City of Vallejo
Traffic Calming Toolbox

June 1, 2013
Final

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Introduction

While traffic calming typically focuses on the "Three E's", Education, Engineering and Enforcement, this document focuses on the engineering aspect of traffic calming and provides guidelines as to how traffic calming devices are to be used and are expected to evolve over time. It is intended to be used by staff to assess the best traffic calming devices for specific streets. This document is not inclusive of all traffic calming devices and includes a set of devices in which the City of Vallejo desired to have guidelines for. Additionally, this document is not intended to be used as "standards" or taken as absolute.

The traffic calming devices discussed within this document include:

- Non-Physical Devices
    - High-Visibility Crosswalk
    - In Pavement Lighted Crosswalks
    - Rapid Flashing Beacons
    - Angled Parking
    - Radar Display Signs
    - Road Diet or Lane Width Reduction

- Speed Control – Narrowing Devices
    - Neckdowns / Bulbouts
    - Center Island Narrowing
    - Chokers?

- Speed Control – Horizontal Devices
    - Traffic Circles

- Speed Control – Vertical Devices
    - Speed Humps

Table 1, Applicability by Street Type, provides guidelines for when each of the above devices should be installed.

Table 1

Applicability By Street Type		
Type of Measure	**Roadway Classification**	
	Local	**Collector**
Non-Physical Control Measures		
High Visibility Crosswalk	No Limitations with Respect to ADT or Speed	
In Pavement Lighted Crosswalk	No Limitations with Respect to ADT or Speed	
Rapid Flashing Beacon	No Limitations with Respect to ADT or Speed	
Angled Parking	ADT<4,000; Width >= 48 feet; Speed Limit <= 30 mph	
Radar Display Signs	No Limitations with Respect to ADT or Speed	
Road Diet / Lane Width Reduction	ADT varies based upon treatment; Speed Limit <= 35mph	
Speed Control - Narrowing Measures		
Neckdowns/Bulbouts	ADT <= 20,000; Speed Limit <= 35 mph	
Center Island Narrowing		
Chokers (Two-lanes)		
Chokers (One-lane)	ADT <= 3,000; Speed Limit <= 30 mph	No
Speed Control - Horizontal Measures		
Traffic Circles	Daily Entering Volumes <10,000; Speed Limit <= 35mph	
Speed Control - Vertical Measures		
Speed Humps*	ADT<3,000; Speed Limit <=30 mph	
Speed Tables/Raised Crosswalks*	ADT<7,500; Speed Limit >25 mph and <=35 mph	
Textured Pavement**	No	Yes

*Consult with the Fire Department for concurrence.

**Noise impacts to adjacent residential units.

Non-Physical Devices

Non-physical devices include measures that do not require physical changes to the roadway that are intended to raise driver awareness and alter driver behavior. These devices are not self-enforcing and may have limited effectiveness. This category includes the following devices:

- High Visibility Crosswalks
- In Pavement Lighted Crosswalks
- Rapid Flashing Beacons
- Angled Parking
- Radar Display Signs
- Road Diet or Lane Width Reduction

High-Visibility Crosswalk

High-visibility crosswalks use special marking patterns and raised reflectors to increase the visibility of a crosswalk at night. A 'triple-four' pattern is created by painting two rows of four-foot wide rectangles, separated by four feet of unpainted space across the roadway. Raised reflectors are placed at the approach edges of these rectangles. The unpainted space along the center of the crosswalk provides an untreated path for pedestrian traffic, as the markings may become slippery in rainy/wet conditions.

- Advantages
  - Increases visibility under low-visibility conditions.
  - Focuses crossing pedestrians at a single location.

- Disadvantages
  - May give pedestrians a false sense of security, causing them to pay less attention to traffic.
  - Requires more maintenance than normal crosswalks.

Approximate Cost: $1,500 per location

In Pavement Lighted Crosswalk

In pavement lighted crosswalks are amber lights that are installed in the roadway on both sides of the crosswalk and oriented to face oncoming traffic. When activated, in pavement lighted markers produce a daytime-visible light that warns drivers that they are approaching a condition on or adjacent to the roadway that might not be readily apparent and might require the driver to slow down and possibly come to a stop. The pedestrian activates the system, either by using a push-button or through detection from an automated device. When activated, the lights begin to flash in unison. The flashing LED's shut off after a set period of time (i.e. the time required for a pedestrian to safely cross the street).

