



EL DORADO HILLS FIRE PROTECTION DISTRICT TRAFFIC CALMING STANDARD

Study and Approval Requirements for Traffic Calming Measures
STANDARD #B-005 EFFECTIVE 01-01-2017

1. PURPOSE

This Standard provides mandatory professional engineering study and El Dorado Hills Fire Department approval requirements, as well as implementation guidance in the associated Appendix, for the installation of context-appropriate traffic calming measures and devices that are compatible with fire protection and emergency response needs in the El Dorado Hills Fire Protection District.

2. SCOPE

This Standard shall apply to all private roadways within the El Dorado Hills Fire Protection District, inside and outside of gated communities.

3. AUTHORITY

Traffic calming devices shall be prohibited unless approved by the fire code official. (California Code of Regulations, 2013 California Fire Code §503.4.1 “Traffic Calming Devices”)

4. DEFINITIONS

For the purposes of this guideline, certain terms and words are defined as follows:

5. **Traffic Control Device:** An approved traffic control device is a regulatory or warning sign or traffic signal, or pavement marking, that is consistent with the California Manual on Uniform Traffic Control Devices.
6. **Traffic Calming Device:** A non-standard but approved and proven application on a roadway that provides additional speed reduction benefit, including changes to roadway texture (e.g., rumble strips, raised pavement markers), visual cues (e.g., speed feedback signs, optical speed bars, speed reduction markings), horizontal roadway deflections (i.e. curves and offsets), and vertical roadway deflections (i.e., speed humps, speed bumps, offset speed tables, speed cushions, and speed lumps).
7. **Traffic Calming Measure:** Any combination of standard traffic control devices and non-standard traffic calming devices installed to provide the necessary speed reduction benefit and additional roadway safety, as appropriate for the roadway context.

8. **Posted Speed Limit:** The posted speed limit is the maximum speed at which automobiles may travel on a roadway in one direction and be in compliance with the posted regulatory sign, per the California Manual on Uniform Traffic Control Devices.
9. **85th Percentile Speed:** That speed at or below which 85 percent of traffic is moving on a given roadway in one direction. Speed limits below the 85th percentile speed do not ordinarily facilitate the orderly movement of traffic and may require constant enforcement to maintain compliance. Speed limits established on the basis of the 85th percentile speed conform to the consensus of those who drive highways as to what speed is reasonable and prudent, and are not dependent on the judgment of one or a few individuals.¹
10. **Vertical Roadway Deflection:** A change of the roadway surface in the vertical direction which forces an automobile to move up and down without losing control, thereby requiring it to slow down before reaching the deflection (e.g., speed bumps, speed humps, speed tables).
11. **Modified Vertical Roadway Deflection:** A change of the roadway in the vertical direction, but with gaps intended only for emergency response vehicles to safely traverse the device with little or no vertical deflection and therefore speed reduction (e.g., offset speed tables, speed lumps, speed cushions).

12. TRAFFIC CALMING MEASURES & APPROVALS

Traffic calming measures and devices may be installed on private roadways within the El Dorado Hills Fire Protection District only when approved by the El Dorado Hills Fire Department Fire Marshal, in accordance with the authorized process contained in this Standard. All traffic calming devices shall be on the approved list contained in this Standard. Modified vertical deflections (e.g., offset speed tables, speed lumps, speed cushions) may only be installed as a Tier III measure, in accordance with the authorized process contained in this Standard. All traffic calming devices shall be removed at proponent's expense if project proponent fails to comply with the authorized process contained in this Standard.

12.1 Authorized Process

If any authorized Homeowners group in the El Dorado Hills Fire Protection District has a desire to implement traffic calming measures on a private roadway or segment of private roadway to decrease traffic speeds, the Homeowners group must follow the process outlined below.

12.1.1 Tier I Traffic Calming Measures: Confirm/Establish and Enforce Speed Limit; Implement Traffic Control Devices.

¹ California MUTCD 2014 Edition (FHWA's MUTCD 2009 Edition, including revisions 1 & 2, as amended for use in California.

