CITY OF LA HABRA

NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM

FINAL

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CHAPTER 1. INTRODUCTION

BACKGROUND

The Neighborhood Traffic Management Program (NTMP) is a city-wide initiative to treat traffic calming issues. The need for the program stemmed from the City's desire for a systematic approach to handling neighborhood traffic requests.

This document provides a framework for the selection, application, and implementation of traffic calming improvement measures in the City of La Habra. The document is primarily intended for use by City staff and residents in developing traffic calming plans. In addition, this document may be helpful for members of the general public who are interested in finding out how the City of La Habra implements traffic calming.

KEY TERMS

The following are key terms used in this document:

Average Daily Traffic (ADT) – the number of vehicles per day on a roadway during a typical workday.

Cut-through – results from motorists who use minor roadways, usually residential streets, as opposed to major roadways to avoid congestion.

85th Percentile Speed – as established by California Vehicle Code, the speed used to set roadway speed limits in order to enforce by radar. As an example, of 100 vehicles, 85 of those would be traveling at the 85th percentile speed or less.

Neighborhood – used in this document to identify an area consisting of a street, or set of streets, which experiences similar traffic-related issues.

Neighborhood Traffic Committee (NTC) – residents and business owners of study area that work with City staff to develop neighborhood traffic calming plan.

Plan – an individual set of improvements specifically designed to treat a neighborhood with a traffic-related problem.

Process – the systematic method of handling traffic-related problems, from requesting a problem to monitoring treatments.

Program – the city-wide guidelines used to develop specific neighborhood treatment plans.

Staff – used in this document to indicate employees of the City of La Habra.

Toolbox – a list of traffic calming treatments to be used in developing neighborhood treatment plans.

Traffic Calming – reducing vehicular impacts, by slowing or reducing traffic, while improving livability and increasing safety of pedestrians and bicyclists.

GOALS

The goals and objectives of this document are summarized below. The main goal is to improve livability by reducing the impact of traffic, which promotes safe and pleasant conditions for all street users.

The goal has four primary objectives:

- To reduce speeds and cut-through traffic volumes

- To enhance the neighborhood environment
- To improve driver behavior
- To improve pedestrian and bicyclist safety

These objectives are pursued through a combination of parallel strategies, known collectively as the "Three E's":

Education – Information-sharing and awareness raising, targeting drivers, pedestrians, and bicyclists about the safest, best ways to share the road.

Engineering – Physical measures constructed to lower speeds, improve safety, or otherwise reduce the impacts of motor vehicles.

Enforcement – Targeted police enforcement supports neighborhood goals.

DEVELOPMENT

In February 2006, the City of La Habra and an advisory committee of 19 community members began work with a consultant to develop the Neighborhood Traffic Management Program. The committee members were selected based on their role in the community and included residents, the Fire Department, the Police Department, school district representatives, and the Planning Department, among others. The committee members comprised a well-rounded group of both traffic calming advocates and opponents of certain traffic calming aspects. This document is a result of the committee's efforts.

PLANNING AHEAD

Slowing and diverting traffic by means of traffic calming is beneficial to neighborhoods and can be safer for pedestrians and non-motorized roadway users. However, there are trade-offs with traffic calming treatments, such as slowing emergency response times and increasing commute times. The full extent of these trade-offs need to be weighed before implementing a traffic calming plan.

The traffic calming methods and devices discussed in this program have been implemented effectively throughout the United States. However, traffic calming is an evolving practice and new methods should be adopted and implemented as they are proven effective.

Traffic calming, or similar features, should be included in designs for new development or redevelopment projects. By designing to keep traffic calmed a greater emphasis will be placed on non-motorized forms of transportation, such as walking and bicycling. Additionally, residents will be more receptive to traffic calming devices installed in the neighborhood prior to purchasing their home, as it is a known condition.

HOW TO USE THIS DOCUMENT

The NTMP manual is presented in the following three chapters:

- Chapter 2 – *Traffic Calming Program Process*
- Chapter 3 – *Traffic Calming Toolbox*
- Chapter 4 – *Guidelines for Development Review*

In addition, the appendices contain detailed information on the best practices of traffic calming, arterial traffic management, and device design guidelines.

While the document is primarily intended for City staff and residents in the formulation of a traffic calming plan, it may also be used by residents interested in learning about the City's traffic calming process, or by those interested in learning more about traffic calming.

The following "bookmarks" are intended to facilitate in the efficient locating of important pieces of this document.

Document Bookmarks

The detailed **Process Flowchart** is located on page 10 (and the text description begins on page 4).

The **Toolbox** of traffic calming devices begins on page 11.

Device Design Guidelines (Appendix C) begin on page C1.

ADDITIONAL NOTE

The guidelines draw from various earlier traffic calming studies and from two documents written by Reid Ewing:

Traffic Calming: State of the Practice (Reid Ewing, FHWA, 1999)
Delaware Traffic Calming Design Manual (Reid Ewing, Delaware Department of Transportation, 2000)

For more detailed information on the topics addressed in this document, please refer to these reports.

CHAPTER 2. TRAFFIC CALMING PROGRAM PROCESS

This section describes the City's proposed traffic calming process. The text accompanies the program process flowchart (letters in bold correspond to individual steps in the flowchart).

The process is separated into four key components focusing on specific tasks towards developing a street/neighborhood traffic management plan (i.e. a set of neighborhood traffic management solutions). The four components of the process are: plan initiation, development, support, and implementation. Each step of these components is discussed in greater detail below.

PLAN INITIATION

The first component of the process is the plan initiation. This component describes how the traffic calming process is initiated and how requests are handled and considered for treatment.

The process is initiated when residents request Department of Public Works staff to investigate speeding, traffic volumes, or traffic-related safety issues within their neighborhood **(A)**. The request is submitted via a formal letter and should be sufficiently detailed for staff to understand the traffic-related problems within the neighborhood.

Staff will review the request and send surveys to all addresses on the street(s) identified in the request, with staff discretion **(B)**. A minimum of 10 surveys need to be returned in support of City action, regardless the size of the neighborhood.

If fewer than 10 surveys are returned, then the process does not continue and the requester will be advised of the lack of support for action. The requester may ask staff to re-survey their neighborhood in subsequent fiscal years.

Requests from an institution are exempt from the survey process. For example, a school may submit a formal letter requesting City action to treat a perceived speeding issue. Staff then assesses the issue and bypasses the minimum response rate of 10 surveys.

When at least 10 surveys are returned in favor of action **(C.1)**, staff will determine whether the perceived problem is deserving of focused action **(C.2)** or deserving of treatment as a traffic calming issue **(D)**.

For detailed information on Focused Actions please refer to page 5.

Once staff has determined the issue to be of a traffic calming nature, the study area is defined. The affected area should include all streets that might be affected by potential actions and should generally be bounded by major features (arterials, freeways, geographic features, etc.). Traffic calming treatments may be applied to multiple streets within the study area.

Staff collects traffic data on the identified streets, including traffic speeds, traffic volumes, and collision history for the previous three years **(E)**. This information is recorded in the Priority Rating Worksheet which allows staff to quantitatively rank requests **(F)**. The Priority Rating Worksheet is located in Appendix D.

Staff continuously collects requests and sends out surveys to determine if there is support of the perceived problem. The problems that are determined to be traffic calming related are evaluated with the Priority Rating Worksheet. Throughout the year, staff ranks the requests (or neighborhoods) based on the results of their priority ratings. At the end of the fiscal year, staff determines the number of areas that can be treated in the upcoming year based upon budget and staff resources **(G)**. Staff presents their list of requested areas in order of rank (based on the Priority Rating Worksheet) to City Council for selection. Council has the option to choose the requests they feel are most vital, not necessarily those at the top of the list. The Priority Rating Worksheet identifies two non-quantitative characteristics: whether the problem is near a pedestrian generator (school, park, civic center, etc.) and whether the problem is on a gateway street into the neighborhood/community. These characteristics help to differentiate neighborhoods and give Council information beyond the data.

The following is an example priority list that staff could give to Council prior to their annual selection.

TABLE 1
EXAMPLE PRIORITY LIST

Neighborhood (Study Area)	Request Date	Priority Rating Score	Pedestrian Generator?	Gateway Streets?
Neighborhood Blue	June 2005	20	No	No
Neighborhood Green	April 2005	18	Yes	No
Neighborhood Red	October 2002	15	No	No
Neighborhood Yellow	December 2004	15	Yes	No
Neighborhood Orange	February 2005	12	No	No
Neighborhood Purple	November 2004	8	Yes	Yes

The areas selected by Council continue to the Plan Development component **(H)**. Areas not selected remain in the list for possible selection in future fiscal years.

Staff determines the amount of construction funding available to each study area based on the total amount available during that fiscal year and the relative size of each of the selected areas (i.e., each study neighborhood receives funding based on its number of households). Residents do have the ability to contribute more funds to their neighborhood plan.

FOCUSED ACTIONS

Through the traffic calming process, staff may determine that the issue in question is deserving of action but that permanently constructed traffic calming devices aren't the most cost-effective approach. These focused actions are intended to provide a solution to traffic issues on a single street or in a relatively small area and generally fall into either enforcement or traffic operations and maintenance. Staff may decide the best solution is to increase enforcement in the affected area by employing one of the following:

- Radar trailers
- Speed feedback signs (permanent version of radar trailer)
- Increased police presence (including targeted speed enforcement)

Radar trailers and speed feedback signs can be a relatively cheap alternative to traffic calming. Increased police enforcement is more costly than the aforementioned two methods and is dependent on police availability. All of these methods can be effective in reducing speed in the short-term, but unless increased police enforcement is continued, driver behavior will often revert back to pre-enforcement levels. In addition, focused traffic enforcement cannot target cut-through traffic per se, as there are no enforcement statutes that address that behavior. Focused traffic enforcement will be limited to those violations that are observed by the traffic

enforcement officers while they are deployed in the problem area. For more information refer to Chapter 3 – Traffic Calming Toolbox.

Traffic operations and maintenance can be altered by the City to reduce neighborhood impacts. The following are examples of traffic operations and maintenance changes that City staff may choose to implement. Many of these improvements are described in Chapter 3 – Traffic Calming Toolbox.

- Centerline/Edgeline lane striping
- Centerline Botts Dots
- Trimming of vegetation to improve sight distance
- Signal timing changes on arterials or collectors
- Restrictions on trucks
- Signage changes

These items are relatively inexpensive and easy to implement in comparison to issues dealt with through the formal traffic calming process. However, resources from the City's operations and maintenance departments may be needed and staff should ensure those resources are available.

Staff will need to gauge the effects of the action to ensure it is benefiting the neighborhood. Additions or removals will be at the discretion of staff and should be made with neighborhood input.

EDUCATION

Neighborhood action is an effective way for neighbors to become positively involved in bringing change to their local streets. The following methods allow individual neighborhoods to take action to address the issues at a local level with support from City staff. These methods are intended to advise and educate drivers in the neighborhood.

- Neighborhood signs
- Trash can brigade
- Pledge program
- Speed watch and warning letters

Neighborhood signs may be posted at the entrances to the neighborhood raising driver awareness about the type of area they are entering. Trash can brigades provide materials (stickers) to residents to place on their trash cans. The stickers can display slogans such as "slow down." As part of a pledge program neighbors may promise to improve their driving behavior. Symbols such as bumper stickers can be used to identify a pledge program participant. Additionally, radar guns can be used by citizens to check the speed of motorists in the neighborhood and warning letters can be sent to the individuals who do not obey the speed limit.

As with any local activity, neighborhood actions can evolve from the aforementioned activities and new methods of traffic education may become available.

Neighborhood action should be carried out with the knowledge of City staff.

PLAN DEVELOPMENT

The plan development component begins after the Council has selected the areas to be treated. This section describes how the neighborhood traffic committee (NTC), staff, and other affected agencies work together to develop a plan to treat traffic-related issues. Letters in bold correspond to individual steps in the plan development component.

Staff will notify all study area residents, property owners, and business owners about the selection of their neighborhood area to participate in the traffic calming plan **(A)**. Following the notice, a neighborhood planning

meeting will be held. The meeting is intended for staff to provide an overview of the process to develop, approve, fund, and implement a neighborhood traffic management plan. At this meeting, staff will provide interested residents the opportunity to volunteer for the NTC **(B)**. Members of the NTC should largely be residents or business owners from the study area. The NTC will meet with City staff to review and develop a plan for their neighborhood. Staff will act as advisors to members throughout the plan formulation.

Although all residents have the opportunity to provide input and receive updates as the plan develops, the NTC is more actively involved, committing the time and effort necessary to develop a comprehensive plan. Residents not selected for the NTC are welcome to attend all meetings, and time will be allocated on the agenda for public comments/questions.

City staff and the NTC will schedule a meeting(s) to review traffic data within the study area and formulate ideas to address problems **(C)**. Data regarding the traffic-related concerns and traffic data will be compared to the toolbox guidelines (see Chapter 3 – Traffic Calming Toolbox) to determine which devices may be most appropriate. At this point in the process, staff can also begin to contact affected agencies to better understand their needs and concerns.

The NTC, with staff guidance, develops the plan within the constraints of the device guidelines **(D)**. Approximate costs of the plan are estimated and, if the cost is above the amount allocated by the City, resident contributions are calculated.

The initial plan development will rely on the following less intrusive devices to treat the traffic-related concerns (see Chapter 3 – Traffic Calming Toolbox for more information):

- Non-Physical Devices – Lane striping, botts dots, speed legends, etc.
- Vertical Devices – Speed lumps, speed tables, etc.
- Narrowing Devices – Bulbouts, center island narrowings
- Horizontal Devices – Traffic Circles, chicanes, lateral shifts, etc.

Because more aggressive measures (i.e. partial closures or forced-turn islands) intentionally divert traffic to another street, new issues can occur as a result. For this reason, more aggressive devices are prohibited until all other options have proven ineffective at reducing the traffic-related impacts.

Once staff and the NTC have developed a plan they feel appropriately addresses the traffic-related issues, City staff will solicit feedback from other agencies that may be potentially affected by the plan **(E)**. The intent of this process is to identify concerns and potential modifications to the plan. The following agencies will likely be involved in reviewing most plans:

- Fire Department
- Police Department
- Transit Agencies
- Local School District
- Environmental Services
- Street Division

Staff will share the input from these agencies with the NTC, and the NTC will revise the plan accordingly.

A neighborhood meeting will be arranged to present the proposed plan to the neighborhood at-large **(F)**. At this meeting the NTC will present a map of the proposed plan and describe the types and locations of devices proposed. The public is invited to give their input on the plan, and the committee will consider this input and make appropriate changes to the plan.

Residents will also be informed of the approval process and surveys they will receive once the proposed plan is refined.

PLAN SUPPORT

The neighborhood support component assesses the amount of neighborhood support for the proposed plan in the form of mail-in surveys. Staff will mail the surveys to neighborhood area residents, property owners, and business owners. Prior to surveys being distributed, the City will inform persons in the study area regarding the pending survey. This could include public notices, mailers, and/or newsletters.

Surveys will be distributed to all residents, property owners, apartment units, and businesses owners within the study area **(A)**. The surveys will include a description and map of the proposed plan indicating the type and location of device(s) being proposed. The survey will also include a mail back postcard with three questions for residents to respond to. Those questions are:

- Do you support the proposed plan?
- Would you oppose a traffic calming device adjacent to your property?
- Would you support funding, if any, of the requested neighborhood plan?

The mail back postcard will also provide a space for residents to write comments regarding the proposed plan.

A minimum response rate and support rate must be met from individuals in the study area before the plan moves forward **(B)**. For implementation of a plan, a minimum of 50 percent of all surveys must be returned with 67 percent of residents in favor. For example, if 100 surveys are mailed out, at least 50 must be returned with 34 of those in favor of the proposed plan.

Apartments present a unique situation because residents may be less likely to respond. For this reason, surveys from apartment units are not counted toward the minimum response rate, but will be counted in favor or against the proposed plan.

The survey process identifies the opinions of those within the study area and does not include opinions of those from outside of the study area (i.e., other motorists, bicyclists, etc.). Signs will be posted and ads should be placed listing a phone number and/or email address in an attempt to collect the opinions of affected persons not receiving the survey **(C)**. These responses will be reviewed and considered as supplemental information.

City staff will count all received surveys and discuss the outcome with the NTC **(D)**. Staff will determine whether the minimum response rate and support rate are satisfied **(E)**. If the minimum number of surveys is not received, staff can assist the NTC in reminding neighborhood residents to submit their mail back postcards in order to meet the minimum response rate.

If the minimum response rate is met but the support rate is not, then the NTC has one opportunity to revise the plan. This would require modifying the plan to address aspects that were not favored by residents. Modifying the plan would also require consulting the affected agencies, holding a public meeting to present the revised plan, and redistributing surveys to the study area.

If the minimum response rate and support rate are met, then the plan continues to the implementation component.

PLAN IMPLEMENTATION

The final component of the traffic calming process is implementation. As in the previous sections, letters in bold correspond to individual steps in the plan implementation component.

