City of Delaware
Delaware Thoroughfare Plan

Appendix 12

Traffic Calming Guidelines

MS CONSULTANTS, INC.

City of Delaware

TRAFFIC CALMING GUIDELINES

Traffic calming, sometimes referred to as Neighborhood Traffic Management, is not a new concept in the field of transportation engineering. Traffic calming responds to public concerns about speeding and cut-through traffic on neighborhood streets. A subcommittee of the Institute of Transportation Engineers (ITE) came up with the following definition as noted in "ITE Traffic Calming Definition" published in the July, 1997 *ITE Journal*, Volume 67:

> "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."

The intent of traffic calming is to reduce the speed and volume of traffic to levels acceptable for the functional class of the street and the nature of the bordering activity. Traffic calming measures are meant to be self-enforcing as opposed to traffic control devices such as stop signs and speed limit signs which are regulatory and require enforcement.

The following is a list of traffic calming measures which may be considered singly or in combination:

Neighborhood Speed Watch Program
Speed Hump
Speed Table
Traffic Circle
Center Island Narrowing
Raised Intersection
Choker
Chicane
Closure

ITE and the Federal Highway Administration (FHWA) have published a summary of each of these traffic calming measures, with the exception of the Neighborhood Speed Watch Program. Each summary contains a description of and the application associated with each of the above listed traffic calming measures along with design and installment issues, potential impacts and typical costs. The summaries are contained in Appendix along with a description of the Neighborhood Speed Watch Program.

A traffic calming method or combination of methods are best selected based on the results of a traffic study on a case by case basis. The purpose of the traffic study is to identify the existence, nature and extent of a traffic situation correctable through traffic calming. It also includes a careful determination of the study area which is important in reducing the possibility of implementation of spot improvements which may divert traffic to neighboring streets. Determination of the study area boundaries also assists in notification of residents and businesses that may be impacted by installation of a traffic calming method. The results of the traffic study identify the best traffic calming options for a study area. Ultimately, the residents of the study

area must decide whether a traffic problem warrants installation of traffic calming method on their community streets.

The basic premise of the City of Delaware Traffic Calming Program is for City staff to assist, coordinate and facilitate the efforts of neighborhoods in implementing traffic calming plans. The approach to neighborhood traffic calming can be not only reactive – in response to citizen complaints, but also proactive – initiated by City staff. In either case, the consideration and implementation process is the similar and involves considerable consensus building in the community.

In order to be eligible for possible implementation of a traffic calming method or methods, the suggested street must be classified as local residential or minor collector with an 85th percentile speed 10 mph greater than the speed limit. When these conditions are met, each subdivision, neighborhood or area desiring to implement a traffic calming measure will be required to establish a Neighborhood Traffic Calming Representative or Committee. The following is the process for consideration and implementation of traffic calming methods on City of Delaware streets:

City of Delaware Process for Consideration of Traffic Calming Methods

1. City staff receives a written request for implementation of traffic calming methods.

2. The following criteria shall be met in order for the street to be eligible for possible implementation of a traffic calming method:

    - The street is classified as local residential or minor collector.
    - A speed survey determines that the 85th percentile speed on the street is 10 mph greater than the posted limit.

3. Upon meeting the criteria in Step 2, a copy of the City of Delaware Process for Consideration of Traffic Calming Methods along with a petition form will be provided to the requesting citizen(s). City staff will identify the study area and the home or business owners whose signatures are required on a petition to initiate an area traffic study for possible installation of a traffic calming method. The area residents must identify a Neighborhood Traffic Calming Representative or Committee to be responsible for interfacing with City staff, circulating petitions and reaching a neighborhood agreement with regard to the type of measure or measures to be implemented and the cost to the neighborhood.

4. The Traffic Calming Representative or Committee must collect two-thirds or 67% of home or business owners signatures on a petition requesting City Council (Safety Committee) to further study the need for implementation of traffic calming methods in their neighborhood.

