TRAFFIC CALMING GUIDE

BENNINGTON COUNTY REGIONAL COMMISSION

SPRING, 2024 EDITION

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Introduction

What is traffic calming?

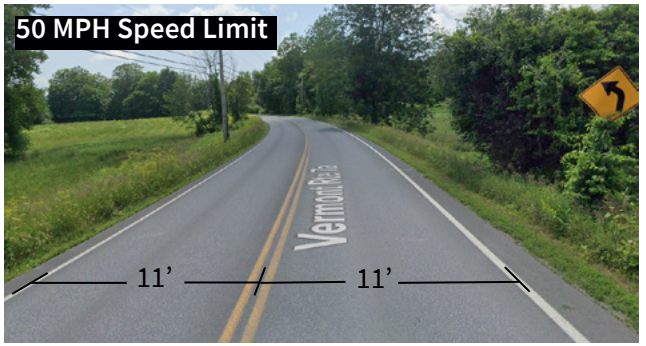
Some roads and streets invite motorists to drive faster than the posted speed limit. Wide roads, wide travel lanes and highway style pavement markings can make a local road look and feel like a high-speed highway. While exceeding the speed limit on these roads may feel comfortable to motorists, it increases the risk and severity of crashes and can hurt the quality of life for people who live along the road. The goal of traffic calming is to make driving at unsafe speeds uncomfortable. By adding physical and perceptual measures to a road, traffic calming makes it most comfortable for motorists to drive at or below the speed limit so that the road becomes "self-enforcing."

Note on sources:

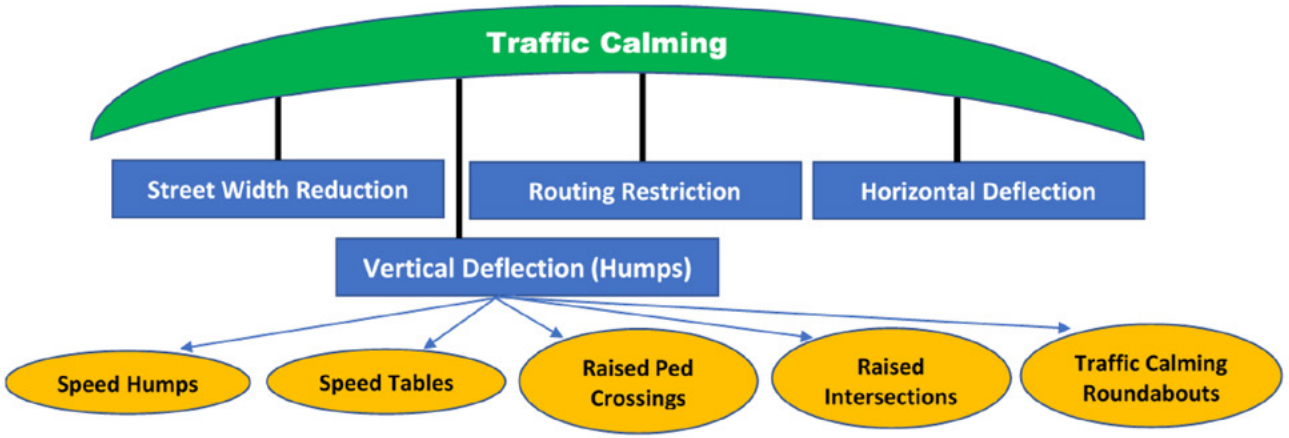
The primary source for this report is A Guide to Vertical Deflection Speed Reduction Techniques, by the Institute of Transportation Engineers (ITE), 2022. This report is a summary of the 160-page ITE book with information from other sources added. Unless otherwise noted, the source for the information that follows is from the ITE.

WHY TRAFFIC CALMING?

Which street would you drive slower on? Most people would probably say they would drive slower on the street pictured on the right. The parked cars, the trees close to the edge of the road, and the lack of a double yellow centerline will compel most motorists to proceed more cautiously. Its characteristics make it more "self-enforcing" than the street pictured on the left.



