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Speed Management Techniques for Principal Roads in Urban Settings

Final Report

SRRB - Transport Scotland

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Notice

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1. Introduction

1.1. Background to Project

This research has the aim of reviewing the use of speed management measures on trunk roads in urban areas.

Route management enforcement strategies are well developed for trunk roads within a rural environment with the latest technology demonstrating sustained driver behaviour changes over extended distances. This provides for consistent journey times and improved journey time reliability.

Speed management within our villages, towns and cities is crucial to making our roads safer as well as a more pleasant and attractive environment. The development of the technology and / or strategies within an urban environment to provide the quality of life and accessibility for non-motorised road users is also considered to be an achievable opportunity.

1.2. Research Project

In many towns and villages along the trunk road network, road users may choose to ignore speed limits and travel at an inappropriate speed, which results in an increased risk of conflict with other road users resulting in accidents as well as reducing the quality of life and accessibility in the area. Higher traffic speeds can make crossing the road more difficult and can result in less pedestrian activity, severing communities.

Measures to influence road user behaviour and speed reduction have evolved over the years however, unacceptable behaviour by some motorists continues to cause concern and contribute to accidents. Speed management measures have been successfully adopted on Local Authority roads but there has been a lesser take-up on the trunk road network. This is generally considered to be reflective of the primary function of the trunk road network which is movement of traffic.

Transport Scotland identified a need to evaluate current strategies, consider their migration to an urban environment and develop recommendations designed to improve the safety and performance of trunk roads running through urban areas.

Accordingly, Atkins Limited was appointed by The Scottish Road Research Board (SRRB) to undertake research on behalf of Transport Scotland as part of the 2017-18 research programme.

1.3. Project Objectives

This research seeks to evaluate current strategies, consider their migration to an urban environment and develop recommendations designed to improve the safety and performance of trunk roads running through built up areas. It will look across Europe at similar routes and investigate what strategies are employed and consider both safety and performance.

The scope of the research is to

- Investigate current speed management techniques currently used in urban settings on Scotland's trunk roads,
- Assess their performance in relation to speed and casualty reduction,
- Assess the longer-term compliance performance of vehicle-activated speed limit signs on Scotland's Trunk Road network,
- Research methods used out-with Scotland including overseas and how they could be applied here and

- Investigate Transport Scotland's position on traditional traffic calming techniques and whether these would be appropriate on trunk roads.

1.4. Contributors

During the development of the project, contributions were sought and received from Transport Scotland in relation to the Trunk Road Network, the Trunk Road Operating Companies and SCOTS, in relation to the Local Authority Local Road Network.

A list of contributors is contained in Appendix A to this report.

2. Desktop Studies

2.1. Transport Scotland / Trunk Road Network

2.1.1. 20mph Limits and Speed Limit Zones

The speed-related outcome from the Priority Focus Area – Speed and Motorcyclists in the mid-term Review of the Road Safety Framework[1] is to increase the proportion of vehicles travelling at appropriate speeds on Scotland's roads to support reducing road casualty numbers. Transport Scotland and its road safety partners want to see all road users travel at speeds which are in accordance with the stated speed limit of the road and are safe for the road or the driving conditions.

Guidance was subsequently developed and published as 'Good Practice Guide on 20mph Speed Restrictions[2]'. The guidance notes the strong correlation between speed and risk of fatal injury and is written with particular reference to application on Local Authority Road Networks. The guidance notes the distinction between a 20mph limit and a 20mph speed limit zone.

- 20mph speed limit zones require traffic calming measures such as road humps or road narrowing and
- 20mph limits do not require any physical measures other than appropriate signage but should be self-enforcing.

Following the continued introduction of 20mph Limits and Speed Limit Zones on Local Authority roads there has been increased pressure to introduce similar speed reduction measures on trunk roads. While the majority of locations next to schools have already been subject to speed restrictions there has been a demand for the introduction of restrictions out-with these areas. A number of pilot sites have been chosen and are listed as follows: -

- A702 Biggar, implemented in 2017 and being monitored,
- A7 Langholm, currently on hold following public consultation,
- A78 Largs, agreed not to progress following public consultation exercise,
- A77 Maybole, implemented in 2015 and being monitored and
- A85 Oban, currently under consultation with local community.

These pilot sites were chosen where there was evidence-led criteria;

- Personal injury accidents, particularly those involving vulnerable road users,
- Vehicle speeds not significantly above an average of 24mph,
- Traffic volumes,
- Vehicle composition, including the HGV proportion of total traffic volume and
- Road environment including layout, key buildings and social amenities.

This research project will consider the effectiveness of these trial sites by comparing the data collected before the trial sites were installed and any data subsequently made available by Transport Scotland.

[1] 'Road Safety Framework, Mid-Term Review', Transport Scotland, March 2016
[2] 'Good Practice Guide on 20mph Speed Restrictions', Transport Scotland, June 2016

2.1.2. Safety Cameras

There are three Safety Camera Units operating across Scotland (North, East and West) which all operate under the rules and guidance of the Scottish Safety Camera Programme. The Programme follows the rules and guidance set out in the Programme Handbook.

'Safety Cameras Scotland' is the collective name for the North, East and West Safety Camera Units and works with the Scottish Safety Camera Programme and Police Scotland in operating speed and red-light cameras across Scotland, on both the Trunk and Local Authority Networks[3].

Cameras used on the Trunk Road Network (TRN) are either mobile, fixed or average types, with the latter becoming more prevalent in recent years.

Average Speed Cameras (ASCs) were installed on the A77 over a 32-mile section from Bogend Toll to Ardwell Bay in 2004. This was the first of its kind to be installed in the UK. The technology on the A77 was upgraded in June 2016. Monitoring has shown that compared to the 2005 baseline, fatal and serious casualties in the three-year period ending July 2015 had both reduced by over 70%.

A further set of average speed cameras were installed on the A9 in 2014, on a 136-mile section from Dunblane to Inverness. Monitoring in 2016 had showed a 45% decrease in all casualties and a decrease in killed or seriously injured casualties by 59%. The number of vehicles detected which requires further action by Police Scotland is considered low at 12% which is less than 0.03% of the traffic volume.

Additional installations were used on various trunk road roadworks including the M8/M73/M74 roadworks, A90 Forth Replacement Crossing and A9 Dalraddy to Kincraig. The latest figures[4] for offences at ASCs were published in July 2018 by Safety Cameras Scotland.

At some ASC locations there appears to be a rise in offences in the summer months which may relate to tourists being less familiar with the locations and means of enforcement.

2.1.3. Vertical Traffic Calming Features

Vertical traffic calming features such a speed tables or road humps have not generally been adopted on the trunk road network.

2.1.4. Horizontal Traffic Calming Features

Horizontal traffic calming features such as splitter islands and road narrowing (by building out from the kerb line) have been adopted at a number of locations. They are effectively used to form gateways from rural sections moving into urban sections of road. The photographs below are on the A76 at Mauchline, Ayrshire, which also highlight the need to ensure that visibility of such features is maintained.

[3] www.safetycameras.gov.scot

[4] 'Offence Data for Average Speed Camera Systems', Safety Camera Scotland, July 2018

Figure 2-1 A76 Ayrshire: Gateway and speed-reducing features

2.1.5. Vehicle Activated Signs (VAS)

Such signs (Speed Indicating Devices, (SIDs)) can either show the speed of the vehicle approaching or display a symbol such as a 'smiley or unhappy face', which relate to speeds below or above the speed limit, respectively. SIDs are less commonly found on the Trunk Road Network and are no longer installed at new locations.

2.1.6. Reverse Speed Discrimination Traffic Signals

Two new sites of reverse speed discrimination traffic signals were installed in Springholm on the A75, with one located at each end of the village within the 30mph speed limit. These signals have been introduced as a pilot form of speed management measure and are being closely monitored.

The signals operate independently for both directions of traffic and are triggered by an approaching vehicle travelling above the set-speed threshold which then turns the traffic signals to a red light. The offending vehicle is then held for a minimum period before being shown a green signal. Associated vehicle-activated warning signs in advance of the signals on all approaches inform drivers of their speed and to also slow down if they are traveling above the set speed threshold.

A similar installation was installed previously on the A78 at Fairlie at a junction within the town.

2.2. Scottish Local Authorities / Local Road Network

2.2.1. 20mph Limits and Speed Limit Zones

The majority of Scottish Local Authorities (LAs) have introduced 20mph limits and 20mph speed limit zones on their networks following the Guidance issued by Transport Scotland. There is a mixture of roads with traffic calming features, such as the streets around schools, and zones with little or no traffic calming.