5. Upon satisfaction of the petition requirement, the request for further study of traffic calming methods will be placed to City Council (Safety Committee) to evaluate the merit of the request.

    Note: If City staff initiates the request for study of traffic calming methods, the project also requires approval by City Council. After receiving approval, home or business owners in the project study area will be notified of the intent to begin the traffic study and a Neighborhood Traffic Calming Representative or Committee will be identified.

6. After authorization by City Council, a traffic study will be conducted to identify if a situation exists that is correctable by traffic calming methods. The study should include speed surveys, traffic counts, review of accident data, affect on emergency response, and possibly license plate surveys to determine the percentage of cut through traffic. The study will identify the "best fit" solution(s) for the study area which may include one or a combination of traffic calming methods, if applicable.

7. The results of the traffic study will be presented to City Council for approval or denial to proceed with consensus building and possible implementation of traffic calming methods.

8. Pending approval by City Council, City staff will present the traffic study findings and recommendations at a meeting of the study area homeowners. A ballot vote for or against the trial implementation of the proposed traffic calming method can be initiated at this meeting with subsequent ballots provided to homeowners not present by the Neighborhood Traffic Calming Representative or Committee. Two-thirds or 67% of homeowners must return ballots acquiescing to the traffic calming method in the study area.

   Note: ballot voting is recommended as it has been found that petition signers sometimes are pressured into signing the form and/or do not fully understand the issues.

9. Upon satisfaction of the ballot vote, City staff will recommend implementation or denial of the request for trial traffic calming method to City Council. If approved, the request could be placed in the City's priority list for funding or other methods of funding could be considered such as a special assessment on each property owners annual tax bill to cover the cost of installation and maintenance of the traffic calming method.

10. When authorized for funding, the temporary traffic calming method or methods will be implemented for a one-year trial period, with the traffic study continuing with periodic collection of data to determine the effectiveness of the device. Data collection will include conducting traffic counts and speed surveys, collecting accident data, and polling of community members.

11. City staff will recommend to City Council approval or denial of the traffic calming method as a permanent device after the one-year trial period dependent on the results of the final traffic study.

Sources:

Traffic Calming: State of the Practice; ITE and FHWA, 1999.

Neighborhood Traffic Management; Janice Newton, Rob Burchfield, Jerome Marksino; City of Portland, Oregon,

Neighborhood Traffic Control Bellevue's Experience; Karen Gonzalez; City of Bellevue, Washington.

Neighborhood Traffic Calming – do We Need Warrants; Resource Paper for the 1997 International ITE Conference; Brian D. Kanely, P.E., City of Gainesville Traffic Engineering Director, Gainesville, Florida.

Neighborhood Traffic Management Program; ITE 1992 Compendium of Technical Papers; W. Martin Bretherton, Jr., P.E. and Joseph E. Womble, P. E.; Gwinnett County Department of Transportation, Lawrenceville, Georgia.

Petition to Initiate an Area Traffic Study for Possible Installation of a Traffic Calming Device

_____ has been identified by City of Delaware Staff as a road with over 85 percent of drivers traveling at a speed 10 mph greater than the speed limit. As such, our road is a possible candidate for installation of a Traffic Calming Device. To begin a study to determine if a Traffic Calming device is appropriate for our road, we need 67% of home or business owners to sign this petition. Your Neighborhood Traffic Calming Representative/Committee Members is/are: _____ and can be reached at _____ to answer questions.

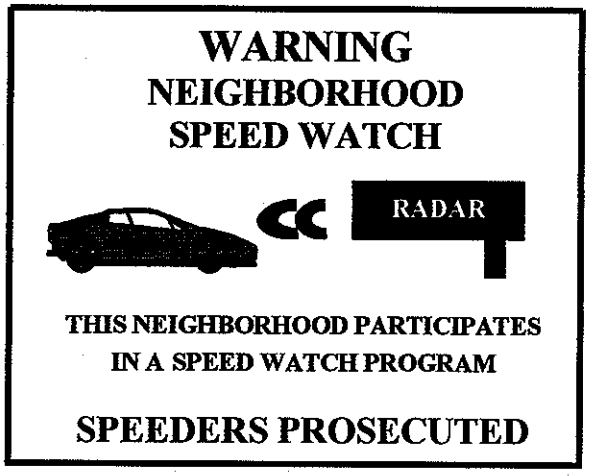
Traffic Calming Measures - Neighborhood Speed Watch Program