- 12.1.1.1 The Homeowners group shall retain a licensed Professional Engineer. In accordance with the California Manual on Uniform Traffic Control Devices (MUTCD), the licensed Professional Engineer must confirm or determine the posted speed limit, and identify all appropriate standard traffic control signs and pavement markings for the roadway or the roadway segment in question. (see Appendix: Tier I Traffic Calming Measures Descriptions)
- 12.1.1.2 The community must post speed limit signs and install all appropriate standard traffic control signs and markings, as specified by the licensed Professional Engineer. Only in combination with and not before the implementation of all applicable standard traffic control signs and markings, the Professional Engineer may choose to specify and install Tier II measures which only include additional roadway striping and pavement markings in this Tier I process step, as appropriate. (see Appendix: Tier II Traffic Calming Measures Descriptions)
- 12.1.1.3 If the Homeowners group still has a safety concern about how traffic is operating at the location after 12.1.1.2 is fully implemented, the Homeowners group should request and arrange for speed limit and traffic enforcement through an authorized public law enforcement agency. Enforcement shall be for a minimum of two (2) months, over two (2) time periods per week with at least 1 hour in each time period during peak traffic hours and school hours. Optional: Preliminary enforcement may include law enforcement agency official speed trailers and/or purchased speed feedback signs, including “SLOW DOWN”.
- 12.1.1.4 If after tracking and evaluating enforcement efforts the desired speed reduction has occurred with the implementation of 12.1.1.3, continued enforcement on an as-needed basis is recommended. If it is believed that enforcement has not sufficiently decreased traffic speeds, the Homeowners group may proceed to Tier II Traffic Calming Measures (12.1.2).

- 12.1.2 Tier II Traffic Calming Measures: Non-Vertical Treatments with Limited Effect or No Effect on Emergency Response
- 12.1.2.1 The Homeowners group shall retain a licensed Professional Engineer. The licensed Professional Engineer shall study the roadway or roadway segment in question, further establishing existing traffic conditions, including 85th percentile speeds (in both travel directions, if applicable).
- 12.1.2.2 If the study in 12.1.2.1 concludes that additional traffic calming beyond all appropriate TIER I measures is needed, the Professional Engineer must prepare a site-specific plan recommending of TIER II traffic calming treatments to achieve only the necessary average speed reduction to gain compliance with posted speed limits. (see Appendix: Tier II Traffic Calming Measures Descriptions)
- 12.1.2.3 After El Dorado Hills Fire Department approval and implementation of the site-specific plan in 12.1.2.2, another study by the licensed Professional Engineer should be conducted to evaluate the effectiveness of the Tier II measures, as implemented. If this study validates that a speeding issue still exists, the Professional Engineer should certify that no appropriate Tier II traffic calming measures will provide the necessary speed reduction to gain compliance with posted speed limits. After the El Dorado Hills Fire Department review of this conclusion, the El Dorado Hills Fire Department may approve proceeding to Tier III Traffic Calming Measures (12.1.3).

- 12.1.3 Tier III Traffic Calming Measures: Modified Vertical Roadway Deflections
- 12.1.3.1 The Homeowners group shall retain a licensed Professional Engineer. The licensed Professional Engineer shall prepare a site-specific plan for modified vertical roadway deflections, with a priority on investigating the feasibility of offset speed tables. (see Appendix: Tier III Traffic Calming Measures Descriptions)
- 12.1.3.2 If after Fire Department review the site-specific plan in 12.1.3.1 is approved for implementation, install the associated modified vertical roadway deflection(s) and traffic controls, as specified in the approved plan in 12.1.3.1.
- 12.1.3.3 The Fire Department will conduct an independent evaluation of the effects of the installed modified vertical roadway deflection from 12.1.3.2 on emergency response vehicles. Any further modifications or improvements to the approved plan in 12.1.3.1 identified by the Fire Department must be installed and paid for by the community.
- 12.1.3.4 Within six months of implementation in 12.1.3.2 (or 12.1.3.3, if necessary), the licensed Professional Engineer shall evaluate the speed reduction and overall safety impacts of the modified vertical roadway deflection device(s), and prepare a report for Fire Department review.
- 12.1.3.5 Upon receipt of the Professional Engineering evaluation in 12.1.3.4, the El Dorado Hills Fire Department will determine the ultimate suitability of the installed device as a permanent installation. If the device(s) is deemed suitable and should not be removed, it/they will be maintained by the Homeowners group. Failure to properly maintain the device(s) could warrant its/their removal at Homeowners group expense.