Fife Council[5] recorded a reduction of traffic speeds where 20mph zones had been introduced. Prior to the introduction of the lower speed limit 50% of traffic on residential streets travelled below 25mph, whereas 83% travelled below 25mph following introduction.

The LAs generally require the support of Police Scotland to introduce such speed limits and the success varies from area to area. In general, such speed limits require to be self-enforcing and accordingly speeds should be low initially or traffic calming measures may require to be installed.

2.2.2. Safety Cameras

Safety cameras have been widely used across the local road networks, primarily fixed or mobile units. In addition, there are a number of sites where red-light cameras have been installed to regulate road user behaviour at traffic signal installations.

The East Safety Camera Unit installed Average Speed Cameras (ASCs) on Old Dalkeith Road, Edinburgh at a cost of £113,000 and these became live on 4 September 2017. This is the first such system to be installed on the local road network and the latest figures[6] for offences at this site were published in July 2018 by Safety Cameras Scotland.

The West Safety Camera Unit installed ASCs on the A713 at Polnessan in East Ayrshire and these were fully operational from 29 October 2018. A further system has been installed on Mill Street in Rutherglen, which went live on 19 September 2018.

2.2.3. Vertical Traffic Calming Features

The Scottish LAs have widely adopted the use of vertical traffic management features, such as;

- Speed Cushions,
- Speed Tables,
- Raised Junctions,
- Raised Pedestrian Crossings (possibly including a Zebra crossing on the top) and
- Rumble Strips.

Such methods can be found, with varying levels of success, across all levels of the local road network from Strategic Distributor Roads to small shared surface housing cul-de-sacs.

[5] 'Road Safety in Fife' Report to Safer Communities Committee, January 2016
[6] 'Offence Data for Average Speed Camera Systems', Safety Camera Scotland, July 2018

2.2.4. Horizontal Traffic Calming Features

The Scottish LAs have also made use of the horizontal traffic calming features described in Section 2.1.4 above.

The image below shows a layout on the B743 at Sorn, Ayrshire where a gateway feature has been created to slow vehicles entering the village, with priority given to the vehicles that are leaving.

Figure 2-2 B473 Sorn: buildouts with priority working

2.2.5. Vehicle-Activated Signs (VAS)

Such signs are becoming more common on the Local Road Networks. Signs such as SIDs can either show the speed of the vehicle approaching or display a symbol, such as a ‘smiley or unhappy face’, which relates to speeds below or above the speed limit, respectively.

2.3. Rest of UK

2.3.1. Introduction

Traffic Advisory Leaflet (TAL 2/05) 'Traffic Calming Bibliography' gives details of Department for Transport (DfT) circulars, TALs and Transport Research Laboratory (TRL) reports which provide details of measures used to reduce speeds and improve safety.

TA 87/04 'Traffic Calming on Trunk Roads A Practical Guide' gives details of various features that can be used on the trunk road to reduce speeds and accidents. Table 2.1 in TA 87/04 shows the reductions in accidents that may be obtained from ranges in 85th percentile speed reductions in mph.

% Changes in Injury Accident Frequency by 85th Percentile Speed Reduction	
Speed Reduction	**Change in Accidents (All Severities)**
0-2mph	- 10%
3-4mph	- 14%
5-6mph	- 32%
7mph or over	- 47%

[From TAL 11/00]

Table 2-1 – Accident reductions associated with speed reductions from TA 87/04

Furthermore, Highways England's 'Guide to Road Safety Route Treatments' provides details of measures used to be used on the Strategic Trunk Road Network (SRN), (i.e. the English Trunk Road and Motorway Network) to reduce accidents. Some of these measures include speed-reducing features.

2.3.2. 20mph Speed Limit Zones and Limits (Temporary & Permanent)

Historically, the use of 20 mph zones in urban areas has been well established. The results are showing that better effects on speeds and accidents are achieved where physical measures are introduced.

One of the first reviews[7] of the 20mph zones was undertaken by TRL in 1996. The review showed that where speed data was available for 32 zones the average reduction in mean speeds after the introduction of measures and the 20mph limit was 9mph.

In London, TfL reviewed the effects on speed and casualties of 20mph speed limits introduced in London in a factsheet[8]. Mean speeds after the installation at 22 zones was measured to be 17mph and an average reduction of 9mph was achieved.

Some English local authorities, e.g. Portsmouth City Council, Bristol City Council and some London Boroughs have recently introduced blanket 20mph speed limits in urban areas.

[7] TRL Report 215 Review of Traffic Calming Schemes in 20mph Zones – Webster and Mackie, 1996
[8] London Road Safety Unit: Safety Research Report No. 2 – Review of 20mph Zones in London (September 2003)

In November 2018, the DfT published a very detailed report 20mph research study[9] process and impact evaluation based on twelve case studies where 20mph limits were introduced. Portsmouth was included as one of the twelve case studies. The main findings are:

- 20mph limits are supported by the majority of residents and drivers;
- there has been a small reduction in average (median) speed - less than 1mph;
- 85th percentile speeds reduced by 1.2mph in residential areas and 1.6mph in city centres.
- vehicles travelling at higher speeds before the introduction of the 20mph limit have reduced their speed more than those already travelling at lower speeds and;
- There is not enough evidence to conclude that that there has been a significant change in accidents and casualties following the introduction of 20mph limits in residential areas

A separate study undertaken by University of West of England for Bristol City Council in 2018 has found a statistically significant reduction in average vehicle speeds of 2.7mph[10] since the introduction of 20mph speed limits across the city. Since the introduction of the 20mph speed limits in 2010 there has been a reduction in casualties, with a reduction of 4.53 fatalities per annum.

From Autumn 2015 the Welsh Government implemented a 3-year programme to introduce part-time 20mph speed limits outside schools on Welsh Trunk Roads in-line with (PAG) 105/16 'Safe Routes to Trunk Road Schools – Part-time 20mph Speed Limits.' The areas outside schools are signed with permanent signs (in advance of the temporary limit) with signs (to TSRGD diag. 545 and 547.1 sub-plate) and with 20mph terminal static Variable Message Signs (VMS) at the limits[11].

2.3.3. Setting Speed Limits

English Local authorities and Highways England use advice on the DFT circular 01/2013 'Setting Local Speed Limits' when considering a lower speed limit. Highways England will only introduce a lower speed limit with support from local stakeholders and the police and where the police will enforce the new limit. Physical measures may be required to change the environment to help the speed limit be self-regulating.

2.3.4. Safety Cameras

The use of fixed (spot) and mobile safety cameras has been widespread within England. The use of mobile safety cameras has reduced whilst there has been an increase in average speed camera systems (ASCs).

Highways England use spot safety cameras not as a standalone measure but in conjunction with other measures and where there is a known history of speeding issues and/or speed-related accidents.

Highways England often use ASCs to reduce vehicle speeds and improve road worker safety at long-term roadworks. On the SRN, Highways England consider ASCs as a mid-term solution, not as a standalone road safety measure and where there have been speed-related collisions spread out along a route.

9 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/757307/20mph-headline-report.pdf

10 http://eprints.uwe.ac.uk/34851/

11 https://beta.gov.wales/sites/default/files/publications/2017-10/safe-routes-to-trunk-road-schools-part-time-20mph-speed-limits.pdf

2.3.5. Vertical Traffic Calming Features

Road humps have been widely used by English Local Authorities very successfully to reduce vehicle speeds, accidents and traffic flows.

With regard to Highways England, The Highways (Road Hump) Regulations 1990 stated that:

4. (1) No road humps shall be constructed in any trunk road, special road or principal road

This was revoked by the introduction of The Highways (Road Humps) Regulations 1996, which changed the requirement to allow the construction of a road hump in any carriageway subject to a speed limit of 30 miles per hour or less. However, Traffic Advisory Leaflet TAL 7/96 'Highways (Road Hump) Regulations 1996 notes that regard needs to be given to the likely approach speeds, and the concerns of the emergency services.

This relaxation was not altered by the introduction of The Highways (Road Humps) Regulations 1999.

There is a move to provide more facilities for pedestrians and cyclists and IAN 195/16 'Cycle Traffic and the Strategic Road Network' states that where cyclists have priority a road hump may be provided. However, in response to a 2015 Freedom of Information Request, the Highways Agency confirmed that there were no road humps on their network.