In this local example, both roads pictured above have similar designs. They both have 11-foot travel lanes, and a double-yellow centerline. Yet, despite similar appearances, the road pictured on the right (Route VT7A in Arlington) has a 50-mph speed limit, while the road on the left (Monument Ave. in Bennington) has a 30-mph speed limit. We want motorists to drive slower on Monument Ave. than on Route 7A because Monument Ave. has much shorter visual sight distances, narrower clear zones on the edge of the road, and more pedestrians and cyclists, yet the visual cues from the road's design encourage driving at unsafe speeds.



TYPES OF TRAFFIC CALMING

The main types of traffic calming are:

A **horizontal deflection** hinders the ability of a motorist to drive in a straight line by creating a horizontal shift in the roadway. Measures include chicanes, realigned intersections, traffic circles, and roundabouts.

A **routing restriction** prevents some turning movements at intersections to reduce cut-through traffic. Measures include diagonal diverters, full and half closures, median barriers, and forced turn islands.

A **street width reduction** narrows the width of the vehicle travel lane. Measures include curb extensions, median islands, on-street parking, and road diets.

A **vertical deflection** creates a change in the height of the roadway that forces a motorist to slow down to maintain an acceptable level of comfort. Measures include speed humps, speed tables, raised crosswalks, raised intersections, and traffic calming roundabouts.

Speed hump.

This report draft focuses on vertical deflection measures because they are the most effective at reducing speeds on rural roads. We hope to expand future drafts to include other types of traffic calming.

VERTICAL DEFLECTION

Speed Humps

A speed hump is an elongated mound in the road extending across the travel way at a right angle to the flow of traffic. It is typically 3 inches in height and 12 feet in length along the vehicle travel path axis. Speed humps 2.75 to 3.5 inches tall are acceptable on streets with posted speed limits of 25-30 mph.

Speed humps should be a little higher on slower streets. On streets with speed limits of 25 mph or less a height of 4 inches is recommended.

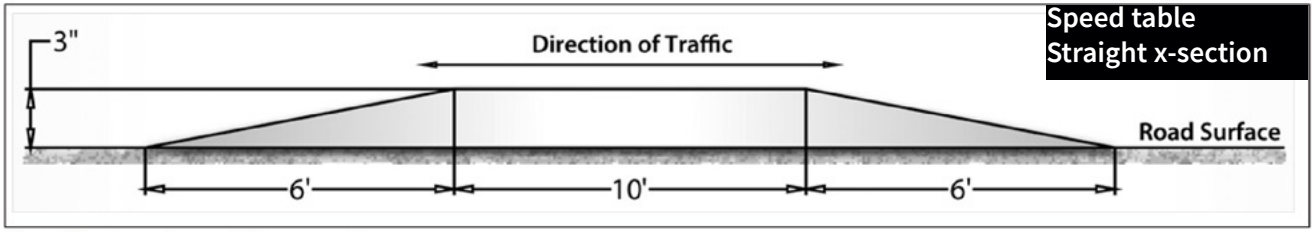
Vehicles slow to about 20-25 mph on streets with properly designed and spaced speed humps.

One of a series of speed humps on Central Avenue in Somerville, MA.

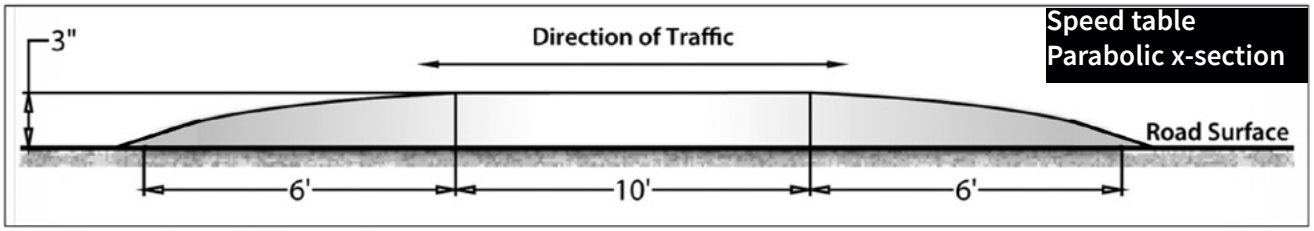
Approach Cross-sections

The three typical approach profiles for speed humps and tables each produce different effects.