Approved Traffic Calming Treatments – Tier I

- Radar Trailer
- Speed Feedback Sign
- Speed Legend

Radar Trailer

Tier I (Low Intensity – No Effect on Emergency Vehicles/Response Time)

- Device that measures and displays each approaching vehicle's speed next to the posted speed limit, in clear view of the driver.
- Mobility increases cost-effectiveness.
- May only be effective for as long as it is deployed.
- May be less visually appealing than a speed feedback sign.

Approximate Cost: \$6,000-\$12,000 per trailer

Approximate Speed Reduction Benefit: varied (more dependent on driver behavior)



Speed Feedback Sign

Tier I (Low Intensity – No Effect on Emergency Vehicles/Response Time)

- Fixed, semi-permanent features next to the roadway, typically installed with or near to speed limit signs.
- Speed display flashes when speeding occurs.
- Advantages: permanence, constant effectiveness.
- Technology can capture historical speed data.
- Helps to justify additional traffic calming measures.



Approximate Cost: \$3,000-\$10,000 per sign

Approximate Speed Reduction Benefit: varied (more dependent on driver behavior)

Speed Legend

Tier I (Low Intensity – No Effect on Emergency Vehicles/Response Time)

- Numerals painted on the roadway indicating the current speed limit.
- Usually placed near speed limit signposts.
- Can be useful in reinforcing a reduction in speed limit between one segment of a roadway and another segment.
- May be placed at major entry points of a residential area.



Approximate Cost: \$75 per location

Approximate Speed Reduction Benefit: varied (more dependent on driver behavior)

Approved Traffic Calming Treatments – Tier II

- Optical Speed Bars
- Speed Reduction Markings
- Raised Pavement Markers
- Rumble Strips
- Textured Pavement
- High Visibility Crosswalk
- Neckdown / Bulbout
- Center Island Narrowing
- Two-Lane Choker
- Chicane
- Lateral Shift

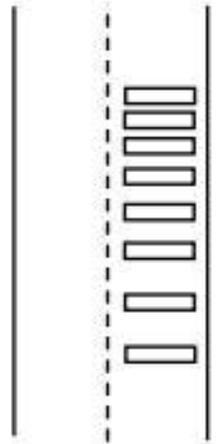
Optical Speed Bars

Tier II (Low Intensity – No Effect on Emergency Vehicles/Response Time)

- A series of pavement markings spaced at decreasing distances.
- Typically used in areas to provide drivers with the impression of increased speed.
- Advantages: relatively low-cost application; can be used in combination with other devices.

Approximate Cost: \$1 per linear foot

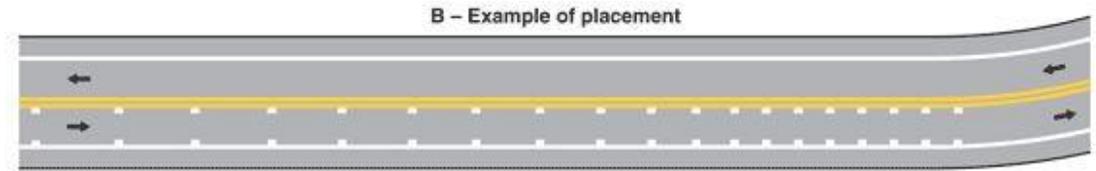
Approximate Speed Reduction Benefit: varied (more dependent on driver behavior)



Speed Reduction Markings

Tier II (Low Intensity – No Effect on Emergency Vehicles/Response Time)

- Transverse markings placed on the roadway along both edges of a lane.
- Pattern of progressively reduced spacing gives drivers the impression that their speed is increasing.
- May be placed in advance of an unexpectedly severe horizontal or vertical curve or other roadway feature, where the desired reduction in speeds has not been achieved by the installation of warning signs and/or other traffic control devices.



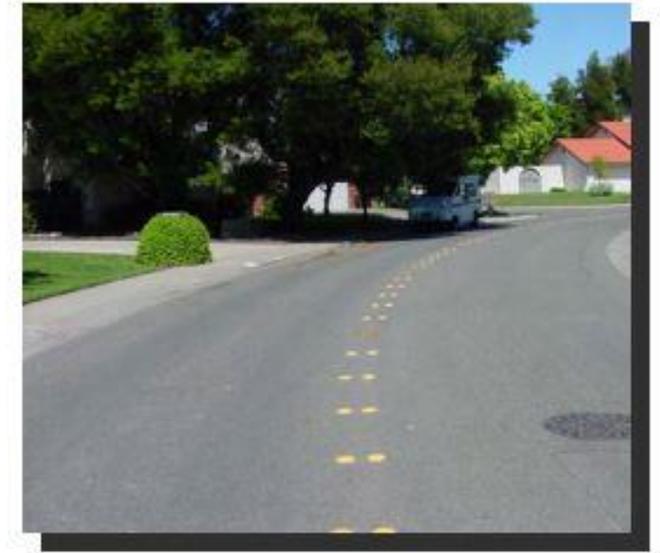
Approximate Cost: \$1 per linear foot

Approximate Speed Reduction Benefit: varied (more dependent on driver behavior)