It is believed that there may not be any road humps on English trunk roads because of the lack of suitable locations and TA 87/04 notes that on trunk roads where there are relatively large traffic flows and high proportions of large vehicles, road humps are unlikely to be used.

2.3.6. Horizontal Traffic Calming Features / Gateways

English LAs have introduced a variety of horizontal deflections to reduce vehicle speeds. Highways England has adopted the use of gateways in village locations as a measure to reduce speeds and accidents.

2.3.7. Vehicle Activated Signs (VAS)

English LAs and Highways England use VAS to highlight hazards on a route. Speed limits can be displayed with the words 'SLOW DOWN' or with a camera warning sign. TAL 1/03 'Vehicle Activated Signs' gives guidance on their usage. SIDs mentioned above are widely used by English LAs often in village locations.

2.3.8. Community Speed Watch

Some English LAs and police forces promote the use of Community Speed Watch where residents note the details of speeding road users through their community. (They are trained in the use of a radar gun by the police.) Offending drivers are sent a warning letter from the local police. Transport for London (TfL) operates a similar Community Road-watch Scheme.

2.3.9. Reverse Speed Discrimination Traffic Signals

Swindon Borough Council undertook a trial of reverse speed discrimination traffic signals at two junctions, Queens Drive and Thamesdown Drive.[12] It should be noted that the two locations were existing traffic signal junctions on dual carriageways subject to a 40-mph speed limit.

The results indicated that the system operated as expected and that there was a significant reduction of upstream vehicle speeds. Furthermore, there was no adverse effect on capacity.

At one site there was no change in red-light violations. Independent research suggested that good publicity of this type of scheme is required so that drivers know that they will be stopped at a red light if they travel above the speed limit.

Further measures are being considered at Thamesdown Drive including the monitoring of reckless behaviour by motorists using CCTV cameras.

2.3.10. Roadside Technology

On SMART and controlled Motorways, Highways England is able to set variable mandatory speed limits according to the traffic conditions, e.g. congestion caused by breakdowns, accidents, obstructions in the carriageway, slow-moving vehicles or other incidents. The document 'SMART Motorways Concept of operations (to accompany IAN 161/15)' gives details of the technology used and how it should be applied. Drivers are advised about new speed limits by signing on gantries, Advance Motorway Indicators (AMIs) on slip roads and Message Signs (MS3 and MS4) on the road side.

While this technology has not yet been applied to urban roads future developments and reductions in cost may make it a realistic option.

[12] 'Speed Amelioration in Swindon, Implementation and Results' paper by Phil Shoobridge, JCT Signals Symposium 2016

2.4. Europe

2.4.1. Reverse Speed Discrimination Traffic Signals

Reverse Speed Discrimination Traffic Signals (RSDTS) have been used extensively across Europe, particularly in Portugal and France.

In Portugal the RSDTS are mainly used at junctions and pedestrian crossings but can be used on other sections of road. The criteria for installing these devices includes:

- directions where the devices may be installed at junctions,
- traffic which is stopped once the device is activated,
- location of the signal pole with the feature (on the nearside) and
- advance signing provided.

The advance signing is a combination of traffic signals ahead and speed limit signs and wig-wags (amber flashing lights). There are types of panels that detect approach speeds are available in two types for speeds in the ranges of 25-38 mph and 38-56mph. The signals are operated such that traffic is stopped in both directions, even when the speeding traffic is only on one approach. This is to avoid conflicts between pedestrians crossing the road when the vehicles are only signalled to stop in one direction.

RSDTS[13] is used in Portugal on the approaches to and within urban areas. Drivers are aware of the speed control device ahead and reduce their speed accordingly. It is primarily used for speed reduction rather than casualty reduction.

2.5. Vehicle Technology UK & World Wide

Whilst engineering and technology measures in the road environment have been used or are being developed to reduce vehicles speeds, various technologies are being developed for vehicles, such as driverless cars (or autonomous vehicles). There are five stages from no automation (0) to full automation (5). Some models already have some features to reduce speeds and avoid collisions which are in the range 1 and 2 of automation. These features include anti-lock brakes, electronic stability control, speed limiters (or governors) and autonomous emergency braking.

Another technology that has been trialled in the authorities of Lancashire, Blackpool and Blackburn with Darwen, is Intelligent Speed Adaptation (ISA). Vehicles fitted with ISA to a satellite navigation system provided drivers exceeding with visual and auditory information. The results from a nine-month trial showed that speeding was reduced by 30% on 30mph road and by 56% on 70mph roads.

TfL has used ISA technology on buses successfully in London. All buses fitted with ISA remained within the speed limit between 97-99% of the time. TfL will require all buses from 2017 to be fitted with this technology. TfL feels that if the bus cannot exceed the speed limit, then the bus will act as a traffic calming measure for following vehicles and reduce the speeds of other vehicles in the vicinity and hence may reduce road accident casualties[14].

[13] 'Portuguese Practice of Introducing Traffic Signals for Speed Control' paper by Instituto de Infra-Estruturas Rodoviarias
[14] '2017 Speed Summit: A Report on Effective Schemes'

3. Review of Responses

3.1. Data Collection

A questionnaire was prepared and submitted to the Trunk Road Operating Companies, the Scottish Safety Camera Programme Office and the Scottish Local Authorities (via SCOTS). The information requested related to the use of the various speed management techniques available and associated data.

The questionnaire was sent by email to the main contacts identified by Atkins and Transport Scotland and the responders are noted in Appendix A to this report.

Responses were received from the Scottish Safety Camera Programme Office and from a number of Local Authorities, Transport Scotland and Operating Companies.

3.1.1. Safety Cameras

Speed, accident and casualty data was provided in a spreadsheet for 26 camera sites from across the Scottish Trunk Road Network. However, before and after collision data was only available at 18 of the camera sites. The before and after data periods were based on the fields in the spreadsheet 'Sites Collision Data' and the column 'Site Operational Data'. Of these 15 were mobile camera sites and 3 were fixed camera sites.

Of the 15 mobile camera sites, there was not sufficient speed readings to produce meaningful results at one of the sites.

Collision and Casualty Results

Greater reductions in the collision and casualty rates were experienced at the mobile camera sites compared to the fixed camera sites. When comparing the average rates per site the mobile sites experienced reductions just over twice that of the fixed camera sites. Across all sites the reduction was greatest for slight injury collisions / casualties. By comparing the percentage change at the sites, the mobile sites experienced a 42.0% reduction in annual collision rate and a 47.7% reduction in annual casualty rate. The fixed sites experienced a 37.7% reduction in annual collision rate and a 44.1% reduction in annual casualty rate.

Savings in the KSI casualty rate of 0.24 casualties per year per fixed camera site and 0.64 per year per mobile camera site were made between the before and after periods.

In many cases for the fields such as child killed, and pedestrian killed the collision and casualty rates were very small and therefore it was difficult to draw meaningful conclusions from the data.

Speed Data Results

The change in speeds were examined at the mobile and fixed camera sites by speed limit. Table 3-2 below shows the ranges in speeds and the change of speeds. The change in the table shows the range of the differences in speeds achieved across all sites by speed limit. For example, across the 8 mobile camera sites within a 30mph speed limit, the lowest average speed reduction was a 3mph increase in speed and the highest average speed reduction was 11.4mph. The data is contained in Appendix D.

Speed Limit & No. of Mobile Sites	Period & Difference	Range in Minimum Average Speed (mph)	Range in Maximum Average Speed (mph)	Range in Minimum 85th Percentile Speed (mph)	Range in Maximum 85th Percentile Speed (mph)
30 mph (8 sites)	Before	29.0	42.0	33.0	53.0
	After	29.8	34.0	35.1	37.4
	Change	-2.0	11.4	-2.5	17.9
40 mph (4 sites)	Before	40	43.0	47.0	50.0
	After	36.0	40.6	41.9	47.2
	Change	-0.6	7.0	2.1	7.1
50 mph (2 sites)	Before	49.0	50.0	57.0	58.0
	After	46.0	47.0	52.9	54.3
	Change	3.0	3.0	2.7	5.1

Table 3-2 – Range in speeds before and after mobile cameras introduced by speed limit at urban trunk road sites

A negative value denotes an increase in speed.

At 10 of the mobile camera sites speeds reduced after the introduction of the camera site. Where speeds had increased at four locations, three of the locations were within 30 mph speed limits.

