

A Study on Speed Humps

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EXECUTIVE SUMMARY

IOWA STATE UNIVERSITY

Until the 1970s, residential traffic problems were not a significant issue. In the past decade, however, there has been research regarding the impacts of high traffic volumes on the quality of life in residential neighborhoods. Speed humps are a geometric roadway design feature with the purpose of slowing traffic in residential neighborhoods. (They are self-enforcing and often called "sleeping police officers".)

Speed humps are three to four inches high and 12-22 feet long. (Design features are in Appendix A) They are found on public residential roadways. To avoid driver discomfort, the vehicle must slow down to a speed of 15-20 mph while traveling over them.

The question of installing speed humps or any other residential traffic control device usually comes from residents who are concerned about safety in their neighborhoods. Before installation, however, research and data collecting concerning current speeds, stop sign obedience, pedestrian activity need to qualify the traffic problems.

Speed humps are designed for public residential roadways that have two lanes or less at a posted speed limit of 30 mph or less, and 85th percentile speeds of 31-34 mph. Roadways that carry traffic volumes of 600-5000 vehicles per day are good candidates for speed hump installation.

Speed humps should be placed so that vehicles do not approach at high speeds. They should also be placed on property lines and near street lights. To be effective, speed humps should be placed in series at 200-600 foot intervals. Speed humps should not be placed on curves, transit routes, or major emergency response routes.

When designed and installed properly, speed humps will reduce vehicle speeds to 15-20 mph at the hump and 25-30 mph between humps in a series.

Before installation, the following should be done:

1. Traffic engineering studies to determine if the route in question is a good candidate for speed humps.
2. Enforce existing laws and ordinances regarding speed limits, revising if necessary.
3. Educate residents on the causes of the speeding problem and possible solutions.
4. Install traffic control devices (regulatory, warning, and guide messages) in conformance with the MUTCD.
5. Consider legal liability. Speed humps are not addressed in the Manual for Uniform Traffic Control Device and public agencies have been held liable for damage and/or injury resulting from speed humps. It is important to document justification for all decisions made concerning installation and to review state and local laws to identify regulations pertaining to roadway design, roadway maintenance, traffic control, and other elements that might be related to the use of speed humps or other geometric design features.
6. If the problem is not solved with the above strategies, consider using speed humps.

If designed, installed, and maintained properly, speed humps can be a safe, effective method of reducing vehicle speeds through residential areas.

INTRODUCTION

Until the 1970's, residential traffic problems were not a significant issue. In the past decade, however, research regarding the impacts of high traffic volumes on the quality of life in residential neighborhoods and higher speeds has been done. Research has concluded that poorly designed street layouts, underdesigned arterial roadways, increased vehicle ownership, longer trip lengths, and smaller household size contribute to this problem. There are several solutions to this problem all with the purpose of slowing traffic down and eliminating through traffic. New residential roadways are being designed in curvilinear fashion with cul-de-sacs and cities are implementing designs such as raised intersections and speed humps in established neighborhoods.

Speed humps are not an official traffic control device and are not addressed in the Manual of Uniform Traffic Control Devices (MUTCD) but are instead a geometric pavement design feature. Their main purpose is to slow vehicles to speeds under 30 mph. They are self-enforcing and often called "sleeping police officers". When driving over them at higher speeds, the driver feels discomfort.

BACKGROUND

Speed humps differ from speed bumps. Speed bumps are 3-4 inches high and 1-3 feet long and have typically been used in parking lots and on private roads. To pass over speed bumps without doing damage to the vehicle or causing discomfort, the driver must slow down almost to a complete stop. The effects of speed bumps are diminished by passing over them at excessive speeds in a vehicle with loose suspension.

Speed humps are 3-4 inches high and 12-22 feet long (see Appendix A). They are found on residential roadways. To avoid driver discomfort, the driver slows to a speed of 15-20 mph. Unlike speed bumps, at excessive speeds, the effects of speed humps are increased sometimes to the point of acting like a bump and jolting both the driver and their cargo.

Speed humps were originally developed in Great Britain by the Transport and Road Research Laboratory (TRRL). Extensive research was conducted on test tracks in a laboratory with vehicles traveling at various speeds over various hump sizes and shapes. The parabolic shaped speed hump used throughout Europe, Australia, and New Zealand was developed by TRRL. After extensive research, it was found that the ideal speed hump is 12 feet long and 3-4 inches high.

