

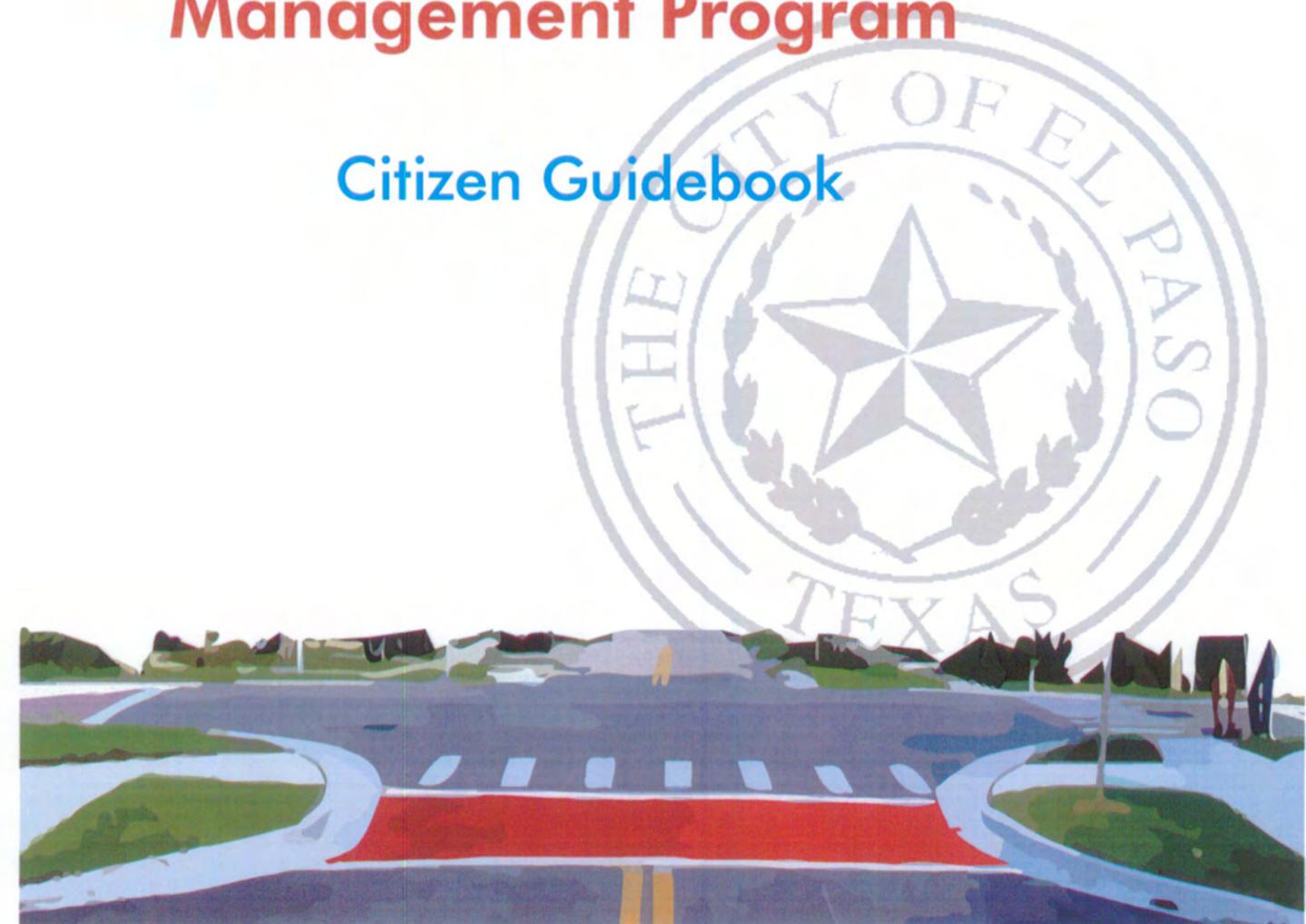
City of El Paso

Neighborhood Traffic Management Program

Citizen Guidebook

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Toolbox of Traffic Calming Measures - Level III

Forced-Turn Island

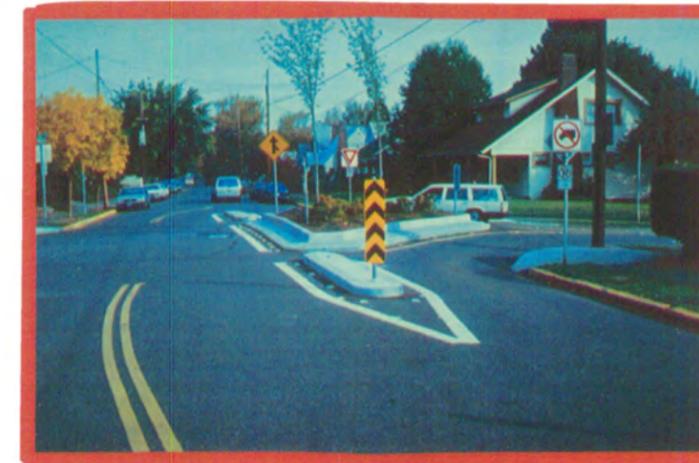
Forced-turn islands are raised islands that block certain movements on approaches to an intersection.

