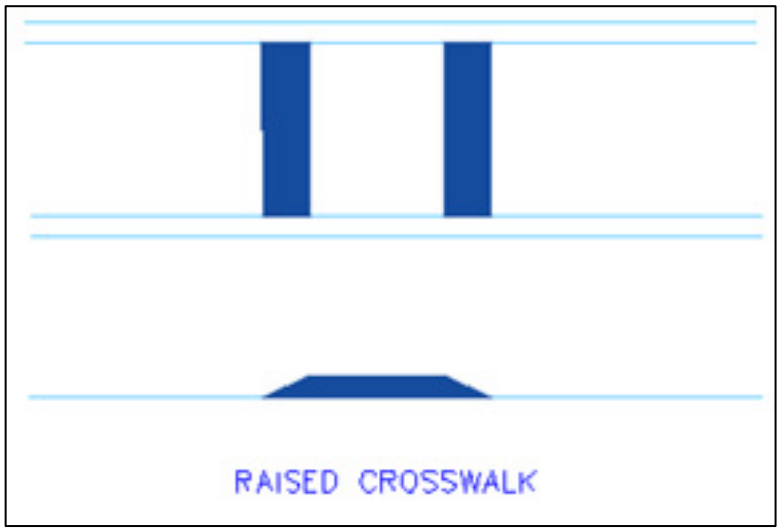
Raised crosswalks are Speed Tables with crosswalk markings and signage. Raised crosswalks are good for locations where pedestrian crossings occur at haphazard locations and vehicle speeds are excessive. *Cost Estimate: $4,000*

**Advantages**

- Improve pedestrian and vehicular safety.
- Can add aesthetic value.
- Effective in reducing speeds, but not as well as Speed Humps .

**Disadvantages**

- Textured materials, if used, can be expensive.
- Potentially impacts drainage.
- May increase noise and air pollution.
- Can cause drainage issues



# Level 3: Major Street Changes
# Speed Control Measures

## Raised Intersection:

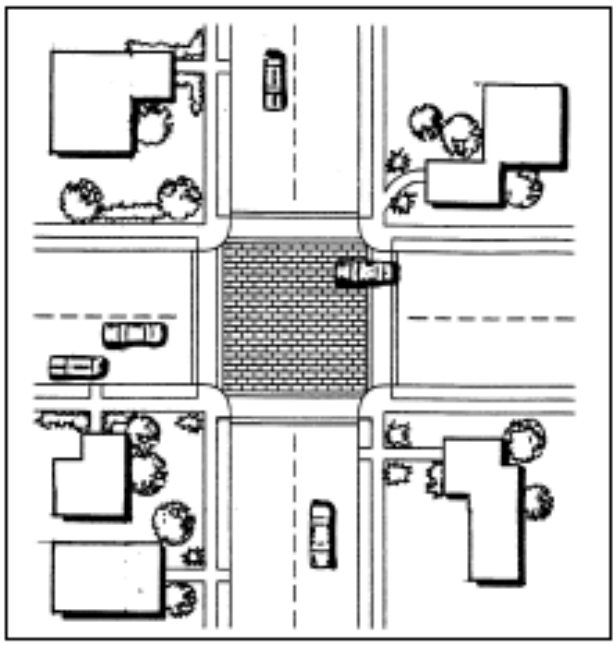
Raised intersections are flat raised areas covering an entire intersection, with ramps on all approaches and often with brick or other textured materials on the flat section. Raised intersections are good for intersections with substantial pedestrian activity, and areas where other traffic calming measures would be unacceptable because they take away scarce parking spaces. *Cost Estimate:$12,000-$13,000*

**Advantages**

- Improves pedestrian and vehicular safety.
- Can add aesthetic value.
- Can calm two streets at once.