Description:

- a joint venture between the Public Agency, the Police Department, and the Neighborhood Traffic Calming Representative or Committee
- periodic radar speed spot checks are conducted by Public Agency staff in each participating neighborhood to identify speeders.
- vehicle speed, time, date, and license plate numbers are sent to the Police Department who sends warning letters to the owner of the vehicle noted as speeding in the participating neighborhood.
- The objective is to change the attitudes of each motorist so they feel as though they would be incurring disapproval and censure of their friends and neighbors by exceeding the speed limit in their subdivisions.
- A sign is installed at the street or subdivision entrance identifying the area as a Neighborhood Speed Watch Program participant. (Figure 1)

Applications:

- "self-contained" residential streets
- not effective in areas with "cut-through" traffic



Traffic Calming Measures - Speed Hump

Description:

- rounded raised areas of pavement typically 12 to 14 feet in length
- often placed in a series (typically spaced 300 to 600 feet apart)
- sometimes called road humps or undulations

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Federal Highway Administration

Applications:

- residential streets
- not typically used on major roads, bus routes, or primary emergency response routes
- midblock placement, not at an intersection
- not on grades greater than 8 percent
- work well with curb extensions

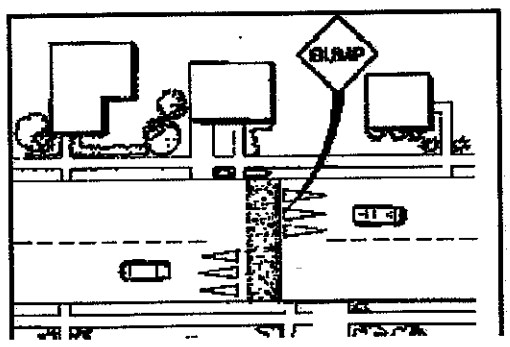
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Design/Installation Issues:

- typically 12 to 14 feet in length; other lengths (10, 22, and 30 feet) reported in practice in U.S.
- speed hump shapes include parabolic, circular, and sinusoidal
- hump heights range between 3 and 4 inches with trend toward 3 - 3 ½ inches maximum

- difficult to construct precisely; may need to specify a construction tolerance (e.g. ± 1/8 inch) on height
- often have signage (advance warning sign before first hump in series and warning sign or object marker at hump)
- typically have pavement marking (zigzag, shark's tooth, chevron, zebra)
- taper edge near curb to allow gap for drainage



- some have speed advisories
- bicyclists prefer that it not cover or cross a bike lane



Potential Impacts:

- no effect on non-emergency access
- speeds determined by height and spacing; speeds between humps have been observed to be reduced between 20 and 25 percent on average
- based on a limited sample of sites, typical crossing speeds (85th percentile) of 19 mph have been measured for 3½ inch high, 12 foot humps and of 21 mph for 3 inch high, 14 foot humps; speeds have been observed to rise to 27 mph within 200 feet downstream
- speeds typically increase approximately 0.5 mph midway between humps for each 100 feet of separation
- studies indicate that traffic volumes have been reduced on average by 18 percent depending on alternative routes available
- studies indicate that collisions have been reduced on average by 13 percent on treated streets (not adjusted for traffic diversion)
- most communities limit height to 3-3½ inches, partly because of harsh ride over 4-inch high humps
- possible increase in traffic noise from braking and acceleration of vehicles, particularly buses and trucks

Emergency Response Issues:

- Concern over jarring of emergency rescue vehicles
- Approximate delay of between 3 and 5 seconds per hump for fire trucks and up to 10 seconds for ambulance with patient