Raised Pavement Markers

Tier II (Low Intensity – No Effect on Emergency Vehicles/Response Time)

- Small bumps lining the centerline or edgeline of a roadway.
- Often used on curves where vehicles have a tendency to deviate outside of the proper lane, risking collision.
- Improve nighttime visibility of the roadway edges, adds definition and texture to a roadway.



Approximate Cost: \$4.50 per marker (vs. \$2 per linear foot for street centerlines and edgelines)

Approximate Speed Reduction Benefit: similar to standard street centerlines and edgelines

Rumble Strips

Tier II (Low Intensity – No Effect on Emergency Vehicles/Response Time)

- Transverse grooves, or raised pavement markers (white plastic or ceramic units) placed in a series *across* the direction of travel.
- Warns drivers of a stop or slow down ahead, or of an approaching danger spot.



Approximate Cost: Depends on method and materials used. If raised markers placed in a series across the lane, approximately \$4.50 per marker.

Textured Pavement

Tier II (Low Intensity – No Effect on Emergency Vehicles/Response Time)

- Includes the use of stamped pavement (asphalt) or alternate paving materials to create an uneven surface.
- Change in texture makes wheel vibrations heard and felt.
- Change in color commands driver's attention to something different in the roadway.
- Has been observed to induce a reduction in travel speed.
- Commonly used to emphasize an intersection or pedestrian crossing.
- Typically used on roadways with a design speed of 45 MPH or less.



Approximate Cost: \$6-8 per square foot

*Approximate Speed Reduction Benefit:
varied (more dependent on driver
behavior)*

High-Visibility Crosswalk

Tier II (Low Intensity – No Effect on Emergency Vehicles/Response Time)

- Use bolder marking patterns than standard crosswalk striping
- Sometimes used in combination with raised reflectors or in-pavement lighting to increase visibility of a pedestrian crossing area.

Approximate Cost: \$1,600 per location

*Approximate Speed Reduction Benefit: varied
(more dependent on driver behavior)*



“Continental” Pattern

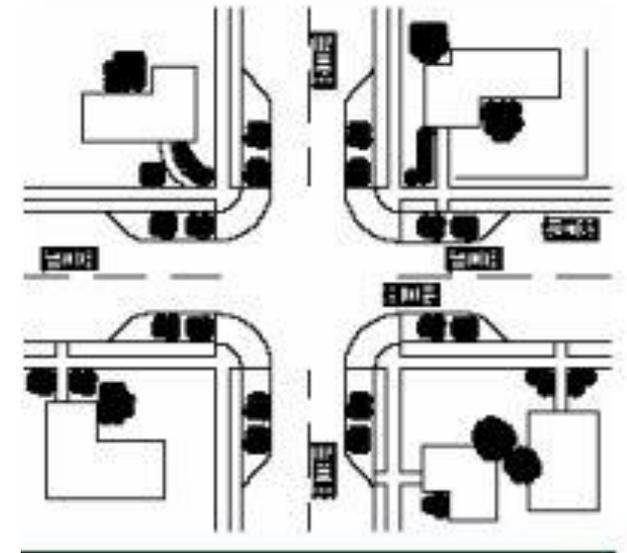


“Triple-Four” Pattern

“Neckdown” / “Bulbout”

Tier II (Physical Changes to Roadway - Navigable by Emergency Vehicles)

- Raised curb extensions that narrow the travel lane at intersections or midblock locations.
- “Pedestrianize” intersections by shortening the crossing distance and decreasing the curb radii, thus reducing turning vehicle speeds.
- Both effects increase pedestrian comfort and safety at the intersection.
- Effects driver route choice and selection of street.



