Department for Transport

Traffic Advisory Leaflet 9/98
December 1998

Sinusoidal, "H" & "S" road humps

Introduction

The Highways (Road Humps) Regulations 1996 and the Road Humps (Scotland) Regulations 1998 allow considerable flexibility in the design of road humps. A variety of shapes/profiles can now be used without the need to seek special authorisation.

The Charging and Local Transport Division (CLT) (formerly DITM) of the Department of the Environment, Transport and the Regions (DETR) have commissioned the Transport Research Laboratory (TRL) to monitor new road hump types which have been (or could be) used on roads in England, Wales and Scotland without authorisation.

This leaflet provides interim advice on investigations that have been made into three type of road humps - sinusoidal profile road humps; "H" shape road humps; and "S" shape road humps.

Sinusoidal humps

Humps with a sinusoidal profile are similar to round-top humps but have a shallower initial rise. They were developed in the Netherlands and Denmark to provide a more comfortable ride for cyclists in traffic calmed areas. The sinusoidal profile has also been used instead of straight ramps for flat-top road humps.

A few highway authorities in the UK have installed sinusoidal humps, though precise information on the discomfort performance is not available.

In the City of Edinburgh, 100mm high sinusoidal asphalt humps (Figure 1) have been installed on residential roads in The Grange area. Speeds have been reduced to values similar to that for round top humps. The original mean speed of 33 mph has gone down to 15.5 mph at the humps, and 22 mph between humps spaced 100m apart.

Flat-top humps with pre-formed sinusoidal ramps (75mm high) have been used in 20 mph zones in Burnley and Warrington. As yet, no detailed information on speed reductions is available.

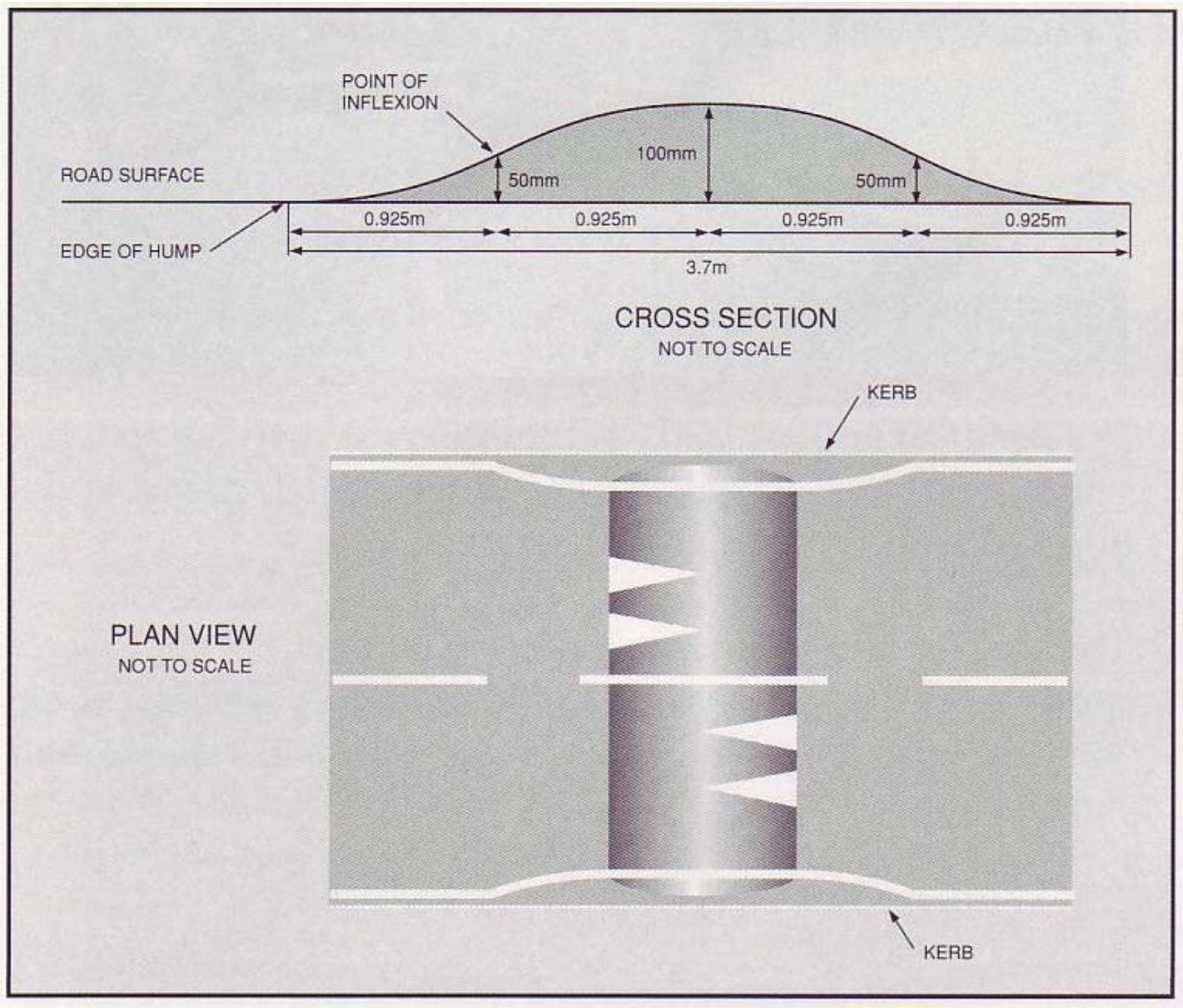
Norfolk County Council have modified 75mm high flat top humps with ramp gradients of 1:13 to 1:15, so that they are rolled over at the top of the ramp to give an approximate sinusoidal profile. Mean crossing speeds (about 16 mph to 18 mph) are slightly higher than for flat-top humps with straight ramps.

