



Neighborhood Traffic Calming Program

City of Concord
Transportation
Division

August 2000



Table of Contents

1. Introduction	3
What is Traffic Calming?	3
Multiple Purposes of Traffic Calming	3
An Integrated Approach to Traffic Calming	4
Future Program Updates	5
What's Included in this Report?	5
2. Traffic Calming Toolbox	6
Application of Tools	6
Level 1 Traffic Calming Tools	6
Level 2 Traffic Calming Tools	17
Combining Traffic Calming Measures	17
Use of Temporary Measures	17
3. Traffic Calming Impacts	33
Travel Speeds	33
Traffic Volumes	34
Collisions	35
Emergency Responsiveness	36
4. Implementation Process	38
Community Identification of the Problem	38
Level 1 Implementation Process	42
Level 2 Implementation Process	43
Funding Considerations	45
5. Guidelines for Installation	46
Speed Hump Guidelines	46
Crosswalk Guidelines	46
Stop Sign Guidelines	46
Acknowledgements	47



1. Introduction

What Is Traffic Calming?

The City of Concord frequently receives complaints from its residents about speeding and cut-through traffic in our neighborhoods. In a recent survey, Concord residents identified safety and traffic congestion as high priorities for improvement. Without proper treatment, neighborhood livability will become more adversely affected. In response to the public's concerns, the City of Concord has developed a Neighborhood Traffic Calming Program.

The term "traffic calming" is defined differently throughout the United States and the world. The Institute of Transportation Engineers, an international educational and scientific association of transportation professionals, defines traffic calming as follows:

*"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."*¹

The City of Concord expands this definition to also include consideration of non-physical measures, such as educational programs and enhanced enforcement.

Multiple Purposes of Traffic Calming

The immediate purpose of traffic calming is to reduce the speed and volume of traffic to acceptable levels. Reductions in traffic speed and volume, however, are just means to other ends such as traffic safety and active street life.² Traffic calming is undertaken for many different reasons, including:

- ❑ Reducing through traffic
- ❑ Reducing truck traffic
- ❑ Reducing the occurrence of excessive speeding
- ❑ Reducing noise, vibration and air pollution
- ❑ Reducing accidents
- ❑ Providing safer environment for pedestrians and children
- ❑ Reducing crime
- ❑ Supporting redevelopment

¹ "ITE Traffic Calming Definition," ITE Journal, Vol. 67, July 1997.

² "Traffic Calming, State of the Practice," ITE, August 1999.



As discussed later, many different traffic calming tools are available to achieve the above goals.

An Integrated Approach to Traffic Calming

The City of Concord's Traffic Calming Program addresses the "too many cars, going too fast by my house" syndrome by working closely with residents to identify existing problems, define neighborhood goals, and garner community support. The program relies heavily on community participation and action.

After the identification of a neighborhood problem, City staff and residents use an integrated approach to develop reasonable measures that consider the "4Es":

Education Enforcement Engineering Enhancement

- ❑ **Education:** Residents are provided with information and tools necessary to make informed decisions about neighborhood traffic concerns.
- ❑ **Enforcement:** Community identified strategies can be put into effect through targeted traffic enforcement.
- ❑ **Engineering:** Through a City staff and resident partnership, physical traffic calming strategies are developed based on engineering principles, community input, and financial constraints.
- ❑ **Enhancement:** Design and landscaping features can be used to improve the aesthetics and livability of neighborhood and to enhance many physical measures.

Elements of one or more of the "4Es" are incorporated into all of the traffic calming tools considered by the City. After development of a community-driven neighborhood traffic calming plan, actions may be implemented using a staged approach.

Level 1 actions are always implemented first. Level 1 measures consist of easily implementable, low-cost, and often less controversial tools such as neighborhood traffic safety campaigns, radar speed display units, neighborhood speed watch programs, targeted police enforcement, sign installation, and pavement marking changes.

If it is determined, after reviewing the effectiveness of Level 1 actions, that more assertive measures need to be implemented, Level 2 improvements may



be considered. Level 2 actions alter the configuration of neighborhood streets, so they often require engineering, are higher-cost, and require community acceptance prior to installation. Level 2 measures consist of physical devices such as speed humps, traffic circles, curb extensions, median islands, and a host of other measures described within this report.

The City's integrated traffic calming approach includes an essential community involvement program. Community involvement and "buy-in" is a requisite. Because for every action there is an opposite reaction -- be it diversion of traffic to another roadway, or neighborhood opposition to particular traffic calming devices -- all City traffic calming projects encourage considerable resident involvement.

Future Program Updates

The City of Concord's Neighborhood Traffic Calming Program is considered a "living document," that is, it will be updated from time to time as new traffic calming techniques are developed and tested. As the City's neighborhoods gain more experience with traffic calming, procedures may be revised. In addition, traffic calming device installation guidelines will be added as they are developed.

What's Included in this Report?

The City of Concord's Neighborhood Traffic Calming Program report is divided into the following five chapters:

- ❑ **Chapter 1. Introduction:** This chapter, which provides an overview of the City of Concord's Traffic Calming Program.
- ❑ **Chapter 2. Traffic Calming Toolbox:** Presents descriptions of various Level 1 and Level 2 traffic calming tools.
- ❑ **Chapter 3. Traffic Calming Impacts:** Provides discussion of travel speed and volume, collision potential, and emergency response impacts.
- ❑ **Chapter 4. Implementation Process:** Discusses the City of Concord's integrated and community-driven traffic calming approach.
- ❑ **Chapter 5. Guidelines for Installation:** This chapter provides suggested guidelines for the installation of various traffic calming tools.



2. Traffic Calming Toolbox

Application of Tools

Traffic calming tools come in all shapes and sizes, from the subtle to the very aggressive. Each tool has appropriate applications, limitations on its use, advantages, disadvantages, and costs associated with it. Before considering any traffic calming tool or a combination of tools, it is important to clearly understand the resident's concerns and the factors or conditions that generated those concerns. For example, sometimes all that is needed to alleviate high speeds along a residential street is increased neighborhood awareness or enforcement of speed limits. Physical devices such as speed humps are often well suited for speed control, but may create increased noise; therefore, if residents are concerned with both speed and noise, the installation of speed humps may not be the best choice at particular locations. It is important to understand all of the issues associated with each tool to identify the most appropriate one for the circumstances.³

It is also important to recognize that if cut-through traffic is the problem (as determined by traffic counts), it suggests one set of measures. If speeding is the problem (as determined by speed measurements), it suggests another set. High collision rates, crime, or urban blight may suggest a third set.⁴

Table 2.1 provides a general assessment of traffic calming measures. Chapter 3 provides more specific detail on various measures effect on traffic speeds and volumes, vehicle collisions, and other quality of life measures.

Level 1 Traffic Calming Tools

Level 1 measures consist of easily implementable and low-cost tools, such as neighborhood traffic safety campaigns, radar speed display units, targeted police enforcement, sign installation, and pavement marking changes. Level 1 measures, as discussed in Chapter 3, will always be implemented and tested prior to consideration of more restrictive measures. Level 1 actions primarily consist of education and enforcement tools.

The following pages provide a gallery of potential Level 1 traffic calming measures.

³ "Traffic Calming Primer," Pat Noyes & Associates, 1998.

⁴ "Traffic Calming, State of the Practice," ITE, August 1999.



