Department for Transport

Traffic Advisory Leaflet 4/94
October 1994

Speed Cushions

Introduction

A speed cushion is a form of road hump, occupying part of the traffic lane in which it is installed. Speed cushions are generally located in pairs, arranged transversely across the carriageway, but single cushions centrally positioned between build outs, "three abreast" versions, and double pair arrangements have also been used.

Speed cushions were notable features within some of the early traffic calming projects in Germany. The theory was that they would cause less interference to larger vehicles such as buses and emergency vehicles, but still reduce the speed of cars. Amendments were made to the Highways Act 1980 by the Road Traffic Act 1991, allowing the Secretary of State to authorise the use of road humps which do not conform to the requirements of the Highways (Road Humps) Regulations 1990. This change in the legislation has enabled non standard road humps such as speed cushions to be authorised for use on public roads.

Bus negotiating a speed cushion

Speed cushion development

It was anticipated that the changes to legislation in 1992 would evoke considerable interest from local authorities, some of whom had already carried out off-road trials of speed cushion designs. Pressure to use cushions arose as a result of complaints received from some emergency services and some bus operators about road humps designed in conformity with the 1990 Road Humps Regulations.

The Department was concerned that designs for speed cushions should accommodate all road users safely. The Transport Research Laboratory (TRL) was commissioned by the Driver Information and Traffic Management Division of the Department to carry out track trials. The aim was to determine design parameters of cushions that might be suitable for use on public roads.

The results of these trials, which are documented in TRL Report PR 32 "Speed Control Humps - A Trial at TRL", established broad design parameters for further testing under actual road conditions.

On-road trials

The track trials provided information on comfort/discomfort ratios, but they could not indicate the speed reductions that might be obtained in practice. This would be related to drivers' perceptions and concerns when negotiating the cushions.

The Department therefore sought the co-operation of two local authorities, Sheffield City Council and York City Council, who had both previously undertaken their own off-road trials, to carry out on-road trials of speed cushions. The Department contributed to the cost of installation, and paid for monitoring studies and analysis of survey results carried out by the TRL.

The results of these trials are fully documented in the TRL Project Report PR43 "On-Road Trials of Speed Cushions in Sheffield and York".

The cushions used in the on-road trials included proprietary brands of speed cushions which differed slightly from the design parameters derived from the track trial. As the intention was to carefully monitor the cushions likely to be used by local highway authorities, it was considered both appropriate and safe to include these designs in the trial. All designs were subject to special authorisation through the Road Safety Division of the Department.

As well as monitoring speeds, the opportunity was also taken to monitor noise, and the results of these measurements can be found in TRL Project Report PR103 "Vehicle and Traffic Noise surveys alongside Speed Control Cushions in York".

Moabit Pad, Berlin

Track Trials

Single Cushion

Two Abreast Speed Cushions

Trial Conclusions

The on-road trials have shown that speed cushions are suitable for use as speed control features. They do not generally cause excessive discomfort to passengers of large buses, or excessive discomfort/delay to fire service vehicles. The discomfort or delay for passengers in mini and midi buses and double rear wheel ambulances is likely to be higher than for the larger buses, particularly at the wider cushions.

Careful consideration needs to be given to the most appropriate cushion design for a particular road, and for the vehicles likely to use that road. Design parameters established from the trials were as follows:

Side ramps gradients

Not steeper than 1:4.

On and Off gradients

It is recommended that on and off gradients should not be steeper than 1:8. The research suggested that where larger buses operate, the use of both of in situ cushions with 1:6 gradients and a proprietary brand of cushion using a curved ramp with an average gradient of 1:5, did not cause any great discomfort or difficulty. However, in some circumstances with the 1:6 gradient cushions, grounding by other vehicles could occur. It is likely that these steeper gradients could be permitted in future, where they are appropriate to the type of vehicles likely to be using the route.

Height

80mm should be considered as an absolute maximum. There have been reports of grounding occurring where cushions have in error been installed at heights greater than 80mm. It is recommended that 75mm should be specified as the maximum height for any cushions to be

constructed in situ. A lower height of 65mm may be appropriate for narrow cushions.