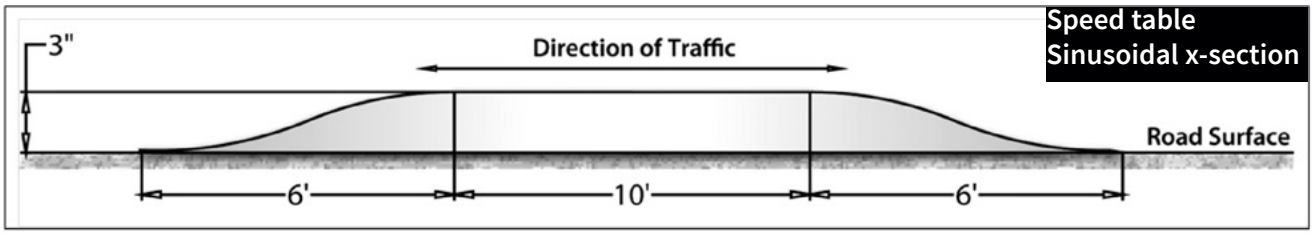
- *Straight* approaches are only recommended with raised crosswalks.
- *Parabolic* approaches are better at slowing cars, but not as good for bicycles and snowplows.
- *Sinusoidal* (wave-like) approaches are gentler and work better with bikes and snowplows.



Note: Not to scale, straight approach.

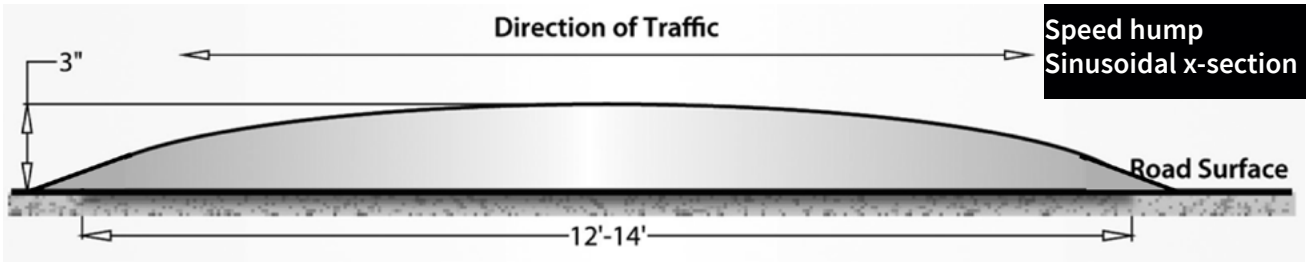


Note: Not to scale, parabolic approach.



Note: Not to scale, sinusoidal approach.

Speed Tables. Straight, parabolic, and sinusoidal cross-sections. Not to scale.



Speed hump with a parabolic cross-section. Not to scale.

Speed Tables

A speed table is longer than a speed hump and supports the entire wheelbase of a motor vehicle. The longer length makes them gentler than speed humps. Speed tables work better with emergency vehicles and should be used instead of speed humps on primary emergency response routes.

A speed tables should be 22-23 feet long with a 10-foot plateau and 6-foot approaches. It should have a vertical height 3-3.5 inches for 30 mph and 4 inches for 20-25 mph.

Vehicles slow to about 25-30 mph on streets with properly designed and spaced speed humps.

Speed table in Lebanon, NH.

The signs at the edge of pavement prevent motorists driving with one tire off the road to avoid the speed table.

Raised Crosswalks

A raised crosswalk is a variation of a flat-topped speed table with a crosswalk on top. It should be the same height as the curb. The approach should be straight, not parabolic or sinusoidal.