Warwickshire County Council used 75mm high flat-top humps with a similar rolled top ramp profile in the Rugby 20 mph zone. The average of mean speeds at and between the humps was 18 mph.

Track trials at TRL, measuring passenger discomfort, have shown that, compared with a round top hump, a sinusoidal hump would produce a small reduction in discomfort for cyclists (both humps 75mm high, 3.7m long). The trial indicated that there was little, if any, benefit in terms of driver or passenger discomfort for car or bus passengers in using a sinusoidal hump in preference to a round-top hump or in using sinusoidal ramps in preference to straight ramps.

The experience of cyclists taking part in the tests was that it was probably more important to ensure that there was no large upstand at the leading edge of the hump where it meets the road surface. The Highways (Road Humps) Regulations 1996 and the Road Humps (Scotland) Regulations 1998 specify that vertical projections should not be greater than 6mm.

Local highway authorities will need to consider carefully the cost effectiveness of achieving the sinusoidal profile, particularly as the reduction in discomfort to cyclists over that of a round top hump appears to be small.



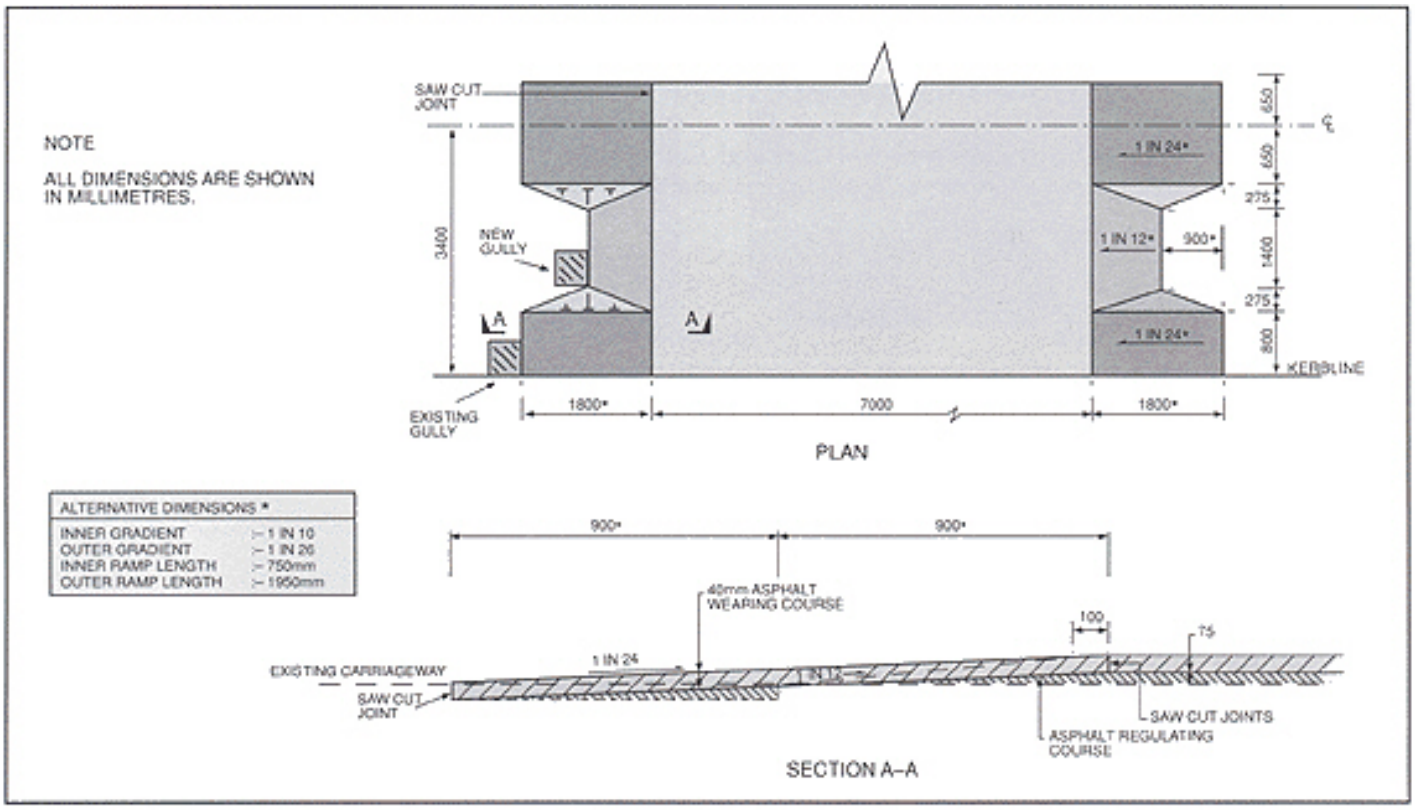
"H" hump