**Disadvantages**

- Tend to be expensive, varying by materials used
- Potentially impacts drainage.
- Less effective in reducing speeds than Speed Humps, Speed Tables, or Raised Crosswalks.
- Can cause drainage issues



# Level 3: Major Street Changes
# Speed Control Measures

## Textured Pavement:

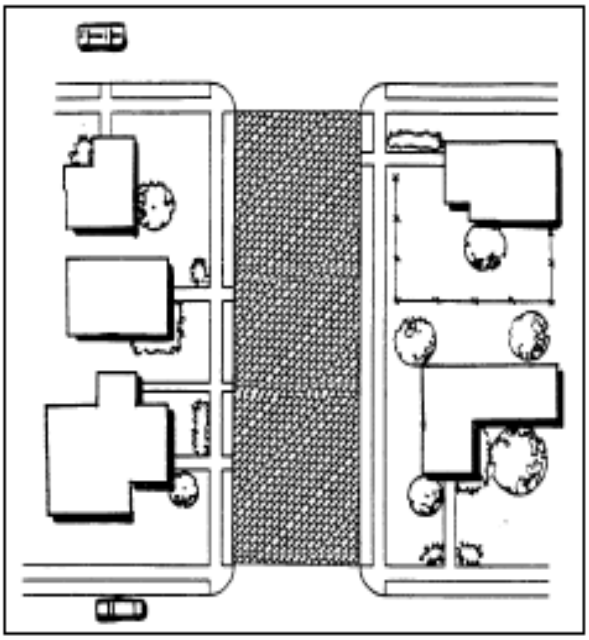
Textured and colored pavement includes the use of stamped pavement or alternate paving materials to create an uneven surface for vehicles to traverse. Textured pavements are good for "main street" areas where there is substantial pedestrian activity and noise is not a major concern. Often effective in conjunction with other measures.
*Cost Estimate: $7 - $8 per square ft.*

**Advantages**

- Can reduce vehicle speeds over an extended length.
- Can add aesthetic value.
- Can calm two streets at once.

**Disadvantages**

- Tend to be expensive, varying by materials used.
- Can make crossings more difficult for wheelchair users and the visually impaired.
- Can create noise disturbance for nearby residences.



# Level 3: Major Street Changes
# Speed Control Measures

## Intersection Bulb-Out (Neckdown):

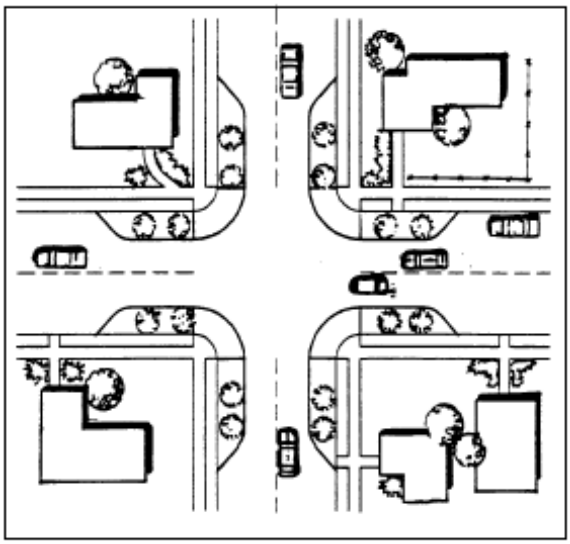
Bulb-outs or neckdowns are curb extensions at intersections that reduce the roadway width from curb to curb. They "pedestrianize" intersections by shortening crossing distances for pedestrians and drawing attention to pedestrians via raised peninsulas. They also tighten the curb radii at the corners, reducing the speeds of turning vehicles. They are good for intersections with substantial pedestrian activity and areas where vertical traffic calming measures would be unacceptable because of noise considerations.
*Cost Estimate: $40,000 to $80,000*

**Advantages**

- Improves pedestrian circulation and space.
- Easily negotiable by large vehicles.
- Create protected on-street parking bays.
- Effective in reducing speeds, especially for right-turning vehicles.

**Disadvantages**

- May slow emergency vehicles.
- May eliminate some on-street parking.
- May require bicyclists to briefly merge with vehicular traffic.
- Can cause drainage issues.



# Level 3: Major Street Changes
# Speed Control Measures

## Chicane:

Chicanes are curb extensions that alternate from one side of the street to the other, forming S-shaped curves. Chicanes can also be created by alternating on-street parking, either diagonal or parallel, between one side of the street and the other. Each parking bay can be created either by restriping the roadway or by installing raised, landscaping islands at the ends of each parking bay. Good for locations where speeds are a problem but noise associated with Speed Humps and related measures would be unacceptable.