Raised crosswalk

Traffic Calming Roundabouts

Traffic calming roundabouts are a raised, traversable circle in the center of an intersection three inches tall. They can be used on local, residential streets with widths less than 35 feet and speed limits 30 mph or less.

Spacing of Vertical Deflection Measures

A single speed hump or speed table will only act as a point of speed control. Vehicles will slow down at the speed hump or table and then accelerate. A single isolated speed hump or table may have little effect and may have negative impacts. To be effective they need to be installed in a series.

Guidance on the proper spacing of speed humps and tables varies, but they are typically spaced 250 feet to 500 feet apart. Wider spacing produces higher vehicle speeds. The area which vertical deflection reduces speeds is 165-180 feet.

The Dutch space speed humps and tables with targeted speeds:

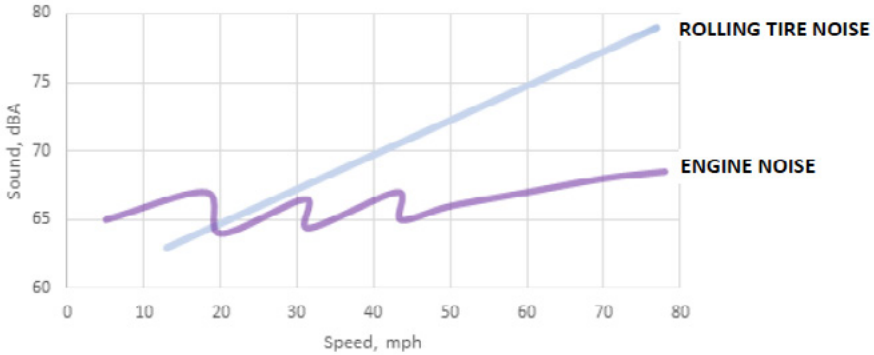
- 165 feet apart at 20 mph
- 260 – 330 feet apart for 30 mph
- Longer humps create higher speeds (11.5 – 15.7 feet)

Vertical grade: vertical deflection is not usually installed on grades 8% or more.

How Effective is Vertical Deflection?

Vertical deflection is highly effective at controlling vehicle speed. The ITE surveyed before and after studies of 125 vertical deflection projects installed since the year 2000 and found that the projects on average produced the following effects:

- Vehicles traveling 5+ mph over the speed limit – decreased by 74%
- Vehicles traveling 10+ mph over the speed limit decreased by 81%
- Typical traffic volume reduction = 20%



Noise Impacts of Vertical Deflection

The two primary sources of noise from motor vehicles are engine noise and rolling tire noise. Engine noise dominates up to about 25 mph. Above this speed rolling tire noise is more noticeable. Traffic calming reduces rolling tire noise by lowering vehicle speeds.

The ITE report concludes that the vertical deflection's net effect on road noise is minimal, but that some studies show a reduction of noise from cars by about 10%, but an increase in commercial truck noise by about 6% due to cargo shifting as the truck goes over a speed table. Speed humps reduced commercial truck noise by 2%. It is unclear why speed humps reduced commercial truck noise while speed tables increased it.

Traffic calming roundabout

OTHER TRAFFIC CALMING MEASURES

Radar Speed Feedback Signs

Radar speed feedback signs display the speed of a passing vehicle in comparison to the posted speed limit. Studies show they reduce speeds by 2-11 mph, but this effect may fade with time unless it is paired with regular police enforcement.