Speed Limit of Fixed Site	Period & Difference	Average Speed (mph)	85th Percentile Speed (mph)
40 mph	Before	36.0	40.0
	After	37.5	41.8
	Change	-1.5	-1.8
30 mph	Before	32.0	43.0
	After	26.7	29.9
	Change	5.3	13.1
30 mph	Before	32.0	46.0
	After	25.7	29.8
	Change	6.3	16.2

Table 3-3 – Changes in speeds before and after introduction of fixed safety cameras at urban trunk road sites

Note the small increase in the speeds in the 40mph limit which are unexplained, however still show a good level of compliance. The reductions in speed at the other fixed sites were impressive.

3.1.2. Reverse Speed Discrimination Traffic Signals

It was noted that the installation on the A75 at Springholm is relatively new and that data is still being collected and reviewed. Early indications are that speeds are lower than previously measured. There is an on-going monitoring regime in place at this location and this will be covered in a future report by Transport Scotland's Operating Company.

Early indications are that the speed monitoring has indicated a positive reduction in both 85th percentile speeds and average speeds throughout the village of Springholm. The number of activations of the traffic signals as well as the number of vehicles failing to stop at a red traffic signal is being continually monitored and will be subject to discussion in this future report as suggested above.

The traffic signals at Fairlie on the A78 have been in operation since August 2013 following a vehicle collision with a building in February 2013. The system utilises an existing set of traffic signals in the village, which turn to red if vehicle speeds in excess of the set threshold are detected. However, it should be noted that in any monitoring of the Fairlie site, other road safety measures were introduced including gateway features and vehicle activated signs for the traffic signals.

These measures may also have an effect of vehicle speeds and accidents. Findings from the monitoring of the speeds in Fairlie following the introduction of the new technology at the traffic signals showed a slight reduction in vehicle speeds approaching and leaving the signals. However, traffic speeds at other parts of the town continued to remain at a level which was cause for concern. Further speed management measures have been implemented more recently at the extents of the town and these will be monitored by the Operating Company.

3.2. Scottish Local Authorities (SCOTS)

3.2.1. 20mph Limits and Speed Limit Zones

Councils utilise a mix of mandatory and advisory 20mph limits and speed limit zones. The majority initially installed these measures in the vicinity of schools and have subsequently rolled out to wider areas of the network. Transport Scotland issued a 'Good practice Guide on 20mph Speed Restrictions' for Local Authorities use.[15]

Physical traffic calming features (both vertical and horizontal) are used to help reinforce the lower speed limit. Fife Council[16] has undertaken an evaluation of 20mph zones (January 2016) and a copy of the relevant part report is contained in Appendix B. The report concludes that the substantially reduced speed of traffic within the 20mph zones can be seen to have helped to deliver a reduction in risk. The number of crashes has reduced as has the severity of injuries to casualties.

The City of Edinburgh Council has introduced 20mph Zones and Part Time 20mph limits across the city, adopting a phased approach[17]. A plan showing the areas and the implementation dates is shown on the plan below. (Fig 3-1)

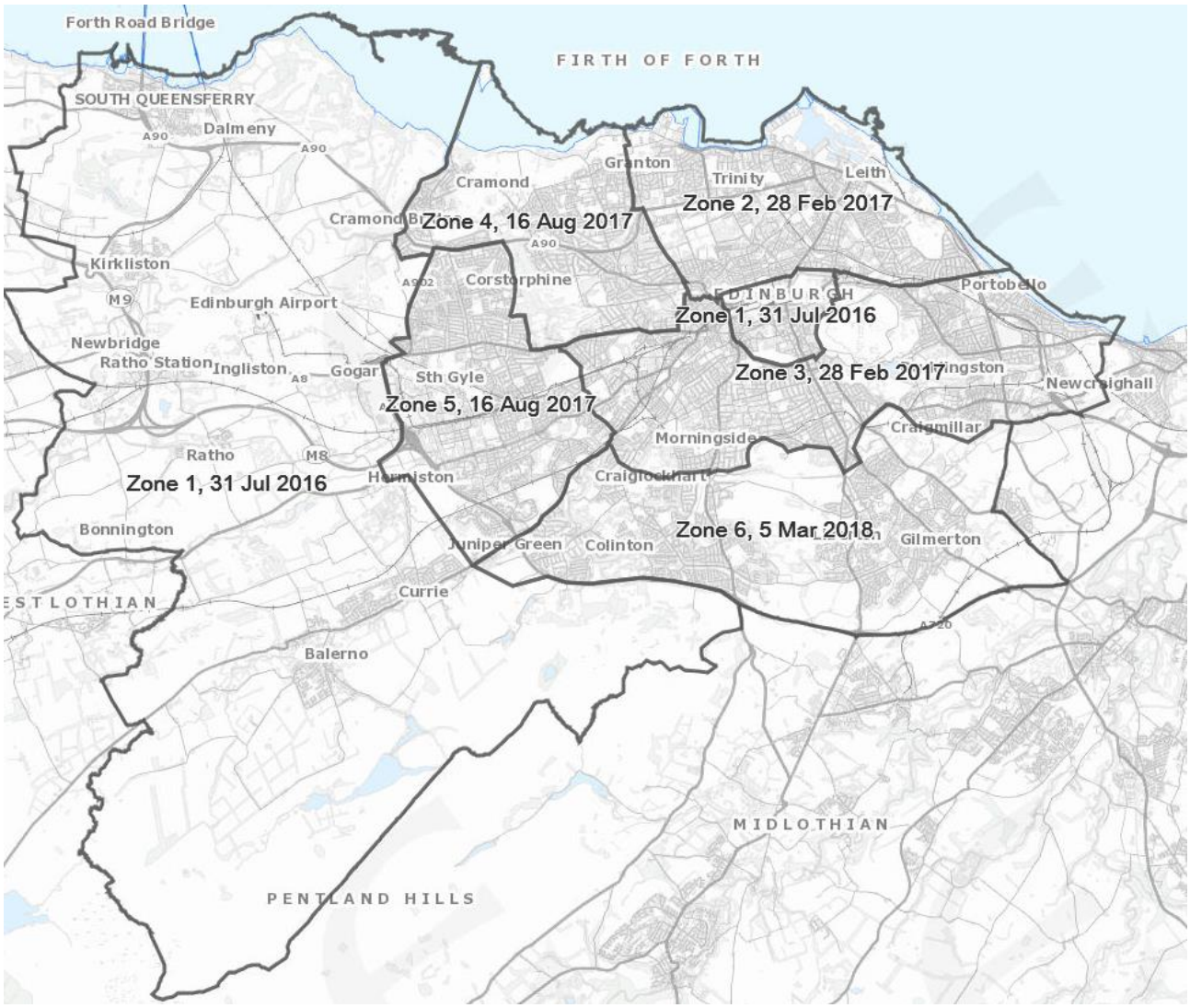


Figure 3-1 Edinburgh 20mph zones by area & implementation date

[15] Transport Scotland, 'Good Practice Guide on 20mph Speed Restrictions' June 2016

[16] Fife Council, Safer Communities Committee Report 'Road Safety in Fife' 21 January 2016

[17] http://edinburghcouncil.maps.arcgis.com/apps/webappviewer/index.html?id=ca131eddb0084197b160edbbad2ca8c7

3.2.2. Safety Cameras

In partnership with Safety Cameras Scotland most Local Authority areas have utilised safety cameras, both fixed and mobile types being utilised. Fixed sites tend to be more popular in the urban locations with the mobile sites deployed on the more rural sections of road.

3.2.3. Vertical Traffic Calming Features

The respondents confirmed that the full range of vertical features had been generally used across their networks. Speed tables and road humps in particular are used extensively across the residential road networks, particularly to achieve self-enforcing 20mph limits.

In some locations uncontrolled pedestrian crossings have been incorporated onto speed tables and raised junctions (e.g. in Stranraer, Dumfries and Galloway).

The use of such features on principal routes is less common, most commonly associated with approaches to schools and other pedestrian generators. The main reasons cited for not adopting widespread use of these features were:

- Noise resulting in complaints from nearby residents and
- Ongoing road maintenance requirements.

3.2.4. Horizontal Traffic Calming Features

Aberdeenshire Council has adopted a policy of not replacing worn centre-lines where there is a speed limit of 30mph or less. As well as saving on maintenance costs a reduction in driver speed has been noted, which is associated with no change in accident statistics at these locations.

