Department for Transport

Traffic Advisory Leaflet 1/98

February 1998

Speed cushion schemes

Introduction

This leaflet describes the results of a study of 34 speed cushion schemes installed by various local authorities in England. It adds to the advice given in Traffic Advisory (TA) Leaflet 4/94 on the design and installation of speed cushions.

The study

Three main types of speed cushion were studied:

- a series of single cushion layouts combined with carriageway narrowings (allowing only single lane working, and therefore more suitable for low flow roads)
- groups of cushions in pairs (allowing two way working, suitable for higher flow roads)
- groups of cushions three abreast (also allowing two-way working - used on wider carriageways and negating the need to have build outs)

Background

Speed cushions were introduced in order to overcome concerns about discomfort and delay expressed by bus companies and the emergency services resulting from the use of flat and round top road humps.

Speed cushions were first tried on the public highway in the UK in 1993. The current legal position is that the Highways (Road Humps) Regulations 1996 make it unnecessary to seek any special authorisation for speed cushion designs. However, until the Traffic Signs Regulations and General Directions 1994 are amended, authorisation for the associated markings is necessary (see TA Leaflet 7/96). In Scotland the legislation differs and advice should be sought from the Scottish Office.

Track trials investigating the design of speed cushions were carried out by the Transport Research Laboratory (TRL) in November 1992 (see TRL Report 32), on behalf of the Driver Information and Traffic Management Division (DITM) of the Department. TRL also undertook monitoring for DITM of on-road speed cushion schemes installed in Sheffield and York in 1993 (see TA Leaflet 4/94).

More recently, many local highway authorities have installed speed cushions on public roads. As part of continuing investigations into road humps by DITM, the TRL was commissioned to carry out an assessment of these schemes.

Results

Cushion dimensions

Recommended dimensions (see TA Leaflet 4/94) for speed cushions are:

- side ramp gradients not steeper than 1:4
- off/on ramps not steeper than 1:8, (curved on/off ramps should have an average gradient not steeper than 1:5)
- a maximum height of 80mm (though 75mm has since been found to be a preferable maximum)
- maximum length 3700mm
- maximum width 2000mm (for bus routes a width of between 1600mm to 1700mm is preferred)

Most of the schemes investigated adhered to the above dimensions, but some differences occurred. Widths generally ranged from 1500mm to 2100mm, lengths from 1700mm to 4750mm, and height 60mm to 100mm. The gradients of on/off ramps varied from 1:3.5 to 1:12, and side ramp gradients varied between 1:3.5 to 1:5.25. Small circular cushions of 1380mm in diameter were used in one scheme as part of a bus route, and in another location cushions only 1000mm wide were installed.

There was no indication from the study that the variation in dimensions used offered any particular advantage over the recommended dimensions. However, where the proportion of heavy commercial vehicles is high, the narrower 1500mm wide cushion may have some advantage in limiting any adverse traffic noise and ground-borne vibrations (see TA Leaflet 2/97).

To avoid the possibility of vehicles grounding on the cushions, in some schemes cushion heights were only 65mm high: in one case a 65mm high cushion was subsequently lowered to 55mm. Despite this, generally the evidence suggests that a maximum height of 75mm should be satisfactory. Speed cushions less than 2000mm long may result in cars being able to straddle the cushion lengthways, increasing the chance of a vehicle grounding on the top of the cushion. Consequently, when short length cushions (2000mm or less) are to be used it may be advisable to limit the maximum height to 65mm. TRL have suggested that to limit grounding, particularly where there are vehicles with low ground clearances combined with long wheelbases or low front overhangs, the cushion plateau should not be less than 800mm in length, with the overall length not less than 2000mm, and ramps no steeper than 1:8.

Speeds at cushions

The study has confirmed that whilst speed cushions can reduce and control vehicle speeds, they do not match the effect of flat or round top road humps. The overall average mean and 85th percentile speeds at the cushions monitored were 17 mph and 22 mph respectively, which is higher than those measured at 75 mm high flat and round top humps (see TA Leaflet 2/96).

Larger vehicles such as buses are likely to be slowed down to a lesser extent than cars, particularly at narrower cushions (see TA Leaflet 4/94). This is one of the advantages of speed cushions where traffic calming is required along a bus route.

