

# Traffic calming on major roads

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## Introduction

In 1994 the Village Speed Control Working Group (VISP - see Traffic Advisory Leaflet 1/94) reported on ways of reducing and controlling the speed of traffic on main roads through villages. The report concluded that, whilst simple traffic calming measures might offer an interim solution, comprehensive schemes would be needed to achieve large reduction in speeds. The Department of Environment, Transport and the Regions subsequently commissioned the Transport Research Laboratory (TRL) to monitor and report on comprehensive schemes installed in villages, particularly on trunk roads. The criteria for schemes in this study were that traffic flows should be greater than 8,000 vehicles per day, and heavy goods vehicles should form at least 10% of the flow. The overall objective of the project was to see if schemes could be designed that would reduce the 85th percentile speed of vehicles to no more than relevant speed limit at each site.

This leaflet summarises the results obtained. They are reported more fully in TRL Report 385. Detailed results have already been published for 3 of the schemes:

- Thorney on the A47 trunk road in Cambridgeshire - TRL Report 238
- Craven Arms on the A49 trunk road in Shropshire - TRL Report 212
- Costessey in Norfolk - TRL Report 364

### Speed limit signage accompanied with a traffic island



### Road narrowing with priority signage



### Road narrowing accompanied with speed limit signage

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**Example of some dragon teeth markings**



**Examples of speed cushions**



**Example of roundel road markings**



**Another example of roundels**



**Woman crossing at a traffic island**



## The schemes

The nine schemes monitored are shown in Table 1. Six of these involved a speed limit reduction concurrent with the installation of the measures.

### Copster Green, Lancashire, A59

On each approach a set of ten red bar markings was laid, 5mm thick. These were preceded by an 'Uneven road surface' sign, a 'REDUCE SPEED NOW' and a 'Road narrows' sign. A 'gateway' feature was installed, comprising 300mm wide build-outs on each side of the carriageway, together with a 40mph speed limit sign integral with the village name and a 'Drive slowly' message. Within the village 5 refuges linked by central hatching were installed.

<b>Village and location</b>	<b>Road number</b>	<b>Vehicle flows (2-way)</b>	<b>Percentage of heavy vehicles</b>	<b>Village population</b>	<b>Original speed limit (mph)</b>	<b>New speed limit (mph)</b>
Copster Green, Lancashire	A59(T)	11,500	18%	400	60	40
Costessey, Norfolk	C162/C171	5,500	10%	5,400	30	20
Crave Arms, Shropshire	A49(T)	9,000	15%	1,900	40	30
Dorrington, Shropshire	A49(T)	9,000	16%	350	30	30
Pant, Shropshire	A483(T)	8,000	16%	1,200	40	30
Great Glen, Leicestershire	A6(T)	17,000	10%	3,900	30	30
Hayton, East Riding of Yorkshire	A1079(T)	17,000	15%	150	60	40
Thorney, Cambridgeshire	A47(T)	13,000	20%	2,200	30	30
West Wellow, Hampshire	A36(T)	16,500	18%	3,370	50	40

### Costessey, Norfolk, C162/C171

A full description is given in TA Leaflet 14/99. The main features were: A 20mph zone in the village core with narrowings together with speed cushions at two of the entry gateways and a mini-roundabout at the third. Speed cushions at 60m to 80m spacing were used within the zone, interspersed with single lane narrowings. Outside the school a 75mm high flat top road hump was installed. On the southern approach to the 20mph zone, a vehicle actuated 30mph speed limit reminder sign was erected.

## Craven Arms, Shropshire, A49

The measures include, 'Countdown' speed limit signs, distinctive gateways, repeated speed limit roundels through the outer limits of the village, and a series of speed cushions located between four mini-roundabouts.

See TA Leaflet 2/97.

## Traffic advisory leaflet, 14/97



### Traffic Calming on Major Roads: A Traffic Calming Scheme at Costessey, Norfolk

**INTRODUCTION**  
The Traffic Advisory Leaflet 14/99, which sets out the measures to be taken to improve the safety of roads in urban areas, is being issued to all local authorities in England and Wales. The leaflet is intended to provide a guide to the measures that can be taken to improve the safety of roads in urban areas. It is intended to be used in conjunction with the Traffic Advisory Leaflet 14/97, which sets out the measures that can be taken to improve the safety of roads in rural areas.

