# New Traffic Calming Device of Choice

**SPEED LUMPS CONSIST OF TWO OR MORE RAISED AND ROUNDED AREAS PLACED LATERALLY ACROSS A ROADWAY WITH PRECISELY SPACED GAPS ALLOWING THE WHEEL TRACKS OF FIRE-RESCUE VEHICLES TO PASS BETWEEN THE LUMPS. SPEED REDUCTION AND COSTS ARE SIMILAR TO SPEED HUMPS; HOWEVER, SPEED LUMPS DO NOT SIGNIFICANTLY SLOW FIRE-RESCUE VEHICLES. SPEED LUMPS HAVE THE POTENTIAL TO BECOME THE TRAFFIC CALMING DEVICE OF CHOICE ON EMERGENCY RESPONSE ROUTES.**

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## INTRODUCTION

Speed lumps are a relatively new traffic calming device that are almost as inexpensive as speed humps and slow cars as much as speed humps but can be designed to minimize delay for emergency vehicles and discomfort for cyclists. This article discusses key aspects of their deployment and describes their measured effectiveness on both passenger cars and fire-rescue vehicles.

In a little more than a decade, traffic calming has entered the transportation planning and engineering mainstream.[1] Despite growing public support for traffic calming, all is not copasetic. States *Traffic Calming State-of-the-Practice*, "Without question, a major obstacle to traffic calming in the United States is opposition from fire-rescue services."[2] This concern was true in 1999, when *Traffic Calming State-of-the-Practice* was written, and is still true in cities and counties across the United States. At a recent stakeholder meeting in La Habra, California, USA, representatives of the Los Angeles County Fire Department expressed opposition to traffic calming and stated "…humps slow us to a near crawl, delaying a response." The department initially refused to take part in a demonstration of temporary speed lumps (described later), because their participation might be seen as tacit support.

Their concern is understandable. Traffic calming measures that are effective in slowing or diverting automobiles have the same effect, or even greater effect, on larger fire-rescue vehicles. The biggest challenge is to keep the effect on emergency response within acceptable bounds, or better still, to find new ways of slowing and diverting traffic without substantially impeding emergency response.

*Not Humps or Bumps*

Speed lumps consist of two or more raised and rounded areas placed laterally across a roadway, with gaps for wheels to pass between the lumps. Speed lumps should not be mistaken for, or confused with, speed bumps or humps, which have been commonly used in the United States for decades and have uninterrupted raised profiles that extend from one edge of the street to the other.

Common speed lump designs are shown in Figures 1 and 2. Lumps are designed to allow the wheel tracks (the distance between the left and right tires) of fire vehicles to pass without significant jostling or displacement, thereby allowing the fire-rescue vehicles to maintain speeds similar to those at which they would travel on roadways without traffic calming. Generally, passenger cars have narrower wheel tracks and are displaced vertically when passing over lumps.

Compliance by passenger car drivers is often reinforced by having wide lumps in the travel lanes and a narrow lump along the centerline. Fire-rescue vehicles cross the centerline to straddle the smaller center lump, while very few passenger cars are observed to do so. Lumps to the outside are wider and function more like speed humps for the passenger cars that stay in their lanes. Cars may ride with one set of wheels in the gap between lumps, but the other set of wheels ride up and over an outside lump.

Motorists in the United Kingdom were driving over speed cushions (the European name for speed lumps) by the early 1990s. American cities, such as Austin, Texas; Alexandria, Virginia; and Mobile, Alabama, followed suit, with evaluation and testing in 2000. In September of 2000, Sacramento, California, USA, tested a set of lumps specifically developed to fit the tire base of their fire vehicles. Speed lumps were just being introduced to the United States at the time *Traffic Calming State-of-the-Practice* was published, and no data were available to report; this article represents an update to that report.


**Figure 1. Typical asphalt speed lumps.**


**Figure 2. Common prefabricated rubber speed lumps.**

*Effects on Fire-Rescue Vehicles*

Tests were conducted to evaluate the effect of speed lumps on delay, comfort and ease of navigation for fire vehicles (Figure 3). The studies were conducted in La Habra, California, USA, and involved Brea, California, USA, and Los Angeles County fire department vehicles. Each vehicle traversed a set of three speed lumps with various geometric designs and with different approaches: straddling the smaller lump and crossing the lumps while staying within the travel lane (similar to a speed hump).