Mouchel Parkman undertook a review of traffic calming measures for Aberdeenshire Council in 2004 and noted a reduction in 85th percentile speeds at various locations where speed limit signs were incorporated with other features at the gateways to various towns and villages. In general, a reduction in speed was recorded but remained above the desired speed.

The conclusion of the study was that the installation of gateway features alone did not necessarily achieve the desired effect and that other features, such as vertical traffic calming, were required.[18]

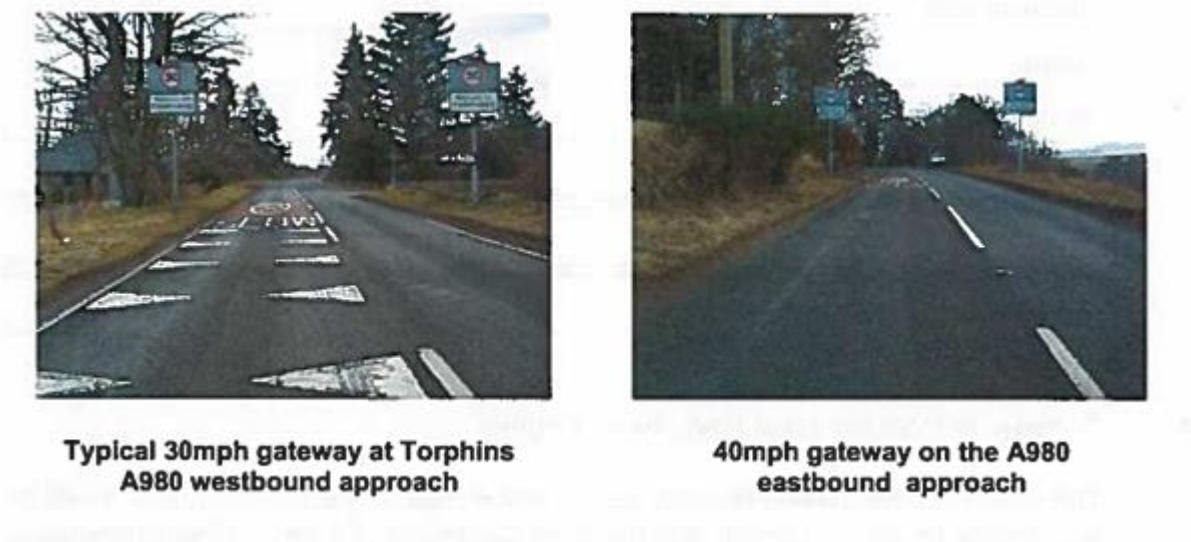


Figure 3-2 Photographs taken from 'The Effectiveness of Traffic Calming in Aberdeenshire'

[18] Mouchel Parkman, The Effectiveness of Traffic Calming in Aberdeenshire' 2004

3.2.5. Vehicle-Activated Signs

In 2010 City of Edinburgh Council reported[19] on the results of a pilot study relating to the use of Vehicle-Activated Signs (VAS). A mix of locations were chosen, including distributor roads and residential streets, all having a history of speeding issues. Vehicle speeds were recorded for a week prior to installation, one week after installation and five months after installation as shown in Appendix C.

The report concluded that both the mean and 85th percentile speeds were reduced following installation. However, there was a marked difference between high volume routes and residential streets. If there are significant vehicle flows the impact of the signs was found to be significantly greater than where vehicle flows are low. The signs utilised in the pilot indicated the speed limit with the message 'Slow Down' below.

The output from the pilot resulted in the development of criteria to be considered when siting VAS within Edinburgh, which has been incorporated into the flow chart in Appendix C of this report.

[19] City of Edinburgh Council, Report to Transport, Infrastructure and Environment Committee, 'Vehicle Activated Signs – Pilot Study Results', 4 May 2010

4. Review of Statistics

4.1. Introduction

Collision (accident) and casualty data (up to 2017) was provided in a spreadsheet for 26 camera sites from across Scotland however, before and after collision data was only available at 18 of the camera sites. The before and after data periods were based on the fields in the spreadsheet 'Sites Collision Data' and the column 'Site Operational Data'. Of these 15 were mobile camera sites and 3 were fixed camera sites.

Annual collision and casualty rates were then calculated for the relevant before period and after periods (using only the collision data taken from after the operational date for each camera) for each site.

4.2. Mobile Safety Camera Sites

Table 4-1 below shows the annual rates for the 15 mobile camera sites combined. The cells highlighted pink indicate a reduction in the collision or casualty rate between the before and after periods.

Total	Camera Type	Collision or Casualty /year	Fatal Collisions	Serious Collisions	Slight Collisions	All Collisions	All Casualties Killed	All Casualties Serious Injuries	All Casualties Slight Injuries	All casualties	Child Killed	Child Serious Injuries	Pedestrian Killed	Pedestrian Serious Injuries
Mobile	All 15 Mobile	Before	1.00	16.00	62.67	79.67	1.00	17.00	88.00	106.00	0.00	0.67	0.00	3.67
	All 15 Mobile	After	0.91	6.74	38.56	46.22	1.02	7.39	47.17	55.42	0.08	0.53	0.39	2.03
	All 15 Mobile	Change	-0.09	-9.26	-24.11	-33.45	0.02	-9.61	-40.83	-50.58	0.08	-0.14	0.39	-1.63

Table 4-1– Total collision rates for 15 mobile camera sites

Table 4-1 shows that overall across all 15 mobile camera sites there was a reduction of 33.5 (42.0%) in the annual collision rate for all collisions and a reduction of 50.6 (47.7%) in the annual casualty rate for all casualties. For both collisions and casualties, the reduction in annual rate was greatest for slight injuries than for killed and serious injuries.

Table 4-2 below shows the average annual rates per site for the 15 mobile camera sites.

Average	Camera Type	Collision or Casualty /year	Fatal Collisions	Serious Collisions	Slight Collisions	All Collisions	All Casualties Killed	All Casualties Serious Injuries	All Casualties Slight Injuries	All casualties	Child Killed	Child Serious Injuries	Pedestrian Killed	Pedestrian Serious Injuries
Mobile	All 15 Mobile	Before	0.07	1.07	4.18	5.31	0.07	1.13	5.87	7.07	0.00	0.04	0.00	0.24
	All 15 Mobile	After	0.06	0.45	2.57	3.08	0.07	0.49	3.14	3.69	0.01	0.04	0.03	0.14
	All 15 Mobile	Change	-0.01	-0.62	-1.61	-2.23	0.00	-0.64	-2.72	-3.37	0.01	-0.01	0.03	-0.11

Table 4-2 – Average collision rate at each mobile camera site

Table 4-2 shows that the average reduction per mobile site was 2.2 (42.0%) for all collisions and 3.4 (47.7%) for all casualties. Again, the greatest reduction was experienced for slight injuries.

The KSI (Killed or Seriously injured) annual casualty rate reduced by 9.58 (53.3%) between the before and after periods. This equated to an average reduction in the annual rate of 0.64 KSI casualties per year per mobile camera site.

4.3. Fixed Safety Camera Sites

Table 4-3 below shows the annual rates for the 3 fixed camera sites combined.

Total	Camera Type	Collision or Casualty /year	Fatal Collisions	Serious Collisions	Slight Collisions	All Collisions	All Casualties Killed	All Casualties Serious Injuries	All Casualties Slight Injuries	All casualties	Child Killed	Child Serious Injuries	Pedestrian Killed	Pedestrian Serious Injuries
Fixed	All 3 Fixed	Before	0.67	1.67	6.33	8.67	0.67	1.67	8.67	11.00	0.00	0.00	0.33	0.00
	All 3 Fixed	After	0.08	0.63	4.69	5.40	0.08	0.63	5.43	6.15	0.00	0.23	0.08	0.39
	All 3 Fixed	Change	-0.58	-1.03	-1.65	-3.26	-0.58	-1.03	-3.24	-4.85	0.00	0.23	-0.25	0.39

Table 4-3 – Total collision rates for 3 fixed camera sites

Table 4-3 shows that overall across all 3 fixed camera sites there was a reduction of 3.3 (37.7%) in the annual collision rate for all collisions and a reduction of 4.9 (44.1%) in the annual casualty rate for all casualties. For both collisions and casualties, the reduction in annual rate was greatest for slight injuries than for killed and serious injuries.

Table 4-4 below shows the average annual rates per site for the 3 fixed camera sites.