The "H" hump was first developed in Denmark. Trials there showed that it was possible to design a combined car and bus hump with two longer, shallower outer profiles to take the tyres of buses, and with a shorter inner steeper profile to take cars. The theory is that buses, because of the shallower ramps, will be able to travel across at higher speeds and/or less discomfort compared to standard humps. The hump is called an "H" hump because the plan view of the half-carriageway hump resembles a letter "H". There is a practical difficulty in that because of the indentation formed by the "H" it is necessary to provide additional drainage gullies to prevent water ponding. This will add to the overall cost. The ramps on the stems of the "H" will also need careful construction to ensure that any side slopes do not cause difficulties to pedal cyclists or motor cyclists.

Cyclists will normally be expected to utilise the shallower outer profile. However, care will be needed to ensure that any gulley located at the foot of this ramp is placed and constructed so that it does not interfere with the smooth passage of cyclists.

"H" humps have not been used in the UK until recently, although several authorities have carried out off-street trials. In 1997 Fife Council installed 3 "H" humps in South Parks Road, Glenrothes, two combined with Zebra pedestrian crossings.

Details of the "H" Hump design, for one half of the carriageway, are shown in Figure 2. The humps are 75mm high with a plateau length of 7m. They have outer ramp gradients of 1 in 24 and inner ramp gradients of 1 in 12.