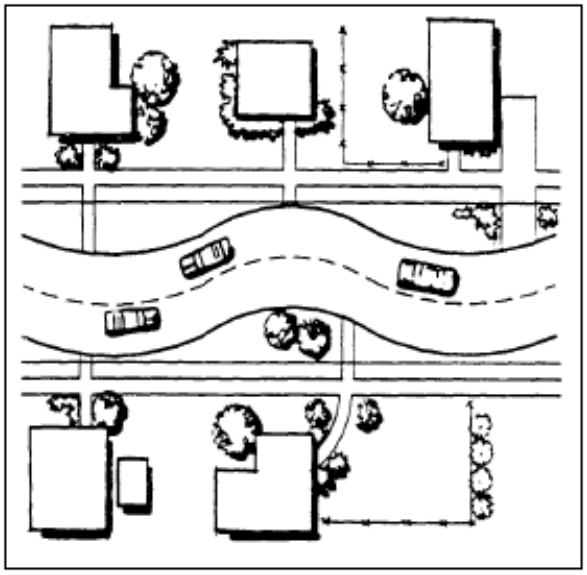
*Cost Estimate: Approximately $15,000*

**Advantages**

- Effective in reducing speeds.
- Easily negotiable by large vehicles, except under heavy traffic conditions.

**Disadvantages**

- Must be designed carefully to discourage drivers from deviating out of the appropriate lane.
- Can be expensive.
- May eliminate some on-street parking.
- Can cause drainage issues.



# Level 3: Major Street Changes
# Speed Control Measures

## Mid-block Choker:

Chokers are curb extensions at mid-block locations that narrow a street by widening the sidewalk or planting strip. 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.

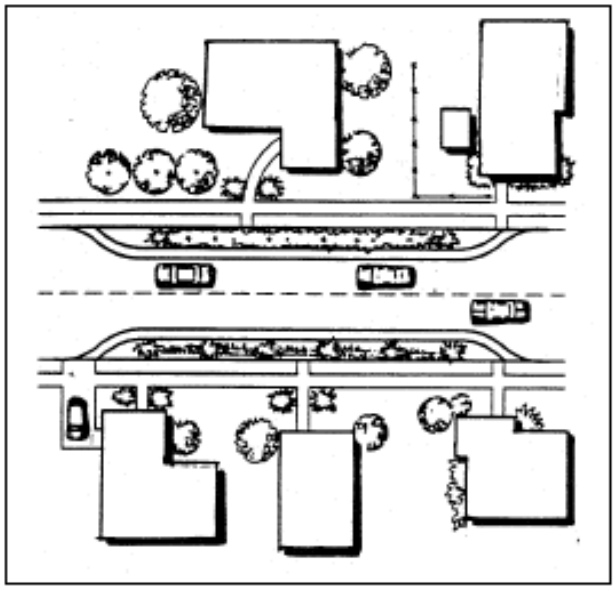
*Cost Estimate: $7,000 to $10,000*

**Advantages**

- Easily negotiable by large vehicles.
- Can add aesthetic value.
- Effective in reducing speeds and volumes.

**Disadvantages**

- May require bicyclists to briefly merge with vehicular traffic.
- May eliminate some on-street parking.
- Can cause drainage issues.



# Level 3: Major Street Changes
# Speed Control Measures

## Center Island Narrowing:

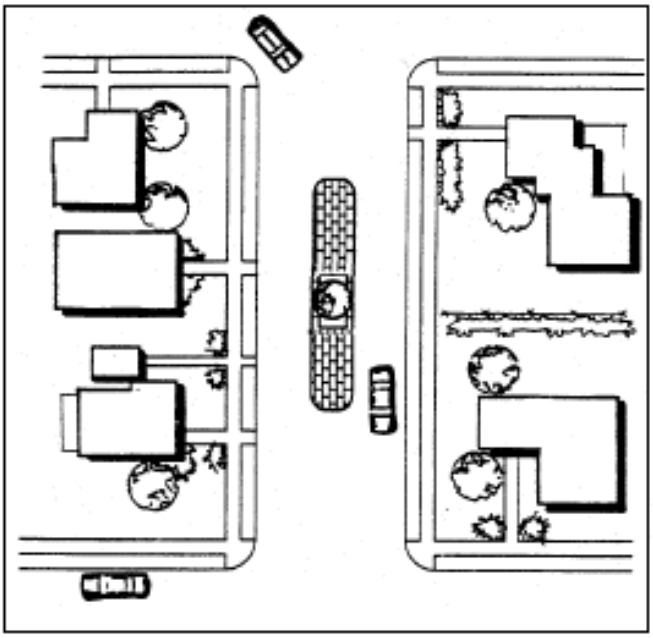
A center island narrowing is a raised island located along the centerline of a street that narrow the travel lanes at that location. Center island narrowings are often landscaped to provide a visual amenity. Placed at the entrance to a neighborhood, and often combined with textured pavement, they are often called "gateway islands." Fitted with a gap to allow pedestrians to 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. *Cost Estimate: $5,000 to $15,000*