Average	Camera Type	Collision or Casualty /year	Fatal Collisions	Serious Collisions	Slight Collisions	All Collisions	All Casualties Killed	All Casualties Serious Injuries	All Casualties Slight Injuries	All casualties	Child Killed	Child Serious Injuries	Pedestrian Killed	Pedestrian Serious Injuries
Fixed	All 3 Fixed	Before	0.22	0.56	2.11	2.89	0.22	0.56	2.89	3.67	0.00	0.00	0.11	0.00
	All 3 Fixed	After	0.03	0.21	1.56	1.80	0.03	0.21	1.81	2.05	0.00	0.08	0.03	0.13
	All 3 Fixed	Change	-0.19	-0.34	-0.55	-1.09	-0.19	-0.34	-1.08	-1.62	0.00	0.08	-0.08	0.13

Table 4-4 – Average collision rate at each fixed camera site

Table 4.4shows that the average reduction per fixed site was 1.1 (37.7%) for all collisions and 1.6 (44.1%) for all casualties. Again, the greatest reduction was experienced for slight injuries.

The KSI (Killed or Seriously injured) annual casualty rate reduced by 1.62 (69.2%) between the before and after periods. This equated to an average reduction in the annual rate of 0.54 KSI casualties per year per fixed camera site.

4.4. Summary

Greater reductions in the collision and casualty rates were experienced at the mobile camera sites compared to the fixed camera sites. When comparing the average rates per site the mobile sites experienced reductions just over twice that of the fixed camera sites. Across all sites the reduction was greatest for slight injury collisions / casualties. By comparing the percentage change at the sites, the mobile sites experienced a 42.0% reduction in annual collision rate and a 47.7% reduction in annual casualty rate. The fixed sites experienced a 37.7% reduction in annual collision rate and a 44.1% reduction in annual casualty rate.

Savings in the KSI casualty rate of 0.24 casualties per year per fixed camera site and 0.64 per year per mobile camera site were made between the before and after periods.

In many cases for the fields such as child killed, and pedestrian killed the collision and casualty rates were very small and therefore it was difficult to draw meaningful conclusions from the data.

4.5. Speed Data

A summary of the speed data results is found in section 3.2.1 above. The data provided was combined into one table which is found in Appendix D from which the results were drawn.

The results found that the best reductions in average and 85th percentile speeds were achieved by mobile speed cameras in 30mph speed limits. Similarly, good average and 85th percentile speed reductions were achieved at the two fixed speed camera sites within a 30mph speed limit. A slight unexplained increase in average and 85th percentile speeds was noted at the site within the 40mph speed limit.

4.6. Other Speed Management Measures

The Average Speed Camera installation on Old Dalkeith Road, Edinburgh has been live for just over one year. The data indicates that prior to installation over 60% of the 15,000 vehicles a day using the route broke the speed limit. This has been reduced to an average of two offences being recorded per day. In addition, there were no injury collisions reported last year compared to six from 2013-15.

5. Conclusions and Recommendations

5.1. Conclusions

There is a great variety of measures that have been used to reduce vehicle speeds on the highway in Scotland and elsewhere in the UK. The types and effects of such measures used have been well documented in various research reports, advisory leaflets, advice notes and circulars. These documents can provide guidance on what features can be used in various cases to reduce both vehicle speeds and casualty reduction.

Generally, the greater the reductions in speed, the greater reductions in accidents are achieved. Whilst the vertical deflections in the highways generally have one of the greatest effect on speed and accident reductions, there may be a lack of suitable sites on the trunk road where they may be installed without an impact on traffic flow and concerns from various parties including the emergency services. However, the promotion of walking and cycling in urban areas may give rise to potential locations for such measures on the urban trunk road in the future.

There are speed reducing and safety benefits in providing horizontal deflections and gateway features have been used in both urban and rural environments. Guidance can be found on the suitability of the design of such features.

Research by TRL and TfL has found that 20 mph zones are more effective at reducing vehicle speeds than 20mph speed limits with mean vehicle speeds reduced by 9mph. In 20mph zones physical traffic calming measures such as horizontal and vertical deflections are introduced which are more effective than 20mph signing alone. For example, in Edinburgh when considering 20 mph limits, the number of vehicles exceeding 24 mph must be considered before signing the limit or introducing traffic calming measures. Evidence from the City of Edinburgh Council suggests that that the lower flow (less than 10,000 vehicles per day) can produce less successful results.

Evidence from England is showing that small reductions (approximately 1mph) in vehicle speeds can be achieved by blanket 20mph limits within cities. These new limits are generally accepted by residents and drivers. However, as part of these initiatives, it is important to gain the support and involvement of the community to assist with acceptance and compliance.

Similar to the programme already undertaken in Scotland, Wales, has introduced a 3-year programme from September 2015 of part-time 20mph speed limits outside all schools on trunk roads using a mixture of traditional and VMS signs as part of a safer routes to school initiative. However, it is too early to tell what the effects of vehicle speeds and accidents are.

If this initiative is successful, then it could be applied elsewhere. It appears that there is a growing acceptance of lower speed limits in urban areas which may be applicable to trunk roads in certain circumstances.

In general, good results are achieved by safety cameras in reducing speeds, accidents and casualties. Impressive results, especially killed or seriously injured reductions, have been achieved from some Average Speed Cameras employed both in Scotland and England. However, in Scotland, on certain routes, offences on routes with Average Speed Cameras peak during the summer months.

Relatively few new engineering initiatives are being trialled in the UK into speed management techniques. However, reverse speed discrimination is being used at sites both in Scotland and England at traffic signals where speeding vehicles are stopped by a red traffic signal. Early evidence suggests that this technology is expensive but does reduce speeds on the approach to traffic signals. It is more effective on 30mph speed limit single carriageway roads than 40 mph dual carriageways and does not

adversely affect capacity at junctions. Good publicity about the scheme and its aims is also important to contribute to the scheme's success. However, red-light violations can increase at the traffic signals and it is too early to judge the effect on accidents.

Roadside technology is being used by Highways England to set variable speed limits to manage incidents on SMART and controlled motorways to improve traffic flow, deal with incidents and improve safety to both the road user and road worker.

Technology installed in vehicles currently and in the future can also help to reduce speeds directly or influence the behaviour of drivers to do so. TfL has been installing ISA in London buses so that their drivers are given more information to comply with speed limits (especially in 20mph limits) with the aim of influencing drivers around them.

5.2. Recommendations

It is recommended that:

- Traditional measures, where proven, are and continue to be used to manage speeds and reduce accidents on the Scottish Trunk Road Network;
- Initiatives where speed limits have been lowered to 20mph and are successful elsewhere in the UK are considered for Scotland where there are suitable locations;
- The reverse speed discrimination traffic signals at the Scottish sites continue to be monitored to determine effects on speed, accidents and red-light running;
- The results from the monitoring of average speed cameras on Local Authority urban roads be evaluated to determine whether they can be applied to the urban Scottish Trunk Road Network, while meeting the requirements of the Safety Camera Programme Handbook[20] and
- New initiatives that use emerging technology to monitor and slow vehicle speeds down is monitored with a view to use on the Scottish Trunk Road Network.

It is noted that a number of recommendations are inconclusive and will require further study or research. This is due to there being insufficient data available at the time of this research.

[20] 'Scottish Safety Camera Programme: Handbook of Rules and Guidance' May 2015

Appendices

Appendix A. Study Contributors

A.1. Transport Scotland Contacts

This study was initiated and managed by Transport Scotland.

Table A-4 – Transport Scotland Contacts

	Contact	Role
1	Derek Williamson	Road Safety Manager, Trunk Road and Bus Operations
2	Amy Phillips	Road Safety Manager, Trunk Road and Bus Operations
3	Linzi Pidgeon	Data Analyst, Scottish Safety Camera Programme Office

A.2. Trunk Road Operating Company Contacts

Contact was made with the Trunk Road Operating Companies via Transport Scotland. This contact initially took the form of a survey questionnaire which was distributed to Trunk Road Operating Companies and returned directly to Atkins.

Table 2 below details the Trunk Road Operating Company contacts.

Table A-5 – Trunk Road Operating Company Contacts

	Trunk Road Operating Company	Contact
1	Amey	Jim Reid
2	Bear Scotland	Alan Campbell
3	Bear Scotland	Kevin McKechnie
4	Scotland TranServ	Vincent Tait

A.3. Local Authority Contacts: SCOTS

Contact was made with the Scottish Local Authorities via the Chair of the Traffic and Road Safety Group. This contact initially took the form of a survey questionnaire which was distributed to the members of the Group and returned directly to Atkins.

