TRANSPORT RESEARCH LABORATORY

Urban speed management methods

Prepared for Road Safety Division, Department of the Environment, Transport and the Regions

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Executive Summary

Possible changes in legislation, which might relax the consent requirement for making 20mph speed limit orders, would allow Local Highway Authorities greater freedom to introduce 20mph speed limits. 20mph zones with engineering measures to make them self-enforcing have been very effective at reducing traffic speeds and casualties on residential and other urban roads (Webster and Mackie, 1996). However, treatment of all residential roads in the manner of existing 20mph zones would be expensive, and they are therefore likely to continue to be selectively applied according to priority and budget.

Whilst any legislation changes would be intended to encourage Local Highway Authorities to continue with the successful formula for 20mph zones, there could be local political pressure on them to increase the number of schemes and therefore reduce the cost of implementing 20mph zones, and possibly to reduce them to signs-only zones without self-enforcing physical measures.

The Department of the Environment, Transport and the Regions therefore wished to assess the effectiveness or otherwise of 20mph speed limits which are not self-enforced, so as to be in a position to offer well informed guidance to Highway Authorities. The Transport Research Laboratory was commissioned to carry out a study to assist in ensuring that policies for reducing urban speed limits to benefit more road users result in the most effective use of resources and implementation of measures which secure an overall reduction in the number of casualties.

The work comprised:

- a review of studies of the effectiveness of attempts to manage speeds in urban areas, with particular reference to those roads which have not or could not be treated by the application of engineering measures in, for example, 20mph zones;
- collection of information on low speed limit zones in other countries which use signs-only and do not make use of physical traffic calming enforcement measures;
- a review of the effectiveness of existing 20mph zones in the UK where physical measures have not been used;
- measurement of speeds at sites in new 20mph zones where the local authority agreed to install signs before implementation of the physical measures so that the effects of using signs only could be assessed.

The main conclusions from the study are:

1 The most effective measures for controlling speed in urban areas are physical traffic calming measures, particularly speed humps. 20mph zones using such measures have generally achieved mean and 85th percentile speed reductions of around 10mph and mean speeds after installation of less than 20mph.

2 Speed cameras have reduced mean and 85th percentile vehicle speeds by about 5mph on average, but the effect has been very localised to the installation. Speed camera signs, informing drivers of the possible use of speed cameras, have not been effective in reducing speed.

3 Various forms of 'flashing' signing (usually made using fibre-optics and often vehicle-activated) have achieved mean and 85th percentile speed reductions of around 4mph on average.

4 The use of static signs only has had a small effect on mean and 85th percentile speed. On average there have been reductions of about 2mph for a range of speed limits for which data are available, but for 20mph zones the reductions were about only about 1mph on average.

5 20mph zones (and 30kph zones) which used signs only did not show any reduction in injury accidents, apart from in the city of Graz (Austria) where there was a 13% accident reduction. However, the signs-only zone installations in Graz were accompanied by a comprehensive publicity and enforcement campaign.

6 From the studies where there were associated public awareness campaigns and/or enforcement, it appears that further reductive effects on speeds of up to 3mph have been achieved, over that achieved by signs only.

To sum up, where speeds of around 20mph are desired in urban areas, traffic calming remains the best option to achieve this. Where funding or other reasons preclude its use, the use of only static signs appears insufficiently effective to reduce speeds to 20mph or to achieve accident reductions. Where signs-only schemes are used, small speed reductions and accident savings can be achieved if associated publicity and enforcement campaigns are also used. However, speeds are still likely to remain well above 20mph.

The use of 'flashing' signing and speed cameras have a substantial effect on speed, generally reducing mean and 85th percentile speeds by around 5mph, and appear likely to have safety benefits in specific locations. However, at current costs, their comprehensive use to control speed over a whole network of urban streets could prove more expensive and less effective in accident reduction terms, than traffic calming.

In-vehicle technology to automatically control speeds may eventually be a further option to manage vehicle speeds, but full implementation of such technology is still many years away as a practical solution to the danger of speed on urban roads.

1 Introduction

1.1 Background

Possible changes in legislation, which might relax the consent requirement for making 20mph speed limit orders, would allow Local Highway Authorities greater freedom to introduce 20mph speed limits. 20mph zones with engineering measures to make them self-enforcing have been very effective at reducing traffic speeds and casualties on residential and other urban roads (Webster and Mackie, 1996). However, treatment of all residential roads in the manner of existing 20mph zones would be expensive, and they are therefore likely to continue to be selectively applied according to priority and budget.

Whilst any legislation changes would be intended to encourage Local Highway Authorities to continue with the successful formula for 20mph zones, there could be local political pressure on them to increase the number of schemes and therefore reduce the cost of implementing 20mph zones, and possibly to reduce them to signs-only zones without self- enforcing physical measures.

The Department of the Environment, Transport and the Regions therefore wished to assess the effectiveness or otherwise of 20mph speed limits which are not self-enforced, so as to be in a position to offer well informed guidance to Highway Authorities. TRL was commissioned to carry out a study to assist in ensuring that policies for reducing urban speed limits to benefit more road users result in: the most effective use of resources; and implementation of measures which secure an overall reduction in the number of casualties.