**Advantages**

- Increases pedestrian safety
- Can add aesthetic value.
- Effective in reducing traffic volume.

**Disadvantages**

- May eliminate some on-street parking

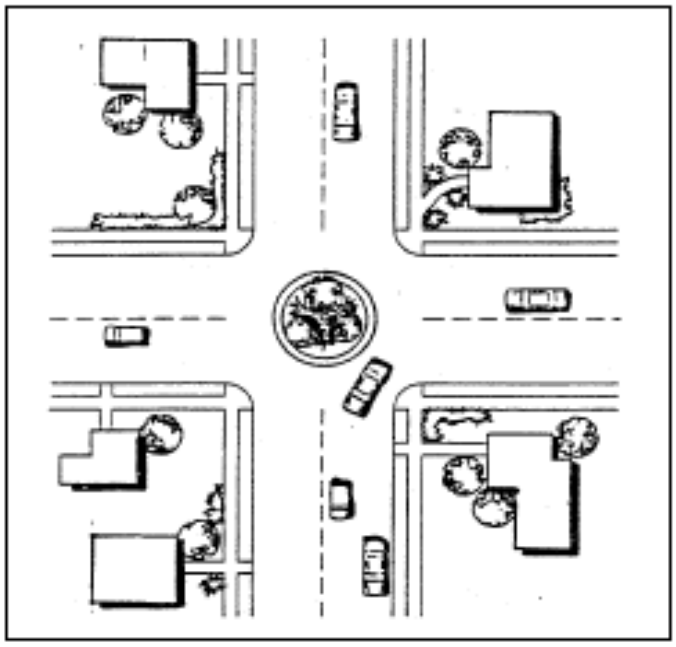


# Level 3: Major Street Changes
# Speed Control Measures

## Traffic Circle:

Traffic circles are raised islands, placed in intersections, around which traffic circulates. They are good for calming intersections, especially within neighborhoods, where large vehicle traffic is not a major concern but speeds, volumes, and safety are problems.
*Cost Estimate: Depends on area/size of circle and materials used.*

| Advantages | Disadvantages |
|---|---|
| • Effective in moderating speeds and improving safety.<br>• Can add aesthetic value.<br>• Can calm two streets at once. | • Difficult for large vehicles.<br>• May eliminate some on-street parking.<br>• Landscaping must be maintained, either by the residents or by the City. |



# Level 3: Major Street Changes
# Volume Control Measures

## Full Closures:

Full street closures are barriers placed across a street to completely close the street to through-traffic, usually leaving only sidewalks open. They are good for locations with extreme traffic volume problems and several other measures have been unsuccessful. May include cul-de-sacs or dead-ends.