Crossing speeds are summarized in Table 1. The speeds of fire vehicles straddling the smaller, center lump were similar to normal operating speeds on the roadways, and there was no observed significant delay at the lumps. Crossing the lumps while

**Figure 3. Testing City of Brea fire engine on speed lumps in La Habra, California.**

**Table 1. Speeds of fire-rescue vehicles crossing speed lumps.**

| Speed lumps configuration<br>Outside lumps = 9'x10.5'<br>Center lump = 6'x10.5'<br>Spacing = 2' | Speed, mph[a] | | |
|---|---|---|---|
| **Trials (Approaches)** | **Fire engine *City of Brea*** | **Fire truck[b] (ladder) *City of Brea*** | **Fire engine *Los Angeles County*** |
| Straddle middle lump – uphill | 24 | 17 | 14 |
| Straddle middle lump – downhill | 29 | 21 | 24 |
| Stay in lane (directly over both lumps) – uphill | 12 | 16 | 9 |
| Stay in lane (directly over both lumps) – downhill | 13 | 11 | 11 |

Notes: [a] Speeds recorded as vehicle crossed lumps.
Notes: [1] Recorded using radar by La Habra Police Department.
Notes: [b] Normal operating speed on test roadway is 20 mph, per City of Brea Fire Department.

**Table 2. Speed-reduction comparison between speed lumps and other similar traffic calming devices.**

| Device | Sample Size | 85th Percentile Speed After Traffic Calming | Change in 85th Percentile Speed with Traffic Calming | % Change in 85th Percentile Speed with Traffic Calming |
|---|---|---|---|---|
| Speed lumps | 50 | 27.0 mph (3.3 mph) | -8.9 mph (5.2 mph) | -25% (10%) |
| 12' humps | 184 | 27.3 (4.0) | -7.8 (3.7) | -22 (-9) |
| 14' humps | 15 | 25.6 (2.1) | -7.7 (2.1) | -23 (6) |
| 22' tables | 78 | 29.2 (3.1) | -7.3 (3.4) | -20 (8) |

Notes: Speeds shown are the averages (means) of the 85th percentile speeds for each sample. Values in parentheses are standard deviations.
Source: Ewing, Reid. *Traffic Calming State-of-the-Practice*. Washington, DC, USA: ITE, 1999, p. 104. (All data except the data on speed lumps)

staying in a travel lane (similar to a speed hump) resulted in maximum vertical deflection and lower crossing speeds. According to the local fire departments, the typical travel speed for fire-rescue vehicles on residential roadways is the 25 miles per hour (mph) speed limit.

The tests were conducted in both directions on the roadway, as a slight grade was present. Except on one occasion, most speeds traveling downhill while straddling the center lump were greater than the uphill speeds.

A telephone survey and Internet research uncovered several other tests of speed lumps. The following summarizes their results:

- In Austin, Texas, USA, speed lumps have very minimal, if any, impact on emergency response times. Most emergency vehicles experienced less than a 1 second delay per set of speed lumps.
- Fire vehicles in San Diego, California, USA, can travel in the middle of the roadway over the lumps at full speed with no delay.
- Speed lumps in Sacramento, California, USA, caused almost no delay to emergency response time. Almost 13 seconds per typical roadway segment could be saved by using speed lumps instead of humps.
- Fire vehicles in Mobile, Alabama, USA, showed 1.76 seconds less delay at speed lumps than speed humps. Ambulance delay was reduced by 4.75 seconds when compared to speed humps.
- In Danville, California, USA, no delay occurred in response time with speed lumps, but a 10- to 15-second delay was observed with speed humps.

The one exception was in Elk Grove, California, where the fire department found the delay with lumps intolerable; emergency vehicles needed to slow to 13 mph to cross the lumps.

*Effects on Passenger Cars*

Passenger cars are generally not able to straddle speed lumps due to their narrower wheel tracks. The vertical deflection for them is similar to that with speed humps, as speed lumps and humps have similar heights, lengths (in the direction of travel) and profiles.

Although many jurisdictions have installed speed lumps, the speed and volume impacts have not been compiled and documented until now. The before and after results of 50 speed lump installations completed by the following eight U.S. cities have been summarized:

- Danville, California;
- Elk Grove, California;
- Huntsville, Alabama;
- Olympia, Washington;
- Oviedo, Florida;
- Sacramento, California;
- Seattle, Washington; and
- Vancouver, Washington.

A comparison of the before and after speeds from all study locations shows that, on average, speed lumps reduce the 85th percentile speed by 25 percent, or 9 mph. Speed lumps reduced the 85th percentile travel speed at all study locations. The speed reduction with lumps is comparable to that with speed humps, which according to ITE's *Traffic Calming State-of-the-Practice* reduce speeds by an average of 23 percent, or 8 mph.[3] Therefore, speed lumps are as effective at reducing passenger car speeds as the most common "current" traffic calming device, the speed hump, and more effective than similar traffic calming devices such as speed tables (see Table 2). A comparison of the pre-traffic calming speeds of the 50 individual speed lumps study locations and the data for speed humps from *Traffic Calming State-of-the-Practice* shows that speed humps are being used on streets with somewhat lower initial speeds.