This report describes the study carried out by TRL.

1.2 Objectives

The objectives of the project were:

- to review and evaluate the measures needed for successful 20mph zones (with average speeds of 20mph or less);
- to consider the broader problem of how to manage speed on residential and other urban roads that are not going to be dealt with as self-enforcing 20mph zones, eg by improving enforcement of existing 30mph limits or by introducing 20mph limits which are effective using alternative techniques to current self-enforcing measures.

2 Method

The work comprised a review of studies of the effectiveness of attempts to manage speeds in urban areas, with particular reference to those roads which have not been or could not be treated by the application of engineering measures in, for example, 20mph zones. It considered the options to develop workable approaches for non-20mph roads (usually those with an existing speed limit of 30mph), looking at the effect of more limited engineering measures, and psychological and perceptual measures, rather than speed enforcing engineering measures such as humps.

The specific part of the work to investigate the effectiveness of 20mph zones without physical speed control measures comprised three main elements:

- collection of information on low speed limit zones in other countries which use signs only and do not use physical engineering enforcement measures;
- a review of the effectiveness of existing 20mph zones in the UK where physical measures have not been used;
- measurement of speeds at sites in new 20mph zones where the local authority agreed to install signs before implementation of the physical measures so that the effects of using signs only could be assessed.

3 Review of effectiveness of measures in reducing speeds

Table 1 summarizes the effectiveness of various measures in reducing speeds. The data have been obtained from a database, created by TRL, from reports from various sources in the UK and overseas.

Table 1 Effectiveness of speed-reducing measures

Measure	*Effect on mean speed (mph)*	*Effect on 85th percentile (mph)*
Traffic calming	-9.3	-10.4
Speed cameras	-6.0	-4.2
Vehicle-activated signs	-4.2	-4.5
Flashing signs - not vehicle-activated	-3.8	no data
Static signs	-2.2	-3.2

Traffic Calming

From Table 1, it can be seen that physical traffic calming has had a large effect on speed (around 10 mph reduction in authorised 20mph zones - Webster and Mackie, 1996), mainly through the use of road humps.

The other methods listed in Table 1 were all less effective than traffic calming.

The averages quoted for those other methods are derived from the individual schemes which are shown in Appendix A. The reports from which these results are obtained are also identified to enable cross reference to the references section here (Section 9).

Speed cameras

Speed cameras are now in use in a number of countries. Their effect on speed has been a reduction of around 5mph on average. Reductions in speeds have been similar whether cameras are in place or just camera housings. No reductions in speeds have been obtained with speed camera warning signs only.

Flashing signs

A variety of ‘flashing’ signs (usually made using fibre-optics and often vehicle-activated) have been effective in reducing speeds, on average by around 4mph. Results have been variable according to location, speed limit, and

sign trigger threshold. Best results have been obtained where the speed limit has simultaneously been reduced.

Static signs

Most speed limits are indicated by conventional static (ie. non-flashing) signs. Such signing on average has given mean speed reductions of 2.2mph. A statistical model developed by TRL, using data from a number of different countries, suggested that the mean speed reduction due to changing a speed limit and using static signs would be one quarter of the difference between the speed limits (Finch et al, 1994).

4 Relevant studies

More detailed information on the use or proposed use of speed management by signs only is provided by the following studies.

4.1 The Suffolk experiment

In 1994 Suffolk County Council introduced new speed limits in many of its villages. 450 new 30mph limits were introduced over a two year period. Standard 30mph signing and entry roundels were used, with costs of about £4500 per new speed limit. These new limits were set up alongside a continuing policy of using physical traffic calming measures where there was an evident accident problem, of introducing mobile speed enforcement cameras, and of using high profile anti-speeding campaigns.

The speeds of 100 free-flowing vehicles were monitored on three occasions before and after the speed limits were introduced, at one location in each village. Overall the effect of the initiative on the 85th percentile speed of vehicles at 66 sites where the limit was previously 40mph, was an average reduction of 3.5mph, one year after implementation of the 30mph limits. Where the limit had previously been 60mph (68 sites), the results showed an average reduction in 85th percentile speeds of 6.2mph (Jeanes, 1997).

4.2 American 30mph sign experiment

In the state of Maryland, USA, measurements of vehicle speeds were taken before and after the removal of a 30mph sign and then after re-instatement of the 30mph sign. Without the sign the limit defaulted to the state 55mph limit. Mean speeds before removal of the sign, after sign removal and after sign re-instatement were 43.4mph, 45.5mph and 43.6mph respectively, showing a reductive effect of the sign of about 2mph (Finch et al, 1994).

4.3 German 30kph zones

A number of European countries make use of 30kph zones and usually it is policy to have self-enforcement by traffic calming measures. However, there are a few examples where signs only have been used. For example, in Germany, a number of 30kph zones have been implemented with signs only, although there are also many which use traffic calming. A study was carried out for the German Ministry of Environment and Traffic to compare the effects on speed and accidents in 24 30kph zones with, and 36 without, physical traffic calming measures. The speed limit had previously been 50kph (Pfundt et al, 1989). Results are given in Tables 2 and 3.