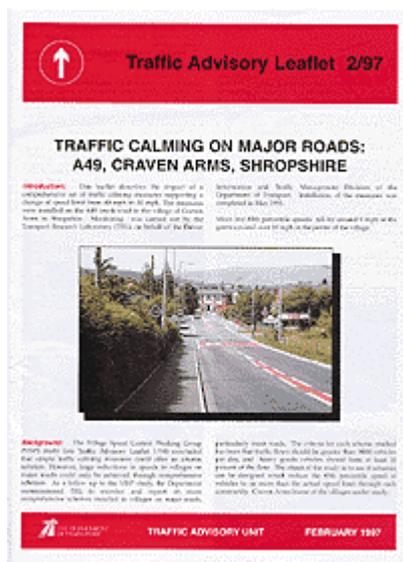
**RECOMMENDATIONS**  
The following recommendations are intended to be used in conjunction with the Traffic Advisory Leaflet 14/97, which sets out the measures that can be taken to improve the safety of roads in rural areas. The following recommendations are intended to be used in conjunction with the Traffic Advisory Leaflet 14/99, which sets out the measures that can be taken to improve the safety of roads in urban areas.

**December 1999**  
Traffic Advisory Unit



## East Gateway, Copster Green

Traffic advisory leaflet 2/97



### Refuges, Copster Green

### Dorrington, Shropshire, A49

On each main road approach 'countdown' signs (specially authorised by DETR) were installed in advance of the 30mph speed limit. 'Dragon's teeth' markings, extending nearly twice the distance of those laid at Craven Arms (17 pairs of teeth instead of 9, as shown in Figure 1) were installed to finish immediately before a gateway. The gateway consisted of signing incorporating the 30mph speed limit, a speed camera warning sign, the village name and slogan 'Please drive carefully', on a yellow background. In conjunction with this, a red patch 12m long was laid over the full width of the carriageway.

Red patches, 8m long, were repeated at five locations through the village. These were accompanied by a 30mph repeater sign. Between the red patches, central hatching on a red background was laid to provide separation and a degree of horizontal deflection.

Portable tripod mounted video speed cameras were to be used from time to time in the village to discourage speeding. For this, permanent piezo-electric sensors were installed at two locations in the village for connection to the cameras.

### Pant, Shropshire, A483

'Dragon's teeth' markings were, as in Dorrington, laid on the approaches to the gateway, but there were no 'countdown' speed limit warning signs. The same number (17 pairs) of teeth as for Dorrington were used, see Figure 1. The gateways comprised similar signing to Dorrington (30mph speed limit,

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speed camera warning sign, with the village name and slogan 'PLEASE DRIVE CAREFULLY' on a yellow background, and a red patch 12m long across the full width of the carriageway). In Pant, however, the patches incorporated a 30mph speed limit roundel. At the southern gateway, in the direction leaving the village, a 40mph speed limit roundel was applied to draw attention to the speed limit between Pant and the next village.

Through the village red patches 8m long were repeated at 10 locations. These incorporated a pair of 30mph speed limit roundels, one for each direction. Speed limit roundels currently require special authorisation, and are not usually permitted as repeater signs in a 30mph speed limit where street lighting is present. As with Craven Arms, an exception was made in the case of Pant.

The carriageway was not wide enough to have central hatched markings, so a single continuous white warning line laid on a red background was used between the repeater patches.

As in Dorrington, portable tripod mounted video speed cameras were to be used to record speeds, and again piezo-electric sensors were installed at two locations in the village to facilitate this.



**North Gateway, Dorrington**



**Southern Gateway, Pant**



**Countdown signs- southern approach, Dorrington**



Repeated red patches and speed limit signs, Dorrington

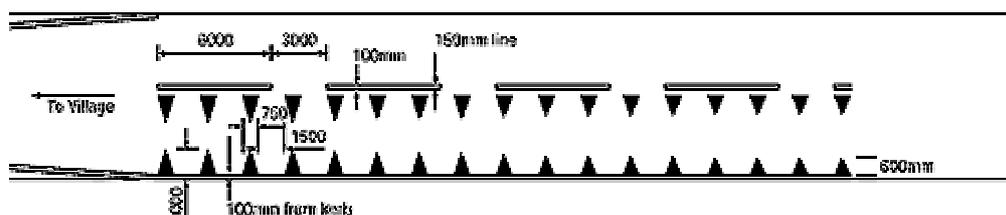


Figure 1: Dragon's teeth

### Great Glen, Leicestershire, A6

Gateways were created, extending for 70m along each approach lane into the village. These incorporated a sign at the start, 'GREAT GLEN, Slow down please' with a speed camera warning sign. On the carriageway was a 'SLOW' warning sign on a red background. From this extended an open box type marking, with boundaries formed by a red colour surface and a white continuous line. Within the box were pairs of yellow teeth markings. At the end of the box the 'SLOW' marking on a red background was repeated. A 30mph speed limit sign was erected on both sides of the carriageway at this point.