In addition to speed data, before and after volume data were collected at 18 of the aforementioned study locations. Analysis of the volume data shows little or no reduction in traffic volumes, and hence no diversion of traffic, after implementation of speed lumps. In contrast, the average volume reduction with speed humps is on the order of 20 percent.[4] The authors have two theories to explain the lack of volume reduction. Perhaps speed lumps are being installed on streets without good alternate routes or, alternatively, speed lumps may be viewed as less onerous than speed humps because the lumps, with their wheel cutouts, are perceived as requiring less slowing down. If a goal is to reduce traffic volumes as well as speeds, speed lumps may not be as effective as speed humps. However, in many applications, traffic diversion is not desirable, because the diverted traffic will end up on other local streets. In such cases, it may be preferable to simply reduce speeds without altering volumes, as speed lumps appear to do.

Public perceptions are arguably as important as data when judging the effectiveness of traffic calming measures. For the test in La Habra, California, USA, the responses from nearby residents were favorable. The residents commented that they perceived a reduction in vehicle speeds and welcomed speed lumps as a new addition to their neighborhood. In San Diego, California, USA, a survey of drivers conducted after the installation of speed lumps showed that 83 percent of the drivers preferred speed lumps to speed humps.[5]

*Design Parameters*

Six design parameters characterize speed lumps: shape, width, length, wheel gap, configuration and bicycle and parking accommodations. These design parameters, as described in this section, are based on a survey of jurisdictions across the United States and on tests conducted in La Habra, California, USA.

Speed lumps are generally constructed in a shape similar to speed humps, with parabolic or flat-sloping sides. If asphalt speed lumps are exceptionally long in the direction of travel, then they take the shape of speed tables with flat-sloping sides. Speed lump height is identical to that of speed humps and should be constructed to match local and national guidelines.

**THE WIDTH OF SPEED LUMPS IS THE KEY TO THEIR EFFECTIVENESS. JURISDICTIONS ACROSS THE COUNTRY USE DIFFERENT CENTER LUMP WIDTHS, VARYING FROM 5.5 FEET TO 7 FEET IN WIDTH.**

The width of speed lumps is the key to their effectiveness. Jurisdictions across the country use different center lump widths, varying from 5.5 feet to 7 feet in width. The majority of locations surveyed have an approximately 6-foot-wide center lump, which can be straddled by fire-rescue vehicles but not passenger cars. The inside-to-inside tire width of typical passenger cars ranges from approximately 47 to 57 inches (the latter figure for a larger truck-type vehicle, such as the Dodge Ram 2500 or Chevrolet Suburban). The inside-to-inside front tire width for a fire truck or engine is approximately 70 inches (the rear wheel gap of fire vehicles is smaller due to the dual rear wheels). Therefore, an approximately 6-foot-wide center lump is the ideal width to minimize fire-rescue delay and discomfort while ensuring vertical deflection for passenger cars. The tests in La Habra confirmed that fire-rescue vehicles could traverse a 6-foot-wide center lump with minimal to no delay. Outside lumps are typically wider and cannot be straddled by passenger cars or trucks.

Speed lump lengths range from approximately 6 feet in Elk Grove, California, USA, to 22 feet in Arlington, Virginia, USA. The length of the lumps in the direction of travel is dependent on the desired effect on passenger cars. It is not a critical design factor for fire-rescue vehicles, as they can traverse the device with minimal deflection. Shorter lumps, 12 feet in length, can act like a speed hump to passenger cars, while longer lumps begin to act as speed tables. In general, speed lump length should be similar to that of speed humps on streets with lower posted speeds (25 mph or less) and similar to speed tables on streets with higher posted speeds (30 mph or more).

The lateral distance between lumps is crucial for fire-rescue vehicles, and gaps of at least 1 foot must be provided. The tests in La Habra found that 1-foot spacing between the lumps resulted in minimal vertical deflection of fire-rescue vehicles. To increase the ease of navigation for fire-rescue drivers, a larger wheel gap of 2 feet was chosen as the optimum design. Tests in Sacramento, California, USA, have also confirmed that 2-foot gaps between lumps are preferable to 1-foot gaps. All surveyed jurisdictions use between 1- to 2-foot spacing between lumps.