City Council will be asked to approve the plan and allocate funds for the design and construction of the plan **(A)**. If Council does not approve, then the plan can return to Plan Development (step D) and be modified by the NTC once **(B.1)**.

After Council approval the engineering designs of the devices are drawn and, if necessary, environmental review is completed **(B.2)**. Staff will notify the public and affected agencies regarding the implementation of a traffic

calming device. Additionally, staff may educate users on the proper maneuvering of the pending devices. Education and notification helps ensure that motorists and other road users are familiar with the device and that they can continue to use the roadway in a safe manner.

The neighborhood residents may be required to contribute to the costs of the plan implementation **(C)**. If the cost of the neighborhood plan exceeds the funding available per neighborhood, as determined by staff in the plan initiation component, then residents would be required to fund the difference, unless Council authorizes additional funds. Resident funding will be collected voluntarily with a mechanism to be determined. Collecting from residents may present problems, especially when attempting to collect from residents who don't support traffic calming in their neighborhood.

The traffic calming devices can be constructed either as temporary or permanent devices **(D)**. Temporary devices can be constructed at staff's discretion based on previous experience with the device. These temporary devices can be converted to permanent devices after four to six months of acceptable performance.

After construction of the approved plan, staff will monitor the devices and collect data three to six months after implementation **(E)** as well as rely on the NTC and community members for feedback on the constructed devices. Based on the NTC and/or community members' feedback and collected data, staff will determine the next steps **(F)**. For example, the approved plan may have produced reasonable and satisfactory results and therefore no further action is needed **(G.1)**.

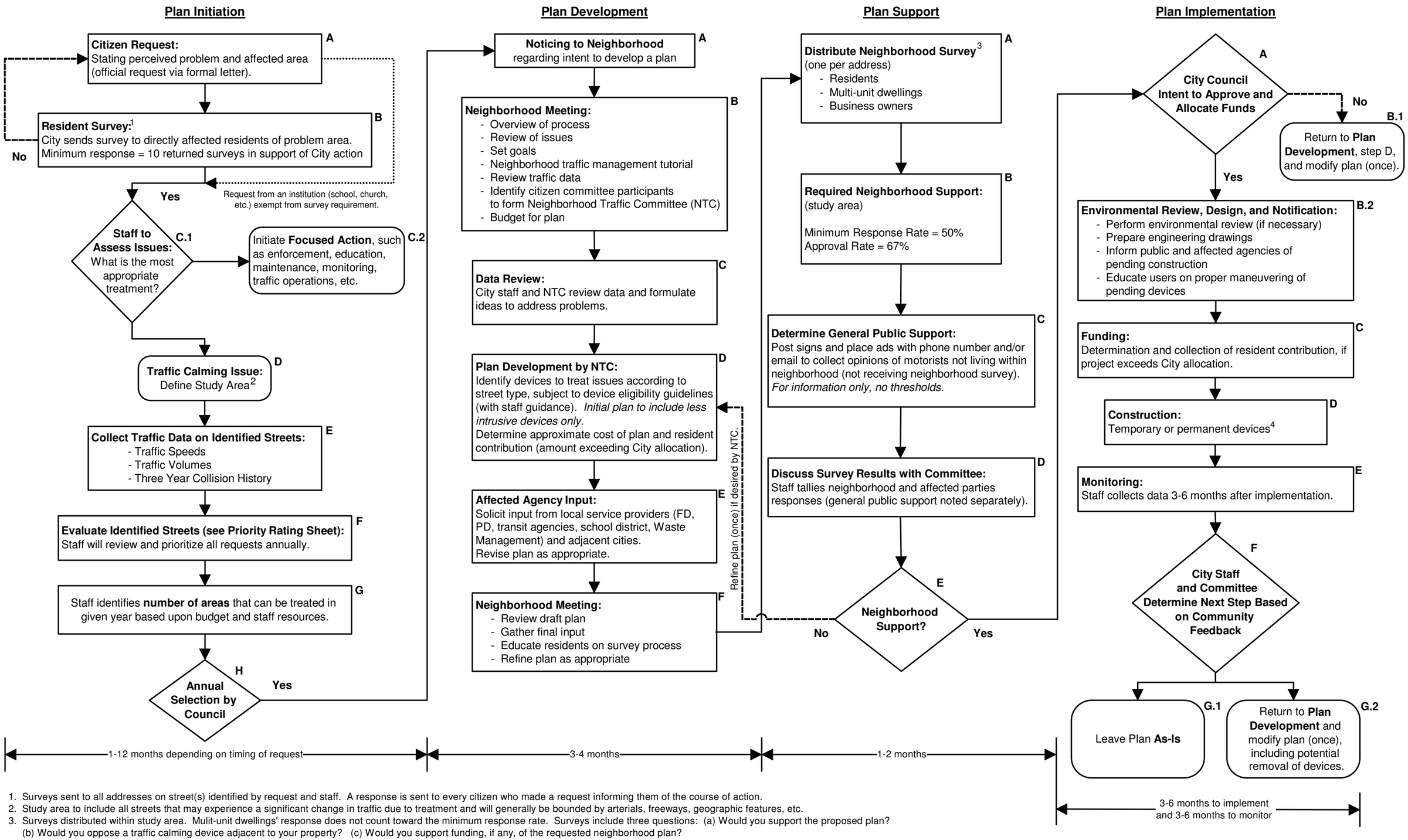
If the approved plan has **not** produced reasonable and satisfactory results, staff can recommend one or more of the following:

- Collect additional traffic data as deemed appropriate.
- Modify constructed devices as deemed appropriate.
- Construct additional less intrusive devices as deemed appropriate.
- Return to plan development and modify the plan **(G.2)**.

The plan can be revised once. This includes the removal of devices found to be ineffective.

If staff determines that less intrusive devices will not adequately address the traffic-related concern, then staff can recommend the use of more aggressive measures.

Figure 1 - Traffic Calming Process



1. Surveys sent to all addresses on street(s) identified by request and staff. A response is sent to every citizen who made a request informing them of the course of action.
2. Study area to include all streets that may experience a significant change in traffic due to treatment and will generally be bounded by arterials, freeways, geographic features, etc.
3. Surveys distributed within study area. Mulit-unit dwellings' response does not count toward the minimum response rate. Surveys include three questions: (a) Would you support the proposed plan? (b) Would you oppose a traffic calming device adjacent to your property? (c) Would you support funding, if any, of the requested neighborhood plan?
4. Temporary devices are constructed at staff discretion based on previous experience. Temporary devices can be converted to permanent devices after 4-6 months of acceptable performance.

CHAPTER 3. TRAFFIC CALMING TOOLBOX

This chapter of the NTMP manual summarizes the "toolbox" of devices that are available to the City of La Habra Public Works staff and community members when developing neighborhood traffic management plans. The "toolbox" contains 28 different devices that address neighborhood traffic-related concerns such as speeding vehicles, high traffic volumes, cut-through traffic, or collisions at neighborhood intersections. The devices vary in their ability to treat various traffic-related concerns. For this reason the toolbox also provides guidance on selecting the most appropriate devices given the type of specific traffic-related concern and street being treated.

Neighborhood Traffic Management Devices

The toolbox of neighborhood traffic management devices is grouped into three categories.

- Non-Physical devices
- Less Intrusive devices
    - Vertical devices
    - Narrowing devices
    - Horizontal devices
- More Aggressive devices

For each device in the toolbox, the following discussions are provided.

- Description of the measure
- Photograph and/or schematic
- List of advantages and disadvantages
- Cost estimation
- Data sheet indicating speed, volume, or collision reduction potential

Cost approximations are provided for informational purposes only. Actual costs depend on many factors, including: dimensions of device, construction materials, and actual construction costs.

NON-PHYSICAL DEVICES

Non-physical devices include any measure that does not require physical changes to the roadway. Non-physical devices are intended to increase drivers' awareness of surroundings and influence driver behavior without physical devices. Because these devices are not self enforcing, they have limited effectiveness as stand alone devices. Non-physical devices should be used to supplement physical devices. This category includes the following devices:

- Targeted Speed Enforcement
- Radar Trailer
- Speed Feedback Sign
- Centerline/Edgeline Lane Striping
- Optical Speed Bar
- Signage
- Speed Legend
- Centerline Botts Dots

TARGETED SPEED ENFORCEMENT

Staff or Neighborhood Traffic Committee (NTC) identifies locations for temporary targeted enforcement, based on personal observations and survey comments. A request can be submitted to the City of La Habra Police Department for the desired enforcement. Depending on police department resources, the targeted enforcement may be limited in duration. Targeted enforcement may also be used in conjunction with new neighborhood traffic management devices to help drivers become aware of the new restrictions.

Approximate Cost: No incremental cost

Advantages

- Inexpensive if used temporarily
- Does not physically slow emergency vehicles or buses
- Quick implementation

Disadvantages

- Expensive to maintain an increased level of enforcement
- Effectiveness may be temporary

RADAR TRAILER

A radar trailer is a device that measures each approaching vehicle's speed and displays it next to the legal speed limit in clear view of the driver. They can be easily placed on a street for a limited amount of time then relocated to another street, allowing a single device to be effective in many locations.

Approximate Cost: $6,000 - $20,000

Advantages

- Portable
- Does not physically slow emergency vehicles or buses
- Quick implementation

Disadvantages

- Effectiveness may be temporary
- Drivers may divert to alternate streets due to uncertainty of devices implications
- Subject to vandalism

SPEED FEEDBACK SIGN

Speed feedback signs perform the same functions as radar trailers but are permanent. Real-time speeds are relayed to drivers and flash when speeds exceed the limit. Speed feedback signs are typically mounted on or near speed limit signs and can also be mobile units.

Approximate Cost: $3,000 - $10,000

Advantages

- Real-time speed feedback
- Does not physically slow emergency vehicles or buses
- Permanent installation

Disadvantages

- May requires power source
- Only effective for one direction of travel
- Long-term effectiveness uncertain
- Subject to vandalism

CENTERLINE/EDGLINE LANE STRIPING

Lane striping can be used to create formal bicycle lanes, parking lanes, or edge lines. As a neighborhood traffic management measure, they are used to narrow the travel lanes for vehicles, thereby inducing drivers to lower their speeds. The past evidence on speed reductions is, however, inconclusive.

Approximate Cost: $2 per linear foot

Advantages

- Inexpensive
- Can be used to create bicycle lanes or delineate on-street parking
- Does not slow emergency vehicles

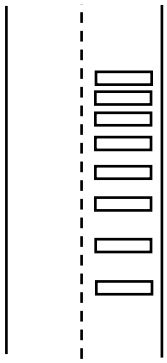
Disadvantages

- Has not been shown to significantly reduce travel speeds
- Requires regular maintenance

OPTICAL SPEED BARS

Optical speed bars are a series of pavement markings spaced at decreasing distances. They have typically been used in construction areas to provide drivers with the impression of increased speed. Does not provide long-term speed reduction benefits.

Approximate Cost: $1 per linear foot



Advantages

- Inexpensive
- Does not physically slow emergency vehicles or buses

Disadvantages

- Long-term affects in residential area unknown
- Increases regular maintenance

SIGNAGE

Signage that can be used as a neighborhood traffic management measure include:

- Truck Restriction Signs; and
- "Cross Traffic Does Not Stop" Signs.

Approximate Cost: $150 - $500 per sign

Advantages

- Inexpensive
- Truck restrictions can reduce through truck traffic
- Does not slow emergency vehicles or buses

Disadvantages

- Requires regular maintenance
- Speed limit signs are not applicable because they do not necessarily change driver behavior. If speed limit is set unreasonably low, drivers are more likely to exceed it.

SPEED LEGEND

Speed legends are numerals painted on the roadway indicating the current speed limit in miles per hour. They are usually placed near speed limit signposts. Speed legends can be useful in reinforcing a reduction in speed limit between one segment of a roadway and another segment. They may also be placed at major entry points into a residential area.

Approximate Cost: $75

Advantages

- Inexpensive
- Helps reinforce a change in speed limit
- Does not slow emergency vehicles

Disadvantages

- Has not been shown to significantly reduce travel speeds
- Requires regular maintenance

CENTERLINE BOTTS DOTS

Botts dots, or "raised pavement markers," are small bumps lining the centerline or edgeline of a roadway. They are often used on curves where vehicles have a tendency to deviate outside of the proper lane, risking collision. Raised reflectors improve the nighttime visibility of the roadway edges.

Approximate Cost: $4.50 per marker

Advantages

- Inexpensive
- Does not physically slow emergency vehicles or buses
- Can help keep drivers in the appropriate travel lane on curves and under low-visibility conditions

Disadvantages

- Noise caused by Botts Dots
- Requires regular maintenance
- Has not been shown to significantly reduce travel speeds

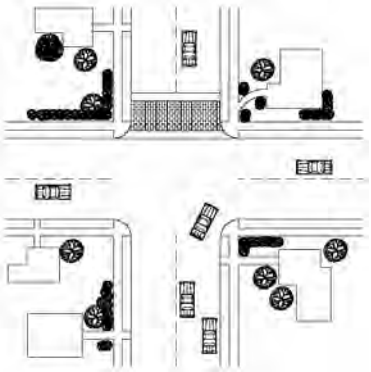
LESS INTRUSIVE - VERTICAL DEVICES

Vertical deflection devices use variations in pavement height and alternative paving materials to physically reduce travel speeds. These devices are designed for travel speeds over the device of approximately 15 to 20 mph depending on the device. The vertical deflection devices in the toolbox include:

- Entry Feature
- Speed Lump
- Speed Cushion
- Speed Table
- Raised Crosswalk
- Rumble Strips
- Textured Pavement

ENTRY FEATURE

An entry feature is an elevated portion of a roadway where a minor street provides access to and from a collector or arterial street signifying the entrance to a neighborhood area. It may be combined with a center median island splitting inbound and outbound traffic. The center median island can be constructed with stamp brick work or landscaping. Little data has been collected to predict the reduction in speed, traffic volumes, or collisions and use of this device may not result in significant decreases. Resources permitting, before and after data can be collected by staff to determine the effectiveness of entry features.



Approximate Cost: $10,000 - $25,000

Advantages

- Alerts drivers that they are entering a neighborhood area
- Aesthetics may be pleasing

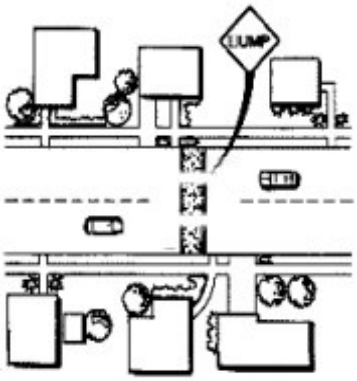
Disadvantages

- Cost, depending on material used
- Slows emergency vehicles and buses

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**I/D**
Volume Reduction	**Reduction in Average Daily Traffic**	**I/D**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	**I/D**
Note: I/D = Insufficient data to predict reduction effect.		

SPEED LUMP

Speed lumps are rounded raised areas placed across the road with two wheel cut-outs designed to allow large vehicles, such as emergency vehicles and buses, to pass with minimal slowing. The design limits passenger cars and mid-size SUVs from fully passing through the cut-outs, but allows one set of wheels to pass through the cut-out while the other set is required to travel over the lump. They are generally 3 to 3 ½ inches high, sinusoidal in shape, and have a design speed of 15 to 20 mph. They are usually constructed with a taper on each side to allow unimpeded drainage between the lump and curb. When placed on a street with rolled curbs or no curbs, bollards are placed at the ends of the speed lump to discourage vehicles from veering outside of the travel lane to avoid the device.



The magnitude of reduction in speed is dependent of the spacing of speed lumps between points that require drivers to slow (see page 48).

Speed lumps are similar when compared to speed humps, therefore, the measured effectiveness of speed humps is shown (there is insufficient data to predict the effectiveness of speed lumps).

Advantages

- Effective in reducing speeds
- Maintains rapid emergency response times
- Relatively easy for bicyclists to cross

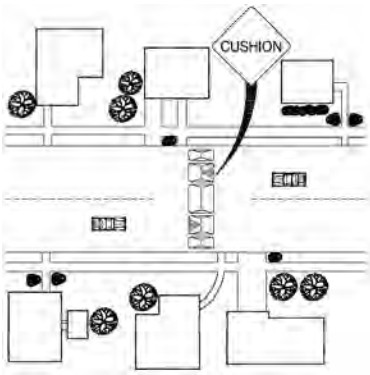
Disadvantages

- Vehicles with wide wheel base can pass through the lump using the wheel cut-outs
- Increased noise
- Aesthetics
- Signs may be unwelcome by adjacent residents

Approximate Cost: $2,000 - $3,000

Measured Effectiveness (of Speed Humps)		
Speed Impacts	**Reduction in 85th Percentile Speeds between Slow Points**	**-22%**
Volume Impacts	**Reduction in Average Daily Traffic**	**-18%**
Safety Impacts	**Reduction in Average Annual Number of Collisions**	**-13%**
Source: *Traffic Calming: State-of-the-Practice*, 1999.		