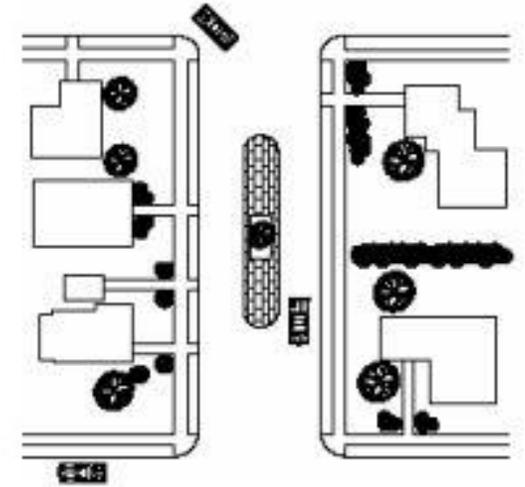
Approximate Cost: \$5,000 – \$10,000 per corner

Approximate Speed Reduction Benefit: Magnitude of speed reduction is dependent on the spacing of neckdowns. On average, neckdowns achieve a 7 percent reduction in speeds.

Center Island Narrowing

Tier II (Physical Changes to Roadway - Navigable by Emergency Vehicles)

- Raised island along roadway centerline that narrows the passable space between edgelines or curbs.
- “Gateway” center island narrowing at the entrance to a community or neighborhood, often combined with textured pavement.
- Can be a “pedestrian refuge”, with a gap in the center island connected to marked crosswalks, that helps pedestrians to cross roadway.
- Can be landscaped to increase aesthetic appeal.



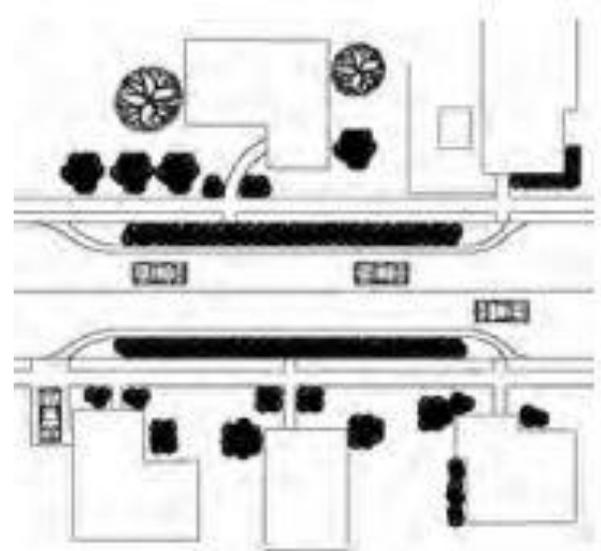
Approximate Cost: \$5,000 - \$10,000 per location

Approximate Speed Reduction Benefit: Magnitude of speed reduction is dependent on the length of the center island, and on spacing if more than one island is used. On average, center island narrowing achieves a 7 percent reduction in speed.

Two-lane Choker

Tier II (Physical Changes to Roadway - Navigable by Emergency Vehicles)

- Curb extensions at midblock locations that narrow a street.
- Leave the street cross section with two lanes that are narrower than the normal cross section.
- On-street parking spaces are typically eliminated in the area of the choker.



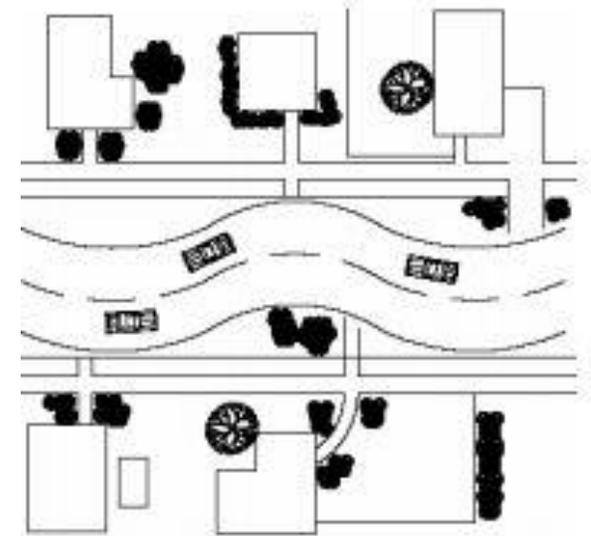
Approximate Cost: \$7,000 - \$8,000 per location

Approximate Speed Reduction Benefit: The magnitude of speed reduction is dependent on the spacing of two lane chokers between points that require drivers to slow. On average, two-lane chokers achieve a 7 percent reduction in speeds.