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

Measured Impacts

Volume Impacts – Reduction in vehicles per day = -31%

Source: Traffic Calming: State of the Practice, 2000



Advantages

- Can improve safety at an intersection of a local street and a major street by prohibiting dangerous turning movements
- Reduces traffic volumes

Disadvantages

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



Toolbox of Traffic Calming Measures - Level III

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 Impacts

Volume Impacts – Reduction in vehicles per day = -31%

Source: Traffic Calming: State of the Practice, 2000



Advantages

Can improve safety at an intersection of a local street and a major street by prohibiting dangerous turning 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 for local residents and emergency services

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Introduction

Program Purpose

Create a comprehensive program designed to protect the environment and enhance the quality of life in El Paso neighborhoods through the management and control of traffic on neighborhood streets.

The Neighborhood Traffic Management Program (NTMP) focuses on neighborhood traffic issues, such as cut-through traffic and speeding vehicles on local streets. The information and tools presented in this document will be applicable on most local and collector-level roadways in an effort to reduce traffic speeds and volume while serving multiple uses. Local roadways are defined as streets that provide direct access into residential neighborhoods to connect individual homes to collector and arterial streets. The NTMP outlines a variety of traffic calming measures to improve the quality of life in local residential neighborhoods. The program provides opportunities for residents to work closely with City staff to identify traffic issues and concerns and to determine appropriate solutions.

The objectives for the NTMP are to:

- improve unsafe conditions,
- provide protection and relief from disproportionate increases in traffic,
- provide a program format that is responsive to all neighborhoods, and
- incorporate community preferences into design and operation of neighborhood streets.



Toolbox of Traffic Calming Measures - Level III

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: \$15,000-35,000

Measured Impacts

Speed Impacts – Reduction in 85th percentile speeds between slow points = -4%

Source: Traffic Calming: State of the Practice, 2000



Advantages

- Does not require a closure per se, only a redirection of existing streets
- Able to maintain full pedestrian and bicycle access
- Reduces traffic volumes

Disadvantages

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



Toolbox of Traffic Calming Measures - Level III

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.



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

Advantages

- Able to maintain pedestrian and bicycle access
- Very effective in reducing traffic volumes
- Opportunity for landscaping

Disadvantages

- Requires legal procedures for public street closures
- Causes circuitous routes for local residents and emergency services
- May be expensive
- May limit access to businesses
- Maintenance of landscaping (City vs. residents)

Half Closure

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. That is, half closures are not lined up along a border, which would preclude through movement, but instead are staggered, leaving through movement possible but less attractive than alternative routes.

Approximate Cost: \$6,500

Measured Impacts

- Speed Impacts – Reduction in 85th percentile speeds between slow points = -19%
- Volume Impacts – Reduction in vehicles per day = -42%

Source: Traffic Calming: State of the Practice, 2000



Advantages

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

Disadvantages

- Causes circuitous routes for local residents and emergency services
- May limit access to businesses
- Drivers can circumvent the barrier

Background

Development of El Paso's Program

In 2005, the City implemented a Neighborhood Traffic Management Program (NTMP) to address community concerns over traffic intrusion into residential areas. This program included a preliminary set of guidelines developed internally by City of El Paso staff.



Success of this program was limited, and it was seen as difficult for citizens to use and for staff to implement. In 2007, the City appropriated funds to update the program using the transportation consulting firm of Kimley-Horn and Associates, Inc. With their experience in national best practices of traffic calming and having established neighborhood traffic management programs in communities across the country, the City was prepared to develop a state-of-the-art program.

The process began with an examination of existing conditions and public participation to identify the neighborhood traffic issues. Over six days in November 2007, City of El Paso staff and consultants conducted public meetings in all eight council districts. The meetings were arranged through each respective council representatives' staff and held in central locations open to the public. Accommodations were made for persons with disabilities. Materials were made available in Spanish, and Spanish-language translators were available. More than 100 citizens attended the meetings and gave valuable insight into the existing neighborhood traffic issues.

A final public meeting was conducted on January 18, 2008. The meeting introduced the program parameters and asked for participants input on how to fund the program and what projects should be prioritized first. The over 100 attendees were afforded time to ask questions of consultants and staff and complete a questionnaire. The response of the public was enthusiastic.



Background

Input from the public meetings helped to define the neighborhood traffic conditions in El Paso:

Cut-Through Traffic

Cut-through traffic has neither its origin nor destination within a neighborhood, but rather is passing through a neighborhood on local streets.

Speeding

Many motorists (neighborhood residents as well as “cut-throughs”) drive too fast on local streets. While some speeding is done by irresponsible drivers, the majority is done by normally responsible drivers who find themselves “invited” to speed by the road’s design features, such as excessively wide pavement, straight sections of road, and absence of vegetation.

Security

Excessive traffic speeds are a threat to neighborhood security and cause residents to retreat into their homes, essentially abandoning the street to vehicles.

Aesthetics

Wide expanses of pavement devoted solely to the movement of traffic and storm water dominate the landscape in El Paso.

Other Issues

Parking, arterial street access and performance; design of school zones; and transit stop locations were also recognized as isolated issues specific to some El Paso neighborhoods.



Toolbox of Traffic Calming Measures - Level II, III

Chicane

Chicanes are curb extensions that alternate from one side of the street to the other, forming S-shaped curves. Chicanes can also be created by alternating on-street parking, either diagonal or parallel, between one side of the road and the other. Each parking bay can be created either by restriping the roadway or by installing raised landscaped islands at each end, creating a protected parking area.