SPEED CUSHION



Speed cushions are a variation of the speed lump that is constructed from durable recycled rubber. These prefabricated devices consistently have a more uniform shape than asphalt humps. Speed cushions provide wheel gaps for emergency vehicles and buses, and can be arranged to fit any street width.

The magnitude of reduction in speed is dependent of the spacing of speed cushions between points that require drivers to slow (see page 48). On average, speed cushions achieve a 14% reduction in speeds.

Approximate Cost: $2,500 - $3,500 (whole street)

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**-14%**
Volume Reduction	**Reduction in Average Daily Traffic**	**Comparable to Speed Lumps**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	
Source: City of Portland, Rubber Speed Bump Research, 1995.		

Advantages

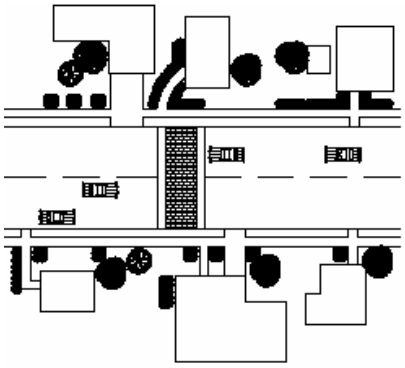
- Provides a more consistent ride than asphalt humps
- Can be used as a temporary device during a testing phase
- Reduces impacts to emergency vehicles due to cut-outs
- Easily accommodates street resurfacing

Disadvantages

- Increased noise
- Aesthetics (but may be better than lumps)
- Signs may be unwelcome by adjacent residents

SPEED TABLE

Speed tables are flat-topped speed humps approximately 22 feet long, which is typically long enough for the entire wheelbase of a passenger car to rest on top. Their long flat fields, plus ramps that are more gently sloped than speed lumps, give speed tables higher design speeds than lumps and thus may be more appropriate for streets with higher ambient speeds. Brick or other textured materials improve the appearance of speed tables, draw attention to them, and may enhance safety and speed reduction.



The magnitude of reduction in speed is dependent of the spacing of speed tables between points that require drivers to slow (see page 48). On average speed tables achieve an 18% reduction in speeds.

Approximate Cost: $4,000 (with basic materials)

Measured Effectiveness		
Speed Impacts	**Reduction in 85th Percentile Speeds between Slow Points**	**-18%**
Volume Impacts	**Reduction in Vehicles per Day**	**-12%**
Safety Impacts	**Reduction in Average Annual Number of Collisions**	**-45%**
Source: *Traffic Calming: State-of-the-Practice*, 1999.		

Advantages

- Effective in reducing speeds, though not to the extent of speed humps

Disadvantages

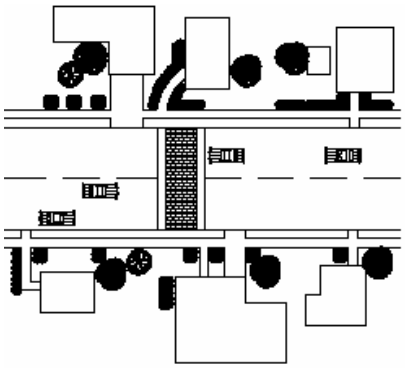
- Aesthetics of device
- Increased noise
- Textured materials, if used, can be expensive
- Signs may be unwelcome by adjacent residents

RAISED CROSSWALK

Raised Crosswalks are speed tables striped with crosswalk markings and signage to channelize pedestrian crossings, providing pedestrians with a level street crossing. Also, by raising the level of the crossing, pedestrians are more visible to approaching motorists.

The magnitude of reduction in speed is dependent of the spacing of raised crosswalks between points that require drivers to slow (see page 48). On average raised crosswalks achieve an 18% reduction in speeds.

Approximate Cost: $4,000 (with basic materials)



Measured Effectiveness		
Speed Impacts	**Reduction in 85th Percentile Speeds between Slow Points**	**-18%**
Volume Impacts	**Reduction in Vehicles per Day**	**-12%**
Safety Impacts	**Reduction in Average Annual Number of Collisions**	**-45%**
Source: *Traffic Calming: State-of-the-Practice*, 1999.		

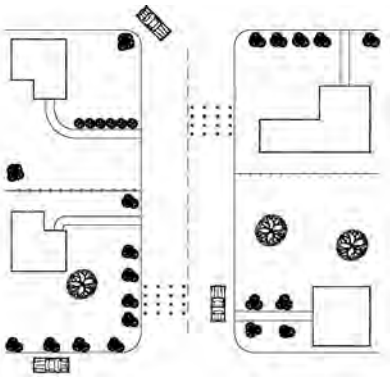
Advantages

- Improve safety for both vehicles and pedestrians
- Aesthetic upgrades can have positive aesthetic value
- Effective in reducing speeds, though not to the extent of speed lumps

Disadvantages

- Textured materials, if used, can be expensive
- Impact to drainage needs to be considered
- Textured pavement can increased noise to adjacent residences
- Signs may be unwelcome by adjacent residents

RUMBLE STRIPS



Rumble strips are closely spaced raised pavement markers at regular intervals on the roadway that creates noise and vibration to the vehicle. Rumble strips can be used to warn drivers of a change in speed limit, leading up to a residential or school area, and upcoming stop sign or intersection. Rumble strips should only be used in areas where the noise impact would be minimal. Little data has been collected to predict the reduction in speed, traffic volumes, or collisions and use of this device may not result in significant decreases. Resources permitting, before and after data can be collected by staff to determine the effectiveness of rumble strips.

Approximate Cost: $500

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**I/D**
Volume Reduction	**Reduction in Average Daily Traffic**	**I/D**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	**I/D**
Note: I/D = Insufficient data to predict reduction effect.		

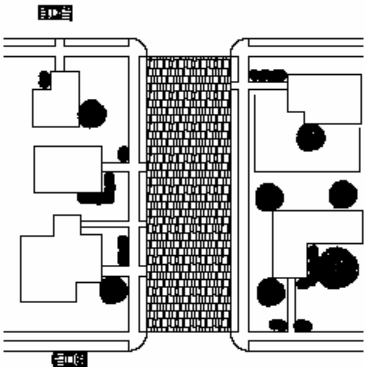
Advantages

- Relatively inexpensive
- Can be effective in slowing travel speeds in specific locations

Disadvantages

- Raised pavement markers can be slippery when wet
- Increased noise in vicinity of rumble strips
- Maintenance of raised pavement markers
- Aesthetics
- Uncomfortable for motorcyclists and bicyclists

TEXTURED PAVEMENT



Textured colored pavement includes the use of stamped pavement (asphalt) or alternate paving materials to create an uneven surface for vehicles to traverse. Textured pavement may have limited effectiveness as a stand alone device and should be used to supplement other devices such as raised crosswalks, center median islands, etc. Little data has been collected to predict the reduction in speed, traffic volumes, or collisions and use of this device may not result in significant decreases. Resources permitting, before and after data can be collected by staff to determine the effectiveness of textured pavement.

Approximate Cost: Varies – based on size

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**I/D**
Volume Reduction	**Reduction in Average Daily Traffic**	**I/D**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	**I/D**
Note: I/D = Insufficient data to predict reduction effect.		

Advantages

- Can reduce vehicle speeds
- Aesthetic upgrades can have positive aesthetic value
- Placed at an intersection, it can slow two streets at once

Disadvantages

- Expensive, varying by materials used
- Can be uncomfortable for bicyclists or handicapped.
- Textured pavement can increased noise to adjacent properties

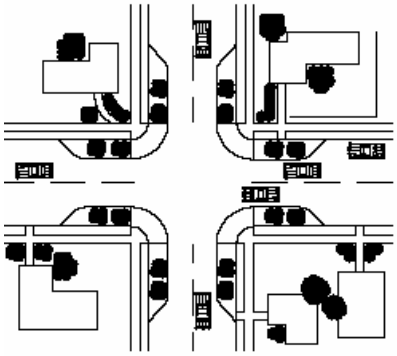
LESS INTRUSIVE - NARROWING DEVICES

Narrowing devices use raised islands and curb extensions to narrow the travel lane for motorists. The narrowing devices in the toolbox include:

- Neckdown/Bulbout
- Center Island Narrowing

NECKDOWN/BULBOUT

Neckdowns/bulbouts are raised curb extensions that narrow the travel lane at intersections or mid-block locations. Neckdowns/bulbouts "pedestrianize" intersections by shortening the crossing distance and decreasing the curb radii, thus reducing turning vehicle speeds. Both of these effects increase pedestrian comfort and safety at the intersection.



The magnitude of reduction in speed is dependent of the spacing of neckdowns between points that require drivers to slow (see page 48). On average neckdowns achieve a 7% reduction in speeds.

Approximate Cost: $5,000 - $10,000 per device

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**-7%**
Volume Reduction	**Reduction in Vehicles per Day**	**-10%**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	**I/D**
Note: I/D = Insufficient data to predict reduction effect. Source: *Traffic Calming: State-of-the-Practice*, 1999.		

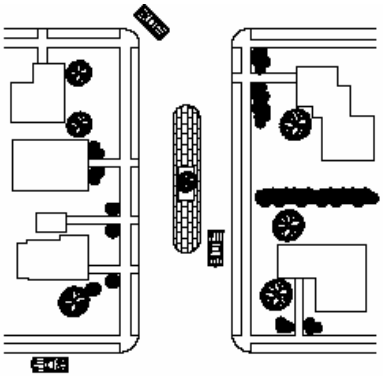
Advantages

- Reduces pedestrian crossing distance and exposure to vehicles
- Through and left-turn movements are easily negotiable by large vehicles
- Creates protected on-street parking bays
- Reduces speeds (especially right-turning vehicles) and traffic volumes

Disadvantages

- Effectiveness is limited by the absence of vertical or horizontal deflection
- May slow right-turning emergency vehicles
- Potential loss of on-street parking
- May require bicyclists to briefly merge with vehicular traffic

CENTER ISLAND NARROWING



Center island narrowings are raised islands located along the centerline of a street that narrow the travel lanes at that location. Placed at the entrance to a neighborhood, and often combined with textured pavement, they are often called "gateways". Fitted with a gap to allow pedestrians to walk through at a crosswalk, they are often called "pedestrian refuges". They can also be landscaped to increase visual aesthetics.

The magnitude of reduction in speed is dependent of the spacing of center island narrowings between points that require drivers to slow (see page 48). On average center island narrowings achieve a 7% reduction in speeds.

Approximate Cost: $5,000 - $10,000

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**-7%**
Volume Reduction	**Reduction in Vehicles per Day**	**-10%**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	**I/D**
Note: I/D = Insufficient data to predict reduction effect. Source: *Traffic Calming: State-of-the-Practice*, 1999.		

Advantages

- Can increase pedestrian safety
- Aesthetic upgrades can have positive aesthetic value
- Reduces traffic volumes if alternative routes are available

Disadvantages

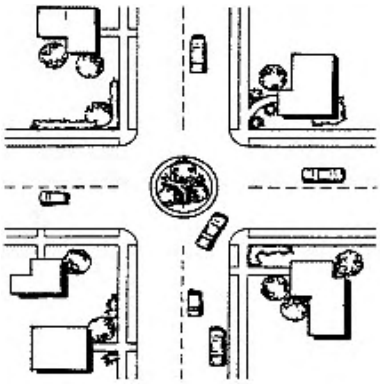
- Effect on vehicle speeds is limited by the absence of any vertical or horizontal deflection
- Potential loss of on-street parking

LESS INTRUSIVE - HORIZONTAL DEVICES

Horizontal deflection devices use raised islands and curb extensions to eliminate straight-line paths along roadways and through intersections. The horizontal deflection devices in the toolbox include:

- Traffic Circle
- Roundabout (Single-Lane)
- Chicane
- Lateral Shift
- Realigned Intersection

TRAFFIC CIRCLE



Traffic circles are raised islands, placed in intersections, around which traffic circulates. Stop signs or yield signs can be used as traffic controls at the approaches of the traffic circle. Circles prevent drivers from speeding through intersections by impeding the straight-through movement and forcing drivers to slow down to yield. Depending upon the size of the intersection and circle, trucks may be permitted to turn left in front of the circle.

The magnitude of reduction in speed is dependent of the spacing of traffic circles between points that require drivers to slow (see page 48). On average traffic circles achieve an 11% reduction in speeds and a dramatic decrease in collisions by 71%.

Approximate Cost: $10,000 - $25,000

Measured Effectiveness		
Speed Impacts	**Reduction in 85th Percentile Speeds between Slow Points**	**-11%**
Volume Impacts	**Reduction in Vehicles per Day**	**-5%**
Safety Impacts	**Reduction in Average Annual Number of Collisions**	**-71%**
Source: *Traffic Calming: State-of-the-Practice*, 1999.		

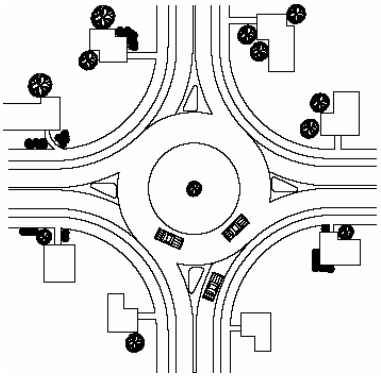
Advantages

- Very effective in moderating speeds and improving safety
- Can have positive aesthetic value

Disadvantages

- If not designed properly, difficult for emergency vehicles or large trucks to travel around
- Must be designed so that the circulating traffic does not encroach on crosswalks
- Potential loss of on-street parking

ROUNDABOUT (SINGLE-LANE)



Like traffic circles, roundabouts require traffic to circulate counterclockwise around a center island. But unlike circles, roundabouts are used on higher volume streets to allocate right-of-way among competing movements. They are found primarily on collector streets, often substituting for traffic signals. They are larger than neighborhood traffic circles, have raised splitter islands to channel approaching traffic to the right, and do not have stop signs. Due to large amount of required right-of-way and construction costs, roundabouts may be most appropriate for new developments or redevelopment areas.

Roundabouts have an insignificant affect in reducing traffic speeds, but serve to allocate right-of-way at an intersection similar to a traffic signal. On average roundabouts can reduce the average number of accidents up to 33% when compared to a signalized intersection.

Approximate Cost: $50,000 - $100,000

Measured Effectiveness		
Speed Impacts	**Reduction in 85th Percentile Speeds between Slow Points**	**Minor**
Volume Impacts	**Reduction in Vehicles per Day**	**Minor**
Safety Impacts	**Reduction in Average Annual Number of Collisions**	**-15% to -33%**
Sources: *Roundabouts: An Informational Guide*, 2000. *Traffic Calming: State-of-the-Practice*, 1999.		

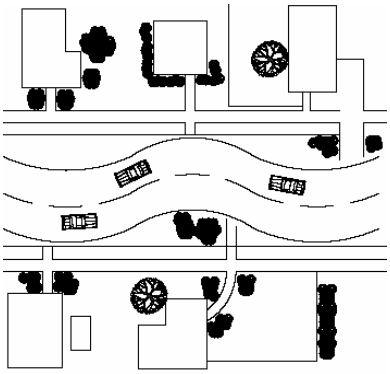
Advantages

- Enhanced safety compared to a traffic signal or stop sign
- Minimizes queuing at approaches to the intersection
- Less expensive to operate than traffic signals
- Can have positive aesthetic value
- Shorter pedestrian crossing distance

Disadvantages

- May require major reconstruction of an existing intersection
- Loss of on-street parking
- Continuous flow of traffic limits opportunity for pedestrians to cross (compared to signal)
- May present additional obstacles to visually impared pedestrians

CHICANE



Chicanes are curb extensions that alternate from one side of the street to the other, forming S-shaped curves. Chicanes can also be created by alternating on-street parking between one side of the road and the other. Each parking bay can be created either by restriping the roadway or by installing raised center islands at each end, creating a protected parking area. Chicanes have limited effectiveness in reducing traffic speeds and volumes as compared to other devices. Little data has been collected to predict the reduction in speed, traffic volumes, or collisions and use of this device may not result in significant decreases. Resources permitting, before and after data can be collected by staff to determine the effectiveness of chicanes.

Approximate Cost: $8,000 - $14,000

Measured Effectiveness		
Speed Impacts	**Reduction in 85th Percentile Speeds between Slow Points**	**up to -17%**
Volume Impacts	**Reduction in Vehicles per Day**	**I/D**
Safety Impacts	**Reduction in Average Annual Number of Collisions**	**I/D**
Note: I/D = Insufficient data to predict reduction effect. Source: Harmony Road Project, Newark, Delaware, 2002.		