Chicane

Tier II (Physical Changes to Roadway - Navigable by Emergency Vehicles)

- Curb extensions that alternate from one side of the street to the other, forming S-shaped curves.
- Easily navigated by emergency vehicles if designed properly, but can still increase response times if used frequently.
- Can be landscaped to increase aesthetic appeal.



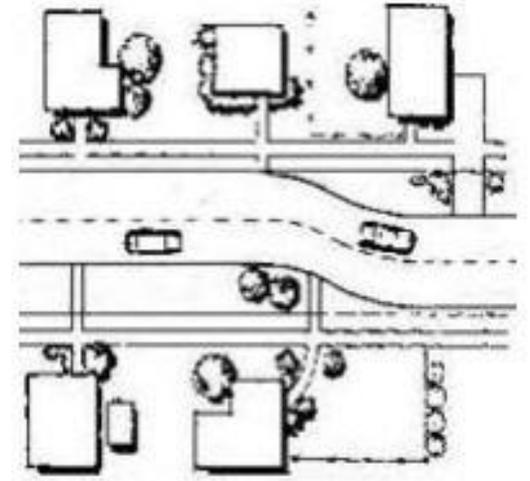
Approximate Cost: \$8,000 - \$14,000 per location

Approximate Speed Reduction Benefit: Dependent on design of S-shaped curves, length or frequency.

Lateral Shift

Tier II (Physical Changes to Roadway - Navigable by Emergency Vehicles)

- Curb extensions on straight street segments that cause a shift in traffic movement in one or both directions.
- Can be effective with just the right degree of horizontal deflection, while still navigable by emergency vehicles. Can still increase response times, depending on frequency.
- Often also be used as a landscaping enhancement.



Approximate Cost: Dependent on size of offset and length of transition (per lateral shift)

Approximate Speed Reduction Benefit: Comparable to that of Chicane, but dependent on deflection angle and frequency.

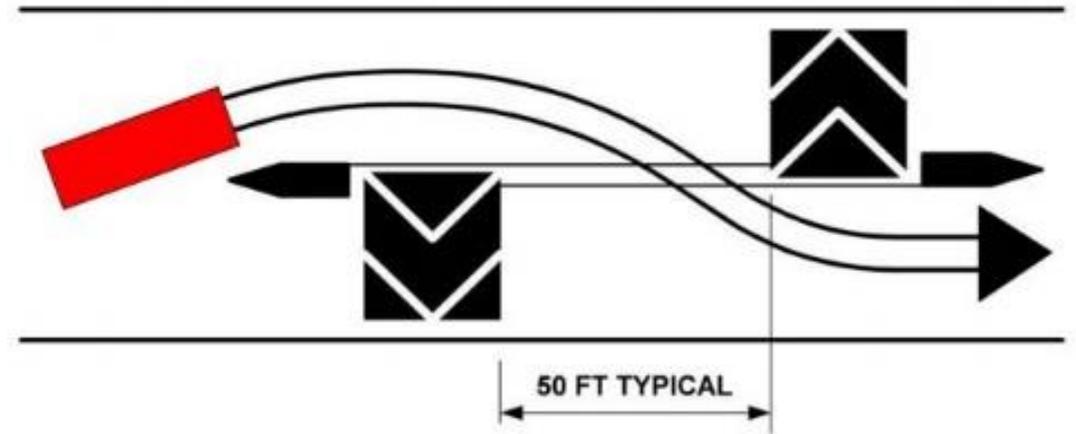
Approved Traffic Calming Treatments – Tier III

- Offset Speed Table (Preferred)

Offset Speed Tables

Tier III (Modified Vertical Deflection – Manageable Effect on Emergency Vehicles/Response Time)

- Constructed across only half of a street. Second half is constructed downstream of the first and in the opposing direction travel lane.
- Emergency equipment is able to use any portion of the roadway to accomplish a response; the space between the speed table halves permits emergency vehicles to navigate the tables in a serpentine path.



Approximate Cost: \$1,500-\$4,000 (less than speed lumps and speed cushions if done with mechanical equipment only, without approach islands and striping/pavement markers).

*Anticipated Speed Reduction Benefit: **Comparable to speed lumps (~22% reduction of 85th percentile speeds)***