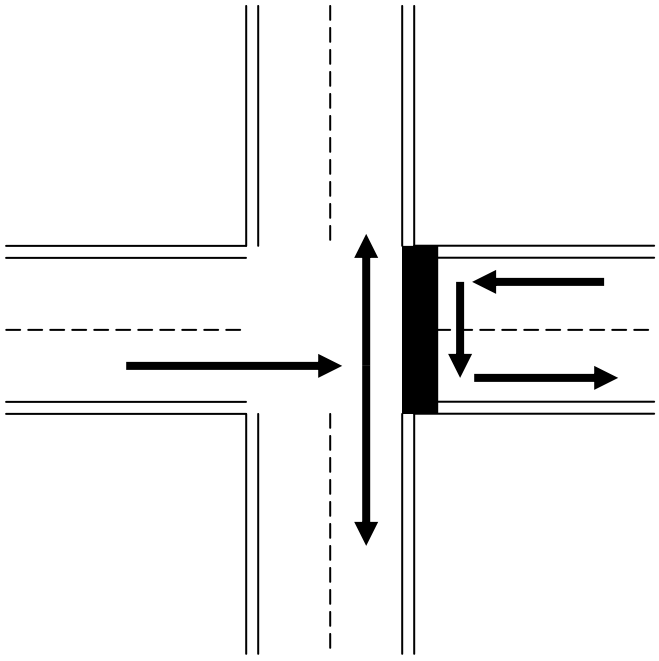
*Cost Estimate: $120,000*

**Advantages**

- Can maintain pedestrian and bicycle access.
- Effective in reducing traffic volume.

**Disadvantages**

- Cause circuitous routes for local residents and emergency services.
- Tend to be expensive.
- May limit access to businesses.



# Level 3: Major Street Changes
# Volume Control Measures

## Half Closures:

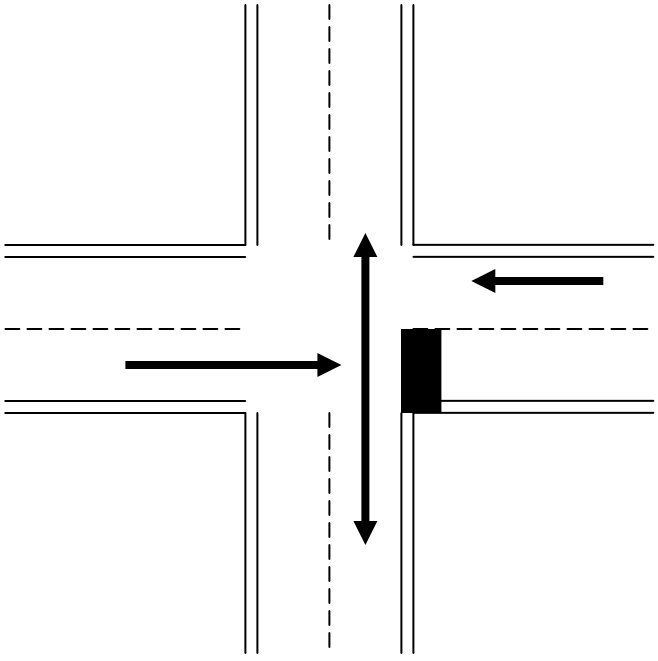
Half closures are barriers that block travel in one direction for a short distance on otherwise two-way streets. They are good for locations with extreme traffic volume problems and other measures have been unsuccessful. Also called partial closures or one-way closures.
*Cost Estimate: $35,000 to $40,000*

**Advantages**

- Can maintain pedestrian and bicycle access.
- Effective in reducing traffic volume.

**Disadvantages**

- Cause circuitous routes for local residents and emergency services.
- May limit access to businesses.
- Depending on the design, drivers may be able to circumvent the barrier.



# Level 3: Major Street Changes
# Volume Control Measures

## Diagonal Diverters:

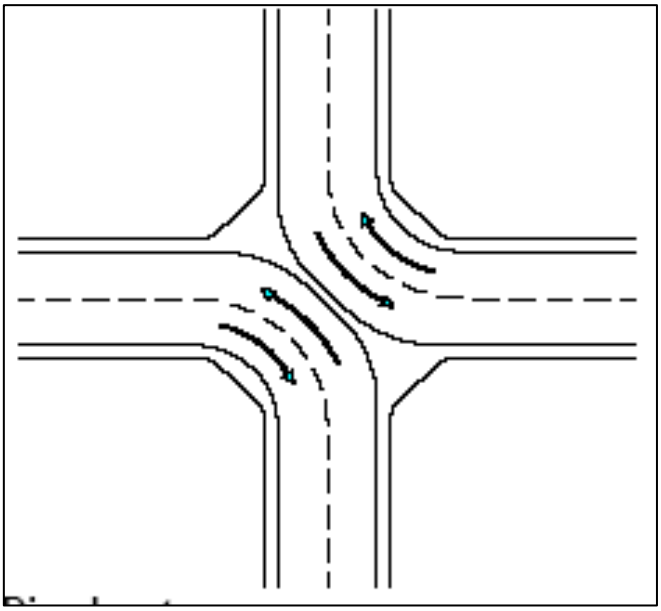
Diagonal diverters are barriers placed diagonally across an intersection, blocking through movements and creating two separate, L-shaped streets. Like half closures, diagonal diverters are often staggered to create circuitous routes through the neighborhood as a whole, discouraging non-local traffic while maintaining access for local residents. They are good for inner-neighborhood locations with non-local traffic volume problems. Also called full diverters or diagonal road closures. *Cost Estimate: $85,000*

**Advantages**

- Does not require a closure per se, only a redirection of existing streets.
- Can maintain pedestrian and bicycle access.
- Effective in reducing traffic volumes.