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

Measured Impacts

Speed Impacts – Reduction in 85th percentile speeds between slow points = I/D

Volume Impacts – Reduction in vehicles per day = I/D

Safety Impacts – Reduction in average annual number of collisions = I/D

Notes: I/D = Insufficient Data

Source: Traffic Calming: State of the Practice, 2000



Advantages

- Discourages high speeds by forcing horizontal deflection
- Easily negotiable by large vehicles (such as fire trucks) except under heavy traffic conditions
- Provides opportunity for landscaping and street furniture

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
- Potential loss of on-street parking
- Maintenance of landscaping (City vs. residents)

Toolbox of Traffic Calming Measures - Level II, III

Lateral Shift

Lateral shifts are curb extensions on otherwise straight streets that cause travel lanes to bend one way and then bend back the other way to the original direction of 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 by size of offset and length of transition



Advantages

- Can accommodate higher traffic volumes than many other traffic calming measures
- Easily negotiable by large vehicles (such as fire trucks)
- Opportunity for landscaping and street furniture

Disadvantages

- Potential loss of on-street parking
- Must be designed carefully to discourage drivers from deviating out of the appropriate lane
- Maintenance of Landscaping

Neighborhood Traffic Management Elements

The problems of cut-through traffic, speeding, security, and aesthetics can be addressed in El Paso with a NTMP that utilizes the three "E's" — Education, Enforcement, and Engineering.

Education

Neighborhood traffic management studies have shown that often the residents themselves contribute to the perceived speeding problem within the neighborhood. The most effective NTMPs begin with residents education about the need to obey speed limits and yield to pedestrians. Engineering measures alone will not produce satisfactory results.



Enforcement

Intensified enforcement of traffic regulations can calm traffic, generally by reminding drivers of posted speed limits and enforcing the observance of stop signs. Police officers are the usual source of intensified enforcement, but neighborhood volunteers can also prove effective in this area.



Engineering

Engineering solutions physically modify the roadway in some manner to encourage drivers to alter their behavior by reducing speed, raising awareness of pedestrians and bicyclists, or diverting traffic to a more appropriate street. These engineering solutions, typically called traffic calming, are often intended to be "self-enforcing" and are performed after education and enforcement activities.



Traffic Calming Defined

Traffic calming involves changes in street alignment, installation of barriers, and other physical measures to reduce traffic speeds and/or cut-through volumes, in the interest of street safety, livability and other public purposes. Traffic calming measures can be separated into two groups based on the main impact intended.

Non-physical measures include education and enforcement initiatives. They also include engineering measures that are relatively low in cost and simple in their implementation. These engineering measures could be signing, striping, curb marking, changes in signal timing, and improvement in street lighting.

Physical measures physically modify the roadway to address cut-through traffic problems by blocking certain movements, thereby diverting traffic to streets better able to handle it. Physical measures also address speeding problems by changing vertical or horizontal alignment, or narrowing the roadway.

Neighborhood Traffic Management Participants / Stakeholders

The NTMP is designed to enhance communication and understanding between the City and its residents.

Citizen Involvement

1. Identify need for NTMP
2. Attend and participate in NTMP public meetings
3. Participate in NTMP education activities
4. Encourage neighbors to participate in NTMP initiatives
5. Vote or petition for sound NTMP solutions
6. Support bond referendums that include NTMP funding

El Paso City Staff

1. Review and respond to NTMP requests
2. Conduct appropriate traffic and warrant studies
3. Recommend appropriate traffic calming options to the City Council and Citizens
4. Maintain NTMP log sheet
5. Initiate implementation of approved traffic calming measures
6. Provide program status reports
7. Provide a process for citizen feedback

El Paso City Council

1. Review and approve the Policies and Procedures for the NTMP
2. Review and approve complex or controversial NTMP recommendations
3. Provide an appeal process for denied NTMP requests
4. Allocate resources and funding guidance
5. Approve annual NTMP budget

Street Eligibility

The NTMP and its associated traffic calming measures can be applied to any local or collector level street. The next section explains further what streets and traffic calming tools are applicable.

Toolbox of Traffic Calming Measures - Level II, III

Roundabout

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 rights-of-way among competing movements. They are found primarily on arterial and collector streets, often substituting for traffic signals or all-way stop signs. They are larger than neighborhood traffic circles and typically have raised splitter islands to channel approaching traffic to the right.

Approximate Cost: \$100,000-\$200,000 for retrofits; \$100,000 for a single lane and \$150,000 for two lanes in new developments

Measured Impacts

Speed Impacts – Reduction in 85th percentile speeds between slow points = I/D

Volume Impacts – Reduction in vehicles per day = I/D

Safety Impacts – Reduction in average annual number of collisions = -15% to 33%

Notes: I/D = Insufficient Data

Source: Traffic Calming: State of the Practice, 2000



Advantages

- Moderates traffic speed on an arterial
- Enhanced safety compared to a traffic signal
- Minimizes queuing at approaches to the intersection
- Less expensive to operate than traffic signals
- Provides opportunity for landscaping and street furniture

Disadvantages

- May require major reconstruction of an existing intersection
- Loss of on-street parking
- Increases pedestrian distance from one crosswalk to the next
- Difficult for visually impaired pedestrian to navigate
- Maintenance of landscaping (City vs. residents)



Toolbox of Traffic Calming Measures - Level II, III

Traffic Circle

Traffic circles are raised islands, placed in intersections, around which traffic circulates. They are usually circular in shape and landscaped in their center islands, though not always. Traffic controls at the approaches vary by location. Circles prevent drivers from speeding through intersections by impeding the straight-through movement and forcing drivers to slow down to yield. Drivers must first turn to the right, then to the left as they pass the circle, and then back to the right again after clearing the circle.