- Advantages
  - Effective at enhancing pedestrian visibility and driver awareness of reduced speeds.
  - High driver awareness during adverse weather conditions such as darkness, fog and rain.
  - Solar or AC power capability.

- Disadvantages
  - Additional studies are required to determine long-term effectiveness.
  - If push button is activated, pedestrians may not use push-button.
  - Potential maintenance issues, especially with street resurfacing.

Approximate Cost: $35,000 to $50,000 per location

Rapid Flashing Beacons

Rapid flashing beacons are a special LED flashing device installed below a crosswalk sign and placed at marked, un-signalized crosswalk locations. The pedestrian activates the system, either by using a push-button or through detection from an automated device. When activated, the lights begin to flash in unison. The rapid flashing beacons produce a daytime-visible light, warning drivers that they are approaching a condition on or adjacent to the roadway that might not be readily apparent and might require the driver to slow down and possibly come to a stop. The flashing LED's shut off after a set period of time (i.e. the time required for a pedestrian to safely cross the street).

- Advantages
  - Effective at enhancing pedestrian visibility and driver awareness of reduced speeds.
  - High driver awareness during adverse weather conditions such as darkness, fog and rain.
  - Solar or AC power capability.

- Disadvantages
  - Additional studies are required to determine long-term effectiveness.
  - If push button is activated, pedestrians may not use push-button.

Approximate Cost: $4,000 to $6,000 each

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 easier for vehicles to maneuver into and out of compared to parallel parking. Angled parking works well in areas with high parking demand and turnover rates.

- Advantages
  - Reduces speeds by narrowing the travel lanes.
  - Favored by businesses and multi-family residences.
  - Increases the number of parking spaces.
  - Makes parking maneuvers easier and takes less time than with parallel parking.

- 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.

Approximate Cost: Dependent upon the amount of parking spaces.

Radar Display Signs

A radar speed sign is an interactive sign, generally constructed of a series of LEDs that displays vehicle speed as motorists approach. The purpose of radar speed signs is to slow cars down by making drivers aware when they are driving at unsafe speeds. They are used as a traffic calming device in addition to or instead of physical devices such as speed humps.

Radar speed signs are often used in school zones, sometimes in conjunction with Safe Routes to School programs, in construction zones, or on busy residential roads. Some college and corporate campuses use radar speed signs to slow traffic as well.

Speed display signs are sometimes used in conjunction with physical traffic calming solutions. They are also used on streets that cities do not want to put physical measures on either because of snow concerns or traffic volume. Often, cities will use these signs to test streets to determine the need for further traffic calming.

Studies conducted both in the UK and in the US have found radar speed signs to effectively slow traffic down. Although the overall speed reductions are generally less than those resulting from physical measures, the signs have the greatest effect on those drivers that are exceeding the posted speed.

- Advantages
  - Reduces speeds by informing drivers of the posted speed limit and of their speeds.

- Disadvantages
  - Initial costs and on-going maintenance.

Approximate Cost: $4,000 to $10,000 each

Road Diet or Lane Width Reduction

A road diet, also called a lane reduction or road re-striping is a technique in traffic engineering whereby a road is reduced in number of travel lanes and/or effective width in order to provide the driver of a vehicle with a narrower path of travel.

A typical road diet technique is to reduce the number of lanes on a roadway cross-section. One of the most common applications of a road diet is to improve safety or provide space for other users in the context of two-way streets with two lanes in each direction. The road diet reduces this to one travel lane in each direction. The freed-up space is then used to provide either or both of the following features:

- Parking Lanes
- Bicycle lanes on one or both sides of the road

If properly designed, traffic does not divert to other streets after a road diet.

Before

After

- Advantages
  - Reduces speeds by narrowing the travel lanes.
  - Favored by bicyclists, businesses, schools and family residences.
  - Increases safety by reducing pedestrian crossing distance.

- Disadvantages
  - May have peak hour congestion.
  - May be incompatible with one-way streets approaching a two-way segment.