The two outside lumps can vary in width according to the roadway width and the desired spacing between the curb and taper of the outside lump. The intent is to design the outside lumps to act as speed humps to passenger cars (in La Habra, the ultimate width of the outside lumps was 9 feet on streets 36-feet wide). Designing them too small may encourage motorists to swerve in an attempt to straddle the lump, as has been observed in several surveyed jurisdictions.

Special consideration may be given to bicyclists when designing speed lumps. Seattle, Washington, USA, uses striping to direct bicyclists toward the center wheel cutout as opposed to going over the lump. Other jurisdictions leave a wide gap (from 3 to 5 feet) between the outside lump and curb so bicycles can traverse the device without deflection.

**Figure 4. Speed lumps striped to appear as a speed hump in Fremont, California.**

As with speed humps, on-street parking and drainage are typically not a problem with speed lumps, as the outside lumps taper off before the gutter. Several surveyed jurisdictions restrict parking adjacent to the speed lumps, while others want to maximize on-street parking. There is no physical reason other than accommodation of bicyclists to restrict parking at speed lumps.

*Rubber Versus Asphalt*

Two common types of speed lumps exist: asphalt lumps created in place and prefabricated rubber lumps that are affixed to the roadway (refer to Figures 1 and 2). Each type has been used successfully in the United States, and their advantages and disadvantages are discussed in this section. Asphalt lumps are permanent while rubber lumps can be removed for street repairs or moved to another location.

*Ease of Construction*

Asphalt speed lumps require skilled construction crews to mold the material in place, while prefabricated rubber lumps can be installed by maintenance crews. Prefabricated lumps consist of multiple interlocking sections that must be attached to the pavement using bolts, which can be a time-consuming task for local street-maintenance crews.

*Profile*

Prefabricated rubber lumps are available in several predetermined vertical shapes. Prefabrication ensures that the profile is always the same and each lump is dimensionally consistent. However, prefabrication also limits the options available with respect to deflection. Asphalt lumps can be constructed to match the specific needs and characteristics of a local roadway.

*Aesthetics*

Appearance is an important attribute of traffic calming devices, especially to the residents that live with the devices on their streets. Asphalt speed lumps tend to blend with an asphalt roadway. Rubber speed lumps have been known to "stand out," especially some models that use brightly colored squares for identification.

In Mobile, Alabama, USA, red-brick-colored speed lumps have been used on several roadways, while speed lumps in Fremont, California, USA, look like a typical speed hump (see Figure 4). Fremont uses asphalt speed lumps with equally spaced striping between the lumps, in the direction of travel, which creates the optical illusion of a solid speed hump stretched across the roadway. Caution should be taken with this striping pattern, as pedestrians may mistake the speed lumps for a crosswalk.

*Costs*

The cost of a speed lump set depends on multiple factors that include size of the lumps, width of the roadway and materials used. Rubber speed lumps, sold by several national companies, are generally priced the same in all parts of the country (approximately \$3,000 to \$4,000 for one set). In contrast, costs for the contractor-constructed asphalt speed lumps vary widely according to the quantity constructed and the level of contractor experience with the device. In some areas, asphalt is more expensive than rubber. In other areas, the reverse is true. For example, a set of asphalt speed lumps in Danville, California, USA, costs approximately \$2,500 (including signing and striping), while a set in Austin, Texas, USA, can cost more than \$6,000. In general, speed lumps cost approximately the same as speed humps.

## CONCLUSION

Speed lumps are effective at reducing speeds on residential roadways while meeting the needs of emergency responders. In before-and-after speed data, speed lumps reduced the 85th percentile speed by an average of approximately 9 mph, a reduction of 25 percent. The speed reductions associated with lumps are similar to those of the speed hump, the current most common traffic calming device. Speed lumps reduce the delay to fire-rescue vehicles when compared to speed humps. Recent tests in this study found that fire-rescue vehicles can traverse a set of speed lumps with minimal vertical deflection. A review of tests from other jurisdictions found that speed lumps cause little to no delay to fire-rescue vehicles.

The results of this study demonstrate that fire department support can be achieved through proper speed lump design and demonstration. ■

*References*


1. Ewing, Reid, et al. "Traffic Calming Practice Revisited." *ITE Journal*, November 2005. Washington, DC, USA: ITE
2. Ewing, Reid. *Traffic Calming State-of-the-Practice*. Washington, DC, USA: ITE, 1999.
3. Ibid.
4. Ibid.
5. Cliamé, Crystal. "Introducing Speed Lumps to San Diego." Presentation at the 2003 International American Public Works Association Congress and Exposition, August 24, 2003.



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