Table 2 Speed changes in German 30kph schemes with and without traffic calming measures

	85th%ile speed (kph)		
Schemes	*Before*	*After*	*Change (kph)*
Signs only	48	47	-1
Signs with traffic calming, (mainly chicanes, pinch points, and staggered parking)	48	44	-4

These show that reductions in 85th percentile vehicle speeds in signs-only schemes were very small, averaging about 1kph. Schemes with physical measures (mainly horizontal deflections) reduced 85th percentile speeds by about 4kph.

There were substantial decreases in accidents in the zones with traffic calming measures - 31% for all injury accidents and 37% for fatal and serious accidents. These changes were statistically significant at the 5% level, but in the signs-only zones no statistically significant accident changes were observed. However, the number of accidents per zone in the zones with physical measures were considerably higher then in the signs-only zones and

Table 3 Accident changes in German 30kph schemes with and without traffic calming measures

	Signs-only			*Signing with traffic calming*		
Accidents per year	*Before*	*After*	*Change %*	*Before*	*After*	*Change %*
All injury accidents involving:						
Pedestrians	8.0	9.0	+13	15.5	11.6	-25
Cyclists	14.4	13.3	-8	31.9	24.4	-24
Total	45.6	41.5	-9	115.9	80.2	-31
Fatal and serious accidents involving:						
Pedestrians	2.5	3.0	+20	7.4	4.9	-34
Cyclists	2.4	6.8	+186	10.5	9.6	-9
Total	9.5	12.8	+35	36.8	23.3	-37

it is therefore possible that a 'regression to mean' effect could mean that the real accident savings are somewhat less than that suggested by the gross accident numbers.

4.4 Austria – Graz

Another example of 30kph zones without physical calming measures is provided by the city of Graz (24000 population) in Austria (Wernsperger and Sammer, 1995). The City Council had previously experimented with physically enforced 30kph zones but soon realised that to achieve full coverage of all residential areas in the city with 30kph zones using physical measures would take many years. They therefore decided not to use physically enforced methods but instead to introduce a general 30kph speed limit for the whole city street network, except in those streets which were designated 'priority' streets. These would retain the existing 50kph limit.

A two-year trial period from September 1992 until August 1994 was agreed. This trial was accompanied by a comprehensive investigation into its effect on speed and accidents. After the results of the trial were known, a decision was made to make permanent the 30kph speed limit on all roads except priority streets.

The 30kph limit in Graz was introduced as part of a comprehensive traffic plan with the slogan 'Gentle Mobility', and with objectives of:

- maximising the promotion of walking, cycling and public transport through improvement of the infrastructure and through public relations work;
- limiting motorised private transport through the introduction of parking charges and limiting private motor vehicle access.

At the outskirts of the city, traffic signs informed drivers that for all streets, except priority streets, a 30kph speed limit was in force. Certain 'sensitive' sections of priority streets, for example near schools, were also designated as 30kph limits. As an additional measure, the priority at junctions within the 30kph network was gradually changed to 'priority to the right'.

To support the 30kph limit, there were large multilingual information boards on the main approaches to the city which informed drivers. As a further reminder, at the entrance to side streets, 30kph roundels were displayed on the road surface. In addition, intensive public relations work was carried out immediately prior to, and after, the introduction of the new limit. Information was disseminated through meetings (symposia, lectures, public discussions etc), street stands, material sent to representatives of interest groups and private households, newspaper announcements, media reports and media discussions. The aim of this public relations work was to further the acceptance by road users of the 30kph limit and to foster the general public's attitude and approval.

An essential component of the trial was enforcement of the speed limit by the Graz police, using mobile laser guns and some fixed-site radar devices for the measurement of vehicle speed. Enforcement was carried out both in the priority streets and in the 30kph streets. At the beginning of the trial, drivers who slightly exceeded the limit were just warned. After this 'adaptation' phase, speeding became a punishable offence.

As an additional measure, the Graz Institute for Traffic Safety showed speed measurements on a large display board to make drivers aware of their speed.

The main reason for the introduction of the 30kph speed limit was to improve safety, so before and after studies of injury accidents in the city of Graz were made. Comparison of the year before the trial with the first year after implementation showed a 13% decrease in the accident total. For fatal and serious accidents the reduction was 24% (Table 4). There was a 17% reduction in pedestrian casualties and a 14% reduction in car occupant casualties (Table 5). These reductions were statistically significant.

Table 4 Accident changes in Graz after 30kph limit introduced

	Accidents		
Severity	*Before (1 year)*	*After (1 year)*	*Change %*
Fatal and serious	267	204	-24
Slight	2480	2181	-12
Total	2747	2385	-13

Table 5 Casualty changes in Graz after 30kph limit introduced

	Casualties		
Road user	*Before (1 year)*	*After (1 year)*	*Change %*
Pedestrians	327	270	-17
Cyclists	532	512	-4
Motorcyclists	437	377	-14
Car occupants	3135	2711	-14
Others	318	320	+1

A reduction in injury accidents of 27% was observed at junctions where the speed limit had been reduced from 50 to 30 kph. A similar reduction in accidents (22%) was observed at junctions in the streets that had retained the 50kph limit. On links, the accident reduction was 11% in the priority streets (50kph limit retained), but in streets where the speed limit had been changed to 30kph, accidents increased by 5%. Unlike the decreases quoted, this small increase was not statistically significant.