Lane Narrowing

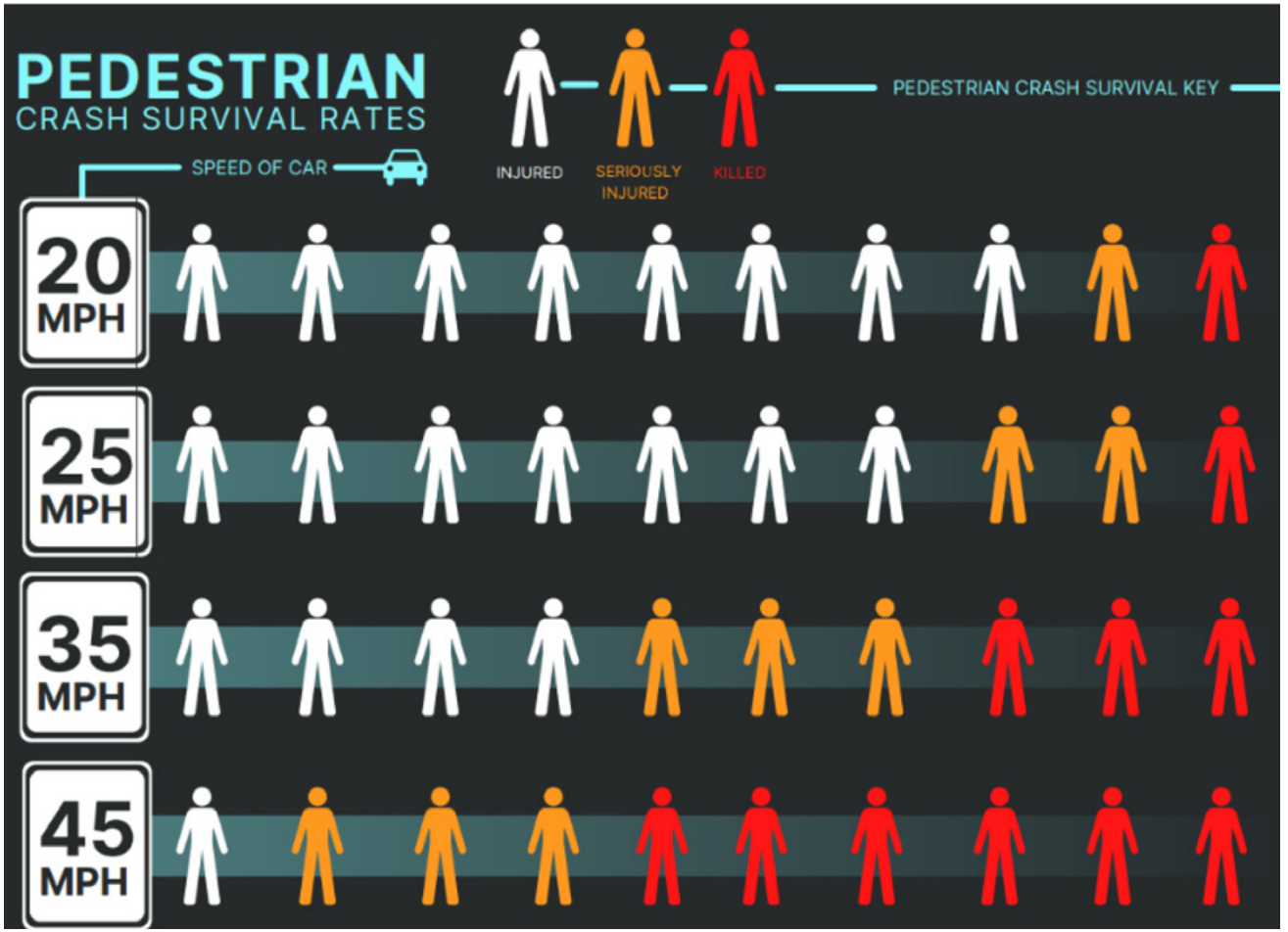
Historically, wider travel lanes (11–13 feet) have been favored to create a more forgiving buffer for drivers. However, studies show that wider travel lanes result in higher vehicle speeds. Methodologies in the *Highway Capacity Manual* (HCM) predict an approximately 0.4 to 1.1 mph increase in speeds on two-lane highways for every 1 ft increase in lane width. The Vermont State Design Standards allow for lane widths of 10-12 feet on principle and minor arterial streets and roads and 9-11 feet on collector streets and roads depending on traffic volume and shoulder width. Lane widths of 10 feet are appropriate in urban areas and have a positive impact on safety without impacting traffic operations (NACTO).