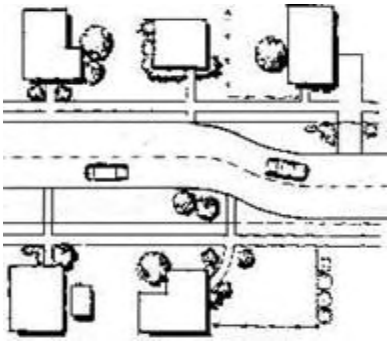
Advantages

- Discourages high speeds by forcing horizontal deflection
- Easily negotiable by emergency vehicles and buses

Disadvantages

- Must be designed carefully to discourage drivers from deviating out of the appropriate lane
- Curb realignment and landscaping can be costly, especially if there are drainage issues
- Loss of on-street parking

LATERAL SHIFT



Lateral shifts are curb extensions on otherwise straight streets that cause a shift in the travel. Lateral shifts, with just the right degree of deflection, are one of the few measures that have been used on collectors or even arterials, where high traffic volumes and high posted speeds preclude more abrupt measures.

Approximate Cost: Varies (depending on size of offset and length of transition)

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**I/D**
Volume Reduction	**Reduction in Vehicles per Day**	**I/D**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	**I/D**
Note: I/D = Insufficient data to predict reduction effect.		

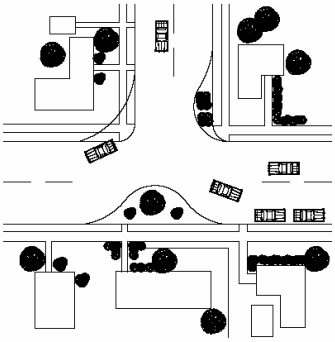
Advantages

- Can accommodate higher traffic volumes than many other neighborhood traffic management measures
- Easily negotiable by large emergency vehicles and buses

Disadvantages

- Modest effect on speeds
- Loss of on-street parking
- Must be designed carefully to discourage drivers from deviating out of the appropriate lane

REALIGNED INTERSECTION



Realigned intersections provide deflection on an otherwise straight approach of a T-intersection. By providing deflection in the form of a curb extension or realignment, drivers are required to slow through the intersection or come to a stop prior to turning. Little data has been collected to predict the reduction in speed, traffic volumes, or collisions and use of this device may not result in significant decreases. Resources permitting, before and after data can be collected by staff to determine the effectiveness of realigned intersections.

Approximate Cost: $15,000 - $30,000

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**I/D**
Volume Reduction	**Reduction in Vehicles per Day**	**I/D**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	**I/D**
Note: I/D = Insufficient data to predict reduction effect.		

Advantages

- Can be effective at reducing speeds at T-intersections
- Can be affective in increasing safety at T-intersections

Disadvantages

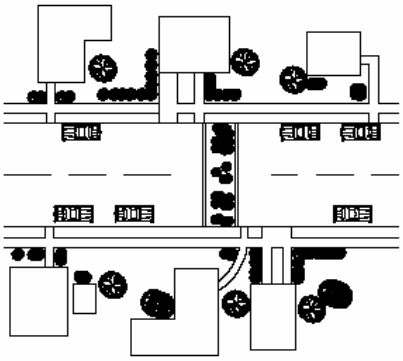
- Modifying curb or drainage can be costly
- Acquiring additional right-of way can be costly

MORE AGGRESSIVE DEVICES

Diversion devices use raised islands and curb extensions to preclude particular vehicle movements, such as left-turn or through movements, usually at an intersection. These devices can be considered after less intrusive devices failed to resolve the traffic problem. The diversion devices in the toolbox include:

- Full Closure
- Partial Closure
- Diagonal Diverter
- Median Barrier
- Forced-Turn Island
- Turn-Movement Restrictions

FULL CLOSURE



Full street closures are barriers placed across a street to close the street completely to through traffic, usually leaving only sidewalks or bicycle paths open. The barriers may consist of landscaped islands, walls, gates, side-by-side bollards, or any other obstructions that leave an opening smaller than the width of a passenger car. Emergency vehicles are accommodated via removable bollards or similar devices.

Approximate Cost: $30,000 - $100,000

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**I/D**
Volume Reduction	**Reduction in Vehicles per Day**	**-44%**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	**I/D**

Note: I/D = Insufficient data to predict reduction effect.
Source: *Traffic Calming: State-of-the-Practice*, 1999.

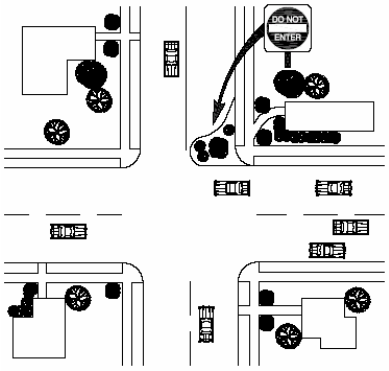
Advantages

- Very effective in reducing cut-through traffic volumes
- Able to maintain pedestrian and bicycle connectivity

Disadvantages

- Requires statutory actions for public street closures
- Causes circuitous routes for local residents
- Diverts traffic to another street
- Delays for emergency services unless through access is provided for

PARTIAL CLOSURE



Partial closures (or half street closures) are barriers that block travel in one direction for a short distance on otherwise two-way streets. Half closures are the most common volume control measure after full street closures. Half closures are often used in sets to make travel through neighborhoods with gridded streets circuitous rather than direct.

Approximate Cost: $5,000 - $7,500

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**-19%**
Volume Reduction	**Reduction in Vehicles per Day**	**-42%**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	**I/D**
Note: I/D = Insufficient data to predict reduction effect. Source: *Traffic Calming: State-of-the-Practice*, 1999.		

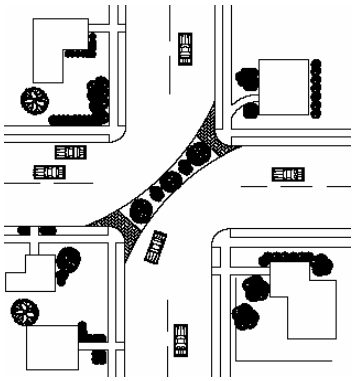
Advantages

- Able to maintain two-way bicycle access
- Effective in reducing traffic volumes

Disadvantages

- Causes circuitous routes for local residents
- May limit access to businesses
- Drivers can bypass the barrier

DIAGONAL DIVERTER



Diagonal diverters are barriers placed diagonally across an intersection, blocking through movement. Like half closures, diagonal diverters are usually staggered to create circuitous routes through neighborhoods.

Approximate Cost: $20,000

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**-4%**
Volume Reduction	**Reduction in Vehicles per Day**	**-35%**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	**I/D**

Note: I/D = Insufficient data to predict reduction effect.
Source: *Traffic Calming: State-of-the-Practice*, 1999.

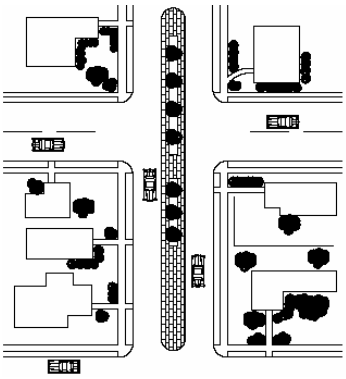
Advantages

- Able to maintain full pedestrian and bicycle access
- Reduces traffic volumes

Disadvantages

- Causes circuitous routes for local residents
- Delays for emergency services
- May be expensive
- May require reconstruction of corner curbs

MEDIAN BARRIER



Median barriers are raised islands that are located along the centerline of a street and continue through an intersection so as to block through movement at a cross street.

Approximate Cost: $15,000 - $20,000 per 100 feet

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**I/D**
Volume Reduction	**Reduction in Vehicles per Day**	**-31%**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	**I/D**
Note: I/D = Insufficient data to predict reduction effect. Source: *Traffic Calming: State-of-the-Practice*, 1999.		

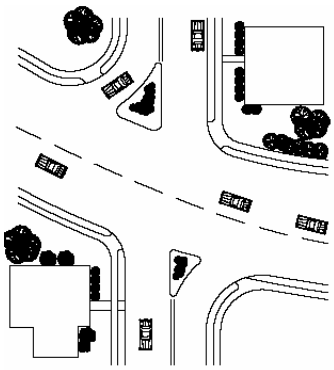
Advantages

- Can improve safety at an intersection of a local street and a major street by prohibiting critical through movements
- Can reduce traffic volumes on a cut-through route that crosses a major street

Disadvantages

- Requires available street width on the major street
- Limits turns to and from the side street or driveway for local residents and emergency services

FORCED-TURN ISLAND



Forced-turn islands are raised islands that prohibit certain movements on approaches to an intersection.

Approximate Cost: $3,000 - $5,000

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**I/D**
Volume Reduction	**Reduction in Vehicles per Day**	**-31%**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	**I/D**
Note: I/D = Insufficient data to predict reduction effect. Source: *Traffic Calming: State-of-the-Practice*, 1999.		

Advantages

- Can improve safety at an intersection by prohibiting critical turning movements
- Reduces traffic volumes

Disadvantages

- If designed improperly, drivers can maneuver around the island to make an illegal movement
- May divert a traffic problem to a different street

TURN-MOVEMENT RESTRICTIONS

Turn-movement restrictions involve the use of signs to prevent undesired turning movements without the use of physical devices. The restrictions may generally apply to turning movements in or out of a residential street to a larger street. The turn-movement restrictions may be permanent or only during peak commute hours.

Approximate Cost: $150 - $1,000 (plus enforcement)

Measured Effectiveness		
Speed Reduction	**Reduction in 85th Percentile Speeds between Slow Points**	**I/D**
Volume Reduction	**Reduction in Vehicles per Day**	**I/D**
Safety Reduction	**Reduction in Average Annual Number of Collisions**	**I/D**
Note: I/D = Insufficient data to predict reduction effect.		

Advantages

- Can reduce cut-through traffic at specific time-of-day
- Can increase safety at an intersection by prohibiting certain turning movements
- Low cost

Disadvantages

- Restrictions apply to resident and non-residents
- Requires enforcement during time of restriction to be effective
- May divert a traffic problem to another street

TOOLBOX GUIDELINES

This section provides guidance on selecting the most appropriate neighborhood traffic management measure for a specific problem. This involves narrowing the toolbox of neighborhood traffic management measures to those that will: most closely target the key traffic issue, are appropriate for the type of location concerned, and are compatible with the traffic volumes, geometrics, and adjacent land uses near the given location. When the list has been narrowed, devices should be considered that balance effectiveness and likelihood of consensus among affected residents. Finally, the selected devices need to be placed in a manner that will produce the desired results.

Traffic-Related Concern

The first task when selecting the most appropriate neighborhood traffic management device is to narrow the field of devices to those that address the primary traffic concern. The most common traffic-related concerns are:

- Speeding – motor vehicle speeds are too high
- Traffic Volumes – motor vehicle usage levels (all trips or non-local trips only) are too high
- Vehicle Safety – motor vehicle speeds or volumes create an inordinate level of risk

Each device in the toolbox is appropriate to a different subset of the above traffic-related concern. The appropriateness of each device is summarized in Table 2.

Non-Physical Measures **–** The first solutions to consider should be Non-Physical Measures, such as signs and markings, since these can devices increase driver awareness and are relatively inexpensive.

Less Intrusive Measures

Less intrusive measures can be used to address any of the major problem types.

Vertical Measures **–** The use of vertical deflection devices provide the greatest reduction in traffic speeds and consequently have the greatest potential to slow emergency response vehicles, buses, trucks. Therefore the placement of these devices should be carefully considered especially to limit any potential impact on emergency vehicles or transit access.

Narrowing Measures **–** Narrowing devices, such as neckdowns and center island narrowings, are less obtrusive than other devices and can be more aesthetically pleasing if landscaping is used.

Horizontal Measures **–** Horizontal deflection devices, such as chicanes and traffic circles, are more intrusive but also more effective than narrowings because they force vehicles to navigate horizontally around physical objects.

More Aggressive Measures

If less intrusive measures fail to produce desired results, then diversion measures, such as through street closures or forced turns may be considered. These devices redirect traffic to an adjacent street and therefore should be considered after all other measures fail to produce desired results. Volume control measures limit through traffic or turning movements at specific locations for both residents and non-residents. The full effect of the traffic diversion should be investigated prior to implementation of such devices.

Location Type

The appropriate device for a given problem is a function of the location (mid-block or at an intersection). Special consideration should be given when considering measures on streets used as streets of first choice by the Fire Department when responding to emergencies.

Table 3 indicates the location(s) where each type of traffic calming measure is applicable.

Street Classification, Location, and Other Constraints

The third step in determining the most appropriate device is to consider how each device is compatible with the street classification, traffic volumes, posted speeds, and special roadway users. Table 4 illustrates where each device is appropriate under certain constraints.

TABLE 2
APPLICABILITY OF TREATMENTS BY TRAFFIC-RELATED CONCERNS

Types of Measures		Types of Traffic-Related Concerns		
		Speeding	**Traffic Volumes**	**Collisions**
Non-Physical Measures				
	Targeted Speed Enforcement	●	○	◒
	Radar Trailer	●	○	○
	Speed Feedback Sign	●	○	○
	Centerline/Edgeline Lane Striping	●	○	○
	Optical Speed Bars	◒	○	○
	Signage	●	◒	◒
	Speed Legend	●	○	○
	Centerline Botts Dots	○	○	●
Less Intrusive - Vertical Measures				
	Entry Feature	●	◒	○
	Speed Lump	●	●	◒
	Speed Cushion	●	●	◒
	Speed Table	●	◒	◒
	Raised Crosswalk	●	◒	◒
	Rumble Strips	◒	○	○
	Textured Pavement	◒	○	○
Less Intrusive - Narrowing Measures				
	Neckdown/Bulbout	●	◒	○
	Center Island Narrowing	●	◒	◒
Less Intrusive - Horizontal Measures				
	Traffic Circle	●	◒	●
	Roundabout (Single-Lane)	◒	◒	●
	Chicane	●	◒	○
	Lateral Shift	◒	◒	○
	Realigned Intersection	◒	◒	●
More Aggressive Measures				
	Full Closure	●	●	○
	Partial Closure	●	●	○
	Diagonal Diverter	●	●	○
	Median Barrier	○	●	◒
	Forced-Turn Island	○	●	◒
	Turn-Movement Restrictions	○	●	◒

Key: ● = Strongly Appropriate ○ = Inappropriate
◒ = Moderately Appropriate

TABLE 3
APPLICABILITY OF TREATMENTS BY LOCATION TYPE

Types of Measures		Residential Streets		Study Perimeter	Collectors*	Regional Transit Route
		Mid-block	Intersection			
Non-Physical Control Measures						
	Targeted Speed Enforcement	●	●	●	●	●
	Radar Trailer	●	●	●	●	●
	Speed Feedback Sign	●	●	●	●	●
	Centerline/Edgeline Lane Striping	●	×	×	●	●
	Signage	●	●	●	●	●
	Speed Legend	●	●	●	●	●
	Centerline Botts Dots	**On Curves**	×	×	●	●
Less Intrusive - Vertical Measures						
	Entry Feature	×	○	●	○	○
	Speed Lump	●	×	×	○	●
	Speed Cushion	●	×	×	○	●
	Speed Table	●	×	×	○	○
	Raised Crosswalk	●	○	○	○	○
	Rumble Strips	●	●	○	●	●
	Textured Pavement	●	●	●	●	●
Less Intrusive - Narrowing Measures						
	Neckdown/Bulbout	×	●	●	●	●
	Center Island Narrowing	●	●	●	●	●
Less Intrusive - Horizontal Measures						
	Traffic Circle	×	●	○	●	●
	Roundabout (Single-Lane)	×	○	○	●	●
	Chicane	●	×	×	●	●
	Lateral Shift	●	×	×	●	●
	Realigned Intersection	×	**Unsignalized Intersections**	**Unsignalized Intersections**	●	●
More Aggressive Measures						
	Full Closure	×	●	●	×	×
	Partial Closure	×	●	●	●	●
	Diagonal Diverter	×	●	×	×	×
	Median Barrier	×	○	●	×	×
	Forced-Turn Island	×	○	●	○	○
	Turn-Movement Restrictions	×	○	●	○	○

Key: × = Never applicable ○ = Seldom, except in some cases ● = Generally applicable
* Due to emergency response concerns.