The fact that a reduction in accidents occurred on priority streets where there was no change in the speed limit suggests that the improvement in safety may be due to the public awareness campaign and the speed limit enforcement creating a somewhat new 'safety culture', rather than to reductions in speed. The 85th percentile speeds of vehicles at 78 sites in the 30kph zones, before and after the speed limit reduction, showed only small speed reductions of 4.2kph four months after implementation, falling to 1.7kph nine months after implementation (see Table 6).

Table 6 Speed changes in Graz after 30kph limit introduced

	Before (50kph limit)	*After 4 months*	*Change from 'Before'*	*After 9 months*	*Change from 'Before'*
Mean speed (kph)	37.6	34.8	-2.8	37.1	-0.5
85th%ile speed (kph)	46.9	42.7	-4.2	45.2	-1.7

4.5 Scotland – 'SCOTS' schemes

In Scotland, SCOTS (Scottish Chief Officers for Transportation Society) intends to trial, beginning in the summer of 1998, how speeds can be managed using psychological and perceptual measures, rather than with enforcing measures such as humps. The aim will be to encourage voluntary driver acceptance of the lower speed limit in residential areas, with compliance achieved through advisory signing and road markings, and possibly by using roundels and 'mild' gateways together with a local publicity campaign.

About 25 Local Authorities have volunteered to take part in the trial, which will be closely monitored by the Scottish Office.

5 Existing 20 mph zones without measures

In England, there are a few 20 mph zones where the 20 mph speed limit was introduced without installing any new physical measures. Some of these zones already had some physical measures (installed earlier as General Improvement Area schemes), or they comprised short lengths of street where speeds were already low. The 20mph zones installed with no new measures are:

- Preston, Lovat Road area;
- Tonbridge, Southern area;
- Plymouth, How Street area;
- Lewes, Chapel Hill;
- Cobham, The Street;
- Liverpool, 9 zones.

In all cases the previous speed limit was 30mph.

5.1 Preston

The Lovat Road area contains a road closure, road narrowings, one-way roads, and sheltered parking, so in fact there are traffic calming measures, but they were installed many years before the area was designated a 20mph zone. Much of this work was carried out in the late 1980's as a General Improvement Area scheme. No further physical measures were installed when the area became a 20mph zone. There was a small reduction in mean speed of 0.5mph when the 20mph limit was introduced (Table 7).

5.2 Tonbridge

This zone comprises eight roads each about 500 metres long. Signs only were used, although there was a short period when 'pinch points' were also in use in one road. The mean speed reduction of 3.7mph shown in Table 7 was for the signs-only period. There was also an associated publicity campaign about the new speed limit.

Table 7 Mean speeds in 20mph zones introduced without new physical measures

Zone	*Before (mph)*	*After (mph)*	*Change (mph)*
Preston	18.7	18.2	-0.5
Tonbridge	27.0	23.3	-3.7
Cobham	20.7	20.3	-0.4
Overall	22.1	20.6	-1.5

5.3 Plymouth

The How Street 20mph zone is a small area with five short roads (maximum 160 metres long) where congestion generally results in low vehicle speeds. Mean speeds on How Street were 16 mph Before, but no After data are available.

5.4 Lewes

Chapel Hill 20mph zone is a single road, 175 metres long, with a physical width restriction, to prevent the passage of large vehicles. 85th percentile speeds were 16mph Before, but again no After measurements were made.

5.5 Cobham

In Cobham, the 20mph zone comprises one relatively straight through road, 280 metres long, plus a cul-de-sac of 200 metres which includes a right angle bend. There was a small reduction in mean speed of 0.4mph following the installation of the 20mph signs (Table 7).

Generally the results shown in Table 7 appear to indicate small speed reductions, averaging 1.5mph when signs only were used to indicate the new speed limit. Accident frequencies did not reduce (Table 8), but the numbers were too small to draw any conclusions about the potential effect on accident occurrence.

5.6 Liverpool

Detailed Before and After speed and accident information was also available for the nine 20mph zones installed in Liverpool with signs only. These are given in Table 9, which shows only a small reduction overall in mean speeds, of less than 1mph. There was no change in accident frequency.

Because of the small reduction in speeds achieved by using signs only, physical measures were introduced in three of the zones, which generally resulted in much larger speed reductions (Table 9).

6 Trial sites

The final part of the TRL study was to monitor sites in Kent, Norfolk and Humberside to assess the effect on speed of 20mph zones installed using signs only. The signs were installed for an experimental period prior to the

Table 8 Accidents in 20 mph zones introduced without new physical measures

Zone	*Before accidents*	*No of years*	*Accidents/ year*	*After accidents*	*No of years*	*Accidents/ year*	*Change in frequency*
Preston	2	3	0.67	8	6.4	1.25	+0.58
Tonbridge	5	4	1.25	9	5.5	1.64	+0.39
Cobham	0	3	0	0	0.75	0	0
All sites	-	-	1.92	-	-	2.89	+0.97

installation of roundels, humps or vehicle-activated signs.