Table 2.1 Generalized Assessment of Traffic Calming Measures

Measure	Reduces Speed	Reduces Traffic	Noise	Loss of Parking	Restrict Access	Emrgny. Impacts	Main-tenance	Cost
Level 1 Measures:								
Traffic Educ. Campaign	Maybe	Maybe	No change	None	None	None	No	Varies
Speed Display	Yes	No	No change	None	None	None	No	\$250/day
Neighborhood Sign	Maybe	Minimal	No change	None	None	None	No	\$200/sign
High Visibility Crosswalks	Maybe	No	No change	None	None	None	Yes	\$1K-\$5K
Police Enforcement	Yes	Maybe	No change	None	None	None	No	\$75/hour
Narrowing Lanes	Yes	Maybe	No change	None	None	None	Yes	\$1K-\$3K
Speed Limit Signing	Maybe	No	No change	None	None	None	No	\$200/sign
Stop Signs	Maybe	No	Increase	None	None	None	No	\$200/sign
Signing Restrictions	No	Yes	No change	None	Yes	None	No	\$200/sign
Level 2 Measures:								
Median Island	Maybe	Yes	Decrease	Maybe	Yes	Yes	No	\$10K-\$75K
Gateway	Yes	Yes	Decrease	Maybe	Yes	None	No	\$10K-\$20K
Curb Extension	Maybe	No	No change	Yes	None	Some	Yes	\$10K-\$20K
Choker	Yes	Maybe	No change	Yes	None	Some	No	\$15K
Speed Hump	Yes	Maybe	Increase	Maybe	None	Yes	Yes*	\$5K
Raised Crosswalk	Yes	Maybe	Increase	Yes	None	Some	Yes*	\$5-\$10K
Raised Intersection	Yes	No	Increase	Yes	None	Yes	Yes	\$25K-\$50K
Traffic Circle	Yes	Maybe	No change	Yes	None	Some	Yes	\$15-\$25K
Intersection Channelizing	Yes	Maybe	No change	Yes	None	None	Maybe	\$15-\$20K
Chicane	Yes	Maybe	Maybe	Yes	None	Yes	Maybe	\$20K-\$40K
Movement Barrier	Maybe	Yes	Decrease	None	Yes	Yes	Yes	\$5K
Entrance Barrier	Maybe	Yes	No change	Maybe	Yes	Maybe	No	\$15-\$20K
One-way Streets	No	Yes	No change	None	Yes	Yes	No	\$5K
Diagonal Diverter	Yes	Yes	Decrease	Maybe	Yes	Maybe	No	\$15-\$35K
Street Closure	Yes	Yes	Decrease	Yes	Total	Yes	No	\$20-\$35K

* Speed humps and raised crosswalks must be reinstalled each time a street is resurfaced.

Sources: "Neighborhood Traffic Management & Calming Program," City of San Buenaventura, CA, 1997 and Parisi Associates.



Citywide Traffic Education Campaign

Level 1

Description: Citywide traffic education campaigns can consist of general flyers, citywide meetings, school meetings, rotating neighborhood banners, trash can stickers, and other tools that can be applied on a citywide basis.

Application: The intended benefit of conducting citywide traffic education campaigns is to educate residents and non-residents about traffic laws, speed limits, safety, conditions near schools, and other traffic-related conditions.

Advantages:

- + Citywide application.
- + Various educational tools.
- + Involves community.
- + Involves schools.

Special Considerations:

- Includes information on all City transportation programs, including traffic calming, application of speed limits, stop signs and traffic signals, marked crosswalks, pedestrian signals, children at play, and traffic safety tips.
- Enables City staff to understand areas of potential concern.
- Educational materials can be presented to neighborhood groups and schools.
- Speed awareness banners, rotated about the City, are sometimes used.
- Yard signs or trash can stickers (e.g., "Slow Down in our Neighborhood") can be made available to the community.
- The City's Traffic Calming Program manual can be discussed.

Cost:

- Varies.

√ Education
Enforcement
Engineering
Enhancement



Disadvantages:

- Requires substantial staff resources.
- Effectiveness may be limited.
- Meetings need to stay focused.
- Enforcement still likely required.



Neighborhood Traffic Education Campaign

Level 1

Description: Neighborhood traffic safety campaigns include: personalized letters, neighborhood flyers, meetings, workshops, specific school programs, and neighborhood speed awareness signs or banners.



Application: The intended benefit of conducting neighborhood traffic safety campaigns is usually to make residents aware of local speed limits and other traffic and safety concerns.

Advantages:

- + Allows residents to discuss views.
- + Identifies issues of concern.
- + Enables staff to see concerns.
- + Reduces speeds temporarily.

Disadvantages:

- Effectiveness may be limited.
- Meetings need to stay focused.
- Potentially time consuming.
- Enforcement still likely required.

Special Considerations:

- Neighborhood traffic safety campaigns can consist of letters and/or flyers.
- Often, neighborhood meetings or workshops are conducted.
- Any meetings or workshops need to stay focused on specific traffic issues.
- Neighborhood speed awareness signs or banners are sometimes used.
- Sometimes only effective over a short duration.

Cost:

- Varies.

Speed Display Unit

Level 1

Description: The most common form of radar speed display unit is a portable trailer equipped with a radar unit that detects the speed of passing vehicles and displays it on a reader board, often with a speed limit sign next to the display.

Application: The primary benefit of speed display units is to discourage speeding along neighborhood streets.



Advantages:

- + Effective educational tool.
- + Good public relations tool.
- + Encourages speed compliance.
- + Can reduce speeds temporarily.

Disadvantages:

- Not an enforcement tool.
- Ineffective on multi-lane roadways.
- Less effective on high volume streets.
- Subject to vandalism.

Special Considerations:

- Used throughout the city on an ongoing basis.
- The purpose of the units is to remind drivers that they are speeding.
- Encourage compliance with the posted speed limit.
- Usually only effective in reducing speeds when actually being used.
- In longer term (30 days), speeds can decrease by 6% on low volume roads.
- Effect usually negligible on higher volumes streets serving through traffic.
- Some motorists may speed up to try to register a high speed.
- Should not be used in remote areas.

Cost:

- \$250 per day.

√ Education
Enforcement
Engineering
Enhancement



Higher Visibility Crosswalks

Level 1

Description: Higher visibility crosswalks can be created by using paving blocks or contrasting color concrete, or painting “zebra” stripes in lieu of or between the crosswalk’s outer boundary stripes.



Application: The primary benefit of higher visibility crosswalks is to increase crosswalk visibility to drivers.

Advantages:

- + More visible than traditional x-walks.
- + Indicates preferred crossing location.
- + Can slow travel speeds.
- + Can be aesthetically pleasing.

Disadvantages:

- Pedestrians may ignore traffic more.
- Only used at uncontrolled crosswalks.
- Usually require more maintenance than traditional crosswalks.

Special Considerations:

- Higher visibility crosswalks indicate preferred crossing location to pedestrians.
- Pedestrians may place too high a reliance on ability to control driver behavior.
- Specially paved types require more maintenance than traditional crosswalks.
- Should only be used at uncontrolled crosswalks.
- Less expensive, but not as effective as raised crosswalks (Level 2).

Cost:

- \$1,000 to \$5,000 each.

Targeted Police Enforcement

Level 1

Description: The Police Department deploys motorcycle or automobile officers to perform targeted enforcement on residential streets for at least an hour a day.



Application: The intended benefit of targeted police enforcement is to make drivers aware of local speed limits and to reduce speeds.

Advantages:

- + Visible enforcement very effective.
- + Driver awareness increased.
- + Can be used on short notice.
- + Can reduce speeds temporarily.

Disadvantages:

- Temporary measure.
- Requires long-term use to be effective.
- Fines lower than enforcement cost.
- Disrupts traffic on high volume streets.

Special Considerations:

- Police enforcement is continually in effect throughout the city.
- Usually used only on neighborhood streets with documented speeding problems.
- Typically only effective while officer is actually monitoring speeds.
- Often helpful in school zones.
- May be used during “learning period” when new devices first implemented.
- Long-term benefits unsubstantiated without regular periodic enforcement.
- Expensive.

Cost:

- About \$75 per hour for officer and equipment.

Narrowing Lanes

Level 1

Description: On this Level 1 type of measure, striping is usually used to create narrow lanes -- often about 10 feet wide. The "unused" pavement can be used to stripe bicycle and/or parking lanes.

Application: The primary benefit of narrowing lanes through striping is to slow vehicle speeds.

Advantages:

- + Can be quickly implemented.
- + Slows travel speeds.
- + Improves safety.
- + Can be easily modified.