**Disadvantages**

- Cause circuitous routes for local residents and emergency services.
- Tend to be expensive.
- May require reconstruction of corner curbs.



# Level 3: Major Street Changes
# Volume Control Measures

## Median Barriers:

Median barriers are islands located along the centerline of a street and continuing through an intersection so as to block through movement at a cross street. Also called median diverter or island diverters. They are good for:

- Local street connections to main streets where through traffic along the continuing local street is a problem
- Main streets where left-turns to and/or from the side street are unsafe

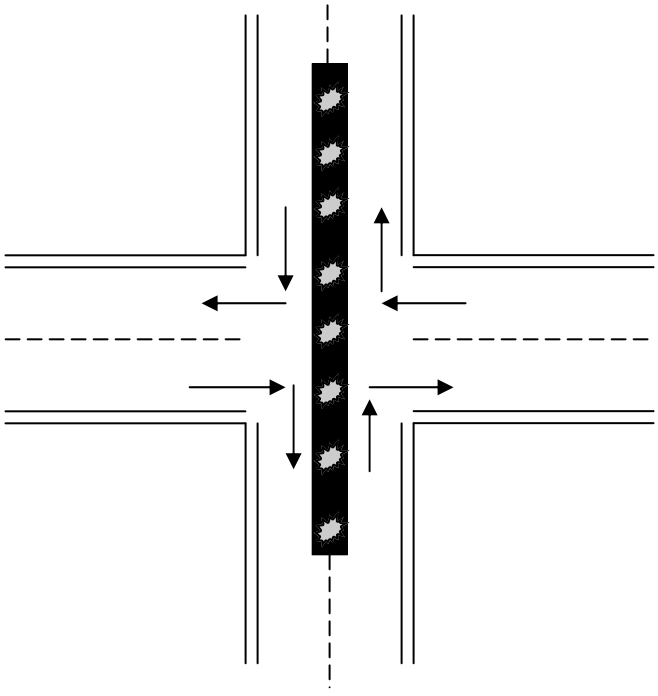
*Cost Estimate: $15,000 to $20,000 per 100 lineal feet.*

**Advantages**

- Can improve safety at an intersection of a local street.
- Can reduce traffic volumes on a cut-through route that crosses a major street.

**Disadvantages**

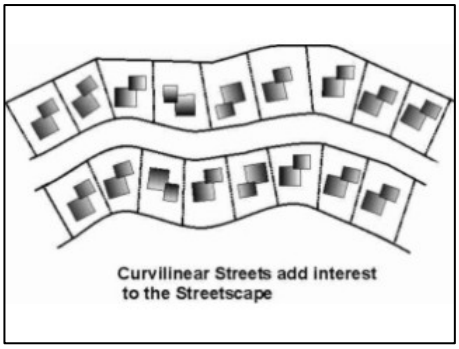
- Require available street width on the major street.
- Limit turns to and from the side street for local residents and emergency services.



# Street Layout and Design

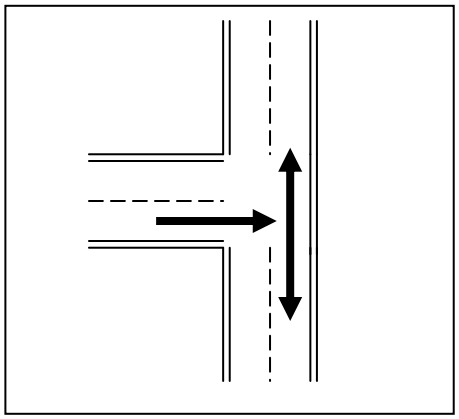
### Curvilinear Street Form

Curvilinear street form takes a grid pattern and applies moderate curves to the street to encourage drivers to slow down.