Continuous monitoring of vehicle speeds was carried out at several locations within each zone, using inductive loops and data loggers (except at two sites in Hull where radar speed measurement was used). The Before and After data were analysed to assess the effect of the signs on mean and 85th percentile speeds.

6.1 Kent – Sandwich

The zone in Kent is in the town of Sandwich, a small historic town with a core of fairly narrow streets. Speeds were therefore already fairly low at most locations with only three streets where speeds were substantially above 20mph. The 20mph zone covers the whole of the central core, which is defined by the original city-wall or moat. The previous speed limit was 30mph.

Initially signs only are being used, but if they are shown to be ineffective, a phased programme of increasingly severe measures will be implemented as necessary. These phases comprise:

- slightly raised coloured surfaces with 20mph roundels;
- single way working at gateways;
- staggered parking, kerb build-outs and chicanes.

The effect of the signs-only phase, averaged over all the monitored locations, was a reduction of 1mph in mean speeds and of 1.3mph in 85th percentile speeds (Tables 10 and 11).

6.2 Norfolk – Horsford

The Norfolk zone is in the village of Horsford, whose junior school, community centre, shops and play centre all lie on a local distributor road with a 30mph limit. The 20mph zone has not yet been installed but will rely on 'fibre-optic' signing, supplemented by conventional speed limit regulatory signs. The conventional static signing will be installed before the fibre-optic signing to enable before and after monitoring of the effects on speeds. Before speed data have been collected but After data were not available at the time of writing.

6.3 Humberside – Hull

New 20mph zones with physical measures were due to be installed in early 1998 in three different parts of the city of Hull, and the City Authority kindly agreed to install the conventional static signs a few weeks before the other planned physical engineering measures.

Speed measurements were made at eight locations within the zones:

- before any measures were introduced;
- after the 20mph signs were installed;
- after 20mph roundels on the road surface had been added.

Results showed that the effect on mean and 85th percentile vehicle speeds of using 20mph signs with no publicity campaign or enforcement was very small - on average a reduction of about 1mph (Tables 12 and 13).

The installation of the 20mph roundels caused further reductions of around 1mph to 2mph (Tables 12 and 13), but mean speeds remained well above 20mph.

7 Conclusions

The main conclusions from the study are:-

1 The most effective measures for controlling speed in urban areas are physical traffic calming measures, particularly speed humps. 20mph zones using such measures have generally achieved mean and 85th percentile speed reductions of around 10mph and mean speeds after installation of less than 20mph.

2 Speed cameras have reduced mean and 85th percentile vehicle speeds by about 5mph on average, but the effect has been very localised to the installation. Speed camera signs, informing drivers of the possible use of speed cameras, have not been effective in reducing speed.

3 Various forms of 'flashing' signing (usually made using fibre-optics and often vehicle-activated) have achieved mean and 85th percentile speed reductions of around 4mph on average.

4 The use of static signs only has had a small effect on mean and 85th percentile speed. On average there have been reductions of about 2mph for a range of speed limits for which data are available, but for 20mph zones the reductions were about only about 1mph on average.

5 20mph zones (and 30kph zones) which used signs only did not show any reduction in injury accidents, apart from in the city of Graz (Austria) where there was a 13% accident reduction. However, the signs-only zone installations in Graz were accompanied by a comprehensive publicity and enforcement campaign.

6 From the studies where there were associated public awareness campaigns and/or enforcement, it appears that further reductive effects on speeds of up to 3mph have been achieved, over that achieved by signs only.