Table 3 below details the SCOTS respondents to the survey

Table A-6 – SCOTS Responders

	Council	Responder
1	Renfrewshire Council	Andrew McNab
2	Fife Council	Murray Hannah
3	Fife Council	Ian Smith
4	Scottish Borders Council	Philippa Gilhooly
5	City of Edinburgh Council	Stacey Monteith-Skelton
6	Aberdeenshire Council	Andrew Wilkinson
7	Aberdeenshire Council	John Bruce

Appendix B. Extract from Fife Council Report – Road Safety in Fife. January 2016

B.1. 20mph Zones Evaluation

B.1.1. At the outset, it was decided that Fife's 20mph zones should be mandatory with associated Traffic Regulation Orders (TROs) so that enforcement of the speed limit was possible. Some very early advisory "20's Plenty" zones were converted to mandatory. To date, Police Scotland has undertaken enforcement deployments in a number of zones across Fife and continues to deploy on an intelligence led basis following community engagement consultation events.

B.1.2. The risk of a pedestrian being fatally injured when hit by a vehicle at 30mph is 5.5% (over 30% at 40mph) however at 20mph the risk reduces to less than 1%. By restricting traffic speed in residential areas, including around schools, to 20mph there will be significant benefits in terms of the risk of injury and the severity of injury. Residential streets generally have a good crash record from a crash cluster analysis perspective, and hence 20mph speed limits may not result in an associated significant reduction in crash and casualty numbers across all zones, however reducing the risk, the severity and the perception of injury will have benefits in terms of pedestrian priority, pedestrian activity and quality of life in those streets and areas.

B.1.3. Fife has 135 primary schools and 19 secondary schools. Assets, Transportation & Environment have been working with schools and Education and Children's Directorate, since around the time the 20mph initiative started, to support them in developing and launching their School Travel Plans. To date, 72 primary schools and 8 secondary schools have a Travel Plan in place which supports and encourages healthier and more sustainable travel to and from school within 20mph zone school catchment areas. A further 46 primary schools and 4 secondary schools are currently working to develop their Travel Plan

B.1.4. Well designed 'Places' will encourage social interaction and foster strong communities. The introduction of 20mph zones to existing streets has provided a foundation within established residential areas which can support future retrofitting of 'Place Making' efforts to enhance quality of life. One good example of this is the "Street Design" initiative in partnership with SUSTRANS where three established 20mph residential areas in Kirkcaldy, in the vicinity of primary schools, have been enhanced through environmental improvements where the lower speed limit has permitted a more flexible approach to street infrastructure and road space priority.

B.1.5. The Scottish Government Cycling Action Plan for Scotland (2013) encourages local authorities to introduce lower speed limits to support cycling by slowing traffic to create an environment where cyclists feel safer. Fife has been able to capitalise on this, through having well established 20mph zones, where we are one of two high profile local authority pilot projects in Scotland with SUSTRANS to develop cycling towns. In Fife, we are delivering this project through the "Make your Move Kirkcaldy" initiative and have been successful in securing significant grant funding from the Scottish Government. This has now led to committed major cycling town projects in Dunfermline and Glenrothes.

B.1.6. Measuring 'quality of life' is challenging. To get an indication of perceptions about quality of life within 20mph zones, a consultation exercise was undertaken with the Fife Peoples Panel. This has helped to evaluate the qualitative aspects of the initiative.

B.2. 20mph Zones Monitoring and Evaluation

B.2.1. Traffic Speed and Risk of Injury

B.2.1.1. National regulations require that physical traffic calming in 20mph zones if 15% or more of traffic exceeds 24mph. This is an important speed measurement from this design perspective as well as from an enforcement perspective.

B.2.1.2. As part of the planning, design and monitoring of 20mph zone schemes, traffic speed surveys are undertaken at representative locations before and after the introduction of each zone. The surveys show significant success, with in general terms before the introduction of lower speed limits, only 50% of traffic on residential streets travelled below 25mph whereas in the after surveys, 83% are travelling below25 mph.

B.2.1.3. Apart from evidencing that the design of these zones has been very successful in controlling speed to around the recommended threshold for a 20mph speed limit, these surveys also indicate that the risk and severity of pedestrian injury has been significantly reduced whereby the speed of two thirds of vehicles exceeding the 20mph threshold has now been controlled to within this threshold.

B.2.2. Casualty Figures

B.2.2.1. An evaluation of the number and severity of road casualties within the areas now covered by 20 mph zones has been carried out. There are currently 499 discrete 20mph zones across Fife which have been introduced between 2003 and 2014, 94 of which have been introduced as part of new residential developments. These new residential developments have not been included in the evaluation figures since there is no speed or casualty data prior to the 20mph speed limit coming into effect from which to undertake a comparison. A discrete zone is where every road within the boundary of the zone has a 20mph speed limit (roads with higher speed limits separate discrete zones).

B.2.2.2. The evaluation methodology covers the period 2003 to 2013 and considers casualty figures for a three-year period prior to the introduction of each zone and a three-year period after its introduction. Since these zones were introduced at different times over the 11-year evaluation period, each set of three year before and after figures have been compiled into a combined before and after data set. Tables A and B show these combined figures for all casualties and for child casualties.

Table A – Combined *Casualty Outcomes for 20 mph zones* 2003-2013

Casualty results – Years before zones introduced					Zones operational	Casualty results – Years after zones introduced				
Severity Of Casualty	3	2	1	Total		1	2	3	Total	Reduction
Slight	80	84	81	**245**		56	57	81	**194**	**20.8 %**
Serious	18	22	17	**57**		16	25	8	**49**	**14 %**
Fatal	2	0	1	**3**		0	0	0	**0**	**100 %**
Total	**100**	**106**	**99**	**305**		**72**	**82**	**89**	**243**	**20.3 %**

Table B – Combined *Child Casualty Outcomes for 20 mph zones* 2003-2013

Child (0-15 yrs) casualty results – Years before zones introduced					Zones operational	Child (0-15 yrs) casualty results – Years after zones introduced				
Severity Of Casualty	**3**	**2**	**1**	**Total**		**1**	**2**	**3**	**Total**	**Reduction**
Slight	38	26	25	**89**		14	21	26	**61**	**31.5 %**
Serious	8	8	5	**21**		7	11	1	**19**	**9.5 %**
Fatal	1	0	0	**1**		0	0	0	**0**	**100 %**
Total	**47**	**34**	**30**	**111**		**21**	**32**	**27**	**80**	**27.9 %**

B.2.2.3. To provide a control sample against which the casualty reductions shown in Tables A and B can be compared, the evaluation included examining casualty reduction data over similar 6-year periods for a sample of residential zones before the introduction of 20mph speed limits (where this data is available within the period 2003-2013). This indicates how effective the reduction in speed limit and traffic speed has been in relation to casualty numbers and severities. Tables C and D show these combined control figures for all casualties and for child casualties.

Table C
Combined *Casualty Outcomes* for zones *prior to introduction* of a 20 mph speed limit 2003-2013

Casualty results – Years 1 to 3					Mid Period	Casualty results – Years 4 to 6				
Severity Of Casualty	**1**	**2**	**3**	**Total**		**4**	**5**	**6**	**Total**	**Reduction/ Increase (+)**
Slight	4	2	1	**7**		1	2	2	**5**	**29 %**
Serious	0	0	1	**1**		0	2	1	**3**	**+ 200 %**
Fatal	0	0	0	**0**		0	0	0	**0**	**0 %**
Total	**4**	**2**	**2**	**8**		**1**	**4**	**3**	**8**	**0 %**

Table D

Combined *Child Casualty Outcomes* for zones *prior to introduction* of a 20 mph speed limit 2003-2013

Child (0-15 yrs) casualty results – Years 1 to 3					Mid Period	Child (0-15 yrs) casualty results – Years 4 to 6				
Severity Of Casualty	1	2	3	Total		4	5	6	Total	Reduction/ Increase (+)
Slight	1	2	0	**3**		0	2	1	**3**	**0 %**
Serious	0	0	0	**0**		0	1	1	**2**	**+ 200 %**
Fatal	0	0	0	**0**		0	0	0	**0**	**0 %**
Total	**1**	**2**	**0**	**3**		**0**	**3**	**2**	**5**	**+ 66 %**

B.2.2.4. It can be seen, albeit from a significantly smaller data set covering 46 zone areas, that the percentage reductions of casualties seen in the 20mph zones has not been replicated in those residential areas which had yet to have 20mph zones introduced during this study period. The sample areas out-with the zones show no reduction in overall casualties and an increase in child injuries.