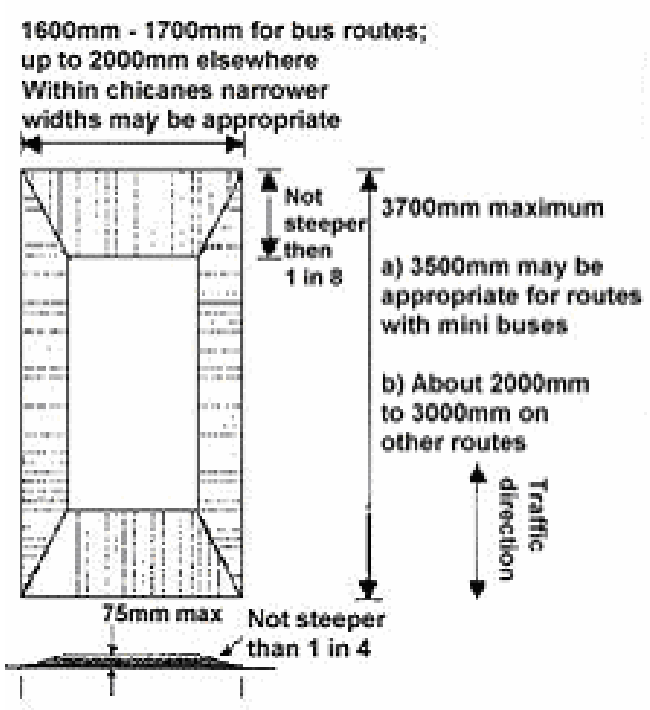
Length

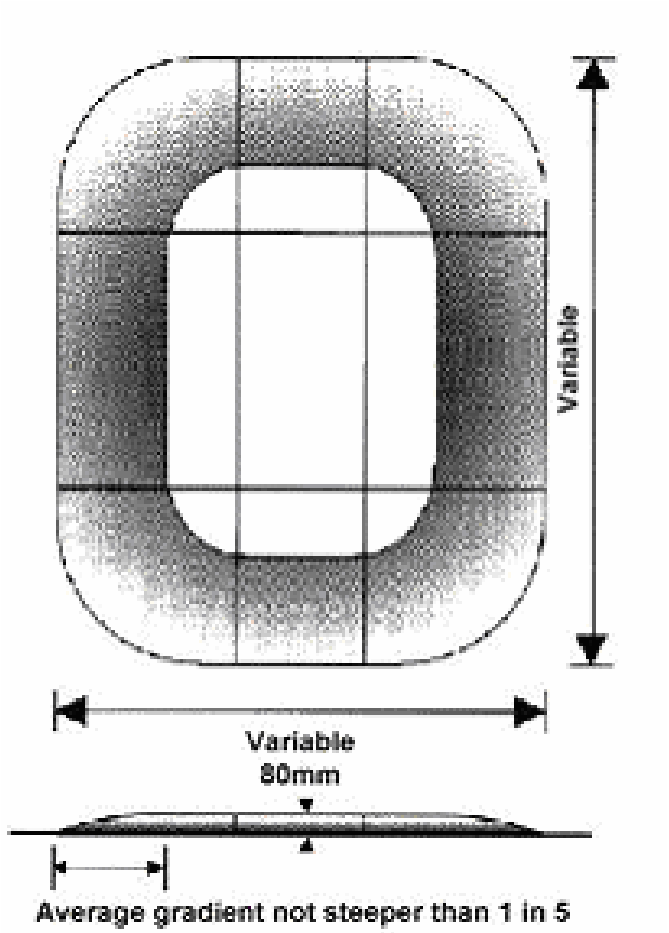
Overall lengths varied between 1.7m and 3.4m, but were generally around 2m to 2.5m. Monitoring of the trials did not indicate any great difference in terms of discomfort. However, it has been suggested from off-road trials elsewhere that cushion lengths of 3.5m, with a width of 1.6m, height not greater than 65mm, and on and of gradients not steeper than 1:8 may cause less discomfort to passengers of mini and midi buses. On-road trials have not yet been carried out to substantiate this claim.

Width

A wide cushion (about 1.9m) will have a slightly higher speed reducing quality than a narrower (1.6m) one. However, whilst the wider cushion would be generally appropriate for fire service vehicles, it may not be acceptable by bus operators because of the increased discomfort. Very narrow cushions (1.3m or less) are best used in conjunction with a chicane or narrowing feature, when the effects tend to be more psychological than physical.

Speed cushion dimensions





Longitudinal spacing

This should generally accord with the requirements of the Highways (Road Humps) Regulations. Cushions cannot control speeds as much as standard road humps, and complete reliance on them in a 20mph zone may not achieve average speeds of less than 20mph. For the narrower cushions (1.6m), spacing in the region of 60m to 80m would normally be required to ensure 85th percentile speeds of 25mph of 30mph. Closer spacing than this should produce 85th percentile speeds of less than 25mph along the road, offering greater encouragement to drivers to maintain a steady speed which then allows the cushions to be negotiated without discomfort or heavy braking, and with consequent environmental benefits.

Transverse gaps

Minimum gaps of 750mm between the base of a cushion and the kerb, as well as between adjacent cushions, are appropriate to accommodate cyclists and motorcyclists, though 1m is an ideal width. It was found that most cyclists and motorcyclists naturally tended to follow the nearside gap. It is important therefore to ensure that this is reasonably level, and the cushion is not located adjacent to a gully. Where parking occurred cyclists could not take advantage of the nearside gap. In some instances parked vehicles straddled

the cushion, reducing the gap available on both sides. As a result cyclists either rode over the cushions or rode to the other side of the carriageway to utilise the gap there. It is not unsafe for cyclists or motorcyclists to ride across cushions of designs agreeing with those specified above, though it is not particularly comfortable. Special care is required in design where three cushions transversely in line are used and regular parking occurs.