Table 9 Before and after speeds and accidents in Liverpool zones

		20mph zones, Liverpool - signs only								
		Before 85th %ile speed (mph)	*After - Change in 85th percentile speed (mph)*				*Before mean speed (mph)*	*After - Change in mean speed (mph)*		*Accidents*	
Area	*Location*	*Prior to 20mph zones*	*May/June '96*	*Aug/Sept '96*	*Nov/Dec '96*	*Feb/Mar '97*	*Prior to 20mph zones*	*Aug/Sept '96*	*Feb/Mar '97*	*Before - Jan '93-Dec '95*	*After - Jan '96-Feb '97*
A	Delamora St @ midpoint	28	-4	-2	(-8)	(-2)	24	-1	(-2)		
	Goodall St. @ midpoint	30	-1	2	(-6)	(-4)	26	1	(-3)		
	Leiton St. @ midpoint	27	2	4	0	-2	24	1	-1		
	Roxburgh St. @ midpoint	27	-1	-1	-3	0	24	0	0		
	Ruskin St. @ midpoint	24	1	1	0	1	21	1	2		
	Average	27.20	-0.60	0.80	(-3.40)	(-1.40)	23.80	0.40	(-0.80)	11	2
B	Hagerton Rd off Queens Drive	27	0	0	(-3)	(1)	23	0	(2)		
	Ivernia Rd @ midpoint	29	-3	-2	(-5)	(-9)	24	-3	(-5)		
	Saxonia Rd @ midpoint	25	1	2	(0)	(-2)	20	2	(2)		
	Average	27.00	-0.67	0.00	(-2.67)	(-3.33)	22.33	-0.33	(-0.33)	1	1
C	Quorn St @ Fell St	27	0	4	(-10)	(-10)	23	1	(-8)		
	Cotswold St @ midpoint	23	2	0	(1)	(3)	20	-1	(3)		
	Gilead St.	30	1	5	(-2)	(-1)	26	1	(-1)		
	Average	26.67	1.00	3.00	(-3.67)	(-2.67)	23.00	0.33	(-2.00)	7	1
D	Formosa Dr. Nth of Karonga	29	-3	-2	-3	-5	24	0	-2		
	Delogoa Rd @ Ladysmith Rd	29	-3	-3	-7	0	26	-4	-2		
	Dereham Cr.	23	0	-2	-2	0	20	-2	1		
	Ferrey Rd @ Grieve Rd	26	-1	-3	1	3	22	-3	2		
	Formosa Dr. N of Drake Rd	26	-1	1	-1	0	22	-2	2		
	Harrismith Rd	25	-3	-4	-2	3	21	-2	4		
	Hawksmoor Rd @ Grieve Rd	28	1	1	0	1	25	0	4		
	Karonga Rd @ Ladysmith Rd	30	0	0	-3	0	26	1	-1		
	Montrovia Cr W of Delagoa Rd	26	-2	-7	-4	-3	22	-5	-1		
	Moss Pitts Lane N of Swainson Rd	26	-1	-2	-1	-1	23	-6	0		
	Average	26.80	-1.30	-2.10	-2.20	-0.20	23.10	-0.90	0.70	9	7
E	Acanthus Rd E/of Doric Rd	31	-2	-2	-5	-1	27	-2	-2		
	Cornice Rd @ midpoint	25	-3	2	-4	-3	21	0	-2		
	Doric Rd nr Acanthus Rd	26	-1	0	-3	-2	23	0	-1		
	Average	27.33	-2.00	0.00	-4.00	-2.00	23.67	-0.67	-1.67	0	0

F	Davidson Rd W of Beatty Rd	33	-2	-4	-3	-2	28	-3	-2		
	Church Rd @ Selkirk Rd	25	1	-1	0	1	23	-2	-1		
	Cromarty Rd @ midpoint	23	2	0	2	-1	21	-1	2		
	Elmhouse Rd @ midpoint	33	1	-1	-3	-2	29	-1	-3		
	Gidlow Rd @ midpoint	28	-1	4	-3	-2	26	2	-2		
	Maskell Rd	26	-4	-1	-5	0	22	-1	0		
	Average	28.00	-0.50	-0.50	-2.00	-1.00	24.83	-1.00	-1.00	9	3
G	Kingsheath Ave (o/s No. 89)	30	0	3	0	1	28	0	0		
	Ackers Hall Ave.	30	2	4	-1	2	27	1	1		
	Max Rd @ midpoint	30	3	-6	0	2	26	-6	1		
	Murcote Rd	28	-3	-4	-4	-3	24	-4	-1		
	Ruscombe Rd	24	0	3	-2	0	21	2	0		
	Haydn Rd	26	1	1	0	3	24	0	2		
	Average	28.00	0.50	0.17	-1.17	0.83	25.00	-1.17	0.50	15	11
H	Snowberry Rd nr Altfinch Cl	28	0	-6	-4	-1	24	-6	2		
	Burtree Rd @ Seacroft Rd	25	0	-2	0	3	24	-4	-1		
	Colweel Rd	25	1	-3	-3	0	22	-2	-2		
	Croxdale Rd	31	-6	-6	-5	-8	26	-5	-5		
	Average	27.25	-1.25	-4.25	-3.00	-1.50	24.00	-4.25	-1.50	8	0
I	Earp St. @ midpoint	24	-2	0	-2	-5	20	0	-3		
	Clifton St. at midpoint	27	-2	-4	-2	-4	23	-2	-3		
	Average	25.50	-2.00	-2.00	-2.00	-4.50	21.50	-1.00	-3.00	0	0
										Accidents per year	
	Average (All Sites)	27.21	-0.71	-0.73	-2.12	-0.74	23.69	-1.31	-0.35	20	21

Figures in brackets: results taken after physical measures introduced, not included in the averages for all sites.

Table 10 Effect of 20mph signs on mean speeds (mph) - Sandwich

	Mean speed (mph)		
Date	*Before 14/3/98-20/3/98*	*After 31/3/98-6/4/98*	*Change*
Site			
New Street (eastbound)	22.3	21.1	-1.2
Strand Street (westbound)	30.9	29.9	-1.0
Strand Street (eastbound)	30.4	29.7	-0.7
High Street (one-way)	23.5	22.3	-1.2
All sites	26.7	25.7	-1.0

Table 11 Effect of 20mph signs on 85th percentile speeds (mph) - Sandwich

	85th percentile speeds (mph)		
Date	*Before 14/3/98-20/3/98*	*After 31/3/98-6/4/98*	*Change*
Site			
New Street (eastbound)	27.2	26.0	-1.2
Strand Street (westbound)	40.5	38.8	-1.7
Strand Street (eastbound)	37.9	36.8	-1.1
High Street (one-way)	27.9	26.5	-1.4
All sites	33.3	32.0	-1.3