Approximate Cost: \$10,000

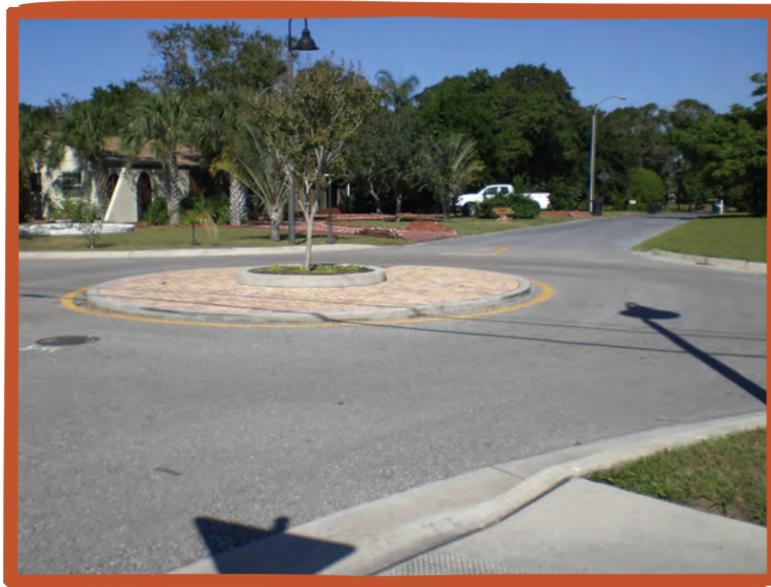
Measured Impacts

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, 2000



Advantages

- If designed well, can have positive aesthetic value
- Very effective in moderating speeds and improving safety
- Opportunity for landscaping

Disadvantages

- Difficult for large vehicles (such as fire trucks) to circumnavigate
- Must be designed so that the circulating lane does not encroach on crosswalks
- Potential loss of on-street parking
- Maintenance of landscaping (City vs. residents)

Neighborhood Traffic Management Program and the Transportation Network

Local and collector streets are eligible for NTMP. Roadway functions are explained below for your information.

The design of a street is usually determined by the different demands that each transportation mode requires. Within El Paso, each street is specifically classified to accommodate certain traffic volumes and speeds in conjunction with the principle uses. Street classifications define the function of each street and the standard to which it should be designed and used. Many factors determine a street's classification, including travel demand, right-of-way, required street width, maintenance costs, access needs, safety, preservation of property, adjacent land uses, and connections to the greater transportation network.

Basically, there are four functional classifications for the streets and roadways in El Paso:

Local Streets

The function of local streets in the City's transportation network is to provide direct access into residential neighborhoods and to provide travel within neighborhoods. The usual speed limit for local streets is 30 mph, as set by Texas State Law. Much of the emphasis of the NTMP will apply to the local streets. However, all recommended mitigation measures will be evaluated for their consistency with standard traffic engineering, safety standards and practices on a case-by-case basis. Some recommendations may not be acceptable.

Collector Streets

The function of collector streets is to carry traffic between local streets and arterial streets. Collector streets are designed to carry higher volumes of traffic, serve greater uses, and accommodate higher vehicle speeds. El Paso's collector streets can carry up to 15,000 ADT (Average Daily Traffic). Speeds on collector streets can vary from 30 mph to 40 mph. Because of their vital role as traffic connectors in the City's transportation network, many of the measures in the NTMP Toolkit will not be applicable to collector streets.

Arterial Streets

The function of arterial streets and roadways is to carry larger volumes of traffic at relatively higher speeds, with minimal delay. Most collector streets connect with arterial roadways, as they direct traffic through the network. Arterial streets in El Paso carry up to 50,000 ADT and are crucial to circulation throughout the City. Speed limits on arterial roadways in El Paso are typically set between 35 mph and 45 mph. Arterial streets are generally not suitable for NTMP applications.

Freeways and Interchanges

The function of freeways and interchanges is to connect El Paso's transportation network to the greater regional transportation system. Freeways and interchanges are maintained by TxDOT and are unavailable for NTMP measures.

Neighborhood Traffic Management Program and the Transportation Network

Modifications to speed limits and the addition of stop signs or traffic signals are not available through the NTMP. The warrants for these devices are explained below.

Speed Limits

Speed limits for collector and arterial roadways are established based upon recognized engineering criteria related to roadway design. Some of the criteria includes:

- Street width
- Lane width
- Sight distance
- The 85th percentile speed (critical speed)

By State statute, local streets, as defined by the vehicle code, have a 30 mph speed limit. Close proximity to sources of pedestrian usage such as schools and parks may be cause for a lower speed limit.



Stop Signs

The City of El Paso does not install stop signs as part of the NTMP. The federal *Manual on Uniform Traffic Control Devices (MUTCD)* which is the recognized authority, states that "Stop Signs shall not be used for speed control." It has been the City's experience that unwarranted stop signs do not make effective traffic calming devices for the following reasons:

- Drivers generally tend to make up the time lost at an unwarranted stop sign by speeding up between signs.
- Stop signs also increase the noise and pollution level in a neighborhood from cars decelerating to stop, then accelerating.
- Drivers tend to run unwarranted stop signs once they notice no traffic in the opposing directions.