A permanent camera site was installed in the village. However, the camera to be used employed digital technology and was still awaiting Home Office type approval at the time of monitoring.



Advance signing, Great Glen

## Traffic calming on major roads



Advance signing, Hayton



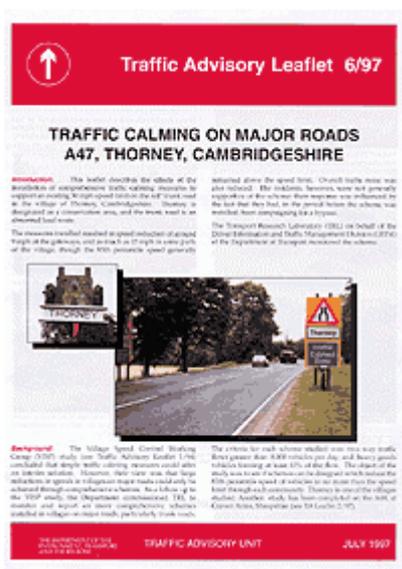
Gateway, Great Glen

### Thorney, Cambridgeshire, A47

Measures consisted of advance signing, distinctive gateways; textured surfaces at the gateways and a zebra crossing in the village, chicanes about 100m from the gateways, a variable 20/30 mph speed outside the school, a mini-roundabout and speed cameras.

See TA Leaflet 6/97.

### Traffic advisory leaflet 6/97



### **Hayton, East Riding Of Yorkshire, A1079**

On each approach (the eastern approach was a dual carriageway) 24 red patches were laid over a distance of some 400m. A sign incorporating a 'Road narrows'/ 'Dual carriageway ends' and 'REDUCE SPEED NOW' on a yellow background was erected on each side of the carriageway at the start of the patches. The patches were 20m long at the start, lessening in length and spacing so that the patch was only 1m long at the gateway. The patches extended across the full width of the carriageway. On the eastern approach the cross-hatch markings used to narrow the two-lane approach to one lane were superimposed over the patches.

At the termination of the patches a sign incorporating the 40mph speed limit, the village name and 'REDUCE SPEED NOW' on a yellow background was erected on both sides of the carriageway.

Within the village, 2 pedestrian refuges and an island linked by central hatched markings on a red background were installed, which provided some horizontal deflection.



**Gateway, Hayton**



**Eastern gateway, West Wellow**



### **Pedestrian refuge**



### **Unsegregated cycle track/footway, West Wellow**



### **Repeat speed limit signs and markings, West Wellow**

#### **West Wellow, Hampshire, A36**

A gateway at each end of the scheme comprised a red patch, 4m long, with a 40mph speed limit roundel on the inbound direction. A 2m long buff strip was laid adjacent to and on both sides of the red patch, giving the visual illusion of a vertical deflection. A cantilevered sign incorporating the 40mph speed limit, 'West Wellow' and 'Please drive carefully' was erected on both sides of the carriageway adjacent to the red patch.

Red/buff patches with low-level 40mph speed limit roundels were repeated at 7 locations through the village, spaced between 120m and 200m apart and accompanied by 40mph repeater signs.

The footway on one side of the carriageway was converted to a shared use cycle track/footway with a red surfacing.

## Results

The individual results for Craven Arms, Costessey and Thorney are summarised in their respective Traffic Advisory Leaflets and therefore, only selective results are reported here. Table 2 summarises 'before' and 'after' automatic speed measurements.

### **Table 2: Mean and 85th percentile speeds - before and after scheme installation (mph)**

This table is available as a separate download in Word format from the foot of this page.

## Gateway Speeds

Following implementation of the schemes there were reductions in inbound speeds at all the gateways, except Great Glen. These ranged from 3mph to 13mph for mean speeds, and up to 15mph for 85th percentile speeds. Speeds at the Craven Arms and Dorrington gateways (both having 'Dragon's teeth' and 'countdown' signs) were reduced by between 8mph and 10mph. The lack of speed limit roundel markings appeared to make no difference at Dorrington. Pant had the roundels at the entrance but speed reductions were only around 7mph; this was possibly due to the inbound 'before' approach speeds being less than at Craven Arms and Dorrington.

It is not clear how much the 'Dragon's teeth' contributed to the speed reductions in any of these villages, as it was not possible to isolate the effect from the other gateway features. However, these markings are only really visible to a driver at the last minute and it is doubtful, therefore, that they would contribute much to any slowing down effect on the approach.

Thorney, which had very prominent advance signing, had speed reductions of around 9mph.