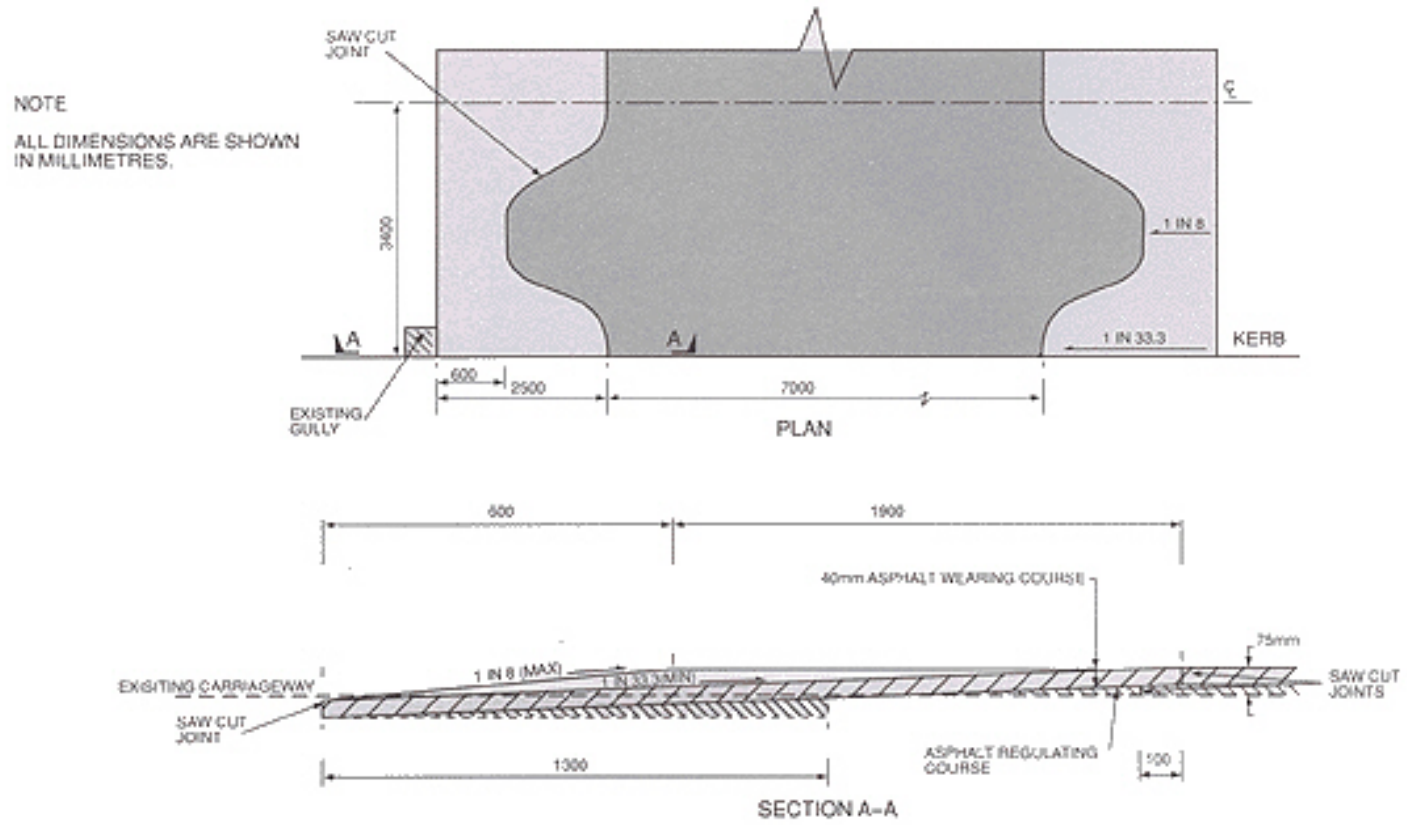
"S" Humps

Engineers from Fife Council carried out off-road trials prior to the on-road trials for the "H" hump. During this period an alternative design was developed, to eliminate some difficulties encountered with the "H" hump. This alternative design, because of its plan profile consisting of continuous curves, was referred to as the "S" hump. A plan view of a half carriageway width "S" hump used for on-road trials at four locations in South Parks Road, Glenrothes is shown in Figure 3.

Two of the "S" humps were used in combination with Zebra pedestrian crossings, and another in the form of a raised junction. The humps are 75mm high with a plateau length of 7m. They have minimum gradients of 1 in 33 for the outer ramps, and maximum gradients of 1 in 8 for the steep inner ramps. The "S" shape was simply cut out after the final wearing course for the plateau had

been laid, the ramps being constructed after this. The base of the ramp, as illustrated in the photographs, forms a straight line across the carriageway, so that the additional drainage gullies as required for the "H" hump are not necessary.