Stop signs are installed at locations where right-of-way assignment is required due to a large number of vehicles entering the intersection from all directions.

The following is a procedural list for stop sign traffic control:

1. Residents request for right-of-way management.
2. Analysis is performed, which includes traffic volume counts, pedestrian volume, accident history, sight distance, and on-site observations.
3. If the intersection meets necessary requirements (warrants), then stop sign traffic control is usually recommended.
4. Recommendations for the installation of stop signs at unwarranted locations would need to be forwarded to the to City Council for final approval.



Toolbox of Traffic Calming Measures - Level II, III

Two-Lane Choker

Chokers are curb extensions at mid-block that narrow a street by widening the sidewalk or planting strip. If marked as crosswalks, they are also called safe crosses.

Chokers leave the street cross section with two lanes that are narrower than the normal cross section.

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

Measured Impacts

Speed Impacts – Reduction in 85th percentile speeds between slow points = -7%

Volume Impacts – Reduction in vehicles per day = -10%

Source: *Traffic Calming: State of the Practice, 2000*



Advantages

- Easily negotiable by large vehicles (such as fire trucks)
- If designed well, can have positive aesthetic value
- Reduces both speeds and volumes
- Opportunity for landscaping

Disadvantages

- Effect on vehicle speeds is limited by the absence of any horizontal deflection
- May require bicyclists to briefly merge with vehicular traffic
- Potential loss of on-street parking
- Maintenance of landscaping (City vs. residents)

Center Island Narrowing/Pedestrian Refuge Island

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

Approximate Cost: \$6,000-9,000

Measured Impacts

Speed Impacts – Reduction in 85th percentile speeds between slow points = -7%

Volume Impacts – Reduction in vehicles per day = -10%

Source: *Traffic Calming: State of the Practice, 2000*



Advantages

- Increases pedestrian safety
- If designed well, can have positive aesthetic value
- Reduces traffic volumes
- Opportunity for landscaping

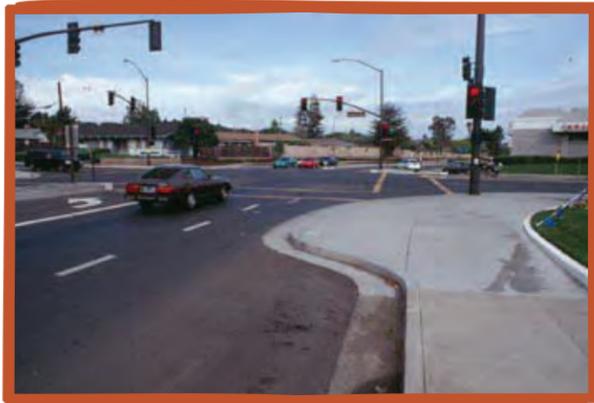
Disadvantages

- Effect on vehicle speeds is limited by the absence of any vertical or horizontal deflection
- Potential loss of on-street parking
- Maintenance of landscaping (City vs. residents)

Toolbox of Traffic Calming Measures - Level II, III

Bulbouts

Bulbouts (neckdowns, intersection narrowings, safe crosses, etc.) are curb extensions that reduce roadway width curb to curb at either midblock or intersection locations. Midblock treatments narrow the travel lane but do not provide additional sidewalk width. Intersection treatments reduce vehicle travel speeds by tightening curb radii and improve pedestrian safety by shortening crossing distance.



Intersection treatments can be retrofit into an existing intersection without modifying the existing drainage, or they can be designed to provide additional sidewalk width for increased pedestrian use or street furniture. The effects are increased pedestrian comfort and safety at the intersection.

Approximate Cost: \$2,000-5,000 for four corners (without drainage modifications) or \$25,000 per corner with full drainage modifications

Measured Impacts

Speed Impacts – Reduction in 85th percentile speeds between slow points = -7%
Volume Impacts – Reduction in vehicles per day

Source: Traffic Calming: State of the Practice, 2000

Advantages

- Improves pedestrian circulation and standing space on sidewalk area
- 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
- Provides opportunity for landscaping and street furniture

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

Eligible But Not Preferred

Speed Hump

Speed humps and tables are not practical mitigation measures on all streets and roadways. Generally, speed humps and tables are designed for local neighborhood roadways with specific traffic volumes, vehicle speeds and residential frontages.

Speed humps are wave-shaped paved humps in the street. The height of the speed hump determines how fast it can be navigated without causing discomfort to the driver. Discomfort increases as the speed over the hump increases.

Approximate Cost: \$2,000

Measured Impacts

Speed Impacts – Reduction in 85th percentile speeds between slow points = -22%
Volume Impacts – Reduction in vehicles per day = -18%

Source: Traffic Calming: State of the Practice, 2000



Advantages

Slows traffic immediately.
Self-enforcing.

Disadvantages

Greatly increases response time for emergency vehicles.
Motorists tend to speed up between humps.
Increases noise and pollution in neighborhood.

Speed Table

Speed tables are flat-topped speed humps often constructed with brick or other textured materials on the flat section. Speed tables are typically long enough for the entire wheelbase of a passenger car to rest on the flat section. Their long flat fields give speed tables higher design speeds than Speed Humps. The brick or other textured materials improve the appearance of speed tables, draw attention to them, and may enhance safety and speed-reduction.