Special Considerations:

- Narrowed travel lanes provide "friction" and can slow vehicle speeds.
- Can be installed quickly and easily revised over time.
- Designated bicycle lanes and/or parking lanes can be created.
- Adds centerline and edgeline striping to neighborhood streets.
- Can be used around curves to "force" vehicles to stay within lanes.
- On curves, raised dots are usually most effective in centerline.

Cost:

- \$1,000 to \$3,000 each.



Disadvantages:

- Increases regular maintenance.
- Not always perceived as effective tool.
- Adds striping to neighborhood streets.
- Increases resurfacing costs.

Speed Limit Signing

Level 1

Description: 25 mile per hour speed limit signs are installed along neighborhood streets.

Application: The primary benefit of installing speed limit signing is to encourage slower vehicle speeds along residential streets. Signs are only installed along streets where speeding is a problem.



Advantages:

- + Clearly defines legal speed limit.
- + Can reduce speeds if enforced.
- + Usually popular with neighborhood.
- + Low cost installation.

Disadvantages:

- Requires on-going police enforcement.
- Not effective solely by themselves.
- Low speed limits may be unreasonable.
- Adds additional signs in neighborhood.

Special Considerations:

- Should only be used on streets where speeding is a documented problem.
- Requires police enforcement to remain effective.
- Speed limits lower than 25 mph can only be set by engineering analysis.
- Unrealistically low speed limits tend to be disregarded.
- Increases cost of sign maintenance.

Cost:

- \$200 per sign.

Education
✓ Enforcement
Engineering
Enhancement



Stop Signs

Level 1

Description: Stop signs are either installed on the “side street” where no signs currently exist -- or on the “main street” at an intersection where the “side street” already has stop signs.

Application: Stop signs should only be considered when warranted based on established criteria.



Advantages:

- + Requires traffic to stop.
- + Assists pedestrian crossings.
- + May slightly reduce cut-thru traffic.
- + Lowers speeds at stop sign.

Disadvantages:

- May lead to increased mid-block speeds.
- Increases noise and air pollution.
- Can create problems if unwarranted.
- May increase emergency response time.

Special Considerations:

- Stop signs should only be installed if warranted based on established criteria.
- Drivers may not comply with stop signs if installation is unwarranted.
- Mid-block speeds can increase to make up for “lost” time.
- At low volume, unwarranted locations, many drivers will “roll” through.
- Can create safety problems for pedestrians when compliance is poor.
- Stop signs may increase certain types of collisions, e.g., rear-ends.
- Stop signs may reduce other types of collisions, e.g., broad-sides.
- May increase emergency response times.
- Increases noise near intersection due to vehicle deceleration and acceleration.

Cost:

- \$200 per sign.

Education
✓ Enforcement
Engineering
Enhancement



Restricted Movement Signing

Level 1

Description: Turn prohibition signs involve the use of standard “No Left Turn”, “No Right Turn”, or “Do Not Enter” signs to prevent undesired turning movements onto residential streets. They may include peak period limitations.

Application: The primary benefit of restricted movement signing is to reduce cut-through traffic volumes along residential streets.



Advantages:

- + Redirects traffic to main streets.
- + Reduces cut-through traffic.
- + Can address time-of-day problems.
- + Low cost.

Disadvantages:

- May divert traffic to other streets.
- Require enforcement.
- Adds more signs to neighborhood.
- Usually not effective all day.

Special Considerations:

- Restricted movement signing is best used on major or collector streets.
- Most effective at periphery of a neighborhood to prevent entering traffic.
- Has little or no effect on speeds for through vehicles.
- Turn prohibitions can be used on a trial basis.
- Violation rates are about 50% without enforcement.
- With active enforcement, violation rates are reduced to about 20%.
- Turn restrictions are most effective when limited to peak hours.
- Less effective when applied around-the-clock.
- 24-hour turn restrictions better served with closures than with signing.

Cost:

- \$200 per sign.

Education
✓ Enforcement
Engineering
Enhancement



Level 2 Traffic Calming Tools

Level 2 actions alter the configuration of neighborhood streets, so they often require engineering, are higher-cost, and require community acceptance prior to installation. Level 2 measures are only used after Level 1 measures have been implemented and proven ineffective in addressing particular neighborhood traffic needs. Before Level 2 traffic calming actions are constructed, the neighborhood and City staff must carefully evaluate the benefits and disadvantages of each action.

The following pages provide a gallery of potential Level 2 traffic calming measures. It is often possible to combine elements of various Level 2 actions or to slightly modify treatments.

Combining Traffic Calming Measures

Often, the most effective traffic calming programs use a variety of traffic calming tools. Combinations of traffic calming measures can be used, and are often encouraged, in different neighborhoods and even along the same street. As shown in the toolbox of Level 1 and Level 2 applications, many of the measures complement each other. For instance, speed humps and chokers can be used effectively together, as can traffic circles and curb extensions. Center median islands and chokers are often installed as a set. Raised crosswalks and curb extensions work well together. Many other combinations of traffic calming tools can be effective.

Use of Temporary Measures

Whenever feasible, the City of Concord will install temporary Level 2 traffic calming devices subject to an assessment of impacts and support of the residents. It should be noted that while the use of temporary devices can help determine the resulting travel speed and traffic volume changes, temporary devices are usually not aesthetic. Because of this, there is always the risk that residents will criticize the device's appearance instead of its effectiveness in traffic calming. However, the use of attractive materials, colors and composition can create acceptable temporary devices. For example, planters, which provide greenery as well as access control, can be used as temporary street closures.



Median Island

Level 2

Description: Median islands are raised islands in the center of a street that can be used to narrow lanes for speed control and/or to create a barrier to prohibit left-turns into or from a side street. They can also be used for pedestrian refuges in the middle of a crosswalk.

Application: Median islands are used on wide streets to lower travel speeds and/or to prohibit left-turning movements. They are also often used to provide a mid-point refuge area for crossing pedestrians.



Advantages:

- + Effectively reduces vehicle speeds.
- + Can reduce collision potential.
- + Reduces pedestrian crossing.
- + Opportunity for landscaping.

Disadvantages:

- Could require parking removal.
- May reduce driveway access.
- Could impact emergency vehicles.
- May divert traffic volumes.

Special Considerations:

- Median islands, when used to block side street access, may divert traffic.
- In this condition, they may impact emergency response times.
- Median islands may visually enhance the street through landscaping.
- Median islands used for lane narrowing should result in at least 12' lanes.
- Fire departments usually prefer median islands to some other measures.
- Bicyclists prefer not to have travel way narrowed.

Cost:

- \$10,000 to \$75,000 each (depending on size).

Education
Enforcement
√ Engineering
√ Enhancement



Gateway

Level 2

Description: Gateway entrance treatments consist of physical and textural changes to streets and are located at key entry ways into a neighborhood. They often consist of features, like chokers, that narrow a street in order to reduce the width of the street's right-of-way.

Application: The primary benefit of gateway treatments is speed reduction. They provide visual cues that tell drivers they are entering a local residential area or that the surrounding land uses are changing.



Advantages:

- + Can reduce vehicle speeds.
- + Creates identity for neighborhood.
- + Can discourage cut-through traffic.
- + Opportunity for landscaping.

Disadvantages:

- Maintenance and irrigation needs.
- May require removal of parking.
- Can impede truck movements.
- Creates physical obstruction.

Special Considerations:

- Gateways have minimal influence on driver's routine behavior.
- Overall speeds and volumes are usually only minimally influenced.
- Gateway treatments make drivers more aware of neighborhood environment.
- Can incorporate neighborhood identification signing and monumentation.
- Care should be taken not to restrict pedestrian visibility at adjacent crosswalk.
- Textured pavements could introduce some new noise.

Cost:

- \$10,000 to \$20,000 each.

- Education
- Enforcement
- ✓ Engineering
- ✓ Enhancement



Curb Extension

Level 2

Description: Curb extensions narrow the street by extending the curbs toward the center of the roadway or by building detached raised islands to allow for drainage and bike lanes passage.