TABLE 4
APPLICABILITY OF TREATMENTS BY STREET TYPE

Types of Measures		Street Types		
		Minor Residential	**Primary Residential**	**Collector**
Non-Physical Control Measures				
	Targeted Speed Enforcement	No limitations with respect to ADT or speed		
	Radar Trailer			
	Speed Feedback Sign	No		
	Centerline/Edgeline Lane Striping	No	No	
	Signage			
	Speed Legend			
	Centerline Botts Dots			
Less Intrusive - Vertical Measures				
	Entry Feature	ADT < 3,000; Speed Limit ≤ 30mph		
	Speed Lump			
	Speed Cushion			
	Speed Table	No	ADT < 7,500; Speed Limit ≤ 35 mph	
	Raised Crosswalk[1]	No		
	Rumble Strips[2]	No	No	No
	Textured Pavement[2]	No	No	Yes
Less Intrusive - Narrowing Measures				
	Neckdown/Bulbout	ADT ≤ 20,000; Speed Limit ≤ 35		
	Center Island Narrowing[1]			
Less Intrusive - Horizontal Measures				
	Traffic Circle	Daily Entering Volume < 10,000; Speed Limit ≤ 35 mph		
	Roundabout (Single-Lane)	No	Daily Entering Volume < 16,000; Speed Limit ≤ 45 mph	
	Chicane	No	ADT ≤ 5,000; Speed Limit ≤ 35	
	Lateral Shift	ADT ≤ 20,000; Speed Limit ≤ 35		
	Realigned Intersection	Daily Entering Volume < 5,000; Speed Limit ≤ 35 mph		
More Aggressive Measures				
	Full Closure			No
	Partial Closure	Proper evaluation should be conducted to determine amount of diverted traffic to alternate routes		
	Diagonal Diverter	No		
	Median Barrier			
	Forced-Turn Island			
	Turn-Movement Restrictions			

Notes: [1] Not appropriate for streets without curbs, gutter or sidewalks.
[2] Use of this device should be limited to locations where noise impacts would be minimal.
- ADT – average daily traffic

Effectiveness Comparison

When more than one neighborhood traffic management device is available, it is helpful to understand the levels of effectiveness for each device to better determine which device will have the greatest effect in meeting the specified objective(s). Table 5 summarizes the effectiveness data that has been compiled for each of the neighborhood traffic management measures in the toolbox. These data are averages and the actual effectiveness will vary based on site-specific circumstances, such as proximity to major roads and the availability of alternate routes.

TABLE 5
QUANTITATIVE IMPACTS OF NEIGHBORHOOD TRAFFIC MANAGEMENT MEASURES

Types of Measures		Effectiveness									
		85th Percentile Change				Vehicles Per Day		Average Annual Collisions			
		Before	After	Change	Percent Change	Change	Percent Change	Before	After	Change	Percent Change
Non-Physical Measures											
	All Non-Physical Measures	Limited Effectiveness as stand alone device									
Less Intrusive - Vertical Measures											
	Entry Feature	I/D				I/D		I/D			
	Speed Lump[1]										
	Speed Lump[1]	35.0	27.4	-7.6	-22%	-355	-18%	2.62	2.29	-0.33	-13%
	Speed Cushion[2]	Comparable to speed lump but I/D			-14%	Comparable to speed lump but I/D					
	Speed Table	36.7	30.1	-6.6	-18%	-415	-12%	6.71	3.66	-3.05	-45%
	Raised Crosswalk										
	Rumble Strips	I/D and Limited Effectiveness									
	Textured Pavement	Limited Effectiveness as stand alone device									
Less Intrusive - Narrowing Measures											
	Neckdown/Bulbout	34.9	32.3	-2.6	-7%	-293	-10%	I/D			
	Center Island Narrowing										
Less Intrusive - Horizontal Measures											
	Traffic Circle	34.2	30.3	-3.9	-11%	-293	-5%	2.19	0.64	-1.55	-71%
	Roundabout (Single-Lane)	Insignificant Speed Effects				Insignificant Volume Effects		Not Recorded			-15% to -33%
	Chicane	I/D and Limited Effectiveness									
	Lateral Shift	Ineffective									
	Realigned Intersection	I/D				I/D		I/D			
More Aggressive Measures											
	Full Closure	I/D	I/D	I/D	I/D	-671	-44%	I/D			
	Partial Closure	32.3	26.3	-6.0	-19%	-1,611	-42%	I/D			
	Diagonal Diverter	29.3	27.9	-1.4	-4%	-501	-35%	I/D			
	Median Barrier	I/D				I/D		I/D			
	Forced-Turn Island										
	Turn-Movement Restrictions										

Notes: I/D = Insufficient data
[1] Data for speed hump shown. Insufficient data for speed lumps.
Sources: - *Traffic Calming: State-of-the-Practice*, 1999.
[2] City of Portland, Rubber Speed Bump Research, 1995.

PLACING THE NEIGHBORHOOD TRAFFIC MANAGEMENT MEASURES

Strategies for the specific placement of devices differ depending on whether the concern is speed control, volume control, or safety related. The placement of devices is described below.

Placing Measures for Speed Control

Where feasible, neighborhood traffic management measures should be spaced in such a way that the following two design speeds are achieved:

- **Slow-Point 85th Percentile Design Speed:** the speed that exactly 85 percent of vehicles are going less than, when they are *crossing* a neighborhood traffic management device; the target slow-point speed is defined as 5 mph *below* the posted speed limit;
- **Midpoint 85th Percentile Design Speed:** the speed that exactly 85 percent of vehicles are going less than, when they are *halfway between* a neighborhood traffic management device or other roadway feature that requires significant slowing (i.e. stop sign or curve). The target midpoint speed is defined as 5 mph *above* the posted speed limit.

Figure 1 on the following page provides details how to estimate the midpoint speed.

The spacing of neighborhood traffic management measures directly affects the midpoint speeds: the farther apart they are, the higher the midpoint speed. In general, speed control measures placed 350 to 750 feet from another slow-point can result in speed reductions similar to those indicated in Table 5. Measures placed at intervals of less that 350 feet can become a nuisance to drivers and measures placed greater than 750 feet decrease the ability to slow speeds to the target midpoint speed. In addition, vertical measures should be placed a minimum of 250 feet from an adjacent intersection.

Placing Measures for Volume Control

Neighborhood traffic management devices intended to control traffic volumes can be placed either at entrances to a neighborhood or internally to the neighborhood.

Gateway Measures – More aggressive measures placed at entrances or gateways to the neighborhood can be more immediately effective in reducing volumes because all traffic is made aware even before entering the neighborhood that passing through is not a desirable option, causing them to choose to take other routes. However, these measures can also cause local traffic to take more circuitous paths than internal measures would.

Internal Measures – When placed internal to a neighborhood, measures have a less direct effect on non-local traffic. First-time attempts to cross the neighborhood will occur more frequently, especially soon after the devices are constructed. However, this type of placement can cause less of an inconvenience to local traffic.

Placing Safety Measures

The placement of safety-oriented neighborhood traffic management devices is dependent on the particulars of the traffic-related concern and of the characteristics of the selected neighborhood traffic management device. For example, if the traffic-related concern involves pedestrian safety, then the solution—a raised crosswalk, for example—should be placed at a location where it is likely to be heavily used by pedestrians.

Figure 2
Estimating Midpoint Speeds

In mathematical terms, the relationship between midpoint speed and spacing of slow points is given by an exponential function:

$$85^{th}_{midpoint\ (mph)} = 85^{th}_{slow\ point\ (mph)} + (85^{th}_{street\ (mph)} - 85^{th}_{slow\ point\ (mph)}) * 0.56 * (1 - e^{-0.004\ *\ spacing\ (feet)})$$

where,

$85^{th}_{midpoint}$ = resulting 85th percentile speed at midpoint after treatment;
$85^{th}_{slow\ point}$ = estimated 85th percentile speed at the slow point after treatment;
85^{th}_{street} = 85th percentile speed of street before treatment;
spacing = distance in feet between two devices.

When placing measures for speed control, the above formula should be used to test proposed spacings to determine whether the estimated midpoint speeds would meet the targeted midpoint speed.

Example (speed lumps on street with starting speed of 32 mph):

Where spacing is 350 feet:

$$85^{th}_{midpoint\ (mph)} = 15\ mph + ((32\ mph - 15\ mph) * 0.56 * (1 - e^{-0.004\ *\ \mathbf{350\ feet}}))$$

$$85^{th}_{midpoint\ (mph)} = \underline{22\ mph}$$

Where spacing is 750 feet:

$$85^{th}_{midpoint\ (mph)} = 15\ mph + ((32\ mph - 15\ mph) * 0.56 * (1 - e^{-0.004\ *\ \mathbf{750\ feet}}))$$

$$85^{th}_{midpoint\ (mph)} = \underline{24\ mph}$$

CHAPTER 4. GUIDELINES FOR DEVELOPMENT REVIEW

Proposed developments can benefit from neighborhood traffic management strategies. Traffic concerns related to speeding and traffic volumes can often be anticipated and prevented by reviewing the plans and proposing refinements to reduce or avoid future traffic-related concerns. In addition, traffic management measures incorporated with project construction often receive greater acceptance by residents. Traffic calming measures can also be included as off-site mitigation measures for infill or redevelopment projects that are surrounded by existing developments that may be impacted by project traffic.

This chapter is intended to be a tool for staff (and project designers) to identify when problems may occur and suggested actions to remedy those problems. Anticipating future problems and remedies is a subjective activity, not conducive to absolute standards.

When necessary, staff and the developer's representatives should be able to identify mutually acceptable traffic management features which are then incorporated into the proposed plans. However, in some cases, City staff may need to develop conditions-of-approval that can be discussed, modified, and/or approved by the relevant governing bodies.

Suggested Development Review process

As part of the City of La Habra development review process, City staff may consider the need for traffic management measures within the proposed development or off-site. New development and redevelopment or infill projects may be required to design, build, and maintain traffic calming features as part of the development project through the subdivision improvement agreement, development agreement, and other development-related mechanisms.

The toolbox and application guidelines contained in other sections of this document should provide staff (and developer representatives) with both ideas and guidance on selecting the most appropriate treatments for the identified problem.

DEVELOPMENT REVIEW PRACTICES

During the development review process, staff should review the street network and intersection traffic controls to determine areas of potential speeding, excessive volume on residential streets, or pedestrian conflict areas. Where appropriate, developers should be required to incorporate traffic calming measures into their development plan before submitting their final plans to the City. The process for reviewing plans for developments and prescribing refinements may include the following, at staff discretion:

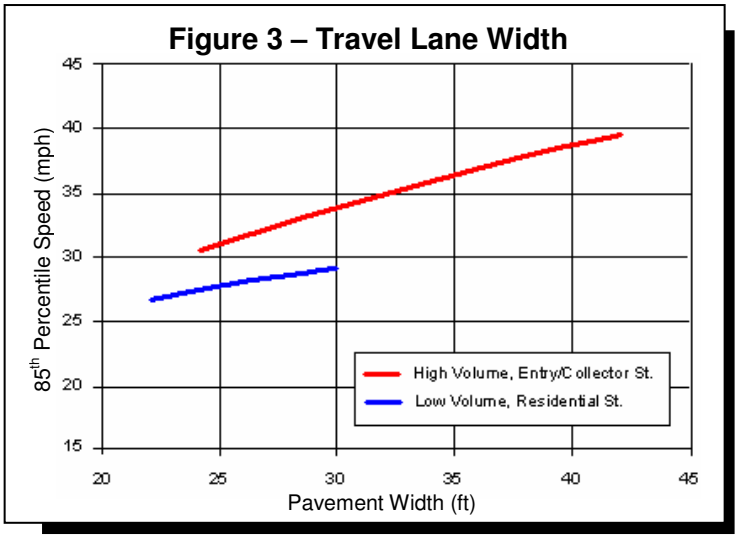
- **Traffic Volumes** – Estimate the average daily traffic (ADT) on residential roadways within and surrounding the proposed project.
    - If traffic volumes on residential streets are projected to be less than 1,500 vehicles per day (vpd), then no action is needed.
    - If the projected traffic volume on a residential street is between 1,500 - 2,500 vpd, then traffic calming treatments should be considered depending upon the context (area history, resident expectations, magnitude of change, etc.).
    - For projected volumes of above 2,500 vpd on a residential street, traffic calming measures should be incorporated to lessen the impact. In addition, driveway treatments that do not require vehicles to back out of driveways, such as loop or hammer head driveways, should also be considered.

- **Traffic Speeds** – Identify potential speeding concerns on adjacent existing streets. Potential problem areas may include:
  - Where there is a distance of greater than 600 feet between traffic control or traffic calming devices, or as determined by staff
  - Where roadway grades may increase the potential for speeding, as determined by staff
  - Potential pedestrian/vehicle conflict areas near schools, parks, community centers, etc.
  - Design attributes that encourage speeding, such as wide travel lane width, absence of on-street parking lane, absence of a bike lane, and long block lengths
- **Street Design** – Street design modifications may be requested by staff if an area is likely to experience cut-through traffic.

Modifying Street Characteristics

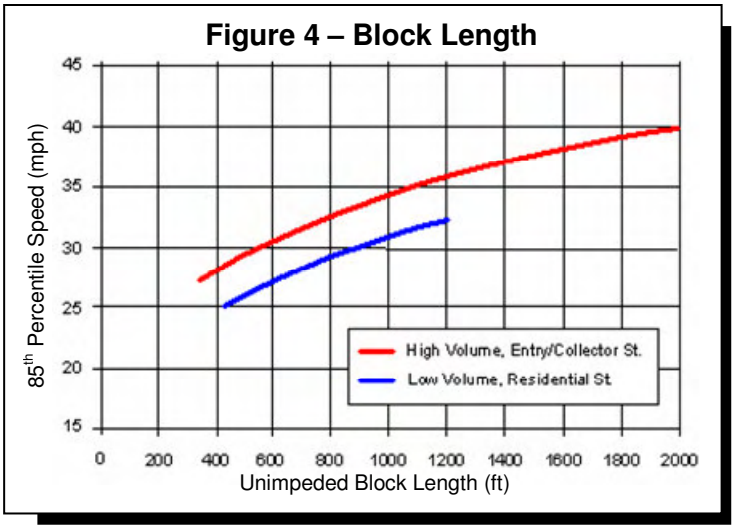
The City of La Habra's street network is already developed and it is cost prohibitive to alter configuration of entire blocks. However, new projects present the City with opportunities to use traffic management strategies to calm project trips associated with the proposed development. The following attributes should be considered when designing and reviewing projects proposing to alter existing street layouts:

- ***Travel Lane Width*** – Where on-street parking demand is anticipated to be low, residential streets should be designed with travel lanes no wider than 10 feet. The Travel Lane Width figure shows the correlation between pavement width and traffic speeds.[1] Wide shoulders should not be included unless they are needed to accommodate demand for parking or are striped as bicycle lanes. If additional width is provided in anticipation of a future need for traffic capacity, then in the short-term this width should be occupied by appropriately spaced chokers, center median islands or other neighborhood traffic management measures.



[1] Ballard, Andrew J. and Haldeman, David M. "Low Speed Design Criteria for Residential Streets." *ITE Journal* December 2002: 44-46

- ***Block Length*** – Some street networks leave excessively long blocks with few side street intersections. Drivers who travel a long distance (600 feet or greater) without being required to slow or stop by traffic control or neighborhood traffic management devices tend to travel at speeds higher than the posted limit. To minimize this effect, the street network can be modified such that street blocks are interrupted by a traffic calming device. The Block Length figure shows the correlation between unimpeded block length and travel speed.



- ***Parking Lanes*** – In circumstances where adjacent land uses generate low on-street parking demand (such as collectors without fronting uses) the street can function as if it were wider than intended. If the parking demand can be accommodated elsewhere, the parking lanes should be eliminated or restricted to one side of the street and the street width reduced accordingly.

Designing for Local Traffic

Some residential collector streets can become cut-through routes, or routes used by non-local motorists as a means of bypassing congested or circuitous arterial roads. In these cases, it may be possible for the proposed project to modify the street layout in such a way as to interrupt the parallel collector route with traffic-controlled intersections. The interruption should be enough that the travel time on the collector is greater than the travel time on the arterial.

Pedestrian/Vehicle Conflict Areas

Some elements of residential areas, such as: schools, parks, community centers, or other high pedestrian generators have particularly high potential for vehicle/pedestrian conflicts. The major pedestrian routes to school should be identified and traffic controls should be structured so that the number of crossings at uncontrolled cross-streets is minimized and pedestrians are directed to the most appropriate crossing locations. For both schools and parks, entrances tend to focus pedestrian street crossings at particular locations. These entrances can be made safer by combining them with roadway intersections, so that the intersection's traffic control can also allocate right-of-way to pedestrians.

If a pedestrian-oriented land use is located in an area where speeding or high traffic volumes are unavoidable, then neighborhood traffic management measures should be selected that accommodate and provide benefit to pedestrians. For example, at an intersection, bulbouts or center island narrowings should be given some preference over other measures, such as speed lumps. While a speed lump may slow traffic in the area, a bulbout or center island narrowing assists pedestrians by creating a shorter crossing distance and physical roadway narrowing thereby reducing driver speed.

Developing a Traffic Management Plan

When a proposed development layout cannot be modified in such a way that will eliminate foreseeable potential traffic problems, a traffic management plan should be developed. The procedure for developing a traffic management plan should be the one described in Chapter 2 – Traffic Calming Program Process.

APPENDIX A. BEST PRACTICES FOR TRAFFIC CALMING

This best practices section provides a discussion of traffic calming in the United States by combining national state-of-the-practice data and our experiences with traffic calming. The information in this section illustrates the current trends in traffic calming, with emphasis placed on traffic calming program structure and implementation.