Approximate Cost: Varies based upon treatment

Speed Control – Narrowing Devices

Narrowing devices use raised islands and curb extensions to physically narrow the travel lane for motorists. Narrowing devices include:

- Neckdowns / Bulbouts
- Center Island Narrowing

Neckdowns / Bulbouts

Bulbouts are simple raised curbs at an intersection that narrow the travel lane, but do not provide additional pedestrian space. Neckdowns/bulbouts shorten the crossing distance and decrease the curb radii, thus reducing turning vehicle speeds. Both of these effects increase pedestrian comfort and safety at the intersection.

- Advantages
  - Improves pedestrian circulation and space.
  - 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.

Approximate Cost: $4,000 - $10,000 per corner

Center Island Narrowings

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. Islands can have a gap to allow pedestrians to walk through at a crosswalk, and are often called "pedestrian refuges". These islands can be landscaped to increase visual aesthetics.

- Advantages
  - Increases pedestrian safety.
  - If designed well, can have positive aesthetic value.
  - Reduces traffic volumes.

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

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

Speed Control – Horizontal Devices

Horizontal deflection devices use raised islands and curb extensions to physically eliminate straight-line paths along roadways and through intersections. Traffic circles are included in these devices.

Traffic Circles

Raised islands, placed in intersections, around which traffic circulates. They are usually circular in shape and sometimes landscaped in their center islands. Traffic controls at approaches can vary. The circles prevent drivers from speeding through an intersection by impeding the straight-through movement and forcing drivers to slow down to yield.

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

- Disadvantages
  - If not designed properly, difficult for large vehicles (such as fire trucks) to navigate.
  - Must be designed so that circulating lane does not encroach onto sidewalk.
  - Potential loss of on-street parking.

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

Speed Control – Vertical Devices

Vertical deflection devices use variations in pavement height and alternative paving materials to physically reduce travel speeds. The design for these devices is approximately 15 to 20 mph depending on the devices.

Speed Humps

A raised area placed across the road. They are generally 12 feet long (in the direction of travel), 3 ¼ to 3 ¾ inches high, parabolic in shape, and have a design speed of 15 mph to 20 mph. They are usually constructed with a taper on each side to allow unimpeded drainage between the hump and curb. When placed on a street with rolled curbs or no curbs, bollards are placed at the end of the speed hump to discourage vehicles from veering outside of the travel lanes to avoid the device.

- Advantages
  - Relatively inexpensive.
  - Relatively easy for bicyclists to cross if taper is designed appropriately.
  - Very effective in slowing travel speeds.

- Disadvantages
  - Causes a "rough ride" for all drivers and can cause severe pain for people with certain skeletal disabilities.
  - Slows emergency vehicles (large vehicles with rigid suspensions).
  - Increases noise and air pollution.
  - Aesthetics

Approximate Cost: $3,000 to $ 4,000 each

Speed Hump Guidelines

The City of Vallejo has developed the following guidelines that a street segment must meet to be considered for the installation of speed humps. The installation of speed humps are subject to the availability of funding and will not be installed without an established funding source.

All of the following criteria must be met:

- The street is residential in character.
- The street is not classified as a collector street or higher as shown on the California Road System.
- The street does not have more than one through travel lane in each direction.
- The street is not a cul de sac.
- The width of the street is less than 40 feet.
- The street is crowned for side-gutter drainage and has an asphalt surface.
- The street has improved curb and gutter.
- The longitudinal grade is less than 8%.
- The vertical alignment of the street shall have adequate sight distance for all signage and markings.
- The prima facie speed limit, posted or unposted is 25 mph or less.
- The 85th percentile speed (prevailing speed) of the street segment shall be measured showing speeds being 32 mph or greater.
- **Fire Department approval.**
- The street is not a primary emergency vehicle route.
- The street is not a transit route.
- Traffic is not likely to be diverted to other nearby residential streets.
- Petition shows support from 67% of residents.
- Approval from 100% of residents fronting the installations must be obtained.

The City of Vallejo does not currently have funding for the installation of these devices; however, the City would accept payment from residents to fund the evaluation and installation of the speed humps if they meet all of the guidelines for installation.

To request a Speed Hump, please call (707) 648-4691 or send a written request to:

Public Works Director
c/o Traffic Engineering
555 Santa Clara Street
Vallejo, CA 94590-5934