Application: Curb extensions are used to narrow the roadway and to create shorter pedestrian crossings. They also improve sight distance and influence driver behavior by changing the appearance of the street.



Advantages:

- + Better pedestrian visibility.
- + Shorter pedestrian crossing.
- + Can decrease vehicle speeds.
- + Opportunity for landscaping.

Disadvantages:

- Can require removal of parking.
- May create hazard for bicyclists.
- Can create drainage issues.
- Difficult for truck turns to right.

Special Considerations:

- Curb extensions can be installed at intersections or mid-block (see chokers).
- Mid-block chokers are often used with pedestrian crossing treatments.
- Curb extensions should not extend into bicycle lanes, where present.
- Curb extensions at transit stops enhance service.
- No noise or emergency service impacts.
- May require landscape maintenance to preserve sight distances.

Cost:

- \$10,000 to \$20,000 each.

Education
Enforcement
✓ Engineering
✓ Enhancement



Choker

Level 2

Description: Chokers are midblock curb extensions that narrow a street by extending the sidewalk or widening the planting strip. The remaining cross-section can consist of one lane or two narrow lanes.

Application: Chokers are intended to reduce traffic volumes by making the roadway narrow so that only one car at a time can pass through it, or two cars can pass very slowly in opposite directions.



Advantages:

- + Effectively reduces vehicle speeds.
- + Shorter pedestrian crossing.
- + Provides improved sight distance.
- + Opportunity for landscaping.

Disadvantages:

- Can require removal of parking.
- May create hazard for bicyclists.
- Can create drainage issues.
- May impede truck movements.

Special Considerations:

- Chokers can be designed with protected bike lane next to original curb.
- Chokers with exclusive bike lanes can collect debris in bike lane.
- Can impact driveway access.
- Also reduce travel speeds when cross-section reduced substantially.
- Preferred by many emergency response agencies to other measures.
- Provide excellent opportunities for landscaping..

Cost:

- \$10,000 each.

Education
Enforcement
✓ Engineering
✓ Enhancement



Speed Hump

Level 2

Description: Speed humps are asphalt mounds constructed on residential streets. They are usually placed in a series and spaced 300 to 600 feet apart. Speed humps are typically 14 feet long and 3 inches high. Their vertical deflection encourages motorists to reduce speed.

Application: The primary benefit of speed humps is speed control. They work well in conjunction with curb extensions.



Advantages:

- + Effectively reduces vehicle speeds.
- + Does not require parking removal.
- + Can reduce vehicular volumes.
- + Easily tested on temporary basis.

Disadvantages:

- Slows emergency vehicles.
- Increases noise near speed humps.
- May divert traffic to parallel streets.
- Not esthetically pleasing.

Special Considerations:

- Vehicle speeds between humps have been shown to decrease by up to 25%.
- Volumes may decrease if parallel route, without measures, is available.
- Possible increase in traffic noise from braking and accelerating.
- Highest noise increase from buses and trucks.
- Speed humps reduce emergency vehicle response times.
- 3-5 second delay per hump for fire trucks, 10 seconds for ambulances.
- Speed humps require advance warning signs and object marker at hump.
- Difficult to construct precisely, unless pre-fabricated.

Cost:

- \$5,000 each.

Education
Enforcement
✓ Engineering
Enhancement

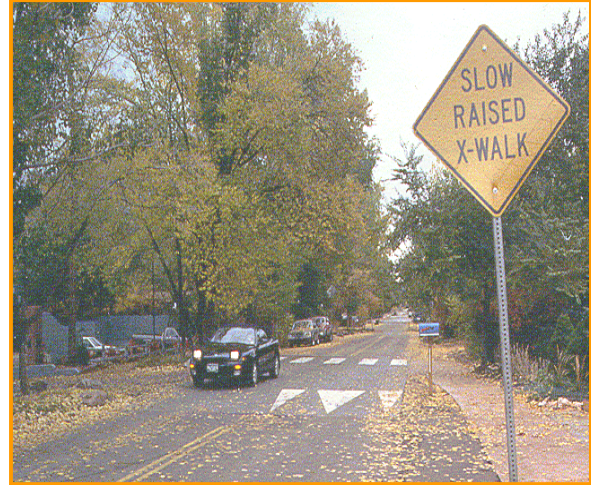


Raised Crosswalk

Level 2

Description: Raised crosswalks are crosswalks constructed 3 to 4 inches above the elevation of the street. They are usually about 22 feet long, with a flat section in the middle and ramps on the ends. Sometimes the flat portion is constructed with brick or other textured materials.

Application: Raised crosswalks are intended to reduce vehicle speeds specifically where a high amount of pedestrians cross the street.



Advantages:

- + Effectively reduces vehicle speeds.
- + Good pedestrian safety treatment.
- + Does not affect access.
- + Flat portion can be textured.

Disadvantages:

- May generate increased noise.
- Can require drainage modifications.
- Only 3 seconds delay for fire trucks.
- Often require signage and markings.

Special Considerations:

- Raised crosswalks are usually 22 feet long, with a 10 foot wide flat section.
- Lower elevation than sidewalk to alert visually impaired it's a crosswalk.
- Careful design is needed due to potential drainage issues.
- Usually preferred by Fire Departments over standard speed hump.
- Work well in combination with curb extensions and curb radius reductions.
- Do not affect access.
- Increases pedestrian visibility and likelihood that driver yields to pedestrian.
- Often referred to as speed tables or speed platforms.

Cost:

- \$5,000 to \$10,000 each.

Education
Enforcement
✓ Engineering
Enhancement



Raised Intersection

Level 2

Description: A raised intersection is a flat, raised area covering an entire intersection. There are ramps on all approaches. The plateau is usually about 4" high. Usually, the raised intersection is finished in brick or other textured materials.

Application: Raised intersections are used to reduce through movement speeds and provide safer street crossings for pedestrians.



Advantages:

- + Effectively reduces vehicle speeds.
- + Good pedestrian safety treatment.
- + Can be aesthetically pleasing.
- + Does not affect access.

Disadvantages:

- Expensive to construct and maintain.
- Requires drainage modifications.
- Affects emergency vehicle response.
- May require bollards to define corners.

Special Considerations:

- Raised intersections usually used in urban areas.
- Make entire intersections more pedestrian-friendly.
- Work well with curb extensions and textured crosswalks.
- Often part of an area wide traffic calming scheme involving both streets.
- Expensive.
- Special signing often required.

Cost:

- \$25,000 to \$50,000 each.

Education
Enforcement
✓ Engineering
✓ Enhancement



Traffic Circle

Level 2

Description: Traffic circles are raised circular islands in an intersection. They are typically landscaped with ground cover and/or street trees. Traffic circles require drivers to slow down to a speed that allows them to comfortably maneuver around the circle in a counterclockwise direction.

Application: The primary benefit of traffic circles is speed control and reduction in angle and turning collisions.



Advantages:

- + Effectively reduces vehicle speeds.
- + Reduces collision potential.
- + Provides better side-street access.
- + Opportunity for landscaping.

Disadvantages:

- Parking removal required.
- Can increase bike/auto conflicts.
- Can impede emergency vehicles.
- Can restrict large vehicle access.

Special Considerations:

- Traffic circles are best used in a series or with other devices.
- About 30 feet of curbside parking must be prohibited in advance of circle.
- Buses can maneuver around traffic circles at slow speeds.
- Noise impacts are minimal.
- If well-maintained, traffic circles can be attractive.
- However, there are also a lot of signs and pavement markings required.
- Traffic circles are less effective at T-intersections and offset intersections.

Cost:

- \$15,000 to \$25,000 each.

Education
Enforcement
✓ Engineering
✓ Enhancement



Intersection Channelization

Level 2

Description: Providing channelization at three-legged intersections forces previous straight-through movements to make slower turning maneuvers. Channelization is usually raised.

Application: The primary benefit of realigning intersections is to slow traffic down. Can also be used to redirect traffic to another facility or to provide neighborhood gateway.



Advantages:

- + Effectively reduces vehicle speeds.
- + Low impact to emergency services.
- + Can discourage through traffic.
- + Opportunity for landscaping.