The first section of this paper provides an in-depth look at the current practices in the United States by presenting findings from our traffic calming survey of leading jurisdictions. This section also revisits topics discussed in *Traffic Calming State-of-the-Practice* (ITE and FHWA, August 1999) and highlights current trends in traffic calming. The second section presents the findings from our traffic calming survey conducted in Southern California. The final section discusses the best approaches to traffic calming, what works and what doesn't work. This later section is based on our experience with numerous traffic calming projects within California.

NATIONAL TRAFFIC CALMING SURVEY AND TRAFFIC CALMING STATE-OF-THE-PRACTICE

This section summarizes a 2004 survey of traffic calming practices of 21 leading jurisdictions, and the results are compared to surveys conducted for a national report almost a decade ago (*Traffic Calming State-of-the-Practice*, ITE and FHWA, August 1999). Some of the most significant changes are: mainstreaming of traffic calming programs within transportation or public works departments; less apparent public controversy surrounding programs; greater reliance on private financing of construction; more public involvement in planning through neighborhood traffic committees; limited expansion of eligibility is some communities to include arterials; and expansion of individual toolboxes to include a greater range of speed control measures.

A recent survey of 21 jurisdictions across the USA was conducted with respect to their traffic calming programs. The surveyed jurisdictions were selected based upon their perceived leadership in the field. The survey was conducted for Sacramento County, as input in updating its traffic calming program. The following table summaries the subjects covered by the survey.

TABLE A-1
TOPICS COVERED BY SURVEY QUESTIONS

Program Structure	Plan Development	Installation Guidelines	Design Guidelines
➢ Department lead	➢ Initiation of Action	➢ Guidelines/Warrants	➢ Maintenance
➢ Year started	➢ Defining the Area	➢ Street Eligibility	➢ Signing/Striping
➢ Staffing	➢ Priority Process	➢ Device Eligibility	➢ Edge Tapers
➢ Staff Background	➢ Public Involvement	➢ Arterial Treatments	➢ Drainage
➢ Program Budget	➢ Voting – when	➢ Emergency Routes	➢ Large Vehicles at Circles
➢ Neighborhood Budget	➢ Voting – area	➢ Urban/Rural Issues	➢ Who Prepared Designs
➢ Resident Funding	➢ Voting – who	➢ New Developments	➢ ADA Issues
➢ Funding Sources	➢ Voting – thresholds	➢ Road User Needs	
➢ Use of Consultants		➢ Temporary Devices	
➢ Controversy/Litigation		➢ Monitoring of Results	
		➢ Removal of Devices	

This paper summarizes the range and commonality of practices followed by these jurisdictions. The commonalities suggest preferred approaches to traffic calming, and the ranges represent distinct choices available to jurisdictions.

In addition to summarizing the practices of the jurisdictions surveyed, this section compares current practices to those documented previously. This survey was the first detailed look at U.S. traffic calming programs since surveys conducted for the August 1997 *ITE Journal*[1] and for *Traffic Calming State-of-the-Practice*[2], a report for the Institute of Transportation Engineers (ITE) and Federal Highway Administration (FHWA). As such, this paper demonstrates how policies and practices have evolved as the field has matured.

Who Was Surveyed

The jurisdictions surveyed were selected from a list of more than 100 jurisdictions known to have traffic calming programs. The selection was based on knowledge acquired from the *Traffic Calming State-of-the-Practice* project, consulting activities of the authors, and review of on-line information. Western jurisdictions were favored in the sample selection.

The 21 surveyed jurisdictions were:

- City of Albuquerque
- City of Austin
- City of Bellevue
- Broward County
- City of Charlotte
- City of Charlottesville
- City of Colorado Springs
- City of Dallas
- City of Eugene
- Gwinnett County
- Howard County
- Los Angeles County
- City of Minneapolis
- Montgomery County
- City of Portland
- Pima County
- City of Riverside
- City of Sacramento
- City of Seattle
- City of Vancouver
- City of Walnut Creek

[1] Ewing, R. and C. Kooshian. "U.S. Experience with Traffic Calming," *ITE Journal*, Vol. 8, No. 7 (August 1997): 28-33.

[2] Ewing, R. *Traffic Calming State-of-the-Practice*. Washington, D.C., USA: Institute of Transportation Engineers/Federal Highway Administration, 1999.

PROGRAMMATIC FINDINGS

Program Staffing

Engineers are the most common professional background in the traffic calming field, while planners are also well-represented. Sometimes persons from both disciplines are involved in the administration of a given program (as in Bellevue, Charlottesville, and Gwinnett County). Beyond the program administration, engineers are clearly involved in the safety and design aspects of all programs.

While the surveys for *Traffic Calming State-of-the-Practice* did not ask comprehensively about staff backgrounds, it is our impression that program administration has shifted somewhat toward engineering backgrounds. If true, this could reflect the mainstreaming of traffic calming within the transportation engineering profession.

Program Budgets

The largest capital budget is Sacramento's at $600k per year. The typical earmarked program has a capital budget between $100k and $250k. Several programs have no set budget, but instead compete for transportation or public works department funds generally or are funded primarily by residents on a demand basis. Several programs operate on shoestrings, including one of the best known, Portland's, with a $50k operating budget and a $30k capital budget. Two programs, Eugene's and Howard County's, have been left unfunded by budget cuts during the recent fiscal crisis.

Seattle's success in competing for local funds was highlighted in *Traffic Calming State-of-the-Practice*. It was attributed both to Seattle's emphasis on, and success in, reducing traffic collisions, and its combination of proactive and reactive approaches to fund allocation.

One big change since *Traffic Calming State-of-the-Practice* is the greater reliance on neighborhood residents to help finance their own traffic calming projects. At that earlier time, many jurisdictions had a bias against any funding mechanism that might be perceived to favor wealthy neighborhoods. Now, perhaps due to local fiscal constraints, about half of the governments surveyed rely partially or fully on private financing: Bellevue (fully for gateway treatments but not other measures); Broward County (fully); Charlottesville (fully in the speed hump program); Minneapolis (fully); Riverside (partially through a matching requirement); Seattle (partially through a matching requirement); and Portland (partially through a matching requirement that varies with need).

Vancouver has proposed a POP (Property Owner Purchased) program. Portland will soon have three matching levels: 25, 50, and 100 percent privately funded. The private contribution can be through an up-front fee or local improvement district. Gwinnett County levies a $12 per year maintenance fee on residents of the plan area through the county property tax. Eugene sometimes requires residents to pay for traffic calming measures, and plans to rely more heavily in the future on local assessment districts. For speed humps, Dallas charges a resident fee which varies according to the pre-treatment roadway speeds.

Controversies and Litigation

Approximately half of the surveyed programs report controversies. Most sound minor and specific to individual plans (as opposed to general and spilling over to the program as a whole). The level of controversy seems diminished compared to that reported in *Traffic Calming State-of-the-Practice*. Portland, for example, had experienced controversy over emergency response and a streamlined approval process. At this time, program personnel report that "up-front public involvement has avoided significant controversy" and that "Fire Bureau concerns were solved in 1998 with new street classification Primary Emergency Response Routes." Up-front public involvement and avoidance of emergency routes are two ways of minimizing controversy. Other reported approaches involve planning for the entire street network (not just individual streets), formalizing program policies (as opposed to more ad hoc treatment), and requiring applicants to work through neighborhood associations.

Most surveyed agencies reported either no litigation or nothing in recent years. Only three lawsuits were reported by the surveyed agencies since publication of *Traffic Calming State-of-the-Practice*. One was settled out of court,

and the other two were decided in the cities' favor. So the earlier conclusion, that a carefully designed and administered program can avoid liability, seems to still hold.

For old cases, see Chapter 6 of *Traffic Calming State-of-the-Practice*. New cases were: in Montgomery County, a person injured on a speed hump received a $10,000 out-of-court settlement; in Portland, a driver claiming injury due to "incomplete speed humps" lost his lawsuit; and in Seattle, the City was not held liable when a boy hit at an intersection where a traffic circle had been requested but not installed. The last two suits, and a threatened suit in Bellevue over the removal of speed tables, illustrate an interesting trend towards litigation for failure to calm traffic rather than the misapplication of traffic calming. The decision to spend money on traffic calming, or to spend money on a particular street, is a discretionary function of government, not a ministerial function. As such, lawsuits over the failure to calm traffic are unlikely to be successful.

In addition to the above lawsuits, only a couple damage claims were reported (vehicles impacting traffic calming devices), and these involved small payouts.

Application in New Developments

Traffic Calming State-of-the-Practice foresaw a shift in emphasis from retrofits to traffic calming within new developments. This shift has occurred only to a limited degree.

Albuquerque, Eugene, Minneapolis, and City of Sacramento make case-by-case recommendations as part of the development review and approval process. None reported opposition from developers. Charlotte and Vancouver are developing formal policies on traffic calming in new developments. Vancouver reports that developers are more receptive to traffic calming than they once were. Howard County already has such a policy in place. Slow points are required at regular intervals between 600 and 1,000 feet. Adopting formal requirements today may be the best way to avoid the need for retrofits in the future.

PROCESS ISSUES

Project Initiation

Traffic Calming State-of-the-Practice predicted a more proactive, staff-driven approach to project initiation in ensuing years. Instead, project initiation has remained largely reactive; projects are initiated mainly through complaints or petitions from residents. Even in Seattle, known for proactively targeting high collision locations, approximately 95 percent of projects are resident-initiated.

Within complaint-driven processes, different threshold levels of neighborhood support are required before any action is taken. Some (Bellevue and Howard County) allow individuals to initiate a needs study with a phone call, written request, or on-line request. Others (Charlotte and Tucson) require petitions signed by a specified number or percentage of residents. Still others (Montgomery County and Vancouver) require the responsible neighborhood association (or city council member where no association exists) to request a study. And a few (Broward County and Minneapolis) first require a petition with signatures, and then concurrence of a neighborhood association. The emphasis on neighborhood associations is a new trend since *Traffic Calming State-of-the-Practice*.

Priorities and Resource Allocation

The great majority of surveyed jurisdictions have adopted rating systems to determine priority among competing traffic calming projects. The reason for doing so is to achieve a degree of objectivity and effectiveness in funding decisions in the face of public demands exceeding the supply of available funds.

In Colorado Springs, priorities are established based on vehicle speeds, cut-through traffic volumes, collisions, proximity to schools, hospitals, or parks, and volumes of pedestrian and bicycle traffic. Charlottesville includes speed, volume, collisions, and proximity to schools in its formula as well (these are most common factors across rating systems) but replaces the remaining factors in the Colorado Springs formula with residential density, street width, and absence of sidewalks.

One interesting variation on a priority rating system is Howard County's street-type priorities. Priority is assigned in the following order: school walking routes, connector or through streets, and cul-de-sacs or isolated networks.

The main alternative to priority-based systems is first come, first served. This is the approach taken in Gwinnett County and Minneapolis. An uncommon alternative is a lottery, used by the City of Sacramento when it first initiated its program (subsequent requests were taken in the order of application).

Public Involvement

In approximately half of the places surveyed, public involvement is limited to passing petitions, voting on plans, or voicing opinions at public hearings. The public reacts to plans, but does not participate in the development of them. It is an up or down, go or no-go, support or oppose decision for the public.

Those agencies that involve citizens in planning use one of two mechanisms: 1) Involvement occurs informally through citizen surveys to solicit ideas, meetings with staff to discuss ideas, or open houses to get comments on a draft plan; or 2) a formal neighborhood traffic calming committee is established to work with staff or consultants on a plan. Since *Traffic Calming State-of-the-Practice*, the latter approach has gained in popularity. Practitioners include Albuquerque, Bellevue, Howard County, Los Angeles, Montgomery County, and the City of Sacramento.

The appropriate type of public involvement may depend on the nature of the treatment. On simple speed hump projects, Portland staff prepares a plan and holds an open house, while residents pass petitions and gather funds. On complex projects, a volunteer committee is formed and staff acts as consultant to the committee regarding policies and technical options.

Public Approval

With three exceptions, all jurisdictions surveyed require a vote (usually by mail) before plans are adopted and implemented. The exceptions, such as Gwinnett County and Riverside, use initial petitions to judge public support for projects, and the projects themselves involve only simple traffic calming devices. Charlotte also relies on petitions at present, but will add a public vote on the final plan as it diversifies its program.

For the jurisdictions with voting requirements, those living in the "affected area" or the "study area" are eligible to vote. The definition of affected area differs by jurisdiction. In some jurisdictions, staff has discretion to draw boundaries subject only to general guidance. In Los Angeles, the affected area includes, but is not limited to, "properties where normal travel routes… are to be altered by the neighborhood traffic management and calming measures, and/or properties that are significantly impacted by traffic that is to be diverted." In other jurisdictions, the affected area is defined by major physical features. In Minneapolis, it consists of all surrounding blocks bounded by through streets or other natural barriers. And in still other jurisdictions, the affected area is defined as the treated street and certain connecting streets. In Montgomery County, it includes all properties that front on the street in question and cul-de-sacs and streets connecting through this street.

Typically, all residents, both property owners and renters, are eligible to vote on traffic calming plans. In about half the surveyed jurisdictions, eligibility extends to business proprietors.

Every jurisdiction has its own plurality requirements for plan approval. Minimum approval rates vary from 30 percent of those voting on temporary measures in Charlottesville, to 100 percent of those voting for permanent measures paid for with special assessments in Broward County. The median approval requirement for jurisdictions surveyed is two-thirds of those voting.

Some jurisdictions also have required response rates for those eligible to vote. Such requirements are imposed to ensure a degree of general public acceptance. Minimum response rates vary from 25 percent for speed control measures in the City of Sacramento to 90 percent for any measure in Los Angeles. For those jurisdictions with such requirements, the median required response rate is 50 percent (not an easy requirement to meet).

Road User Needs (Fire, Ambulance, Waste)

Fire department interests are most often accommodated by allowing them to review and comment on traffic calming plans. This mechanism is used in at least nine of the surveyed jurisdictions. In one jurisdiction, Riverside, the fire department not only reviews and comments but also must approve speed hump installations. Riverside reports that the department usually grants its approval.

Another way in which fire interests are accommodated is in the geometric design of measures (refer to Figure A-1 below). In this survey, only Gwinnett County mentioned selecting a speed table profile based on the needs of fire-rescue. But *Traffic Calming State-of-the-Practice* cites other examples from Portland, Seattle, and elsewhere.