Table 12 Effect of 20mph signs and roundels on mean speeds (mph) - Hull sites

Site *Date*	*Before 30/1/98-4/2/98*	*After 20mph signs 6/2/98-11/2/98*	*Change*	*After roundels 13/2/98-18/2/98*	*Further change*
Site					
Annandale Rd (1) (westbound)	29.8	29.3	-0.5	27.3	-2.0
Annandale Rd (1) (eastbound)	29.9	29.3	-0.6	28.3	-1.0
Annandale Rd (2) (westbound)	22.3	21.9	-0.4	21.3	-0.6
Annandale Rd (2) (eastbound)	29.2	28.6	-0.6	27.2	-1.4
Shannon Road (northbound)	26.6	26.1	-0.5	25.3	-0.8
Shannon Road (southbound)	24.2	23.7	-0.5	22.5	-1.2
Wawne Road (northbound)	32.9	30.8	-2.1	28.3	-2.5
Wawne Road (southbound)	31.8	29.8	-2.0	27.7	-2.1
All sites	28.3	27.4	-0.9	25.9	-1.5

Table 13 Effect of 20mph signs and roundels on 85th percentile speed (mph) - Hull sites

Site *Date*	*Before 30/1/98-4/2/98*	*After 20mph signs 6/2/98-11/2/98*	*Change*	*After roundels 13/2/98-18/2/98*	*Further change*
Site					
Annandale Rd (1) (westbound)	35.6	35.7	+0.1	34.0	-1.7
Annandale Rd (1) (eastbound)	35.8	35.5	-0.3	34.7	-0.8
Annandale Rd (2) (westbound)	33.8	33.1	-0.7	31.3	-1.8
Annandale Rd (2) (eastbound)	34.8	34.5	-0.3	33.2	-1.3
Shannon Road (northbound)	34.2	33.8	-0.4	33.1	-0.7
Shannon Road (southbound)	32.0	31.6	-0.4	30.3	-1.3
Wawne Road (northbound)	37.0	35.0	-2.0	33.0	-2.0
Wawne Road (southbound)	35.0	33.0	-2.0	32.0	-1.0
All sites	34.7	34.0	-0.7	32.7	-1.3

To sum up, where speeds of around 20mph are desired in urban areas, traffic calming remains the best option to achieve this. Where funding or other reasons preclude its use, the use of only static signs appears insufficiently effective to reduce speeds to 20mph or to achieve accident reductions. Where signs-only schemes are used, small speed reductions and accident savings can be achieved if associated publicity and enforcement campaigns are also used. However, speeds are still likely to remain well above 20mph.

The use of 'flashing' signing and speed cameras have a substantial effect on speed, generally reducing mean and 85th percentile speeds by around 5mph, and appear likely to have safety benefits in specific locations. However, at current costs, their comprehensive use to control speed over a whole network of urban streets could prove more expensive and less effective in accident reduction terms, than traffic calming.

In-vehicle technology to automatically control speeds may eventually be a further option to manage vehicle speeds, but full implementation of such technology is still many years away as a practical solution to the danger of speed on urban roads.

8 Acknowledgements

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9 References

1 Atkins W S (1996). *Variable Speed Limit Trial.* Welsh Office.

2 Baier H (1994). *Area wide traffic calming measures in Darmstadt*. Conferenzia Internazionale vivere e camminare in citta urbano, pp 135 - 140. University of Brescia, Italy.

3 Cairney P T and Fackrell H L (1993). *The effects of a 40kph limit on traffic behaviour*. ARRB 243. Australian Road Research Board.

4 Farmer S A, Barker J K and Mayhew N (1998). *A trial in Norfolk of interactive speed limit signs*. Traffic Engineering and Control 1998, Vol 39, p287-293.

5 Fife Council (1995). *Speed Detection and Warning Signs in Fife*. Network Management Report. Fife County Council.

6 Finch D J, Kompfner P, Lockwood C R and Maycock G (1994). *Speed, speed limits and accidents.* TRL Report TRL58. Transport Research Laboratory, Crowthorne.

7 Fox K, Balmforth P, Franklin P and Montgomery F (1995).*Integrated ATT strategies for urban arterials: DRIVE II project PRIMAVERA: The Dewsbury Road experiment.* Traffic Engineering and Control 1995, Vol 36, p427-431.

8 Hawley L (1993). *Towards traffic calming: a practitioner's manual of implemented local area traffic management and black-spot devices*. W Sidney Regional Organisation of Councils.

9 Hook D, Kirkwood A and Evans D (1995). *Speed cameras in Oxfordshire*. Highways and Transportation, February 1995.

10 Jeanes M (1997). *Suffolk's 30mph speed limit initiative*. Paper presented to Conference: Road speed limits. University of Aston, Birmingham.

11 Koziol J S Jr and Mengert P H (1977). *Evaluation of speed control signs for small rural towns*. Public Roads Vol 41, (1) p23-31.

12 Oei H (1989). *A few kilometres reduction near a school complex: so what?* Report 23/5 p761-764. Crow Publikatie, Holland.

13 McCoy P T, Mohaddes A K and Haden R J (1981). *Effectiveness of School Speed Zones and their Enforcement.* Transportation Research Record 811. Transport Research Board, USA.