Speed tables are good for locations where low speeds are desired but a somewhat smooth ride is needed for larger vehicles.

Approximate Cost: \$2,500

Measured Impacts

Speed Impacts – Reduction in 85th percentile speeds between slow points = -18%
Volume Impacts – Reduction in vehicles per day = -12%

Source: Traffic Calming: State of the Practice, 2000



Advantages

They are smoother on large vehicles (such as fire trucks) than Speed Humps
They are effective in reducing speeds, though not to the extent of Speed Humps

Disadvantages

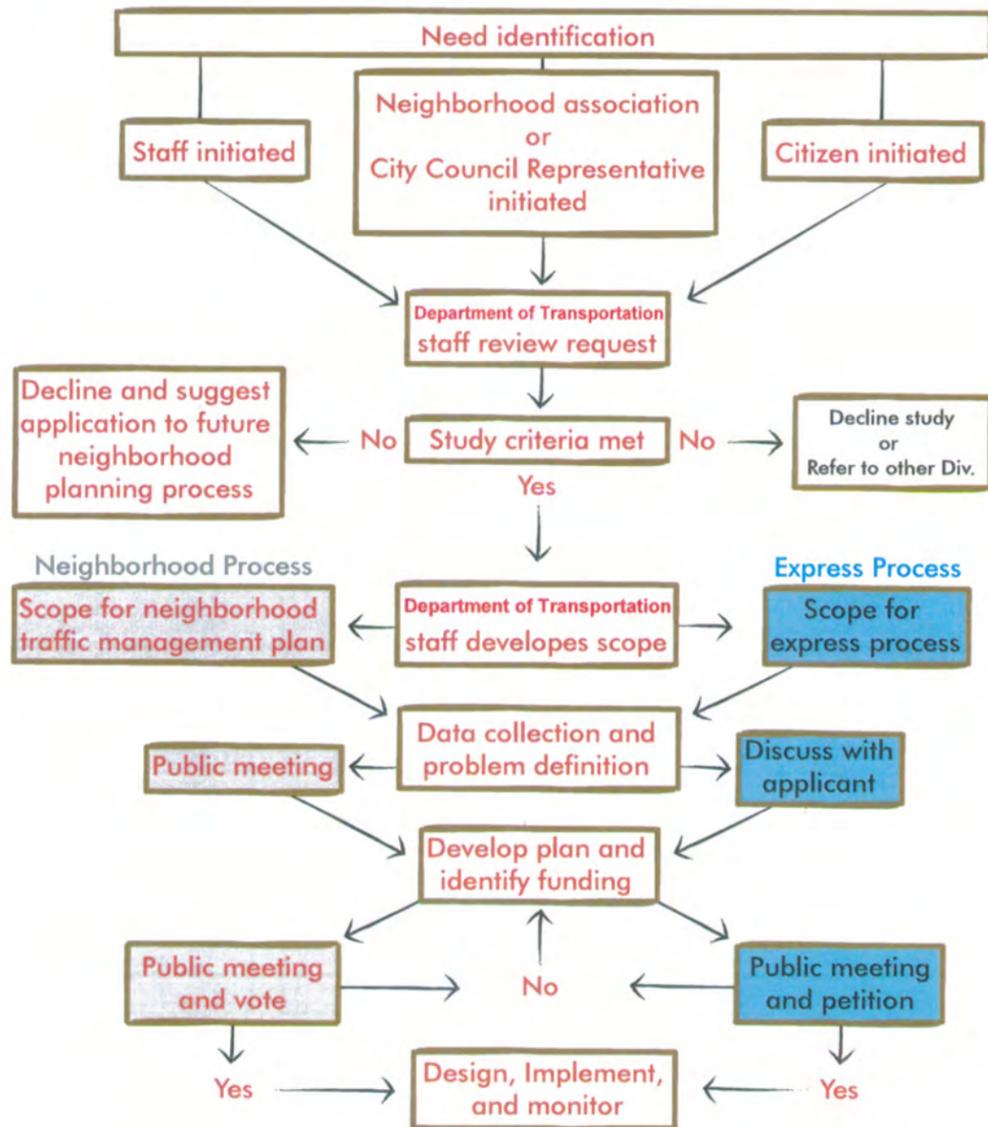
They have questionable aesthetics, if no textured materials are used;
Textured materials, if used, can be expensive; and
They may increase noise and air pollution.

Neighborhood Traffic Management Program Options

Will traffic calming work in my neighborhood?

The NTMP is a three-level program with two options for implementing the program. The "express" process is available to address dangerous traffic situations that need immediate attention. This process requires less citizen participation, therefore less time to implement, but results may not be in keeping with neighborhood values and desires. The "neighborhood" process is a comprehensive approach to solving traffic issues at a scale larger than a single street. Typically, this process will study an area of less than a square mile and will require extensive citizen participation in devising solutions to traffic issues.

Most NTMP requests will begin with the "express" process. The "neighborhood" process can be requested, or staff may recommend it based upon the complexity of the issues defined and the time frame needed to resolve them. The chart below describes the general flow of a NTMP request.



Toolbox of Traffic Calming Measures - Level I, II, III

High Visibility Cross Walk

Using special pavement marking patterns and raised reflectors increases the visibility of a crosswalk. The "triple four" marking pattern is an effective manner to increase the visibility of a crosswalk with typical painting materials. The unpainted space along the center of the crosswalk allows pedestrians and those in wheelchairs to cross in the rain without the sliding problems found on typical crosswalks that engross the entire crossing area.