Disadvantages:

- Parking removal required.
- May direct traffic to other street(s).
- Maintenance responsibility.
- Fairly expensive.

Special Considerations:

- Intersection channelization slows traffic down near the intersection.
- Improvement may also discourage some cut-through traffic..
- No significant impedance to fire and transit service.
- Provide landscaping opportunities and potential gateway treatments.
- Can require drainage modifications.
- Possible to vary traffic control with stop signs on one or all three legs.

Cost:

- \$15,000 to \$20,000 each.

Education
Enforcement
√ Engineering
√ Enhancement



Chicane

Level 2

Description: A chicane is a series of two or more staggered curb extensions on alternating sides of a roadway. Horizontal deflection influences motorists to reduce speed through the serpentine roadway.

Application: The primary benefit of chicanes is speed control without a significant impact to emergency vehicle mobility.



Advantages:

- + Effectively reduces vehicle speeds.
- + Low impact on emergency vehicles.
- + Does not restrict resident access.
- + Opportunity for landscaping.

Disadvantages:

- Significant parking loss.
- Increased maintenance.
- May require right-of-way.
- Expensive.

Special Considerations:

- Chicanes cannot usually be used where right-of-way is limited.
- May require removal of substantial amounts of on-street parking.
- Alternatively, on-street parking can be used to create a chicane.
- Most effective with equivalent traffic volumes along both approaches.
- May increase conflicts with pedestrians and bicyclists.
- Chicanes provide landscaping opportunities.
- Most residents would have their driveways affected by type of installation.
- No expected noise impacts.

Cost:

- \$20,000 to \$40,000 each.

- Education
- Enforcement
- ✓ Engineering
- ✓ Enhancement



Restricted Movement Barrier

Level 2

Description: Restricted movement barriers are raised islands that prevent certain movements at an intersection. They are often landscaped.

Application: The primary benefit of restricted movement barriers is to reduce cut-through traffic levels. They also provide pedestrian refuge areas for street crossings.



Advantages:

- + Redirects traffic to other streets.
- + Reduces cut-through traffic.
- + Provides pedestrian refuge area.
- + Opportunity for landscaping.

Disadvantages:

- Redirects traffic to other streets.
- Will increase trip lengths.
- May impact emergency response..
- Creates physical obstruction.

Special Considerations:

- Barriers have little or no affect on speeds for through vehicles.
- Should not be used on critical emergency response routes.
- Reduces number of potential conflict points for turning vehicles.
- Possibility for landscaping.
- Many variations are possible, including prohibiting turns to/from main street.
- Design needs to consider drainage needs.
- Usually require signing.

Cost:

- \$5,000 each.

Education
Enforcement
√ Engineering
√ Enhancement



Entrance Barrier

Level 2

Description: Entrance barriers are curb extensions or barriers that restrict movements into a street. They are constructed to approximately the center of the street, effectively obstructing one direction of traffic. Entrance barriers create a one-way segment at the intersection, while maintaining two-way traffic for the rest of the block.



Application: The primary benefit of entrance barriers is traffic volume reduction.

Advantages:

- + Reduces cut-through traffic.
- + More self-enforcing than signs.
- + Shorter pedestrian crossings.
- + Opportunity for landscaping.

Disadvantages:

- May divert traffic to other streets.
- Can increase trip lengths.
- Potential parking removal.
- Maintenance responsibility.

Special Considerations:

- Restrict movements into street while allowing resident access within block.
- Potential use must consider how residents will gain access.
- In emergency situations, emergency vehicles can gain access.
- But, required maneuver may increase emergency response times.
- Can be provided on opposite intersection corners.
- Bicycles are typically permitted to travel through in both directions.
- Entrance barriers can be nicely landscaped.
- In effect at all times, even when cut-through volumes may be low.

Cost:

- \$15,000 to \$20,000 each.

Education
Enforcement
✓ Engineering
✓ Enhancement



One-way Streets

Level 2

Description: This measure converts a segment of a two-way street to one-way operations.

Application: The primary benefit of two-way to one-way street conversions is reduction in cut-through traffic.



Advantages:

- + Redirects traffic to other streets.
- + Reduces cut-through traffic.
- + Improved safety with one-way.
- + Emergency services can bypass.

Disadvantages:

- Can encourage increased speeds.
- Redirects traffic to other streets.
- Will increase trip lengths.
- Requires signage.

Special Considerations:

- Restrict movements into street while allowing resident access within block.
- Potential use must consider how residents will gain access.
- Bicycles are typically permitted to travel through in both directions.
- In effect at all times, even when cut-through volumes may be low.
- Can be accomplished with just signing and pavement markings.
- Possible to landscape channelizing islands, but maintenance required.
- Often used in combination with other one-way street conversions.

Cost:

- \$5,000 each.

Education
Enforcement
✓ Engineering
Enhancement



Diagonal Diverter

Level 2

Description: Diagonal diverters are raised areas placed diagonally across a four-legged intersection. They prohibit through movements by creating two "L" shaped intersections.

Application: The primary benefit of diagonal diverters is reduction in traffic volumes. These type of diverters also minimally decrease speeds near the intersection.



Advantages:

- + Reduces cut-through traffic.
- + Self-enforcing.
- + Reduces collision potential.
- + Opportunity for landscaping.

Disadvantages:

- Redirects traffic to other streets.
- May increase trip lengths.
- Can impede emergency vehicles.
- Always in effect.

Special Considerations:

- Diagonal diverters can be designed to allow emergency vehicle access.
- Can be designed to allow pedestrian and bicycle access.
- They may shift problems elsewhere unless strategic program developed.
- Provide advantage over complete street closure as circulation less impacted.
- Can be attractively landscaped.
- Has little or no effect on speeds for local traffic.
- Traffic circles are less effective at T-intersections and offset intersections.

Cost:

- \$15,000 to \$35,000 each.

Education
Enforcement
√ Engineering
√ Enhancement



Street Closure

Level 2

Description: 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.

Application: Cul-de-sacs and street closures are intended to change traffic patterns. They are very effective at reducing cut-through and general traffic volumes.



Advantages:

- + Reduces cut-through traffic.
- + Reduces speeding near device.
- + Self-enforcing.
- + Opportunity for landscaping.

Disadvantages:

- Directs traffic to other streets.
- Increases trip lengths.
- Affects emergency response time.
- May lose some on-street parking.

Special Considerations:

- Cul-de-sacs/street closures typically used after other measures have failed.
- Often used in sets to make travel circuitous -- typically staggered.
- Require strategic pattern of devices to not shift problem elsewhere.
- Can be placed at an intersection or mid-block.
- Not used on major emergency response routes or transit routes.
- May be designed to allow emergency vehicle access.
- Usually designed with small opening to allow bicyclists and pedestrians.
- Often consist of landscaping.

Cost:

- \$20,000 to \$35,000 each.

Education
Enforcement
✓ Engineering
✓ Enhancement



3. Traffic Calming Impacts

This chapter describes impacts of different types of traffic calming measures. Using qualitative and quantitative data available from before-and-after studies, the ability of various Level 2 devices to reduce travel speeds, cut-through traffic volumes, and collision potential are discussed. In addition, traffic calming measures' impact on emergency responsiveness is presented. Level 1 impacts are not discussed since very few before-and-after studies have been conducted on these type of traffic calming improvements.

Travel Speeds

One of the primary goals of traffic calming is to reduce travel speeds on residential streets. In traffic engineering, speed distributions are typically represented by 85th percentile speeds since it is generally felt that at least 85 percent of the drivers operate at speeds which are reasonable and prudent for the conditions pertaining in each situation. Most of the speed data available from before-and-after studies of traffic calming are 85th percentile speeds.

Table 3.1 summarizes the speed impacts of various traffic calming measures. The data shown in the table is based on the results of hundreds of before-and-after studies.