Test runs made with fire appliances indicated that "urgent" crossing speeds for fire appliances at speed cushions could be10 mph to 20 mph higher than over 75mm high humps. For ambulances, crossing speeds at wide cushions were similar to 75mm high humps, but slightly higher at narrow cushions.

Overall the analysis (see Fig.1) indicated that mean speeds at 1600mm wide cushions were likely to be about 19.5 mph, and for 1900mm wide cushions about 15.5 mph, based on "before" mean speeds of 30 mph, and "before" 85th percentile speeds of 35.6 mph. A separate study (see TA Leaflet 2/97) found that mean speeds for light vehicles at 1500mm wide cushions was about 26 mph.

It appears that to gain maximum reductions in speed the speed cushions need to have the appearance of being more formidable than they actually are. Using a colour for the cushions which contrasts with the adjacent carriageway surface will help to create this effect.

Speeds between cushions

Spacing between cushions at the sites varied between 50m and 105m, with an average of around 70m. Mean and 85th percentile speeds between cushions were reduced on average by about 10 mph when comparing "before" speeds with "after" speeds. The overall average mean speed was 22mph and the 85th percentile speed 26 mph.

Analysis of the speed data collected is shown in Figure 2. It indicates that with a spacing of 60m a mean speed of 20.5 mph between cushions could be expected, whilst a spacing of 100m should result in a mean speed of about 24.5 mph. Using narrow cushions (1500mm to 1700mm) in a 20 mph zone may not result in an average speed of 20 mph or less being achieved, particularly where before speeds are higher than 30 mph.