Approximate Cost: \$2,000



- Advantages**
- Inexpensive
 - Does not slow buses and emergency vehicles
- Disadvantages**
- Effectiveness diminishes after repeated use

Angled Parking

Angled parking reorients on-street parking spaces to a 45-degree angle, increasing the number of parking spaces and reducing the width of the roadway available for travel lanes. Angled parking is also easier for vehicles to maneuver into and out of than parallel parking. Consequently, it works well in locations with high parking demand, such as multi family, commercial, and mixed-use areas.

Approximate Cost: \$250- \$300 per stall



- Advantages**
- Reduces speeds by narrowing the travel lanes
 - Increases the number of parking spaces
 - Makes parking maneuvers easier and takes less time than with parallel parking
 - Favored by businesses and multi family residences
- Disadvantages**
- Precludes the use of bike lanes (unless roadway is wider than 58 feet)
 - Ineffective on streets with frequent driveways
 - May be incompatible with one-way streets approaching a two-way segment

Toolbox of Traffic Calming Measures - Level I, II, III

Raised Pavement Markers

Raised reflectors lining the centerline and/or edgeline of a roadway add a visual cue to the driver to not deviate outside of the proper lane. Raised reflectors also improve the nighttime visibility of roadways.

Raised pavement markers can also be arranged in a rectangular array across the roadway, creating a rumble strip. These can be effective in reducing travel speeds but also increase roadway noise considerably. Consequently, rumble strips are only recommended for placement in very low density areas.

Approximate Cost: \$4.50 per marker



Advantages

- Inexpensive
- Does not slow trucks, buses, and emergency vehicles
- Queues drivers to respect lanes on curves and under low visibility conditions

Disadvantages

- Increased noise
- Increased maintenance

Delineator

Much like raised pavement markers, delineators may be used to further define a centerline and/or edgeline of a roadway. Moreover, delineators add a vertical element to the roadway. Delineators can also be used with physical measures found in Level II to further improve their traffic calming effectiveness.

Approximate Cost: \$45 per Delineator



Advantages

- Inexpensive
- Reduction in 85th percentile speed
- Does not slow buses and emergency vehicles
- Does not require time for design

Disadvantages

- Increase maintenance
- Decreased aesthetics

Toolbox of Traffic Calming Measures

The NTMP is a three-level program. Level I focuses on informing and educating residents regarding traffic calming features and providing the neighborhood with tools for resolution and documentation of traffic problems. Level I measures should be thoroughly explored and implemented before implementing Level II. If the traffic issue still exists after the first level then more restrictive physical devices can be considered for recommendation and implementation. Level II addresses problems that require permanent and more costly traffic control solutions. Level III includes all measures in Level I and II and adds additional street closure measures. Level III is only available to the "neighborhood" process.

Level I "Express" Non-Physical Measures

Purpose

Response to individual complaints or other's observations

Request process

Individual, no petition needed

Study

Visual inspection during peak time. Traffic counts if needed.

Implementation and Monitoring

Measures can be implemented using permanent or temporary traffic calming measures. If temporary measures are selected, they should be installed and monitored for a period of three to six months.

Project prioritization

First-come, first-serve basis typically completed in 1 to 6 months.

Level II "Express" Physical Measures

Purpose

Response to individual complaints, block or street-long complaints, or other's observations

Request process

Petition of two-thirds of households on street

Study

Speed and volume traffic counts and visual inspection

Implementation and Monitoring

Measures can be implemented using permanent or temporary traffic calming measures. If temporary measures are selected, they should be installed and monitored for a period of three to six months.

Project prioritization

Request are prioritized twice per year based-upon the adjacent project selection criteria. Applicants will be provided a date for which they will be informed of their project ranking.

Toolbox of Traffic Calming Measures

Level III "Neighborhood" Traffic Management Plan

Purpose

A comprehensive approach to neighborhood traffic management

Request process

Neighborhood Association Petition or Council Representative Commitment

Study

Speed and volume traffic counts, visual inspection, simulations, and photo morphing.

Implementation and Monitoring

Measures must be implemented using permanent traffic calming measures. Monitoring should be done within three to six months of installation.

Project prioritization

On an annual basis a call for projects will be announced to the community. The call for projects will have a sixty-day filing period to provide an equal opportunity for all interested residents to submit their completed form. At the close of the filing period, a selection criteria will determine the order of applicants. the Department of Transportation will continuously accept NTMP Request Forms after the initial filing period, but will not rank them until the following year.



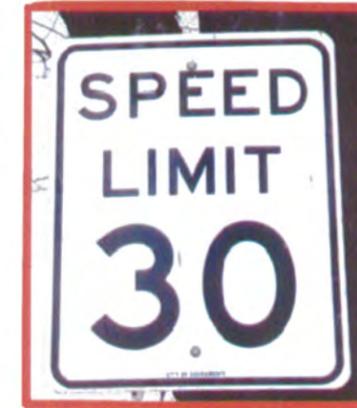
Toolbox of Traffic Calming Measures - Level I, II, III

Signage

Signage can be an effective tool for advising drivers of

- speed limits,
- truck restrictions, and
- cross traffic that does not stop.