Table 3.1 Speed Impacts Downstream of Traffic Calming Measures

Sample Measure	Sample Size	85 th Percentile Speed (mph) *			Percentage Change*
		Avg. Before Calming	Avg. After Calming	Change After Calming	
Speed hump	179	35.0	27.4 (4.0)	-7.6 (3.5)	-22 (9)
Raised crosswalk	58	36.7	30.1 (2.7)	-6.6 (3.2)	-18 (8)
Raised intersection	3	34.6	34.3 (6.0)	-0.3 (3.8)	-1 (10)
Traffic circle	45	34.2	30.3 (4.4)	-3.9 (3.2)	-11 (10)
Narrowing	7	34.9	32.3 (2.8)	-2.6 (5.5)	-4 (22)
Entrance barrier	16	32.3	26.3 (5.2)	-6.0 (5.2)	-19 (11)
Diagonal diverter	7	29.3	27.9 (5.2)	-1.4 (4.7)	-4 (17)

* Measures within parentheses represent the standard deviation from the average.
Source: "Traffic Calming, State of the Practice," ITE, August 1999.



As shown in Table 3.1, speed humps have the greatest impact on 85th percentile speeds, reducing them by an average of more than seven miles per hour (mph), or 20 percent. Raised intersections and traffic circles have the least impact.

It should be noted that the speed impacts of traffic calming measures rely not only on the geometrics of the device, but the spacing between successive devices. Previous studies indicate that speeds increase about 0.5 to 1.0 mph for every 100 feet of separation for speed hump spacing up to 1,000 feet.

Traffic Volumes

Another primary goal of traffic calming is to reduce cut-through volumes on residential streets. Traffic volume impacts are much more complex and site-specific as compared to speed impacts because of the availability of alternative routes and the split of traffic between localized trips (that need to travel along the traffic calmed location) and through traffic (which can often take another route).

Although traffic volume changes are difficult to assess, based on previous studies, two measures of impact are summarized in Table 3.2. The table provides information on average percentage change in daily traffic after treatment. The results shown in Table 3.2 should be viewed as representative only.

Table 3.2 Volume Impacts of Traffic Calming Measures

Sample Measure	Sample Size	Average Percent Change in Volume* (vehicles per day)
Speed hump	143	-18 (24)
Raised crosswalk	46	-12 (20)
Traffic circle	49	-5 (46)
Narrowing	11	-10 (51)
Entrance barrier	53	-42 (41)
Diagonal diverter	27	-35 (46)
Full closure	19	-44 (36)

* Measures within parentheses represent the standard deviation from the average.
Source: "Traffic Calming, State of the Practice," ITE, August 1999.



Traffic volume changes are usually the greatest when roadway closure devices are used, such as entrance barriers, diagonal diverters and cul-de-sacs. Of Level 2 measures, traffic circles typically have the least effect in reducing traffic volumes.

It should also be pointed out that while implementation of certain traffic calming devices can reduce traffic volumes along the intended route, they may also increase traffic volumes along nearby residential streets. This potential impact should be considered before deciding on which traffic calming tools are to be implemented.

Collisions

By slowing traffic, eliminating conflicting movements, and increasing drivers' attention, traffic calming can result in fewer collisions. And, due to lower speeds, they are often less serious when collisions do occur.

Table 3.3 compares before-and-after collision frequencies for various Level 2 traffic calming measures. As shown, several traffic calming devices reduce the potential for collisions. Traffic circles are very effective as they lower the number of potential vehicle conflict points (since no left-turn or straight-through movements are allowed).

Table 3.3 Average Annual Collision Frequencies Before and After Traffic Calming

Sample Measure	Sample Size	Average Annual Collisions		
		Before Calming	After Calming	Percentage Change
Speed hump	50	2.62	2.29	-13
Raised crosswalk	8	6.71	3.66	-45
Traffic circle	130	2.19	0.64	-71

Source: Unpublished documents supplied by traffic calming programs.

Many traffic calming measures not only reduce the potential for collisions between two or more vehicles, but also between vehicles and pedestrians or between vehicles and bicyclists. Several treatments improve the sight distance between these modes, and/or provide safe refuge areas for crossing non-motorized users. On the other hand, some measures that reduce travel lane widths could increase the potential for conflicts between vehicles and bicyclists.



Emergency Responsiveness

Any traffic calming tools that are effective due to their ability to physically control traffic could also negatively impact several classes of emergency vehicles. The City of Concord and its residents place a very high priority on minimizing emergency response times.

Several localities have performed controlled tests of speed humps, raised crosswalks, and traffic circles to see how much delay they produce. Table 3.4 presents the test results.

Table 3.4 Emergency Response Time Study Results

Community	Measure	Delay at Slow Point (seconds)
Austin, TX	12-foot speed hump	2.8 (fire engine) 3.0 (ladder truck) 2.3 (ambulance w/out patient) 9.7 (ambulance with patient)
Berkeley, CA	12-foot speed hump	10.7 (fire engine) 9.2 (ladder truck)
	22-foot raised crosswalk	3.0 (fire engine) 13.5 (ladder truck)
Boulder, CO	12-foot speed hump	2.8 (fire engine)
	25-foot traffic circle	7.5 (fire engine)
Montgomery Co., MD	12-foot speed hump	2.8 (ladder truck) 3.8 (ambulance) 4.2 (fire truck) 7.3 (pumper truck)
	18-foot traffic circle	5.4 (ladder truck) 3.2 (ambulance) 5.0 (fire truck) 7.0 (pumper truck)
Portland, OR*	14-foot speed hump	5.2 (fire engine) 2.9 (custom rescue vehicle) 6.6 (ladder truck)
	22-foot raised crosswalk	3.0 (fire truck) 0.3 (custom rescue vehicle) 3.0 (ladder truck)
	16 to 24-foot traffic circle	6.1 (fire engine) 3.1 (custom rescue vehicle) 8.4 (ladder truck)
Sarasota, FL	12-foot speed hump	9.5 (ambulance)

* Assumes a 35-mph response cruising speed.

Source: "Traffic Calming, State of the Practice," ITE, August 1999.



As shown in Table 3.4, regardless of the traffic calming measure or fire-rescue vehicle, the delay per traffic calming measure is nearly always under 10 seconds. Traffic circles appear to create longer delays than speed humps, but speed humps have a greater probability of damage to fire-rescue vehicles and injury to patients in ambulances. Finally, speed tables, because they are longer, create shorter delays than speed humps.

Consideration of traffic calming devices will always include a review of possible negative impacts, including emergency response times.



4. Implementation Process

The City of Concord's Neighborhood Traffic Calming Program is based on substantial community participation. Because residents are primarily the initiators of traffic calming requests and must live day-to-day with the resulting actions, the City includes neighborhood participation throughout the process. Development of successful traffic calming programs depends on strong interaction between the community and City staff.

One of the intents of the program is to provide a clear structure for addressing traffic concerns in the City's neighborhoods. Traffic concerns may exist throughout an entire neighborhood, or may be specific to a particular street, segment of roadway, or at a spot location. The City's implementation process consists of two levels, as shown in Figure 4.1. Both levels require, as a first step, community identification of existing problems. The process allows implementation of traffic calming tools in a timely manner in conditions where problems could be addressed with fairly routine solutions.

Community Identification of the Problem

The traffic calming process begins once the City's Transportation Division receives a request from a neighborhood to initiate a study. Neighborhoods must complete a Community Action Request form. The form must include a discussion of the current traffic problem and the names and signatures of at least five other affected property owners supporting the request to initiate a study. A Community Action Request form is provided within this chapter.