The largest reduction in speed at the various gateways, relative to the magnitude of 'before' speeds, occurred at the narrowed entries (with speed cushions) to the 20mph zone at Costessey.

The gateway design for West Wellow was deliberately more muted to be in keeping with the adjacent New Forest; also, it did not have any advanced signing. Speed reductions at the gateway (5mph to 7mph) were less than at sites with bolder designs.

At Hayton, 85th percentile speeds fell by 10mph. Radar speeds (which are not included in the table) showed the 85th percentile speed of free flowing vehicles on the dual carriageway approach at Hayton to have been reduced by 20mph.

Copster Green also had red patches on the approach, but these were less prominent and there were fewer of them than at Hayton. Speed reductions at Copster Green were between 3mph to 5mph compared to the 'before' speeds.

The small reductions obtained at Great Glen are difficult to explain, but the gateway designs clearly had little effect on drivers.

Even though speed reductions were achieved at all of the gateways, only the mean speeds were close to (or in the case of West Wellow equal to or below) the speed limit. The 85th percentile speeds were all considerably above the speed limit.

## Speeds within Villages

Reductions in mean speed, over both directions, ranged from 2mph to 12mph, with 85th percentile reductions of up to 14mph. The largest reductions occurred in Costessey, Craven Arms and Thorney, where physical measures were used, and in Hayton with its high 'before' speeds prior to the reduction in speed limit from 60mph to 40mph. Individually, physical measures yielded speed reductions of between 7mph and 12mph.

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A comparison between Pant and Dorrington, where the schemes were similar, shows greater speed reductions in Pant. These were mainly due to the change in speed limit, and could also have been influenced by the use of the speed limit roundels, the closer spacing of the patches and the lower 'before' speeds in Dorrington. However, the mean and 85th percentile speeds remained higher in Pant than in Dorrington. In Craven Arms and Pant the use of the repeater roundels reduced speeds by about 4mph to 5mph; however, similar markings in West Wellow resulted in average reductions of only 3mph.

The series of refuges, linked by centre hatching, in Copster Green had only a small effect, with a reduction in mean and 85th percentile speeds of only 2mph to 3mph.

In cases where fixed speed cameras were used (Thorney and Great Glen) additional speed reductions were no more than 2mph.

The target of obtaining 85th percentile speeds which did not exceed the speed limit, was seldom met. In Thorney it was achieved near the chicane (not shown in table 2). In Craven Arms it was achieved where the speed cushions were employed, but not on the sections where repeater roundels were marked. Elsewhere, 85th percentile speeds were above the speed limit.

Night-time mean and 85th percentile speeds were typically higher than daytime speeds, by 2mph to 4mph. Night-time reductions in speed were similar to, or slightly greater than, day-time reductions.

### **Traffic Flows**

The lack of alternative routes for the trunk road villages meant that there was no change in the overall traffic flow levels, or in the proportion of heavy vehicles, after scheme installation. In Costessey there were some changes, and these are reported more fully in TA Leaflet 14/99.

### **Noise**

Measurements of both vehicle noise (noise of individual vehicles passing over measures) and traffic noise (the overall effect of the scheme on ambient noise levels) were taken. These measurements were made in Thorney, Craven Arms, Costessey and Hayton.

For vehicle noise, the measures resulted in a reduction for both light and heavy vehicles which ranged from about 1 dB(A) to more than 10 dB(A). Further details of vehicle noise measurements for Thorney, Craven Arms and Costessey are contained in their respective TA Leaflets. In Hayton, vehicle noise surveys showed that the average maximum noise levels at the mean site speed were reduced by 10.5 dB(A) for light vehicles and 7.1 dB(A) for heavy vehicles. The surfacing (that is the textured surfacing used for the red patches and the resurfacing that took place before the patches were laid) appeared to contribute to the reduction in noise levels. A resident had complained of a 'pulsing' sound as vehicles crossed the textured patches. This was measurable but the fluctuation in noise levels was less than 1 dB(A) and only occurred with some types of cars. The reason for the complaint appeared to be the change in character of the noise, rather than an increase in noise.

For traffic noise, in all cases (except at the Craven Arms site at night) a reduction in overall traffic noise was achieved. This was largely attributable to reductions in speed. Daytime noise levels at Hayton fell by 8.6 dB(A) while night-time levels were down by 13 dB(A). Background daytime noise levels in Hayton fell by 9.4 dB(A) but night-time background noise levels were only reduced by 2.3 dB(A). This is due to the much lower traffic flows at night and, therefore, the less influence that traffic has on background (or ambient) noise levels.