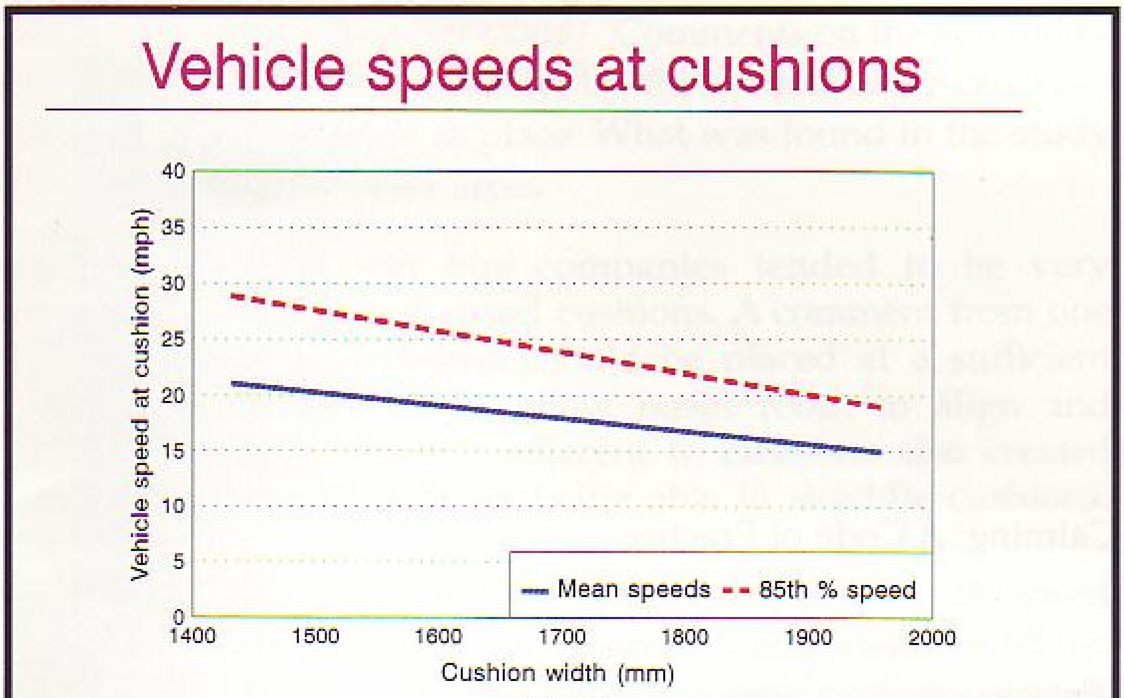

FIGURE 1

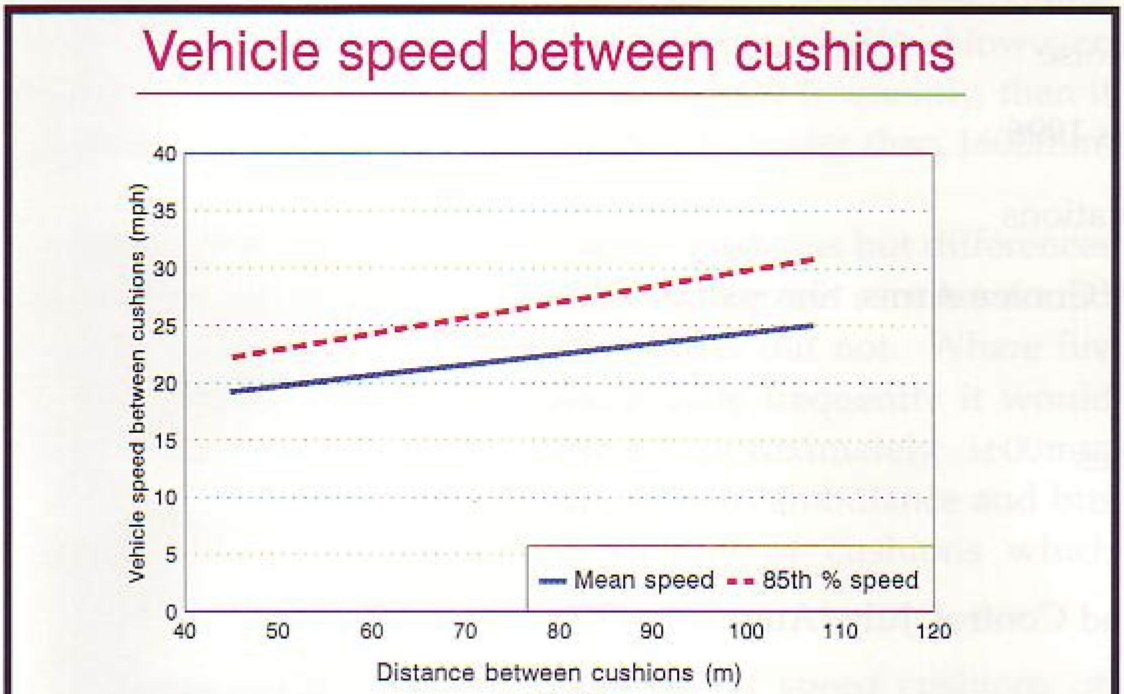

FIGURE 2

Accidents

A comprehensive analysis of accidents was not carried out. However, previous studies have shown that changes in speed are related to changes in accidents, with a1 mph reduction in speed giving a 5% reduction in accidents. Based on this and TRL Report 215, it has been estimated that overall accidents for the schemes studied would have been reduced by about 60%.

Passenger discomfort

The measurement of passenger discomfort was not included as part of this trial. However, on-road trials have shown that passenger discomfort in large buses is likely to be low at speed cushion schemes, providing buses straddle the cushions centrally. When buses did not straddle the cushions, passenger discomfort increased, similar to the experience with flat and round top humps. Therefore, it is important that cushions are located so that vehicles, and particularly buses, can straddle them. This may demand removal of parking in the immediate vicinity of the cushions, with care given to ensuring that the gaps on either side of each cushion are adequate. Previous advice (see TA 4/94) is still relevant, and as far as possible gaps should not be less than 750mm. A maximum gap width of 1000mm to 1200mmis also recommended. Any larger than this and there is a greater tendency for drivers to aim for the gaps rather than the cushions. This can cause concern to other road users particularly when this occurs at a central gap.

The level of passenger discomfort experienced by passengers in minibuses and ambulances using some cushion schemes has been found to be unsatisfactory. Results from off-road trials have indicated that reducing the cushion width to 1600mm would reduce levels of discomfort in minibuses and ambulances, but would be likely to result in some increase in the speed of cars.

Driver behaviour

The position that drivers take to negotiate speed cushions was examined in the trial. The results showed that when the approach and exit was unaffected by parking, about 55% of cars and 90% of buses were found to straddle the cushions. In general, cushions with narrower plateaux resulted in more cars straddling. Most cyclists and motor cyclists avoid the cushions and utilise the gaps, and a minimum gap of 750mm between the lower edges of adjacent cushions, or between the edge of the cushion and kerb, is of value to them. However, should motor cyclists or cyclists need to ride over a cushion they should be able to do so safely, provided they are not travelling at an excessive speed. Motor cycle and sidecar combinations should also be able to negotiate the cushions, though trials have suggested this may need to be at relatively low speeds (i.e. below 20 mph) if the stability of the combination is not to be adversely affected.