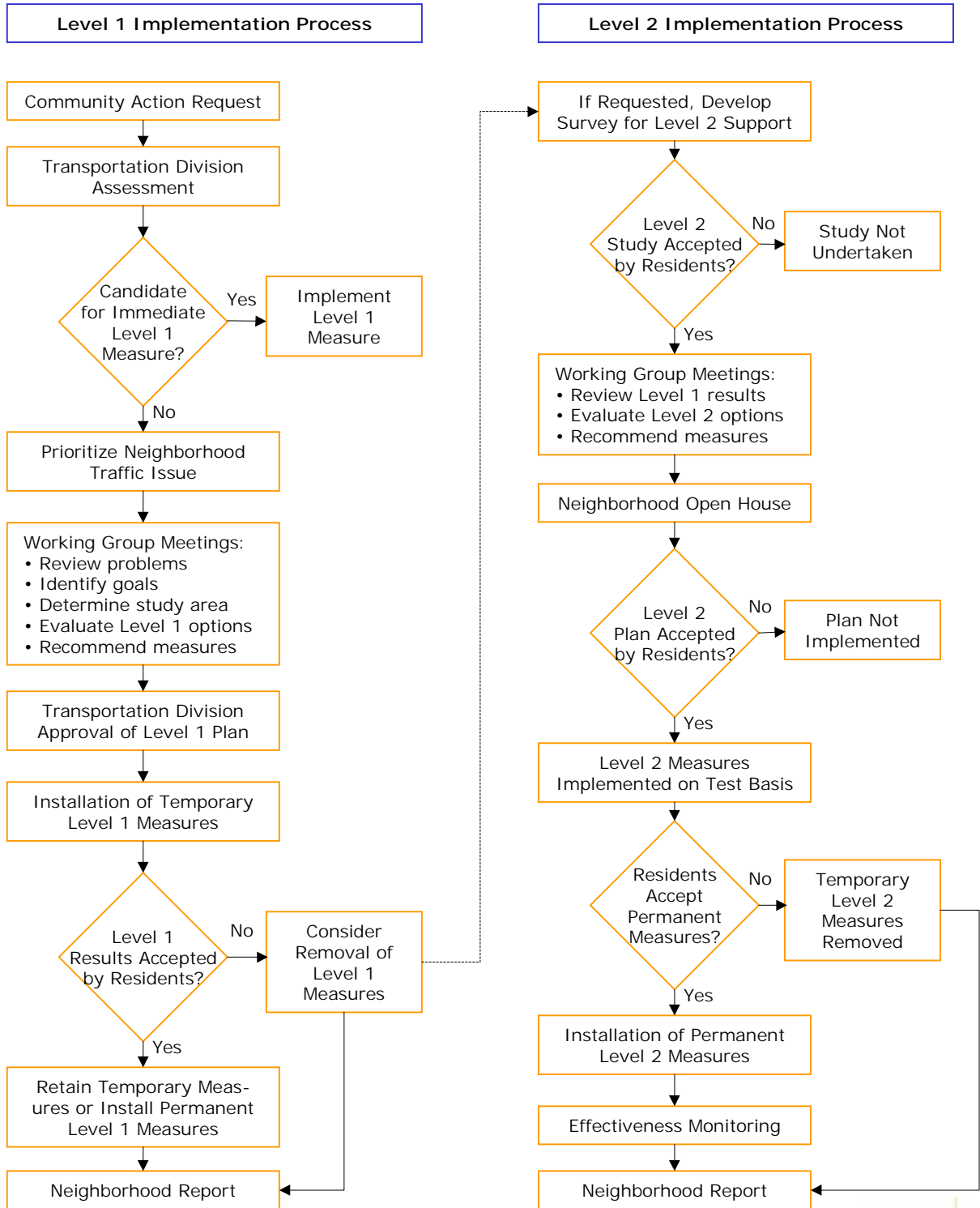
Upon receipt of the Community Action Request form, the City's Transportation Division will document the neighborhood concern, conduct a field investigation, and collect data, as appropriate (e.g., traffic volumes, collision data, travel speeds, etc.). If City staff determines that the neighborhood's identified problem can be easily reduced or alleviated with a Level 1 action (e.g., easily implementable and low cost tools, primarily consisting of education and enforcement techniques), the City will program implementation of the most appropriate Level 1 improvement(s).

If City staff determine that the identified issue cannot be easily reduced or alleviated with a Level 1 action, or that the implementation of such an action may be controversial, the City will prioritize the level of the neighborhood traffic issue based on several factors, including traffic volumes, travel speeds, collision history, cut-through traffic levels, and presence of schools and public facilities. The City's Neighborhood Traffic Calming Priority Worksheet will be used to accomplish this task. A copy of the worksheet is provided within this chapter.

The City's prioritization process provides the City with clear guidelines on how to manage its limited resources effectively and appropriately when dealing with



**Figure 4.1
Neighborhood Traffic Calming
Implementation Process**



Community Action Request Form

The purpose of this form is to enable neighborhoods to request the possible initiation of a traffic study in accordance with the City of Concord's Neighborhood Traffic Calming Program. The form must be filled out in its entirety, including a short description of current problems, and names of residents and/or property owners from at least five different residences within the affected area.

After completing of this form, please submit it to:

City of Concord
Transportation Division
1455 Gasoline Alley
Concord, CA 94520
Phone: (925) 671-3132
Fax: (925) 680-1660

1. Please describe any traffic or safety issues that concerns residents in your neighborhood. Use the back side of this sheet if necessary.

2. Please describe the location of concern, as well as the limits of your neighborhood. Feel free to provide a sketch of any concerns on the back side of this sheet.

3. Please provide the names and signatures of at least five residents and/or property owners who are requesting that this neighborhood be included in the City's Neighborhood Traffic Calming Program. Additional names can be placed on the back of this sheet. Place a check mark by the main contact person.

Signature	Printed Name	Address	Phone No. (Optional)
1.			
2.			
3.			
4.			
5.			

4. Please indicate today's date.



Neighborhood Traffic Calming Program Prioritization Worksheet

This worksheet will be completed by City of Concord staff in accordance with the City of Concord's Neighborhood Traffic Calming Program. It will be used to prioritize the potential initiation of specific neighborhood traffic calming processes.

Name of neighborhood: _____

1. Traffic Volumes

Greater than 2000 vehicles per day = 5 points

1,500 to 2,000 vehicles per day = 4 points

1,000 to 1,500 vehicles per day = 3 points

2. Collision History on Local Streets

More than 5 collisions in a one year period = 8 points

2 to 4 collisions in a one year period = 4 points

3. Travel Speeds

80% - 100% of traffic exceeds speed limit = 5 points

60% - 80% of traffic exceeds speed limit = 4 points

40% - 60% of traffic exceeds speed limit = 3 points

30% - 40% of traffic exceeds speed limit = 2 points

20% - 30% of traffic exceeds speed limit = 1 point

4. Cut-through Traffic Levels

Greater than 25% of vehicles are cut-through = 5 points

20% to 25% of vehicles are cut-through = 4 points

15% to 20% of vehicles are cut-through = 2 points

5. Schools and Public Facilities

Each school and public facility adjacent to street = 1 point

6. Neighborhood Impact

Each 500 linear feet of street experiencing above problems = 1 point

Total Score: _____



citywide traffic calming needs. It is also allows the City to work with the neighborhoods that have the most pressing problems first. When a particular location reaches the top of the City's prioritization list, it will enter into the next phase of the traffic calming implementation process.

Level 1 Implementation Process

Once the neighborhood priority process is reviewed by City staff, which will occur once a year, and a specific neighborhood is approved for study, City staff will arrange an initial neighborhood meeting with the assistance of those residents that signed the original Community Action Request form. At the meeting, City staff will present findings from the initial field investigation and data collection phase, and provide a presentation of the City of Concord's Neighborhood Traffic Calming Program.

A volunteer group of residents will form the project's Community Working Group. A goal is to have members that represent the various geographical areas and interests within the neighborhood.

The Community Working Group will work with City staff and will meet to review existing problems, determine community goals, establish the neighborhood study boundary, discuss and evaluate various Level 1 measures, and gain community acceptance on which Level 1 measures to implement as means of addressing the problems. The group will also determine how long to implement the recommended improvements, although a minimum testing period of three months will be required.

Upon approval by the City's Transportation Division, the appropriate Level 1 improvements will be installed. Following the pre-established implementation period, City staff will collect new data to determine the effectiveness of the measures put into place. The Community Working Group will then meet to discuss if their goals have been met.