### **Public Opinion Surveys**

These were carried out in Thorney, Craven Arms and Costessey and the results of these are summarised in the respective TA Leaflets.

**Accidents**

Analysis of the accidents occurring at all the schemes covered by this project and those in the previous VISP project is part of a separate study, and will be reported in 2000.

## Conclusions

The study was intended to monitor measures designed by the Highways Agency and local highway authorities. It is not possible to recommend particular measures, only to indicate the level of speed reduction that these measures obtained. Additionally, it was not possible to measure the particular effect of some of the measures, either because they were used in combination with other measures or sufficient monitoring could not be undertaken.

The effect of countdown signs was not monitored under this project, so the degree to which they may or may not have contributed to speed reductions obtained on the approach to the gateways cannot be determined. However, in the opinion surveys for Craven Arms, residents gave them relative high marks in terms of their effectiveness. Trials with the TRL driving simulator (reported in TRL 245) indicated that lower approach speeds were obtained at sites with countdown signs than at those without. However, an earlier study into the use of countdown signs carried out by TRL for the Eastern Accident Reduction Working Group (TRL Report 201) in 1995 reported that there was no statistical evidence of a reduction of speeds at countdown sign sites. Current DETR policy on the use of these signs is that they would not be authorised unless the main speed limit sign had an insurmountable visibility problem.

The project has demonstrated that vehicle speeds can be influenced by the installation of traffic calming measures. However, the size of the speed reduction is likely to be influenced by the magnitude of the 'before' speeds, the margin between old and new speed limits, and the traffic calming measures installed.

Signing (including marking) measures giving a high visual impact can produce quite large speed reductions at village entries. However, these speeds are still likely to be above the speed limit. It is important that features are visible at night, particularly as it has been shown that speeds tend to increase at this time. The use of reflective material is therefore imperative, particularly if signs are not to be directly illuminated. Reflective bollards appropriately located at gateways may be helpful in achieving this.

Physical measures, such as speed cushions, chicanes and mini-roundabouts, have been used with some success within villages. They help achieve greater speed reductions than signing and marking measures alone. Care must be taken with the design and location of physical measures, especially vertical deflections, where there are high flows of heavy vehicles. Incorrect placement can result in increased noise and/or vibrations. Speed cushions can be straddled by heavy vehicles if they are no more than 1.5m wide, thus avoiding excessive body rattle developing, provided they are aligned correctly in the vehicles' path. They are effective in reducing speeds below 30mph, but will not be suitable for reducing speeds to 20mph or less.

When repeated through a village, markings in the form of coloured bands, both with and without roundels and other supporting signs, can achieve some speed reduction, but this is unlikely to be large.

Residents are unlikely to be satisfied with schemes that do not achieve their expectations of reducing speeds below the speed limit. It is important, therefore, not to raise their hopes unrealistically.

Where traffic calming is proposed for villages, residents should be involved in the development of the scheme. They should be informed that for measures to be effective, a high visual impact is likely to be needed. Scheme effectiveness in terms of vehicle speeds and accident reduction may need to be weighed against unwanted effects such as visual intrusion.

## Technical Enquiries

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## References

- TA Leaflet 1/94, VISP - A Summary
- TA Leaflet 2/97, Traffic Calming on Major Roads, A49, Craven Arms, Shropshire
- TA Leaflet 6/97, Traffic Calming on Major Roads, A47, Thorney, Cambridgeshire
- TA Leaflet 14/99, Traffic Calming on Major Roads: A Traffic Calming Scheme at Costessey, Norfolk
- TRL Project Report 85 - Speed Reduction in 24 Villages: Details from the VISP Study
- TRL Report 201 - Count-down Signs and Roundel Markings Trials
- TRL Report 212 - Traffic Calming on Major Roads: The A49 Trunk Road at Craven Arms, Shropshire
- TRL Report 238 - Traffic Calming on Major Roads: The A47 Trunk Road at Thorney, Cambridgeshire
- TRL Report 245 - Using the TRL Driving simulator to Evaluate Traffic Calming Measure
- TRL Report 364 - A Traffic Calming Scheme at Costessey, Norfolk
- TRL Report 385 - Traffic Calming in Villages on Major Roads: Final Report

The Department of the Environment, Transport and the Regions sponsors a wide range of research into traffic management issues. The results published in Traffic Advisory Leaflets are applicable to England, Wales and Scotland. Attention is drawn to variations in statutory provisions or administrative practices between the countries.

The Traffic Advisory Unit (TAU) is a multi-disciplinary group working within the Department of the Environment, Transport and the Regions. The TAU seeks to promote the most effective traffic management and parking techniques for the benefit, safety and convenience of all road users.

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