Figure 3: Dimensions of an "S" hump



Speeds at "H" and "S" humps

TRL monitored the performance of the "H" and "S" humps in conjunction with Fife Council. The 85th percentile speeds between both types of hump (spaced about 100m apart) were reduced by 7 mph from about 36.5 mph to about 29.5 mph.

The mean and 85th percentile speeds at the "H" and "S" humps are given in Tables 1 and 2, respectively. The speeds over the "S" humps were similar to those over the "H" humps. Although only limited data for bus and goods vehicle speeds is available, it suggests that goods vehicle speeds were within 2 mph of car speeds, but bus speeds were about 5 to 6 mph lower than car speeds. On average, the mean speed for cars (about 22 mph) and buses (about 16.5 mph) over the

"H" and "S" humps are about 6 mph higher than the speeds of cars and buses over 75mm high flat-top and round-top humps (TRL Report 186).

Observations of driver behaviour at "H" and "S" humps showed that few drivers (less than 0.5%) tried to minimise their discomfort by driving down the centre of the road.

The "H" and "S" humps have proved successful in maintaining the 85th percentile speeds to below 30 mph and increasing the mean speed that buses could travel over the humps. However, there is still a 5-6 mph difference in speed between buses and cars.

An "S" hump was installed in Northampton in 1998 to replace a set of 1880mm wide rubber speed cushions. The design of the "S" hump was similar to that used in Fife, but the plateau was 5m instead of 7m long. The effect of changing from the 1880mm wide cushions to the "S" hump was that the mean speed of cars was increased marginally by about 1.5 mph to 19 mph, and the mean speed of buses was reduced by about 2.5 mph to about 16.5 mph. While the mean bus speed at the "S" hump in Northampton was similar to that at the "S" humps in Fife, the mean speeds for cars at the "S" hump in Northampton was lower than that in Fife. This may be due to the different site environments: in Northampton the site was close to a shopping centre with many pedestrians crossing the road.

The "S" hump, as with most traffic calming measures, does not offer a complete solution in terms of speed reduction. Initial results from two schemes suggest that the mean speed of cars at "S" humps are likely to be similar to those at narrow width cushions. "S" humps appear to be more bus friendly for large buses (allowing higher operating speeds) than round-top or "standard" flat-top humps, but less bus friendly than cushions. "S" humps could be usefully installed within a speed cushion scheme, where raised junctions or pedestrian crossings are required.

The Project Engineer, for the Glenrothes scheme in Fife, Mr Eddie Ross, has developed a computer program for the design of the "S" hump. This allows alterations to be made to the dimensions, and may enable an improved design capable of reducing the speed differential between buses and cars. Mr Ross is currently employed by Perth and Kinross Council and can be contacted by telephone on 01738 476542.

Table 1 - Speeds at "H" Humps, Glenrothes

Vehicle type	Mean speed (mph)	85th %ile speed (mph)	No. of vehicles
Car	21.8	26.6	502
Goods Vehicle	20.0	25.0	12
Bus	16.3	21.2	19

Table 2 - Speeds at "S" Humps, Glenrothes

Vehicle type	Mean speed (mph)	85th %ile speed (mph)	No. of vehicles
Car	21.9	26.4	504
Goods Vehicle	22.6	28.3	10
Bus	16.9	20.4	23

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References

- Highways Act 1980
- Roads (Scotland) Act 1984
- Highways(Road Humps) Regulations 1996 (SI 1996 No 1483)
- Road Humps (Scotland) Regulations 1998 (SI 1998 No 1448)
- Traffic Advisory Leaflet 2/96: 75mm High Road Humps
- Traffic Advisory Leaflet 7/96: Highways (Road Humps) Regulations 1996
- TRL Report 186 - Traffic Calming - Road Hump Schemes using 75 mm High Humps
- TRL Report 337 - Traffic Calming - Sinusoidal, 'H' and 'S' Humps

Acknowledgement

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