In the United States, the Federal Highway Administration (FHWA) began testing the TRRL speed humps in 1979 in St. Louis and concluded that they were safe to continue with public street testing. In 1983, the

Subcommittee of California Traffic Control Devices supported, via a public report, the use of speed humps on public streets. Speed humps are now being used in Florida, California, Oregon, and other locations.

Australia developed an alternative to the original TRRL speed hump. The Australian Road Research Board designed the "flat-topped" hump which is 22 feet long and 3-4 inches high. The flat-top section is made of brick paving and has asphalt or concrete ramps. This design is more aesthetically pleasing and it reduces the pavement deformation problems associated with asphalt humps.

DESIGN METHODOLOGY

The question of adding speed humps or any other residential traffic control device usually results from residents who are concerned about traffic safety in their neighborhoods. Because of general increased traffic flow, more traffic naturally moves through residential neighborhoods. Due to poorly designed roadways, it is easy for cars to use local streets as shortcuts between collectors and arterials. In addition, drivers often do not obey the residential speed laws, which are generally lower than on collectors and arterials.

Installing street humps is not a small project nor does it have a small impact. Nothing should be implemented, or even considered, unless there is strong urging from residents along the affected roadway. Even then, there are a number of things that should be evaluated and implemented before installation.

1. Traffic engineering studies of the area need to be done to determine if the path in question is a good candidate for speed humps utilizing the criteria mentioned earlier. These studies include safe sight distance, pedestrian activities, vehicle classification, traffic count, speed studies. Current land use, school routes, "as built" plans, other control devices, and stop sign compliance should also be examined.
2. If the traffic engineering studies show that there is a prevailing problem, the next step should be to enforce existing laws and ordinances regarding speed limits, revising them if necessary.
3. The third strategy is to educate residents on the causes of the speed problem and the potential solutions to it. They should be well informed on the advantages and disadvantages of each possible solution. This can be done in a number of ways including town meetings, flyers, posters, and door to door education.
4. Installation of traffic control devices, including regulatory, warning, and guide signs, in conformance with the Manual on Uniform Traffic Control Devices, is the next step.
5. Consider legal liability. Review the current laws and regulations regarding speed humps. Courts have held the installing agency liable for damage and personal injuries resulting from speed humps.
6. If none of the above strategies alleviates the speed problem, then speed humps should be considered. The plan, however, should not be implemented until other alternatives have been explored, all groups affected are informed and/or consulted concerning the matter, and traffic engineering studies have been conducted and conclude that there is a need for speed humps.

Speed humps are designed for residential roads that have two lanes or less at a posted speed limit of 30 mph or less, and 85th percentile speeds of 31-34 mph. Local roadways that carry traffic volumes of 600-5000 vehicles per day are good candidates. Traffic volumes less than 600 do not typically impact neighborhoods enough to require speed humps. Speed humps will not have a significant positive effect on roads with volumes greater than 5000 vehicles per day. Roads with high volumes need other traffic control devices to alleviate problems.

Location

The first speed hump in a series should be placed 50-200 feet from a small radius curve or stop signs assuring that vehicles are not approaching at high speeds. If installed on a street with a significant gradeline, the first hump in a series should be placed at the top of the grade.

If possible, speed humps should be placed on property lines for noise abatement. Although the overall noise level along a hump controlled section of roadway is not increased significantly, the noise of a vehicle traversing a hump can increase. Humps can also be placed on property lines for aesthetic reasons. Humps should be placed near street lights to increase nighttime visibility.

To be effective along a section of roadway speed humps should be placed in series at 200-600 feet intervals when considering the geometries of the roadway. (Please see Appendix B) On a flat, straight roadway, research has shown that 275 foot intervals are ideal for maintaining speeds of 25 mph. The following equation was developed by the California Subcommittee of the California Traffic Control Devices Committee to determine spacing between humps:

$$H_s = 0.5[2(V_{85})(V_{85})-700]$$

Where H_s = optimal spacing between 3" humps (ft)

and V_{85} = the desired 85th percentile speed (mph) between humps

Each speed hump or series of humps must have accompanying warning signs in accordance with MUTCD. (Please see Appendix C)

Each speed hump must be painted with a pattern that makes them visible to drivers and provide a safe and reasonable sight distance. (Please see Appendix D)

Speed humps should not be placed on sharp curves (either vertical or horizontal). If the curves are too sharp, it can result in lateral and/or vertical forces on the vehicle when traversing the speed hump. Speed humps should not be placed on a vertical curve with less than the safe stopping sight distance. Placing humps on horizontal curves increase the risk of losing control of a vehicle because it will not approaching perpendicular to the hump.