Observations showed that some drivers chose to adopt a central position to take advantage of the gap between cushions. Reducing the width to 1200mm or less, as mentioned above, will help to deter such actions, but it was noted that a few drivers attempted this route even where gaps were only 1000mm wide. Having a single cushion between build outs on both sides, or installing a central island, can prevent such manoeuvres. However, apart from the extra expense this involves, such provision may not always be appropriate.

Bus and emergency services

Comments on the suitability or otherwise of speed cushions by these road users can vary considerably from place to place. What was found in the study may not be true for other areas.

The study found that bus companies tended to be very supportive of the use of speed cushions. A comment from one operator was that cushions should be placed at a sufficient distance from junctions to allow buses room to align and straddle cushions. Parking adjacent to cushions also created difficulties in terms of buses being able to straddle cushions.

Ambulance operators were generally supportive of speed cushions. One preferred the use of straight ramps with 1:8 off/on ramps to the curved ramps which had steeper gradients overall. Views on appropriate widths of cushions varied with some finding 1900mm wide cushions acceptable whilst others found narrower cushions around 1600mm wide preferable. However, if there was a route which ambulances used frequently, then it would seem advisable to use cushions no wider than 1600mm.

Fire services accepted the use of speed cushions but differences arose on actual widths to be used. Some fire services found 2m wide cushions tolerable, whilst others did not. Where fire appliances are likely to use a route quite frequently it would seem appropriate to use cushions approximately 1600mmwide. The other cause of concern, as with ambulance and bus operators, was parking in the vicinity of cushions which prevented cushions being straddled.

Some police forces objected to the use of speed cushions on district distributor roads because of possible adverse effects on response times. The effect of parked vehicles in the vicinity of the cushions was another concern.

Environmental effects

As far as noise and ground-borne vibrations are concerned, TA Leaflets 6/96 and 8/96 should be referred to. There is at present limited factual information on the effects that traffic calming might have on emissions, though some advice on vehicle emissions is given in TA Leaflet 4/96, and research is being undertaken. It is worth noting that overall traffic flows, on those roads with speed cushions that were studied, were reduced by an average of 24%, thus limiting any adverse environmental effects.

The appearance of road cushions can be important, and their visual impact may be an influence in public acceptability. It is worth noting that overall traffic flows, on those roads with speed cushions that were studied, were reduced by an average of 24%, thus further limiting any adverse environmental effects.

Pedestrian crossing places

Speed cushions should not be provided across any pedestrian crossings because of the possibility that pedestrians might trip on them (see also TA Leaflet 7/96). Where speed cushions are installed on approaches to pedestrian crossings, care needs to be taken that pedestrians are directed to cross between the speed cushions, not over them.

Using a conspicuous colour for speed cushions, either at or away from crossings, may help pedestrians to identify where they are, and thus avoid them when crossing the road.

The use of staggered single-pair cushions at crossing places may result in drivers crossing the carriageway centre line to avoid the cushions, unless a pedestrian refuge has been provided to prevent this manoeuvre.

References

Highways Act 1980

Road Traffic Act 1991

Highways (Road Humps) Regulations 1996

Traffic Signs Regulations and General Directions 1994

Traffic Advisory Leaflet 3/94 - Fire and Ambulance Services, Traffic Calming: A Code of Practice

Traffic Advisory Leaflet 4/94 - Speed Cushions

Traffic Advisory Leaflet 2/96 - 75mm High Road Humps

Traffic Advisory Leaflet 4/96 - Traffic Management and Emissions

Traffic Advisory Leaflet 6/96 - Traffic Calming: Traffic and Vehicle Noise

Traffic Advisory Leaflet 7/96 - Highways (Road Humps) Regulations 1996

Traffic Advisory Leaflet 8/96 - Road Humps and Ground-borne Vibrations

Traffic Advisory Leaflet 2/97 - Traffic Calming on Major Roads: A49, Craven Arms, Shropshire

TRL Project Report 32 - Speed Control Humps - A Trial at TRL

TRL Report 215 - Review of Traffic Calming Schemes in 20 mph Zones

TRL Report 312 - Traffic Calming - Speed Cushion Schemes

"The Grounding of Vehicles on Road Humps" Traffic Engineering and Control, July/August 1993

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