Typical Cost:

- Approximately $2,000 (1997 dollars)

For additional detail, refer to ITE's Recommended Practice entitled *Guidelines for the Design and Application of Speed Humps.* Visit the ITE Bookstore for more information about this publication

Traffic Calming Measures - Speed Table

Description:

- long raised speed humps with a flat section in the middle and ramps on the ends; sometimes constructed with brick or other textured materials on the flat section
- sometimes called flat top speed humps, trapezoidal humps, speed platforms, raised crosswalks, or raised crossings

Applications:

- local and collector streets
- main roads through small communities
- typically long enough for the entire wheelbase of a passenger car to rest on top
- work well in combination with textured crosswalks, curb extensions, and curb radius reductions
- can include a crosswalk

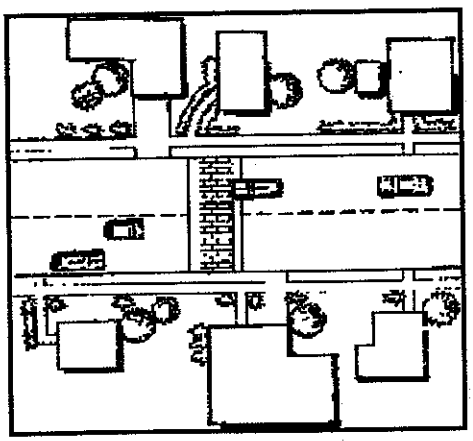
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Design/Installation Issues:

- typically 22 feet in the direction of travel with 6 foot ramps on each end and a 10 foot flat section in the middle; other lengths (32 and 48 feet) reported in U.S. practice
- most common height is between 3 and 4 inches (and reported as high as 6 inches)
- ramps are typically 6 feet long (reported up to 10 feet long) and are either parabolic or linear
- careful design is needed for drainage



Potential Impacts:

- no effect on access
- speeds are reduced, but usually to a higher crossing speed than at speed humps (typically between 25 and 27 miles per hour)
- traffic volumes have been reduced on average by 12 percent depending on alternative routes available
- collisions have been reduced on average by 45 percent on treated streets (not adjusted for traffic diversion)
- reported to increase pedestrian visibility and likelihood that driver yields to pedestrian

Emergency Response Issues:

- typically preferred by fire departments over 12 to 14-foot speed humps
- generally less than 3 seconds of delay per hump for fire trucks

Typical Cost:

- approximately $2,500 (in 1997 dollars) for asphalt tables; higher for brickwork, stamped asphalt, concrete ramps and other enhancements sometimes used at pedestrian crossings

Traffic Calming Measures - Neighborhood Traffic Circle

Description:

- raised islands, placed in intersections, around which traffic circulates
- motorists yield to motorists already in the intersection
- require drivers to slow to a speed that allows them to comfortably maneuver around them
- sometimes called intersection islands
- different from roundabouts

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Applications:

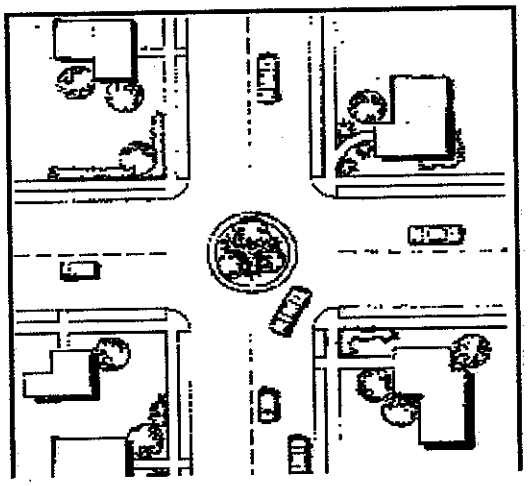
- intersections of local or collector streets
- one lane each direction entering intersection
- not typically used at intersections with high volume of large trucks and buses turning left

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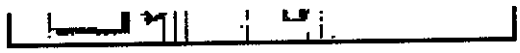