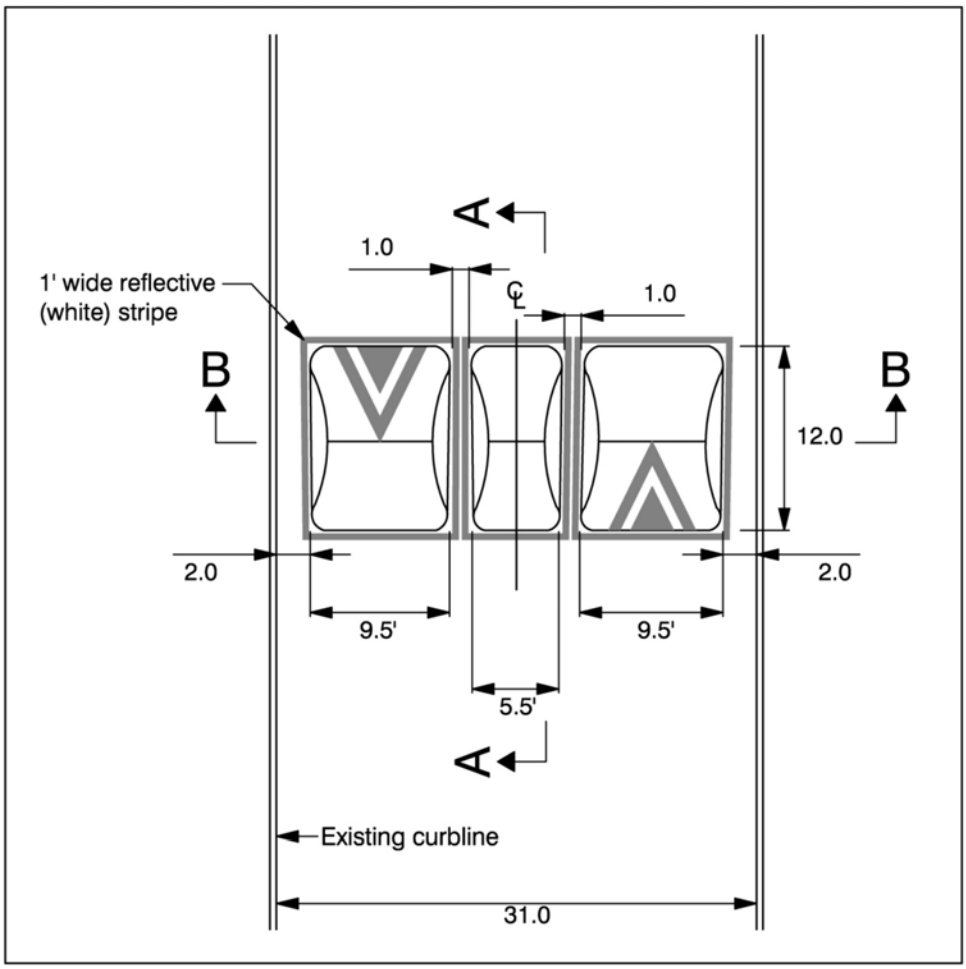
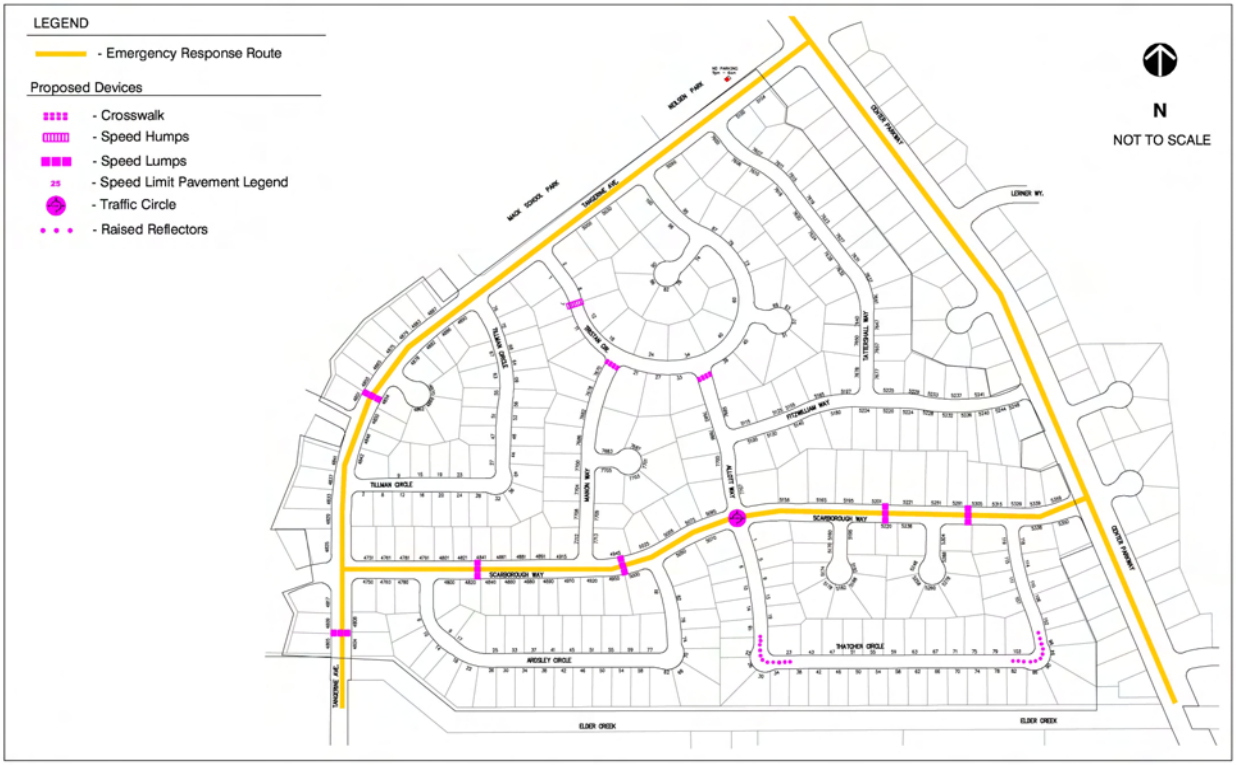


Figure A-1: Geometric design with emergency vehicle clearance

A third way in which fire interests are accommodated is the designation of primary emergency response routes, which are subsequently ineligible for some or all traffic calming measures. Designation of such routes ended the moratorium on traffic calming in Portland. Primary emergency response routes in the City of Sacramento limit the use of vertical devices to speed lumps. Figure A-2 illustrates the primary emergency response routes and proposed traffic calming devices of a local NTMP. Conversely, Vancouver avoids placing traffic calming devices on primary emergency response routes and, in addition, seeks to make street connections that provide alternate routes to fire emergencies.



EMERGENCY RESPONSE ROUTE EXAMPLE - CITY OF SACRAMENTO
FIGURE A-2

Chapter 7 of *Traffic Calming State-of-the-Practice* reports other approaches to reconciling traffic calming and emergency response goals, including the use of experimental measures such as speed cushions and split humps.

Medical emergency responders are accommodated in the same way as fire responders. They are often one and the same, as fire-rescue operations provide emergency medical services and fire engines are often the first on the scene at medical emergencies. Three jurisdictions reported that ambulance services, in particular, are considered secondary to fire services and are given less priority in traffic calming plans.

Waste collection is either not considered at all or accommodated indirectly through planning for fire response. In Portland, the SU-30 design vehicle is used to design traffic calming devices for waste collection, while larger vehicles are used for fire response.

TECHNICAL ISSUES

Street Eligibility

Surveyed jurisdictions vary in the types of streets eligible for traffic calming. Some such as Broward County and Seattle limit traffic calming to local streets. More jurisdictions, including Albuquerque, Montgomery County, and Portland, extend eligibility to collector streets.

Traffic Calming State-of-the-Practice predicted an expansion of U.S. programs to streets higher up the functional hierarchy. To a limited degree, this has occurred. Six surveyed jurisdictions – Bellevue, Charlottesville, Eugene, Howard County, Portland, and Vancouver – indicated that they would consider treating arterials for speed problems. None of these agencies would install vertical measures on a street. The City of Eugene allows for roundabouts, parking bays, raised medians, surface markings, and landscaping. Two surveyed agencies have experimented with signal timing to slow speeds.

Almost half of surveyed jurisdictions limit traffic calming to residential streets. Among them are Albuquerque, Charlotte, Gwinnett County, Los Angeles, and Riverside.

Guidelines/Warrants for Device Eligibility

Over half of the surveyed jurisdictions have warrants or guidelines for installation of different traffic calming measures. Warrants are minimum requirements that must be met before individual measures are installed, while guidelines are advisory and context-sensitive. The national trend has been away from warrants and towards guidelines, with the exception being speed humps, which are typically governed by warrants for historical reasons.

In Seattle, speed humps are warranted only for local streets with 85th percentile speeds of 35 mph or more and traffic volumes of 400 vehicles per day or more. In Riverside, the minimum qualifying 85th percentile speed is 6 mph over the speed limit, and the minimum qualifying traffic volume is 500 vehicles per day. Dallas requires traffic volumes to be less than 6,000 vehicles per day and 85th percentile speeds to be in excess of 35 mph.

Guidelines often address the selection of a device in consideration of several factors: the type of problem, the location (intersection, mid-block, school, etc.) and street type (local, collector, arterial). Bellevue, Charlotte, Minneapolis, Portland, and Vancouver have guidelines for their different measures based upon criteria such as 85th percentile speed and daily traffic volume.

Toolboxes

Two surveyed jurisdictions have small traffic calming toolboxes. While it has experimented with other measures, Gwinnett County has settled on 22-ft speed tables as the tool of choice. Riverside currently uses only speed humps and stop signs.

Many jurisdictions have large toolboxes but limit specific tools to certain street types. Howard County has a large toolbox for local streets but limits major collectors to restriping, roundabouts, chokers, and medians (and then only if enforcement and education have proven ineffective). Vancouver is similar with respect to local streets, but limits arterials to landscaping, high visibility striping, roundabouts, chokers, medians, and photo enforcement. Portland excludes volume control measures such as partial closures from neighborhood collectors. Eugene excludes speed humps and Charlottesville excludes all vertical measures from collectors and arterials.

Most jurisdictions are open to new ideas and experiments but few have identified good candidate devices. Bellevue has a $50,000 annual budget towards the development of new devices. Two respondents reported experimenting with measures that are new to them but were developed decades ago and were in regular use at the time of *Traffic Calming State-of-the-Practice*: Charlottesville has built its first diagonal diverter and Sacramento its first raised crosswalk.

SUMMARY OF PRACTICES

The following table summarizes the findings from the 2004 survey. Since *Traffic Calming State-of-the-Practice*, the field of traffic calming has matured. Some of the most significant changes are: mainstreaming of programs within transportation or public works departments; less apparent public controversy surrounding programs; greater reliance on private financing of construction; more public involvement in planning through neighborhood traffic committees; limited expansion of eligibility beyond local streets to collectors and arterials; and expansion of individual agency toolboxes to include a greater range of speed control measures.

Policies and practices that have not changed significantly since *Traffic Calming State-of-the-Practice* include: relatively small budgets and staffs; minimal litigation and few paid damage claims; preference for in-house planning and design; project initiation largely in reaction to citizen complaints; near universal reliance on petitions and/or balloting to judge public support for projects; accommodation of fire-rescue agencies; use of priority rating systems to allocate scarce resources; and limited innovation in the nature of devices.

TABLE A-2
SUMMARY OF PRACTICES
(BASED UPON SURVEY OF 21 AGENCIES)

Issue	Findings
Program Budget	Program capital budgets range from $30,000 to $600,000 per year. Of the agencies surveyed, approximately 50% are either unfunded or rely exclusively on resident funding.
Resident Funding	Approximately half of the agencies rely on resident's to fund some or all of the construction costs.
Installed with New Development	Approximately half of the agencies incorporate traffic calming devices into new developments. Two agencies have adopted guidelines for traffic calming in new developments.
Public Involvement	All agencies surveyed rely on resident or neighborhood associations to submit petitions requesting treatment. Some agencies would also consider staff or commission appointed petitions. More than half involve the public through a committee or neighborhood association to help develop a plan.
Fire Department Involvement	All of the agencies surveyed involve the Fire Department in the design of the available devices and/or during the plan development process. Some agencies give veto power to the Fire Department, and several agencies have designated primary emergency response routes that preclude certain types of treatments.
Treatment of Arterials	Six of the surveyed agencies consider treating arterials, with limited toolbox of eligible devices. None of these agencies allow the use of vertical devices on arterials.
Priorities	75% of the agencies rely on some form of a quantifiable priority ranking system to determine priorities. Some agencies treat problems in the order petitions are received; while two agencies rely on resident funding and therefore no prioritizing system is needed.
Device Eligibility	A majority of agencies use warrants or guidelines to determine device eligibility, and the remaining eight agencies rely on a staff determination.
Toolbox	All but two of the agencies have comprehensive toolboxes. Almost half of the agencies reject stop signs as a traffic calming devices.

SOUTHERN CALIFORNIA TRAFFIC CALMING SURVEY

In late fall of 2005, we conducted a survey of Southern California jurisdictions that have, or were in the process of implementing, a neighborhood traffic management program. Of the requests for information sent out, we received responses from the following six jurisdictions:

- City of Culver City
- City of Irvine
- County of Ventura
- City of Ventura
- City of Newport Beach
- City of West Hollywood/County of Los Angeles

Several of the jurisdictions that responded currently have a proposed program. All of these jurisdictions have updated their program since its inception. The following sections discuss the results of the survey as they pertain to neighborhood traffic management program structure, plan procedures, installation, and design and maintenance.

Program Structure

The number of full-time employees dedicated to the jurisdictions' programs range from none to three. The City of Irvine has three full-time employees who work in the program with a varying annual capital budget dependent on grant money. Two of the jurisdictions have no annual capital budget allocated to their traffic calming program while Culver City and Newport Beach have less than $100,000 and $50,000, respectively. Additionally, Newport Beach is the only jurisdiction that allows more elaborate devices to be constructed with local neighborhood funding. The City and County of Ventura are the only respondents that require residents to participate in the funding of devices. Additional funding sources identified by the respondents are gas tax, general budget fund allocations, and grants.

The County of Ventura requires residents to fully fund speed humps (the only devices allowed). This method of funding has been problematic and has led to very few installations. The City of Ventura has also experienced a resident's unwillingness to fund improvements. Requiring residents to fund improvements can become problematic, especially when collecting funds from residents who are against the installation of the planned traffic calming devices.

Other controversies with programs include the inability to reach a consensus in a community or powerful groups that have blocked the use of certain devices. Another controversy, affecting the City of Irvine, is the perceived degradation of property values for those locations near a traffic calming device. Despite these controversies, there has been no litigation brought against any of the respondents' programs.

Plan Procedures

For the majority of the respondents, the neighborhood traffic management selection process begins by a residents' complaint. Additionally the majority of the respondents establish priorities between the streets/neighborhoods on a first come first served basis. Of the respondents, only West Hollywood/Los Angeles County use a priority points system.

When a plan is developed to treat a street or area, all of the respondents involve the public in the development of the plan. However, only Culver City and West Hollywood/Los Angeles County use public committees.

In addition to developing the plan, the public is asked to vote on the proposed treatment plan before its adoption for all jurisdictions which responded. The percentages of approval for neighborhood acceptance vary by jurisdiction. Culver City's approval percentages vary within their program from a high of 75% to a low of 50%+1 for plan acceptance. The other respondents' approval rates fell within Culver City's range. Of those that

responded all require a minimum response rate from the surveys/ballots distributed. The minimum response rate required to grant tallying of the votes ranges from a low of 50%+1 to a high of 90%. Both the County of Ventura and Newport Beach require a minimum response rate of 90%.

Environmental review is often needed before implementation of a treatment. A categorical exemption was the type of review used by the respondents.

The governing council (or board) may need to approve each neighborhood treatment plan. In the case of the jurisdictions that responded, 80% always need to gain approval from their council or board while 20% only need to gain approval some of the time.

Installation

The following table summarizes the actions/devices that the respondents have included as part of their traffic calming toolboxes. All the respondents have established guidelines that have limited the use of certain treatments.

TABLE A-3
ACTIONS/DEVICES IN TOOLBOX

Actions/Devices	Percentage of Respondents
Humps	60%
Lumps or Cushions	20%
Other vertical devices	0%
Bulb-outs	60%
Traffic Circles	60%
Roundabouts	40%
Other horizontal devices	20%
Narrowings	60%
Targeted Enforcement	80%
Targeted Education	80%
Other – cul-de-sacs and closures	20%
Other – signing and striping	20%

Four of the jurisdictions surveyed have used stops signs for traffic calming purposes. These instances of stop sign installation have all been politically driven.

Culver City and the City of Ventura construct both lateral and horizontal traffic management devices on dedicated emergency response routes. Installations in the City of Ventura are made only after approval from the fire and police departments, while the fire department holds veto power over any proposed treatment plan. Culver City fire department drives the temporarily installed devices to quantify the impact to emergency responses and formally express their opinions. In Newport Beach, the fire department is provided an opportunity to comment on the proposed treatments. In Ventura County, the fire department is not involved in the neighborhood traffic calming process. However, in both the County of Ventura and Newport Beach traffic management devices are not allowed to be constructed on dedicated emergency response routes.

After the installation of traffic calming devices it can be beneficial to evaluate the effectiveness of the treatment. Three of the respondents conduct evaluations of the constructed devices. During evaluations some of the jurisdictions have permanent devices while some only have temporary devices (Culver City and the City of Ventura install devices for a trial period of 6 months). Sometimes the device is found to not be as affective as anticipated and removal of the device may be necessary. Culver City removes devices if they are found to have

not accomplished their purpose. Newport Beach and Ventura County remove devices (speed humps) if there is neighborhood opposition to them. Ventura County requires residents to pay for the removal of the speed humps. In the City of Ventura the neighborhood votes to make the installation of devices permanent after their trial period has ended (City Council has the final vote).

Of the jurisdictions surveyed only the City of Ventura indicated that they require traffic calming devices be included in new developments.

Design and Maintenance

Traffic calming treatments need to be aesthetically pleasing to neighborhood residents. This often involves landscaping within the devices. Although beneficial, landscaping often becomes a burden and some jurisdictions prefer to have the public maintain landscaping in the devices. Newport Beach and the City of Ventura responded that they require the public to maintain landscaping in traffic calming devices.

Proper signing and striping is necessary to help ensure appropriate maneuvering of the devices. All of the respondents use signing and striping specified in the *Manual on Uniform Traffic Control Devices*. This helps to avoid motorists' confusion by not introducing new signs or roadway striping (i.e., signing and striping will not be specific to the jurisdiction).

Traffic circles can be a useful traffic management device. One of their important design features is turning radius. Often large vehicles (fire trucks, waste removal vehicles, etc.) will be allowed to make a left-turn in front of the traffic circle without having to navigate around the circle. Two of the respondents, Culver City and the City of Ventura, allow large vehicles to make left-turns in front the center island.

Consultants prepare the final designs for Culver City, while Newport Beach prepares its own designs. Ventura County residents must hire their own consultant to prepare the designs.

CALIFORNIA EXPERIENCES

This section presents our opinion on what has worked best with respect to neighborhood traffic management programs and traffic calming projects, particularly within California. Our opinion is based upon our direct experiences in more than 25 communities, our research, and our review of other's work.