If the prescribed Level 1 actions have proven effective in addressing the goals, the improvements will stay in place or permanent devices will be installed. If the actions are ineffective, the Community Working Group may consider reapplying for a traffic calming plan (in three years) or pursue potential implementation of Level 2 measures. A discussion of this process is provided below.



Level 2 Implementation Process

Level 2 traffic calming improvements will only be considered if Level 1 measures do not meet the goals established by the Community Working Group, as previously discussed. In special circumstances, City staff may determine that previously installed Level 1 measures cannot achieve the desired outcomes and may recommend consideration of Level 2 measures. Projects that move into Level 2 consider physical travel speed and traffic volume reduction measures and therefore require increased neighborhood consensus.

Before a Level 2 program can commence for a particular neighborhood, residents and property owners within the study area boundary will be surveyed to determine their level of support in considering Level 2 improvements. The City's Transportation Division will conduct the survey. A minimum of 33-1/3 percent of those surveyed must agree to proceed in developing an expanded plan. If less than 33-1/3 percent agree, then Level 2 improvements will not be considered.

If the vote supports consideration of Level 2 measures, the Community Working Group will be reestablished. It may be necessary to expand or otherwise alter the composition of the group due to the likely greater impacts that could result under a Level 2 traffic calming plan.

In addition, a Technical Working Group will be formed. The stakeholders in this group will include City staff, emergency service providers, and others that may be directly impacted by any changes to neighborhood streets. Their perspective is essential for developing a plan that effectively addresses existing concerns without creating new problems that cannot be mitigated or that keep the ultimate plan from being implemented. A traffic consultant may be a part of the Technical Working Group.

The Community and Technical Working Groups will meet to review the results from the Level 1 program, revisit existing problems and community goals, and identify the appropriateness of various Level 2 measures in addressing the existing problems. City staff will collect, sometimes with neighborhood support, additional data to support the process (e.g., delay studies, vehicle license plate studies, etc). City staff will assist the Community and Technical Working Groups in developing a Level 2 traffic calming plan (note that the plan may contain some Level 1 types of measures).

Next, the Community Working Group will present the proposed Level 2 traffic calming plan (which may consist of alternatives) to neighborhood residents and property owners at a Neighborhood Open House. In addition, the plan may be presented through a newsletter or other type of mailing. The City will assist the neighborhood in these efforts. However, it is up to the Community Working Group to gather support for the project.



After the Neighborhood Open House, residents and property owners will vote on whether or not to conduct a temporary test of the proposed Level 2 traffic calming plan. A minimum of 60 percent of the residents and property owners (household locations will be determined by City staff) that could be affected by the proposed changes in traffic flow must favor implementation of Level 2 measures in order to proceed. In addition, a minimum of 75 percent of the residents and property owners immediately adjacent to each proposed device must favor implementation. One vote will be granted to each residence and/or property owner. The voting period will last up to four weeks. In order for the vote to be considered valid, a minimum of 33-1/3 percent of all of those balloted must respond.

In some cases, neighborhood participation in funding a proposed Level 2 plan may be necessary. If a financial commitment is required from the neighborhood, this stipulation will be included in the ballot. More information about funding is provided later in this chapter.

After conclusion of the voting process, City staff will notify residents and property owners about the ballot results. If the Level 2 traffic calming plan does not receive enough votes for testing, the proposed devices will not be installed. The community may re-apply for a traffic calming plan in three years or sooner if special circumstances indicate that further review should be considered.

If approved, the proposed Level 2 traffic calming plan will be implemented on a test basis using temporary control devices, where possible, for a period determined by the City's Transportation Division. In most cases, the test program will last one year – with the ultimate duration agreed to by the Community and Technical Working Groups.

Following the test period, City staff will collect new data (e.g., traffic volume counts, speed surveys, etc.) to determine the effectiveness of the measures put into place. These results will be provided to all of the neighborhood's residents and property owners. Then, residents and property owners will again vote, using the same process as described previously, to determine whether permanent traffic calming devices should be installed or the temporary devices removed. Again, City staff will notify residents and property owners about the ballot results. If permanent measures are voted in, the Level 2 traffic calming plan will be fully implemented with permanent devices and notification will be given by City staff prior to construction.

After construction of the permanent Level 2 measures, the City's Transportation Division will continue monitoring the effectiveness of the plan for up to one year. City staff will prepare a report of the findings for presentation to the neighborhood. Depending on the nature of the measures, this report could include a maintenance plan for residents and property owners.



Funding Considerations

Funding for the implementation of a traffic calming plan should be considered throughout the plan development process. If funding limitations will impact the range of options available, this needs to be identified early in the process and the variety of appropriate devices should reflect these limitations. It must be reiterated that Level 2 devices are expensive. Furthermore, the City's Neighborhood Traffic Calming Program operates on a limited budget. The budget is approved annually and is contained in the City's Capital Improvement Program.

However, if a neighborhood wants to implement a more extensive plan than what City staff believes is appropriate to resolve the identified problem(s), then the City Council may need to approve the plan with additional funds and/or the neighborhood may be requested to participate in funding all or a part of the project.



5. Guidelines for Installation

The City of Concord will continually develop recommended guidelines for the installation of various traffic calming tools. This chapter will be updated from time to time to provide new and/or revised guidelines for traffic calming devices. The guidelines discussed below can be used in most circumstances; however, special situations may sometimes apply since many streets have differing characteristics.

Speed Hump Guidelines

The following guidelines should be followed when considering the installation of speed humps:

1. The street or street segment shall be a two-lane residential local or collector street where its primary function is to provide access to abutting residences.
2. The street or street segment shall be improved, i.e., it includes curb and gutter.
3. The street or street segment shall be at least 750 feet long.
4. The installation of speed humps shall not adversely affect response times for emergency service vehicles. This shall be determined by transportation staff in conjunction with staff from the potentially affected emergency service providers.
5. The guidelines apply to streets with posted speed limits of 25 or 30 miles per hour.
6. The critical speed (i.e., 85th percentile speed) should be at least seven (7) miles per hour faster than the posted speed limit.
7. At least 50 percent of the traffic should exceed the posted speed limit.
8. The average daily traffic volume should be more than 500 vehicles per day and less than 3,000 vehicles per day.

Crosswalk Guidelines

Crosswalk installation guidelines are currently being developed.

Stop Sign Guidelines

Stop sign installation guidelines are currently being developed.



Acknowledgments

The City of Concord wishes to thank the following for their assistance in the development of the Neighborhood Traffic Calming Program:

City of Concord City Council

Helen Allen, Mayor
Laura Hoffmeister, Vice Mayor
Bill McManigal, Councilmember
Michael A. Pastrick, Councilmember
Mark Peterson, Councilmember



City of Concord Staff Members

Edward R. James, City Manager
Greg Jones, Deputy City Manager
Alex Pascual, Director of Engineering and Transportation
John Templeton, Transportation Manager
Garland Wong, Senior Transportation Engineer
Jim Haggerty, Traffic Operations Technician
Mary Miller, Traffic Operations Technician

Consultant

David Parisi, Parisi Associates



The development of the City of Concord's Neighborhood Traffic Calming Program took advantage of several successful traffic calming programs being used throughout the United States and Canada, as well as current literature on the topic. The City would like to particularly thank:

City of Austin's (TX) Neighborhood Traffic Calming Program
City of Boulder's (CO) Neighborhood Traffic Mitigation Program
City of Pleasanton's (CA) Traffic Calming Program
City of Portland's (OR) Traffic Calming Program
City of Sacramento's (CA) Neighborhood Traffic Management Program
City of San Buenaventura's (CA) Neighborhood Traffic Management and Calming Program
City of Sunnyvale's (CA) Neighborhood Traffic Calming Actions

The Institute of Transportation Engineers and the Federal Highway Administration ("Traffic Calming, State of the Practice", 1999)
The Canadian Institute of Transportation Engineers and the Transportation Association of Canada ("Canadian Guide to Neighbourhood Traffic Calming", 1998)
Pat Noyes & Associates ("Traffic Calming Primer", 1998)