Standard speed humps are 12 feet long which is longer than the average wheel base length for cars (10 ft). This allows the car to maintain control while passing over the hump and omits "bottoming out". Vehicles with a wheel base longer than 12 feet will experience the same effect as a speed bump (jolting of cargo and passengers). If traffic volumes consist of more than 5% long wheel base vehicles, speed humps should not be installed. Because the wheel base length of most buses is greater than 12 feet, speed humps should not be placed on transit routes.

Speed humps should not be placed on major emergency vehicle response routes. In Britain, fire department and ambulance drivers reported having to slow down to 10 mph when crossing each hump to avoid damage to on board equipment, thus increasing emergency response time.

Speed humps along a street can divert traffic to a nearby route. If traffic engineering studies show that the diverted traffic may cause equal or greater problems on a nearby route, speed humps should not be installed.

EXPECTED RESULTS

Research has shown that speed humps, when designed and installed properly, reduce vehicle speeds to 15-20 mph when traversing speed humps and 25-30 mph in between properly spaced speed humps. When traversing a speed hump, the vehicle experiences a gentle rocking motion that increases with speed. This enables the speed humps to be self-enforced because the vehicle occupants will experience discomfort when passing over a hump at higher speeds and a jolting when passing over at excessive speeds.

Although speed humps have been proven to be effective at reducing speeds, there are drawbacks. Installed speed humps have actually been removed in response to resident complaints. The major complaints have been aesthetics of having speed humps and the increased noise level at each hump although the net noise change throughout the controlled strip is insignificant.

Although they are the most important group, more than just the residents are affected by the installation of speed humps. Other groups such as emergency service providers, street maintenance providers, school

districts, transit operators, refuse collection agencies will be affected and should, therefore, be informed and consulted concerning the installation of speed humps.

Bicyclists and Motorcyclists

Bicyclists and motorcyclists will have the most direct physical impact of all travelers passing over the speed humps. It should be noted that if the hump has a length that is shorter than the wheel base of a bicycle (3.5 feet), the hump should be no higher than 2 inches so that the toes of a bicyclist do not strike the humps.

Liability

Speed humps are not addressed in the Manual for Uniform Traffic Control Device but are instead geometric roadway design features. If not installed properly and property damage or personal injury occur, the installing agency may be held liable. In fact, many California courts have held public agencies liable for damage and/or injury resulting from both speed humps and speed bumps. It is prudent to document justification for all decisions made concerning installation. It is also important to review state and local laws to identify regulations pertaining to roadway design, roadway maintenance, traffic control, or other elements that might be related to the use of speed humps or other geometric design features.

FEEDBACK FROM IOWA

City	Favorable	Unfavorable
Ames	<input type="checkbox"/>	x residents don't want
Cedar Rapids	<input type="checkbox"/>	x
Council Bluffs	x Citizen requests	<input type="checkbox"/>
Iowa City	x Have a strip installed	<input type="checkbox"/>
Sioux City	x Citizen requests	<input type="checkbox"/>
West Des Moines	<input type="checkbox"/>	x Diverts traffic to other routes

CONCLUSION

The procedure for installation begins with the residents' request and continues with traffic engineering studies to determine the need for speed humps. These studies include but are not limited to: safe sight distance, pedestrian studies, vehicle classification, traffic count, and average speed. Current land use, school routes, "as built" plans, other control devices, and stop sign compliance should also be examined.

If it is determined that speed humps are the best solution for a roadway, then the installation can begin. The humps installed should follow the design criteria. They should be 12 feet long and 3-4 inches high (see Appendix A), have accompanying warning signs in accordance with MUTCD (see Appendix C), and be painted with a pattern that makes them visible to drivers and provide a safe and reasonable sight distance (see Appendix D).

If designed, installed, and maintained properly, speed humps can be a safe, effective method of reducing vehicle speeds through residential areas.

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