14 Pfundt K, Eckstein K and Meewes V (1989). *Zonen-Geschwindigkeits-Beschrankung*. Innenministerium Baden-Wurttemberg, Germany.

15 Swali L N (1993). *The effect of speed cameras in West London*. PTRC Summer Annual Meeting, University of Manchester. September, 1993.

16 Toogood J (1993). *Gatso - A Road Safety Success Story*. Milestones 1993 Winter Issue, p32-6.

17 Truls V, Christensen P and Ragnoy A (1995). *Mobile roadside speedometer reduced speed*. Nordic Road & Transport Research No 2, 1995.

18 Webster D C (1995). *Traffic calming - vehicle activated speed limit reminder signs*. TRL Report TRL177. Transport Research Laboratory, Crowthorne.

19 Webster D C , Mackie A M (1996). *Review of traffic calming schemes in 20mph zones*. TRL Report TRL215. Transport Research Laboratory, Crowthorne.

20 Wernsperger F and Sammer G (1995). *Results of the scientific investigations accompanying the pilot trial of 30 kph limit in priority streets*. 23rd PTRC European Transport Forum, September 1995. PTRC.

Appendix A: Speed reduction measures in urban areas

Table A1

Measure	*Speed limit (mph)*	*Effect on mean(mph)*	*Effect on 85%ile(mph)*	*Country*	*Reference number*
Speed	40	-5	N/A	UK	15
cameras	40	N/A	-4.2	UK	9
	40	-7	N/A	UK	16
Overall		-6	-4.2		

N/A = not available

Table A2

Measure	*Speed limit (mph)*	*Effect on mean(mph)*	*Effect on 85%ile(mph)*	*Country*	*Reference number*
Vehicle	30	-6.5	-8.0	UK	18
activated	30	-5.0	-7.0	UK	18
signs	30	-4.0	-6.0	UK	18
	37.5	-2.5	N/A	NORWAY	17
	40	-4(E)	N/A	UK	7
	19	-6.0	N/A	SWEDEN	18
	30	-3.5	N/A	USA	11
	40	N/A	-1.4	UK	5
	30	N/A	-4.6	UK	5
	30	-4.0	-2.0	UK	18
	30	-2.0	-1.0	UK	18
	30/40	-4.3	-5.9	UK	4
Overall		-4.2	-4.5		

N/A = Not available
E = Enforcement campaign

Table A3

Measure	*Speed limit (mph)*	*Effect on mean(mph)*	*Effect on 85%ile(mph)*	*Country*	*Reference number*
Flashing	30	-3.5	N/A	USA	11
signs	25(SZ)	-3	N/A	USA	13
(not vehicle	25(SZ)	-5.7(E)	N/A	USA	13
-activated)	20(SZ)	-3	N/A	UK	1
	31(SZ)	-3.1	N/A	Netherlands	12
Overall		-3.8			

N/A = Not available
SZ = School Zone
E = Enforcement Campaign

Table A4

Measure	*Speed limit (mph)*	*Effect on mean (mph)*	*Effect on 85%ile (mph)*	*Country*	*Reference number*
Static	30	-1.5	N/A	USA	11
signs	25	-3	-3	Australia	8
	20	-3.1	-1.9	Germany	2
	31	-1.3	N/A	Netherlands	12
	30	N/A	-6.7(PC)	UK	10
	30	N/A	-4.2(PC)	UK	10
	25	-3.1(E)	N/A	Australia	3
	19	-2	-2.9	Germany	6
	19	-1.8	-2.6	Austria	20
	30	-2	N/A	USA	6
	19	N/A	-0.6	Germany	14
Overall		-2.2	-3.2		

N/A = not available
PC = publicity campaign
E = enforcement campaign

Abstract

The report describes a study by TRL for the Department of the Environment, Transport and the Regions, to review the methods available for managing speeds in urban areas. In particular it assesses the likely effect of introducing signs-only 20mph zones compared with the effect of those which are self-enforced by means of traffic calming measures.

The study comprised three main elements:

- collection of information on low speed limit zones in other countries which use signs only;
- a review of the effectiveness of existing 20mph zones in the UK where physical measures have not been used;
- measurement of speeds at sites in new 20mph zones where signs were installed before implementation of physical measures.

Results indicate that where speeds of around 20mph are desired in urban areas, traffic calming remains the best option to achieve this. Where funding or other reasons preclude its use, the use of only static signs appears insufficiently effective to reduce speeds to 20mph or to achieve accident reductions. Where signs-only schemes are used, small speed reductions and accident savings can be achieved if associated publicity and enforcement campaigns are also used. However, speeds are still likely to remain well above 20mph.

Related publications

TRL312 *Traffic calming – speed cushion schemes* by R E Layfield and D I Parry. 1998 (price £30, code H)

TRL215 *Review of traffic calming schemes in 20 mph zones* by D C Webster and A M Mackie. 1996 (price £30, code H)

TRL177 *Traffic calming – vehicle activated speed limit reminder signs* by D C Webster. 1995 (price £20, code E)

PR58 *Speed, speed limits and accidents* by D J Finch, P Kompfner, C R Lockwood and G Maycock. 1994 (price £20, code E)

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