### T-intersections (three-way intersections)

T-intersections, or three-way intersections, help slow down traffic while still maintaining connectivity. Typically, a minor street intersects into a major street.



### Entry Treatments

Subdivision entry treatments, such as a landscaped median with signage help encourage drivers to slow down and pay closer attention to surroundings. The entry treatments helps drivers become aware that they are entering a residential area.


### Tree-lined Streets

Streets lined with large, mature trees establishes a natural canopy, which creates a sense of enclosure. The sense of enclosure tends to compel a driver to reduce speed.

| Impact of Traffic Calming Measures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Measure** | **Volume Reduction** | **Speed Reduction** | **Improved Safety** | **Emergency Access** | **Costs** | **Maintenance Problems** | **Noise Pollution** | **Loss of On-Street Parking** |
| **Level 1 Measures** | | | | | | | | |
| Discussion | No | Possible | Possible | No impact | Minimal | No impact | No | No |
| Radar Trailer | No | Possible | Possible | No Impact | Incidental | No impact | No | No |
| Enforcement | Possible | Yes | Possible | No impact | Incidental | No impact | No | No |
| Signage | Unlikely | Possible | Possible | No impact | Minimal | Vandalism | No | No |
| **Level 2 Measures** | | | | | | | | |
| High Visibility Crosswalks | Unlikely | No | Possible for pedestrians | No impact | Low | No impact | No | No |
| Narrowing Lanes | Unlikely | Possible | Possible for pedestrians | No impact | Low | No impact | No | No |
| **Level 3 Measures – Speed Control** | | | | | | | | |
| Speed Hump | Possible | Possible | No | Possible problems | Low | Snowplow problems | Yes | No |
| Speed Table | Possible | Possible | No | Possible problems | Low | No impact | Possible | No |
| Raised Crosswalk | Unlikely | Possible | Possible | Minimal impact | Moderate | | Possible | No |
| Raised Intersection | Unlikely | Possible | No | Minimal impact | High | | Possible | No |
| Textured Pavement | Unlikely | Temporary | No | Minimal impact | Moderate | | Yes | No |
| Intersection Bulb-Out | Unlikely | Possible | Possible for pedestrians | Minimal impact | Moderate | No | No | No |
| Chicane | | | | | | | | |

| Impact of Traffic Calming Measures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Measure** | **Volume Reduction** | **Speed Reduction** | **Improved Safety** | **Emergency Access** | **Costs** | **Maintenance Problems** | **Noise Pollution** | **Loss of On-Street Parking** |
| Mid-block Choker | Unlikely | Possible | Possible for pedestrians | Some constraints | Moderate | No | No | Yes |
| Center Island Narrowing | | | | | | | | |
| Roundabout | Possible | Possible | Possible | Some constraints | High | Vandalism | No | No |
| Traffic Circle | Possible | Possible | Possible | Some constraints | High | Vandalism | No | No |
| Entry Treatment | | | | | | | | |
| **Level 3 Measures – Volume Control** | | | | | | | | |
| Full Closure | Yes | Likely | | | | | | |
| Half Closure | Yes | Likely | | | | | | |
| Diagonal Diverters | Yes | At diversion | Possible | Some constraints | High | | | |
| Median Barriers | Yes | Yes | Yes | Some constraints | High | No | Decrease | |

Costs Key: Low - $0 to $5,000
**Moderate - $5,000 to $15,000**
**High - Over $15,000**

# Resources

- Traffic Calming: State of the Practice ITE/FHWA, August 1999 - www.ite.org/traffic/tcstate.htm#tcsop
- State of the Art Report: Residential Traffic Management; Federal Highway Administration. Report No. FYWA/RD-80/092. December 1980.
- Institute of Transportation Engineers, Traffic Calming Library - www.ite.org/traffic/
- Federal Highway Administration - www.fhwa.dot.gov/environment/tcalm/index.htm
- Victoria Transport Policy Institute - www.vtpi.org/tdm/tdm4.htm
- Fehr and Peers Associates - www.trafficcalming.org
- Transportation Alternatives - www.transalt.org/campaigns/nsn/trafficcalming.html
- Pedestrian and Bicycle Information Center - www.bicyclinginfo.org/de/calm.htm