Signing

Should be in accordance with the requirements of the Road Hump Regulations.

Three Abreast Speed Cushions

Set of Four Cushions

Cyclist using nearside gap

Indiscriminate parking

This can be a reason for buses being unable to centrally straddle cushions. In these cases it may be preferable to consider using cushions positioned adjacent to build outs or pinch points to prevent parking within the vicinity of the cushions. Another alternative would be to have a central refuge with a cushion either side. However, if the refuge is likely to be used by pedestrians to cross, the cushions will need to be positioned before or after the refuge, usually offset one to the other, to allow pedestrians to cross the road at one level. Groups of three cushions spaced across the road allow at least one cushion to be available to be straddled, limiting the impact of parking directly over the cushions.

Speeds

Within the design parameter of having forward gradients of about 1:8, mean speeds at the cushions were about 19mph for the narrower cushions (1.6m), and about 14mph for wider cushions (1.8m to 1.9m).

Before the schemes were installed the mean speed of buses was about 2mph to 8mph slower than the mean speed of cars. After the cushions were installed the mean speeds of buses were generally similar to or slightly faster than cars.

For emergency vehicles the mean "urgent" speeds for the fire appliance were higher than that at 75mm road humps, whilst for the ambulance the mean speeds at the wider cushions were similar to that at road humps.

Double pair arrangements of cushions resulted in mean speeds about 1mph less than single pair arrangements. Three cushions in line transversely had mean speeds about 2mph higher than single pair groups.

Single cushions at single lane pinch points (with or without priority signing) resulted in unopposed speeds about 1mph higher than single pair cushion arrangements.

The mean unopposed speeds at the cushion groups which had a "set of three" or a "set of 5" cushions within a narrowing were about 3mph lower than the single lane pinch points where only a single or double single cushion arrangement had been used.

Set of Three Cushions

Set of Five Cushions

Cushion Combined with Build Out

Cushion Combined with Build Out

Driver behaviour

Overall about half the car drivers straddled the cushions. The remainder generally let their wheels ride up onto the cushions on one side only. At other sites where speed cushions have been installed in pairs, it is reported that some drivers choose to drive in the central gap. This is not entirely desirable. particularly where frequent opposing traffic occurs. Obviously having a central refuge would prevent this but would add to the cost. Ensuring the gap was not wider than 1.1m and/or placing hatched markings between the cushions might discourage this action.

Location

Where cushions are located near to bus stops, care should be taken that parked vehicles in the vicinity do not prevent buses straddling the cushion. At junctions there should be sufficient space for a large vehicle to complete its turn and straighten up before crossing a cushion.

Noise

The presence of a speed cushion can result in a substantial drop in traffic noise levels. The maximum vehicle noise for light vehicles can also be reduced, as a result of light vehicles slowing down at the cushion.

It is possible that some nuisance could be caused, due to variations of noise that occur between the cushions and at the cushions. This suggests that the spacing between cushions should be chosen so that constant traffic speeds are encouraged along the route, resulting in less variation in noise. Further research has suggested that 50m spacings of cushions results in very little variation in noise levels, with average speeds along the route of around 20mph. The conditions were too variable to be able to form comparisons between the noise generated by different types of cushions.

Future work

The TRL, on behalf of the Driver Information and Traffic Management Division of the Department, will analyse the results obtained at cushions installed at other sites, and evaluate their performance. The Department will continue to examine innovative designs so that greater knowledge on the design of speed cushions can be gained and disseminated.

Local highway authorities may use speed cushions if they obtain special authorisation from the Department (see Traffic Advisory Leaflet 3/93). In the longer term changes may be made to the legislation to remove the need to seek special authorisation.

Costs

These can vary significantly and therefore the following should only be regarded as indicative:

Precast concrete cushion:

£350 per unit
+ £1,300 for installation

Block paving cushion, in situ construction:

£1,000

Moulded rubber cushion:

£600 - £1,000

In situ asphalt:

£150 - £200

Contacts

Applications for special authorisation of speed cushions should be sent to the appropriate Government Integrated Regional Office.

Acknowledgement

The Department wishes to acknowledge the considerable co-operation of Sheffield City Council and York City Council who carried out the design and construction of the cushions used, and the TRL for their overall supervision of the research project and analysis and reporting of the results.

References

- TRL Project Report 32 - Speed Control Humps - a trial at TRL.
- TRL Project Report 18 - Road humps for controlling vehicle speeds.
- Circular Roads 2/92 - Road Humps and Variable Speed Limits.
- Traffic Advisory Leaflet 3/93 - Traffic Calming Special Authorisations.
- TRL Project Report PR43 - On Road Trials of Speed Cushions in Sheffield and York
- TRL Project Report PR103 - Vehicle and Traffic Noise Surveys alongside Speed Control Cushions in York

Enquiries

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