Removing the Centerline

A study by Transport for London found that removing road centerlines resulted in a reduction in vehicle speeds by 5.4 to to 8.8 mph. The study concluded that "center line removal introduces an element of uncertainty which is reflected in lower speeds".

The Manual of Uniform Traffic Control Devices, which governs road sign and lines in the US, does not require centerlines for all roads. The MUTCD states that:

"Center line markings **shall** be placed on all paved urban arterials and collectors that have a traveled way of 20 feet or more in width and an ADT of 6,000 vehicles per day or greater."



It is very important to reduce speed in residential areas where there is potential for MV/pedestrian crash.

"Center line markings **should** also be placed on all rural arterials and collectors that have a traveled way of 18 feet or more in width and an ADT of 3,000 vehicles per day or greater."

IMPLEMENTATION

What is a speeding problem?

There are no warrants for installing traffic calming measures, but the ITE found the following conditions exist where vertical deflection projects were installed:

- More than 25% of vehicles exceeding posted speed limit by 5+ mph.
- More than 10% of vehicles exceeding posted speed limit by 10+ mph.
- 85th percentile speed 7+ mph above posted speed limit.

It is important to note that the 85th percentile speed, which is often used in traffic studies to set speed limits, is more a measurement of vehicle performance than neighborhood livability and safety.

Public Input Process

Many jurisdictions have established a traffic calming program with a process for public input and approval. Many towns and cities with traffic calming programs require that most fronting residents approve a vertical deflection project on their street or road before it can be installed. The ITE found many municipalities require 67% approval, with a range of 51% to 75%.

It is important to survey residents after project definition, so they know what they are supporting.

Before and After Studies

A study should be done before and after a project. Studies may include:

- Vehicle speed
- Cut-through traffic
- Resident perception surveys
- Crash data
- Could also add pedestrian and cyclist level of comfort and traffic stress where applicable.

After studies should be done 6 months to a year after implementation. Crash data should be reviewed 2-3 years after implementation.

Construction

Most vertical deflection is constructed on existing roads to address residents' concerns, but they can be added during paving projects.

Most agencies use a template to achieve the sinusoidal and parabolic cross-sections.

Some have found installing asphalt concrete humps in two lifts or by hand is most accurate.

Getting the height correct is the most difficult part of construction.

Please see ITE book for detailed design and construction information.

Snowplowing

Vertical deflection projects have been successfully implemented in snowy places like Rochester, New York; Minneapolis, Minnesota; Toronto, Ontario; and Edmonton, Alberta; and Burlington, Vermont.

Sinusoidal (wave-like) approach cross-sections work better with snowplowing than parabolic approaches.

Many agencies use appropriate or specialized equipment (rubber-tipped plows), slightly raise the plow at vertical measures, and using salt at the measure.

It is important to mark speed tables/humps with warning signs so they can be seen if they are covered with snow.

"Vertical deflection/humps should be implemented to serve a purpose of improving neighborhood livability through reduced speeds and volume, supported by a community-driven transportation engineering review."
-ITE

Common Mistakes

- Not following height recommendations (too high or low). Sweet spot is between 2.75 in. to 3.5 in.
- Lack of proper traffic control devices (signs and lines).
- "One speed hump/table is all we need." A single isolated speed hump/table may have little effect and may have negative impacts.
- Not following process, data collection, coordination with fire officials, etc.
- Humps/tables too close to driveways. They should be at least one car length from a driveway.

Resources

A Guide to Vertical Deflection Speed Reduction Techniques, by the Institute of Transportation Engineers (ITE), 2022. The book is available for purchase at the ITE Bookstore, or can be borrowed from the BCRC.

ITE/Federal Highway Administration (FHWA) Traffic Calming ePrimer is a free, online resource.

National Association of City Transportation Officials (NACTO) has useful information on traffic calming in urban settings.

Traffic Safety Toolbox: Speeding Countermeasures Toolbox for Vermont is a resource developed by VTrans and UVM with examples from Vermont.