Approximate Cost: \$200 per sign



Advantages

- Inexpensive
- Does not require time for design
- Turn restrictions can reduce cut-through traffic
- Does not significantly slow emergency vehicles

Disadvantages

- Speed limit signs are ineffective if unaccompanied by increased police enforcement
- If speed limit is set unreasonably low, drivers are more likely to exceed it

Speed Legends

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.



Advantages

- Inexpensive
- Helps reinforce a change in speed limit
- Does not require time for design
- Does not slow emergency vehicles

Disadvantages

- Has not been shown to significantly reduce travel speeds

Toolbox of Traffic Calming Measures - Level I, II, III

Lane Striping

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

Approximate Cost: \$1 per linear foot



Advantages

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

Disadvantages

- Has not been shown to significantly reduce speeds
- Increased 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.

Approximate Cost: \$1 per linear foot



Advantages

- Inexpensive
- Reduction in 85th percentile speed
- Does not slow bus and emergency vehicles
- Does not require time for design

Disadvantages

- Effectiveness diminishes after repeated use
- Aesthetics

Toolbox of Traffic Calming Measures

Toolbox of Traffic Calming Measures

The following traffic calming measures constitute the standard toolbox of devices available to citizens and Department of Transportation staff when developing neighborhood traffic management plans. The devices are divided into the following types:

Level I Measures

- Non-physical measures

Level II Measures

- Narrowing measures
- Horizontal deflection measures

Level III Measures

- Non-physical measures
- Narrowing measures
- Horizontal deflection measures

Level III phase II Measures

- Diversion measures

For each non-physical and physical measure in the toolbox, a description, photograph, list of advantages and disadvantages, and approximate cost are provided.

Types of Measures	Type of Problem				
	Speeding	Traffic Volume	Vehicle Accidents	Pedestrian Safety	Noise
Level I Non-Physical Measures					
Targeted Speed Enforcement	★	○	●	●	●
Radar Trailer	★	○	○	○	●
Speed Feedback Signs	★	○	○	○	●
Edgeline / Centerline Striping	●	○	○	○	○
Optical Speed Bars	●	○	○	○	○
Speed Limit Signage	★	○	○	○	○
Speed Legends	★	○	○	○	○
Truck Restriction Signs	○	●	○	○	★
"Cross Traffic Does Not Stop" Signage	○	○	★	●	○
Raised Pavement Markers	○	○	★	●	○
High-Visibility Crosswalks	●	○	○	★	○
Angled Parking	★	●	○	○	○
Level II Narrowing Measures					
Bulbouts	★	○	○	★	○
Two-Lane Chokers	★	○	○	○	○
Center Island Narrowings / Pedestrian Refuges	★	○	○	★	○
Level II Horizontal Measures					
Traffic Circles	★	●	★	●	○
Roundabouts (Single-Lane)	●	●	★	○	★
Lateral Shifts	●	●	○	○	○
Chicanes	★	●	○	○	○
Speed Table	★	●	X	●	X
Speed Hump	●	●	X	X	X
Level III Measures					
Full Closures	★	★	○	○	○
Half Closures	★	★	○	○	○
Diagonal Diverters	★	★	○	○	○
Median Barriers	○	★	○	○	○
Forced Turn Islands	○	★	●	○	○

Toolbox of Traffic Calming Measures - Level I, II, III

Education

Activities that change people's perceptions and help alter driver behavior are most preferred. Meetings and workshops with neighbors and City staff can help implement and direct NTMP applications. Most traffic problems are a result of human behavior. Through outreach programs and neighborhood watch programs, all residents can play a big part in spreading the information.

Approximate Cost: Varies



Advantages

- Education can be flexible in duration
- Everyone can afford it

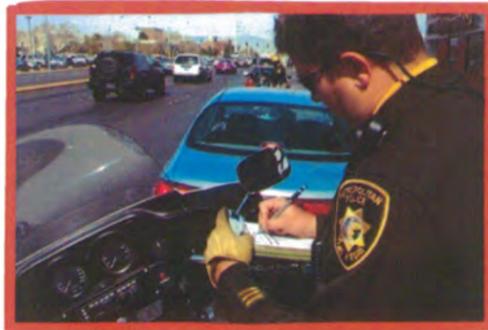
Disadvantages

- May be difficult to measure its effectiveness
- May take time to be effective

Targeted Speed Enforcement

The Department of Transportation identifies locations for temporary targeted enforcement enhancements, based on personal observations and survey comments. A request is then submitted to the Police Department for the desired enforcement. Because of limited citywide resources, the targeted enforcement will not be continued indefinitely. Targeted enforcement may also be used in conjunction with new traffic calming devices to help drivers become aware of the new restrictions.

Approximate Cost: Varies



Advantages

- Inexpensive if used temporarily
- Does not require time for design
- Does not slow trucks, buses, and emergency vehicles
- Effective in reducing speeds in a short time frame

Disadvantages

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

Toolbox of Traffic Calming Measures - Level I, II, III

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, reminding speeding drivers to slow to the speed limit. 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

- Inexpensive if used temporarily
- Does not require time for design
- Does not slow emergency vehicles
- Effective in reducing speeds in the short-run

Disadvantages

- Effectiveness may be temporary
- Aesthetics
- Only effective for one direction of travel
- Subject to vandalism

Speed Feedback Signs

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. They are especially effective near schools and parks.

Approximate Cost: \$3,300 - \$4,200



Advantages

- Inexpensive
- Does not require time for design
- Does not slow emergency vehicles
- Effective in reducing speeds in a short time frame

Disadvantages

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