Design/Installation Issues:

- typically circular in shape, though not always
- usually landscaped in their center islands, though not always
- often controlled by YIELD signs on all approaches, but many different signage approaches have been used
- key design features are the offset distance (distance between projection of street curb and center island), lane width for circling the circle, the circle diameter, and height of mountable



outer ring for large vehicles such as school buses and trash trucks



Potential Impacts:

- no effect on access
- reduction in midblock speed of about 10 percent; area of influence tends to be a couple hundred feet upstream and downstream of intersection
- only minimal diversion of traffic
- intersection collisions have been reduced on average by 70 percent and overall collisions by 28 percent
- can result in bicycle/auto conflicts at intersections because of narrowed travel lane

Emergency Response Issues:

- emergency vehicles typically slow to approximately 13 mph; approximate delay of between 5 and 8 seconds per circle for fire trucks
- fire trucks can maneuver around traffic circles at slow speeds provided vehicles are not parked near the circle

Other/Special Considerations:

- large vehicles may need to turn left in front of the circle (which could be unsafe at higher volumes); legislation may be required to legally permit this movement
- quality of landscaping and its maintenance are key issues
- landscaping needs to be designed to allow adequate sight distance
- care must be taken to avoid routing vehicles through unmarked crosswalks on side-street approach

Typical Cost:

- approximately $3,500 to $15,000 (1997 dollars)

Traffic Calming Measures - Center Island Narrowing

Description:

- raised islands located along the centerline of a street that narrow the travel lanes at that location
- sometimes called midblock medians, median slow points, or median chokers

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Applications:

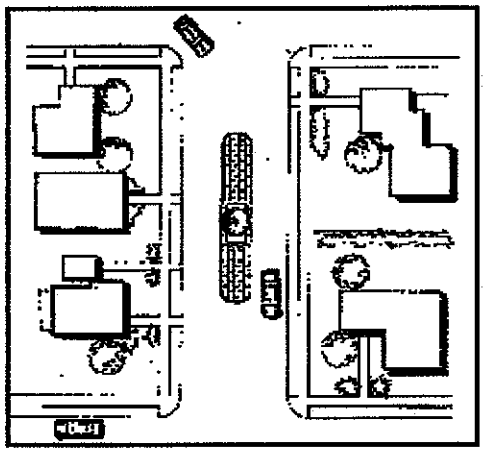
- are often nicely landscaped to provide visual amenity and neighborhood identity
- can help pedestrianize streets by providing a mid-point refuge for pedestrians crossings
- sometimes used on wide streets to narrow travel lanes
- work well when combined with crosswalks



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Potential Impacts:

- may reduce parking and driveway access
- reduces pedestrian crossing width
- may visually enhance the street through landscaping but may also limit visibility of pedestrian crossings
- bicyclists prefer not to have the travel way narrowed into path of motor vehicles
- collision, speed and volume data are not available



- preferred by fire department/emergency response agencies to most other traffic calming measures

Typical Cost:

- reported costs range between $5,000 and $15,000 (1997 dollars)

Traffic Calming Measures - Raised Intersection

Description:

- flat raised areas covering entire intersections, with ramps on all approaches and often with brick or other textured materials on the flat section and ramps
- sometimes called raised junctions, intersection humps, or plateaus

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Applications:

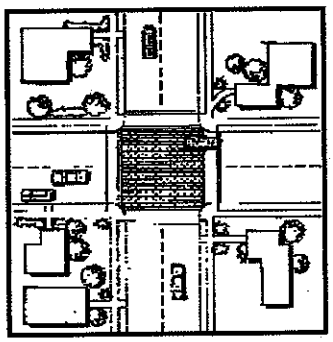
- work well with curb extensions and textured crosswalks
- often part of an area wide traffic calming scheme involving both intersecting streets
- in densely developed urban areas where loss of parking would be unacceptable



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Design/Installation Issues:

- typically rise to sidewalk level
- may require bollards to define edge of roadway
- Canadian installations typically have gentle 1:40 slopes on ramps
- storm drainage modifications are necessary



Potential Impacts:

- reduction in through movement speeds at intersection
- reduction in midblock speeds typically less than 10 percent
- no effect on access
- make entire intersections more pedestrian-friendly

- no data available on volume or safety impacts

Emergency Response Issues:

- slows emergency vehicles to approximately 15 miles per hour

Typical Cost:

- reported costs range between $15,000 and $50,000 (1997 dollars)

Traffic Calming Measures - Choker

Description:

- curb extensions at midblock or intersection corners that narrow a street by extending the sidewalk or widening the planting strip
- can leave the cross section with two narrow lanes or with a single lane
- at midblock, sometimes called parallel chokers, angled chokers, twisted chokers, angle points, pinch points, or midblock narrowings
- at intersections, sometimes called neckdowns, bulbouts, knuckles, or corner bulges
- if marked as a crosswalk, they are also called safe crosses

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Applications:

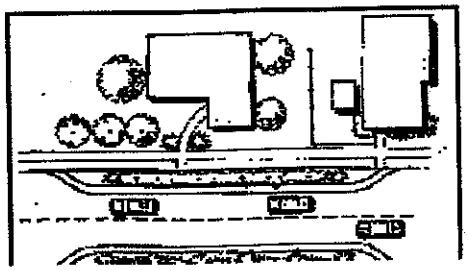
- local and collector streets
- pedestrian crossings
- main roads through small communities
- work well with speed humps, speed tables, raised intersections, textured crosswalks, curb radius reductions, and raised median islands



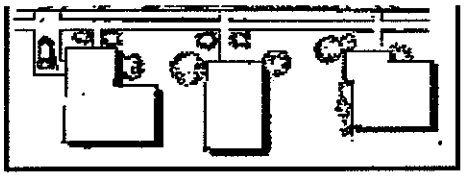
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Design/Installation Issues:

- some applications use an island which allows drainage and bicyclists to continue between the choker and the original curb line
- typically designed to narrow road to 20 feet for two-way traffic; typically avoid



- adequate drainage is a key consideration
- provides opportunity for landscaping
- vertical delineators, bollards or object markers are often used to make visible to snowplow operators



Potential Impacts:

- can impact parking and driveway access
- reduces pedestrian crossing width and increases visibility of pedestrian
- speeds have typically been reduced on average by 4 percent for two-lane chokers and 14 percent for one lane chokers
- minor decrease in traffic for two-lane and 20 percent reduction for one-lane chokers
- collision data not available
- bicyclists prefer not to have the travelway narrowed into path of motor vehicles

Emergency Response Issues:

- preferred by many fire department/emergency response agencies to most other traffic calming measures

Other/Special Considerations:

- one-lane chokers rely on regulatory signs and driver courtesy to work

Typical Cost:

- approximately $7,000 to $10,000 (1997 dollars)

Traffic Calming Measures - Chicane

Description:

- a series of narrowings or curb extensions that alternate from one side of the street to the other forming S-shaped curves
- also called deviations, serpentines, reversing curves, twists, and staggerings

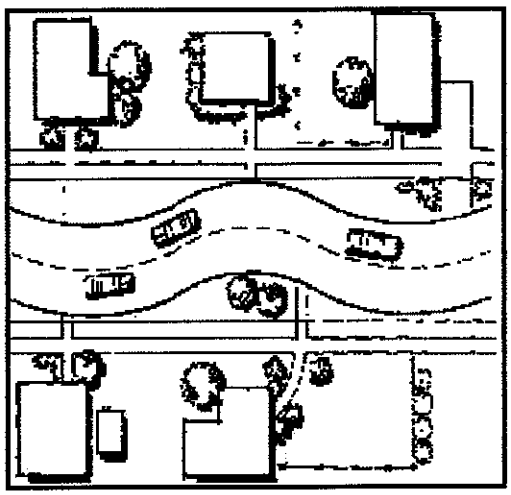
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Applications:

- appropriate for midblock locations only
- most effective with equivalent volumes on both approaches
- typically, is a series of at least three curb extensions
- can use on-street parking to create chicane



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Design/Installation Issues:

- unless well-designed, chicanes may still permit speeding by drivers cutting straight paths across the center line
- European manuals recommend shifts in alignment of at least one lane width, deflection angles of at least 45 degrees, and center islands to prevent drivers from taking a straight "racing line" through the feature

Potential Impacts:

- no effect on access
- limited data available on their effect on speed, volume, and collisions
- street sweeping may need to be done manually
- can impact parking and driveway access
- provides opportunity for landscaping

Emergency Response Issues:

- limited data available on their effect on delay to emergency response
- emergency response typically prefer two-lane chicanes to speed humps

Typical Cost:

- reported costs range between $5,000 and $15,000 (1997 dollars)

Traffic Calming Measures - Closure



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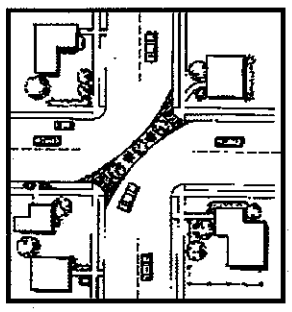
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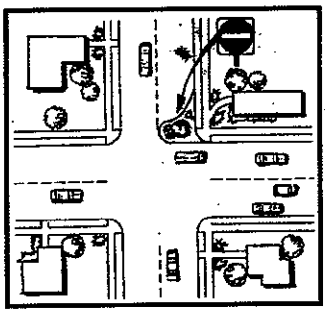
- closures are typically applied only after other measures have failed or been determined to be inappropriate
- for all types of closures, provisions are available to make diverters passable for pedestrians and bicyclists
- often used in sets to make travel through neighborhoods more circuitous - typically staggered internally in a neighborhood, which leaves through movement possible but less attractive than alternative (external) routes
- closures have been used as a crime prevention tool

Descriptions:

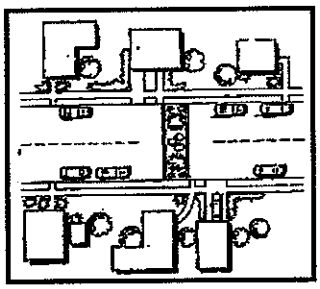
Diagonal diverters are barriers placed diagonally across an intersection, blocking through movement; they are sometimes called full diverters or diagonal road closures



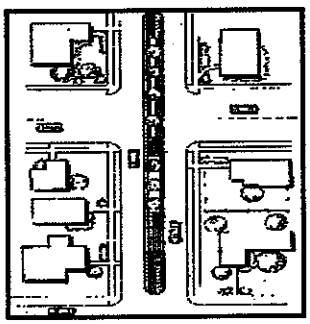
travel in one direction for a short distance on otherwise two-way streets; they are sometimes called partial closures, entrance barriers, or one-way closures (when two half-closures are placed across from one another at an intersection, the result is a semi-diverter)



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



Median barriers are raised islands in the centerline of a street and continuing through an intersection that block the left turn movement from all intersection approaches and the through movement at the cross street



Design/Installation Issues:

- there may be legal issues associated with closing a public street
- can be placed at an intersection or midblock
- barriers may consist of landscaped islands, walls, gates, side-by-side bollards, or any other obstruction that leave an opening smaller than the width of a passenger car

Potential Impacts:

- concern over effects on emergency response, street network connectivity and capacity, and parallel local streets that carry diverted traffic
- may divert significant traffic volumes
- no significant effect on vehicle speeds beyond the closed block

Emergency Response Issues:

- half closures allow a higher degree of emergency vehicle access than full closures or diagonal diverters
- all three types of closures can be designed to allow emergency vehicle access

Typical Cost:

- costs range between $2,000 for a simple half-closure and $35,000 for highly-landscaped diagonal diverter