Neighborhood traffic management programs differ by jurisdiction. One jurisdiction may work from a full toolbox, while a neighboring jurisdiction's fire department refuses to allow vertical devices. One jurisdiction may include the public in the development of a treatment plan, while the neighboring jurisdiction does not. Since no two locations are the same, the best information comes from knowledge and experience of the methods and fundamentals that are working best regardless of location.

Items/Actions to Include

The following have been found to be most effective in establishing and executing a traffic calming program:

- Establish a program that sets "the rules" before developing plans for a specific neighborhood. The program defines procedures such as: who gets treatments, how devices are selected, how the treatments are funded, how consensus is defined, etc.
- Use a petition process to identify that a significant number of people are concerned about a problem, rather than allowing a single person to cause the agency to devote resources to the issue.
- Develop some type of prioritization process to identify the sequence in which eligible neighborhoods will receive attention.
- Set clear goals/purpose of the treatment plan which can be used as a benchmark to determine the success of the implemented treatment.
- Use public committees in the development of a treatment plan. Include input from non-neighborhood affected residents as well.
- Involve affected agencies (fire department, transit agencies, etc.) throughout plan development.
- Determine general public support with a vote/survey. Include a minimum response rate, but do not set it too high that it is extremely difficult to achieve.
- Prevent proposed plan from continuous altering if approval is not granted after several attempts.
- Establish funding sources. If residents are required to fund devices establish a funding mechanism to help avoid funding disputes.
- Remember that it may be necessary to develop phasing opportunities if full funding of devices is not available.
- Consult affected agencies (fire department, transit agencies, etc.) on final design of treatment. It may even be necessary to have agencies test the proposed devices before finalizing the design.
- Monitor treatments 3-6 months after implementation to determine plan effectiveness and possibly to determine next steps.
- Allow time for final step after plan implementation. Should the treatment be left as-is, should the plan be modified, or should the treatment be removed?

APPENDIX B. ARTERIAL TRAFFIC MANAGEMENT – STRATEGIES TO PROTECT NEIGHBORHOODS

Managing traffic on arterial streets to protect neighborhoods includes two strategies: restricting access to side-streets and maximizing flow on the arterials. Both of these strategies assist in reducing neighborhood cut-through traffic. When congestion on arterials is reduced, there is less of a chance for motorists to use residential routes to bypass the arterials. The two following sections discuss measures that can assist in managing arterial traffic. The first section discusses methods for restricting access from arterials onto neighborhood streets, while the second describes methods for improving arterial street performance.

RESTRICTING SIDE-STREET MOVEMENTS

Residential streets can be attractive alternatives to motorists facing severe congestion on arterials. Normally low volume neighborhood streets can become plagued with cut-through traffic avoiding congestion.

Volume restricting devices use raised islands and curb extensions to preclude particular vehicle movements, such as left-turn or through movements, usually at an intersection. These devices are listed below.

- Full Closure
- Partial Closure
- Diagonal Diverter
- Median Barrier
- Forced-Turn Island
- Turn-Movement Restriction
- Time of Day Restrictions

Many cities use volume control devices only after all other devices have been attempted and failed to resolve the traffic problem. Some cities refuse to use volume restricting devices due to the challenges of limiting roadway access. If used, then volume control measures need to be properly designed to make it difficult to illegally maneuver around the devices.

Time of day restrictions can help limit vehicle movements through neighborhoods. Signage can be placed at intersections indicating which turning movements are prohibited during certain parts of the day. This can also help to alleviate congestion for through traffic on arterials by reducing the number of left-turning vehicles blocking through travel lanes. Unless enforced, time of day restrictions will be violated and will not restrict all vehicles from making the indicated movements. Another method of implementing time of day restrictions is to adjust signal timing plans to prevent or limit certain movements. The green-time of a particular movement used for cut-through traffic can be reduced. This will increase the delay for that movement and hopefully discourage cut-through traffic by making that route less attractive. However, this will also increase the delay for residents of the neighborhood.

Entry features are another method that can alert motorist that they are entering a neighborhood area. Examples of entry features are textured pavement, raised medians, landscaping, and neighborhood signs or facades. Although no substantial data proves entry features reduce vehicle speed or traffic volumes, they can deliver benefits by creating a neighborhood identity.

IMPROVING ARTERIAL STREET PERFORMANCE

The following section describes methods for improving traffic flow and performance of arterial streets. It is important to keep congestion at a level that will discourage motorists from pursuing an alternate (cut-through) route through neighborhoods. The following are several strategies intended to reduce congestion on arterials.

Signal Timings Improvements – should be reviewed, and if necessary, updated to ensure proper timings for the current traffic volumes. Changes in traffic due to new development and background growth in travel patterns

cause the need to optimize signal timings to reduce intersection delay. New hardware may be needed at signalized intersections, such as improved detection systems (i.e. video detection) and controllers (updated signal controller and software).

Advanced Signal System – such as a coordinated system of signals can greatly benefit arterial efficiency by reducing delay along a street or area-wide. Signal timings that vary by time of day (i.e. morning, midday, evening, weekend, etc.) can be used to reduce delays and minimize congestion. Additionally, newer technologies allow systems to immediately adapt and respond to changes in traffic volumes. Although advanced signal controls have great benefits, they can be costly to install.

Minor Geometric Improvements – can result in a significant improvement in traffic flow and reduce congestion. Minor geometric improvements include adding dedicated right-turn lanes, left-turn lanes, or bus turnout bays. These types of improvements can increase traffic flow along an arterial and increase safety.

Traffic Monitoring – helps to decrease the response time of service vehicles and minimize congestion as a result of vehicle breakdowns, accidents, and signal equipment malfunctions. Arterial monitoring involves a network of video cameras at key intersections and roadway segments to detect traffic incidents and deploy service vehicles as early as possible.

Access Management – includes driveway spacing and access consolidation to effectively manage side-street access and reduce delays along the arterial. Multiple driveways require vehicles to slow more often for entering and exiting vehicles. This delay can be reduced by consolidating driveways and constructing deceleration and acceleration lanes to serve inbound and outbound driveway traffic. Additionally, effective spacing of signalized intersections for side streets will minimize delays and improve traffic progression on the arterial street.

While all of the methods discussed above can be beneficial, the following strategies are most appropriate for the City of La Habra.

1) Signal timing improvements are a relatively inexpensive way to decrease delay at intersections. Signal timings should be optimized to the current peak period traffic conditions and can be set to favor through travel on the arterial without impacting access to side street traffic (i.e. businesses, residences, etc.). Signal coordination, where needed, can be of great benefit also.

2) Coordinating signals can be more costly because of the improvements that need to be made to signal controller hardware, software, and communication between a group of traffic signals. To achieve the best results from coordinated signals, detailed operations/simulation analysis should be performed to obtain an optimal signal timing plan for different times of the day.

3) Minor geometric improvements at key intersections, where right-of-way exists, would provide benefits to traffic flow and reduce congestion and delays.

APPENDIX C. DEVICE DESIGN GUIDELINES

This section identifies various physical and engineering design considerations and constraints associated with the neighborhood traffic management measures discussed in the Toolbox. These designs were developed based on recommended designs published in *Traffic Calming State-of-the-Practice*[1], *Canadian Guide to Traffic Calming*[2], and conform to the considerations expressed by the advisory committee.

NON-PHYSICAL DEVICES

Signage

Signage should be provided at or near traffic calming devices advising motorists of the devices. Signage should be visible to both motorists and bicyclists. The signs should be comprised mostly of symbols and easily understandable to motorists. Figure C-1 illustrates examples of several common warning signs.

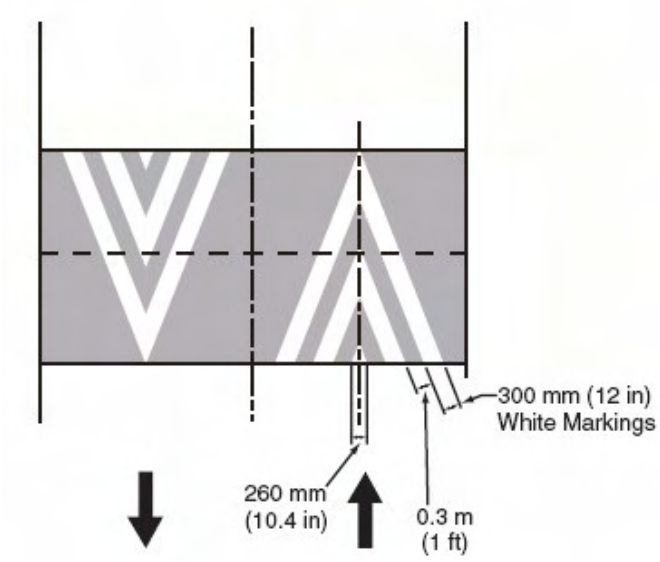
The warning sign for a traffic circle or roundabout shown on Figure C-1 should be the standard used at such intersections in the City. The warning sign is clear and concise, showing drivers the route around and turning options of the upcoming traffic circle or roundabout.

Special signing specific to bicyclists may be used as determined by staff or the neighborhood traffic committee. Examples of this signing include advising motorists not to pass bicyclists through narrow traffic calming devices or informing bicyclists of proper maneuvering of devices. This signage should be used when the travel rights of bicyclists warrant emphasis.

Striping

Pavement markings assist in warning motorists of traffic calming devices in the roadway. Vertical devices should always include pavement markings (on the device). The example image to the right illustrates the preferred striping option for vertical devices, such as speed lumps. This marking option is compliant with the *Manual on Uniform Traffic Control Devices* (FHWA, 2003).

The recommended practice is that no advanced warning markings be placed on the roadway surface adjacent to traffic calming devices. Excessive roadway striping results in increased maintenance for cleaning and restriping.



Example: Recommended striping for vertical devices

[1] Ewing, R. (1999). *Traffic Calming: State-of-the-Practice*. Washington, DC: Institute of Transportation Engineers/Federal Highway Administration

[2] *Canadian Guide to Neighbourhood Traffic Calming,* (1998) Ottawa, Canada: Transportation Association of Canada.

Sign Dimensions	Color Code		
	Background	Message	Border
30" x 30"	Flourescent Yellow or Yellow-Green	Black	Black

SPEED CUSHION

SPEED TABLE

RAISED CROSSWALK

CHICANE

TRAFFIC CIRCLE OR ROUNDABOUT

COMMON WARNING SIGNS

FIGURE C-1

LANDSCAPING

All applicable traffic calming devices should include landscaping. Landscaping includes small shrubs, low-lying vegetation, flowers, and small trees, among others. Landscaping adds an aesthetic benefit to the implementation of traffic calming devices. The image to the right is an example of low-lying shrubs and small tree landscaping in a traffic circle.

Standards should be adopted to ensure that all traffic calming devices in the City are of the same design and landscaping.

Example: Small tree landscaping

LESS INTRUSIVE - VERTICAL DEVICES

Ramp Profiles

Ramp profile describes the angle or approach of the vertical measure that a vehicle would traverse. Vertical measures (e.g. speed lumps) should use ***Sinusoidal*** profiles on the approach and departure ramps to the device. Sinusoidal profiles were selected by the committee during the development of the NTMP as the preferred profile for vertical measures. Figure C-2 shows three commonly used profiles and a description of each follows below.

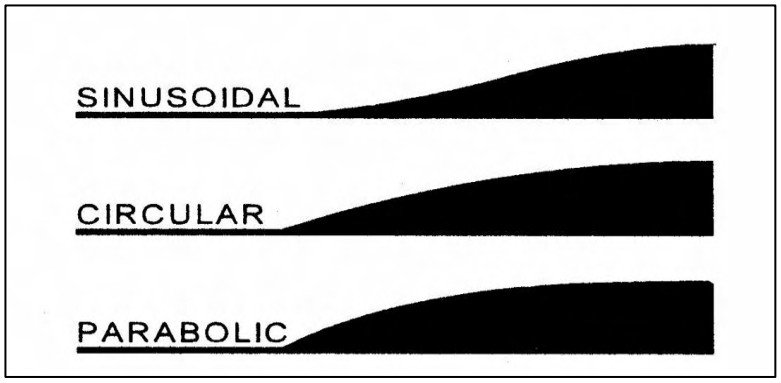


Figure C-2: Ramp profiles of vertical measures

- *Sinusoidal* profiles have slightly less reduction effects on speed than circular and parabolic profiles but higher comfort levels for vehicles and bicyclists and are typically more difficult and expensive to construct due to the slope of the profile.
- *Circular* profiles have moderate reduction effects on speeds (compared to the two other profiles) and comfort levels for vehicles and bicyclists.
- *Parabolic* profiles has the greatest reduction effects on speeds but have the lowest comfort levels for vehicles and bicyclists to the greater rise in the slope of the profile.

Edge Tapers

The edge taper refers to the transition area between a vertical measure at its full height and the edge of the device. Edge tapers on vertical measures (e.g. speed lumps and excluding raised crosswalks) should extend to the edge of the pavement (i.e. not into the gutter) to prevent blocking the gutter drainage.

Edge Tapers – Parking and Bikeways

Vertical devices should extend across any parking or bike lane to prevent drivers from veering into the bike lane. Consequently, bicyclists will traverse the even section (as opposed to the tapered portion) of the device. In addition, vehicles parking on the street will have the option to park on a portion of the device or avoid the device entirely.

Example: Vertical device extending to edge of pavement, through bike lane

Raised Crosswalk Tapers

Raised crosswalks should be designed so that the elevated portion ends at the gutter. This design would not block existing drainage. Adequate distances need to be provided for pedestrians to traverse the downslope from the sidewalk and the upslope to the raised crosswalk

Raised crosswalks are not appropriate where curbs do not exist.

LESS INTRUSIVE - NARROWING DEVICES

Neckdowns/Bulbouts

Narrowing measures, such as neckdowns or bulbouts, should not be constructed wider than the approximate width of a parked vehicle. Extension of these devices any further than the width of a parked vehicle could present potential safety issues to other drivers and bicyclists. As shown in the photo to the right, the neckdown is the same width at the on-street parking stalls.

Example: Neckdown at an intersection

LESS INTRUSIVE - HORIZONTAL DEVICES

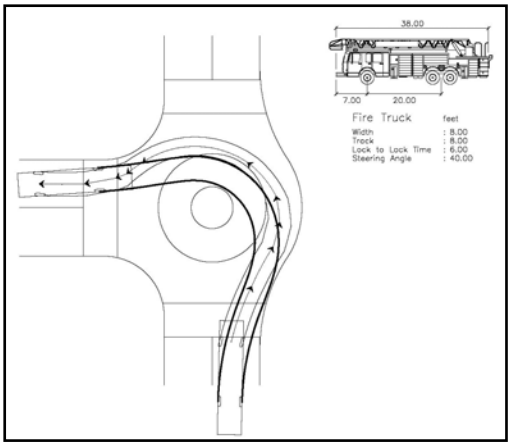
Traffic Circle Center Island Profile

Traffic circles should be designed with both a vertical inner curb and a mountable apron. The vertical inner curb prevents vehicles from driving over the circle. The apron is a shallow-sloped curb extending out from the bottom of a vertical curb; the apron has a low lip at its pavement-side edge. This apron effectively reduces the diameter of the center island for large vehicles, facilitating easier turns. The lip at the apron's edge discourages vehicles from using it unnecessarily.

Example: Vertical inner curb and mountable apron

Traffic Circle Turn Operations

All vehicles should circulate around the center island on left-turns. However, an exception can be made for large trucks and buses, in some cases, if geometric constraints require it. If a specific intersection has a high proportion of large trucks and/or bus traffic, then signage should be included indicating that those vehicles can make a left-turn in front of the circle.



All traffic circles should be designed using Autocad/AutoTurn software or using appropriate truck turning templates as specified in *A Policy on Geometric Design of Highways and Streets* (FHWA, 2001) to identify whether emergency response vehicles and buses can turn left around the circle.

Example: Large truck turning template

APPENDIX D. PRIORITY RATING WORKSHEET

This worksheet will be completed by City of La Habra Department of Public Works staff to identify relative priorities for City Council consideration. This worksheet will be used to prioritize potential initiation of specific neighborhood traffic management projects.

Data may be collected on several different streets in the study area. In these situations the worst-case street will be used for prioritization.

Date: _____

Name of Neighborhood: _____

Study Area: _____

Prepared by: _____

1. **Traffic Speeds**

   1 point for every 85th percentile mph in excess of posted speed limit during a one hour period (10 pts. max) _____

2. **Traffic Volume**

   1 point for every 500 vehicles per day (10 pts. max) _____

3. **Three Year Accident History**

   1 point for every accident per mile (10 pts. max) _____

Total Score (30 pts. possible): _____

Other Considerations

4. **Pedestrian Generators**

   Does a pedestrian generator exist within ¼ mile of the perceived problem? Yes / No
   (pedestrian generators include schools, parks, civic centers, etc.)

5. **Gateway Streets**

   Is the perceived problem located on a street that is a major gateway into the neighborhood/community? Yes / No