B.2.2.5. A further evaluation has been undertaken on those 20mph zones that are fully or partially within data zones defined as being within the 20% most deprived areas in Scotland, under the terms of the Scottish Government's 'Scottish Index of Multiple Deprivation (SIMD) 2012'. This index ranks these data zones (containing around 700 people on average) across Scotland from 1 (most deprived) to 6505 (least deprived). As an index, it measures relative, not absolute, deprivation (i.e. how multiple deprivation compares between data zones, rather than how much deprivation is in each). It considers issues including income, employment, health, education and crime. Children are 4 times more likely to become pedestrian fatalities in these SIMD areas.[21]

B.2.2.6. Using the same analysis methodology, Tables E and F show the combined casualty outcome figures for all casualties and for child casualties for those 20mph zones which are within Fife's areas of multiple deprivation.

Table E Combined Casualty Outcomes for 20 mph zones within SIMD areas 2003-2013

Casualty results – Years before zones introduced					Zones operational	Casualty results – Years after zones introduced				
Severity Of Casualty	3	2	1	Total		1	2	3	Total	Reduction
Slight	33	27	31	**91**		17	21	21	**59**	**35%**
Serious	7	6	13	**26**		5	10	4	**19**	**27%**
Fatal	1	-	-	**1**		-	-	-	**-**	**100%**
Total	**41**	**33**	**44**	**118**		**22**	**31**	**25**	**78**	**34%**

Table F
Combined Child Casualty Outcomes for 20 mph zones within SIMD areas 2003-2013

Child (0-15 yrs) casualty results – Years before zones introduced					Zones operational	Child (0-15 yrs) casualty results – Years after zones introduced				
Severity Of Casualty	3	2	1	Total		1	2	3	Total	Reduction/ Increase (+)
Slight	20	12	14	**46**		8	10	14	**32**	**30%**
Serious	4	-	2	**6**		2	4	1	**7**	**+16%**
Fatal	1	-	-	**1**		-	-	-	**-**	**100%**
Total	**25**	**12**	**16**	**53**		**10**	**14**	**15**	**39**	**26%**

B.2.2.7. The casualty results from zones within the SIMD areas show a greater reduction, 34% vs. 20% overall and a similar level in child casualties (26% vs. 27%) when compared with the results from the zones as a whole in Tables A & B. The SIMD areas cover 51 of the zones, fully or in part. The SMID results are included within the overall results.

B.2.2.8. The casualty results show good reductions particularly in child casualties within the zones in the SMID areas showing an even greater overall reduction.

B.3. Conclusions

B.3.1. This report provides an overview of the wide range of road safety education work being undertaken by community safety partners to promote road safety in Fife, demonstrating positive results in terms of reductions in road casualties.

B.3.2. The substantially reduced speed of traffic within the 20mph zones can be seen to have helped deliver a reduction in risk. This has reduced the number of crashes and where crashes do occur, has reduced the severity of casualties. Although this is shown clearly from the results of speed measurement equipment used in site surveys, it was not strongly reflected in the Peoples Panel survey results showing the perception does not in this case reflect the actual situation.

B.3.3. There has been a significant reduction in both road crashes and the associated casualties.

B.3.4. Results from the zones covering areas defined as within the 20% most deprived in Scotland have shown a greater reduction in casualties than the overall results from all the zones in operation.

B.3.5. There has been a significant increase in cycling (20%) and a continued choice of more sustainable methods of travel to school as an alternative to car use.

B.3.6. The introduction of 20mph zones has successfully resulted in a perceived increase in quality of life by making residential areas feel safer and more pleasant to walk and cycle.

[21] (David White, Robert Raeside, Derek Barker, Napier University – Scottish Government Development Department Research Programme Research Findings No. 81 - Road Accidents and Children Living in Disadvantaged Areas.)

Appendix C. Extract from City of Edinburgh Council Report – VAS – Pilot Study Results and Recommendations. May 2010

C.1. Background Research

C.1.1. Historically, there has always been a perceived link between vehicle speed and the frequency and severity of road traffic collisions. To try to quantify this relationship the Transport Research Laboratory (TRL) conducted a study in 2000 into the correlation between vehicle speeds and the frequency of collisions. It concluded that:

- In any given situation, higher speeds are associated with more collisions,
- Reducing the speed of the fastest drivers (relative to the average speed for the road) is likely to bring greater collision benefits than reducing the overall average speeds for all drivers, particularly on urban roads. This demonstrates the value of engineering and enforcement measures which target the fastest drivers,
- The often-quoted broad result that a “5% reduction in collision frequency results per 1mph reduction in average speed” although still a good rule of thumb actually varies according to road type and is around 6% for urban roads with low average speeds or 4% for higher speed urban roads and
- In selecting sites priority should be given to roads which combine high speeds with high collision frequency.

C.1.2. This TRL study advocates the use of speed reducing measures which are not specifically targeted at the majority of drivers, just at the higher speed vehicles. A system of VAS would be considered ideal for this purpose as long as it was targeted at roads with a speeding problem and a higher than expected collision frequency. Any reduction in speed can mean the difference between a fatal collision and a serious or even slight injury

C.1.3. An initial list of 49 sites which had a history of speeding problems was drawn up and investigated by gathering the following data:

- Collision details, broken down into slight, serious and fatal,
- Vehicle speeds and
- Proximity to pedestrian generators, e.g. schools, nurseries, churches etc.

C.1.4. This information was then put through a weighting process to produce an overall score which was taken against the length of the site. This was then factored to a value per kilometre and the figures were compared to create the prioritised list.

C.1.5. An online questionnaire was composed to canvas public opinion on how effective they perceived them to be. This received around 450 responses. In summary the results of this survey showed:

- 65% of respondents believed that VAS is effective as a speed enforcing measure,
- 54% believe that there is a need for signs such as these within urban Edinburgh,
- 63% said that the signs should be more widely used and
- 58% stated that these signs would be more effective as part of a larger road safety scheme and not as a standalone measure.

C.1.6. The 7-day speed survey results taken before the signs were erected have been analysed alongside "after" surveys taken at the same locations in the week immediately after the erection of the signs. A third survey was also carried out approximately 5 months after the erection of the signs.

C.1.7. An additional 7-day survey was carried out at a suitable location around 250m beyond the sign location. This additional survey was undertaken to try to find if the signs had an effect on the speed of vehicles beyond the immediate location of the sign.

C.2. Speed Survey Conclusions

C.2.1. The overall speed trend was a reduction in both the mean speeds and 85%ile speeds. This was found at all of the pilot sites situated on main traffic routes. The signs in place on more residential routes with lower traffic flows did not produce as positive a set of results with sites on Craigentinny Avenue and Lauriston Farm Road showing no real reduction in mean or 85%ile speeds. Craigentinny Avenue also showed an increase in speed in one direction. This could be attributed to the overall daily traffic flow decreasing from a figure in the region of 4,500 a day to around 3,000 a day after the completion of roadworks at Seafield Junction. This would again highlight the relationship between the effectiveness of the signs and total daily traffic volume less than 10,000 vehicles per day.

C.2.2. The remaining sites on main traffic routes have shown that if there is sufficient volume of daily traffic then the speed reduction can be encouraging. The average mean speed reduction at these sites was 2.5mph which increased to 3.7mph after 5 months along with an average reduction of 2.9mph increasing to 4.3mph after 5 months to the 85 percentile speeds.

C.2.3. A reduction in the total percentage of vehicles travelling above the posted speed limit was also found to be promising with an immediate average reduction of 14.4% to a 29.5% reduction after 5 months. These results are shown in Appendix 2.

C.2.4. These results were also mirrored at the secondary speed surveys carried out 250m downstream from the sites, showing that the driver behaviour was not only affected at the signs themselves.

C.3. Proposed Criteria

C.3.1. As with any road sign, an abundance of a specific type of sign will, over time, reduce its impact and usefulness. Accordingly, the following set of criteria is recommended for the Committee's approval for the future use of this type of sign. The criteria are as follows:

- Traffic volume,
- Vehicle speeds,
- Collision details, broken down into slight, serious and fatal,
- Proximity to pedestrian generators, e.g. schools, nurseries, churches etc,
- Site location and
- Local community support

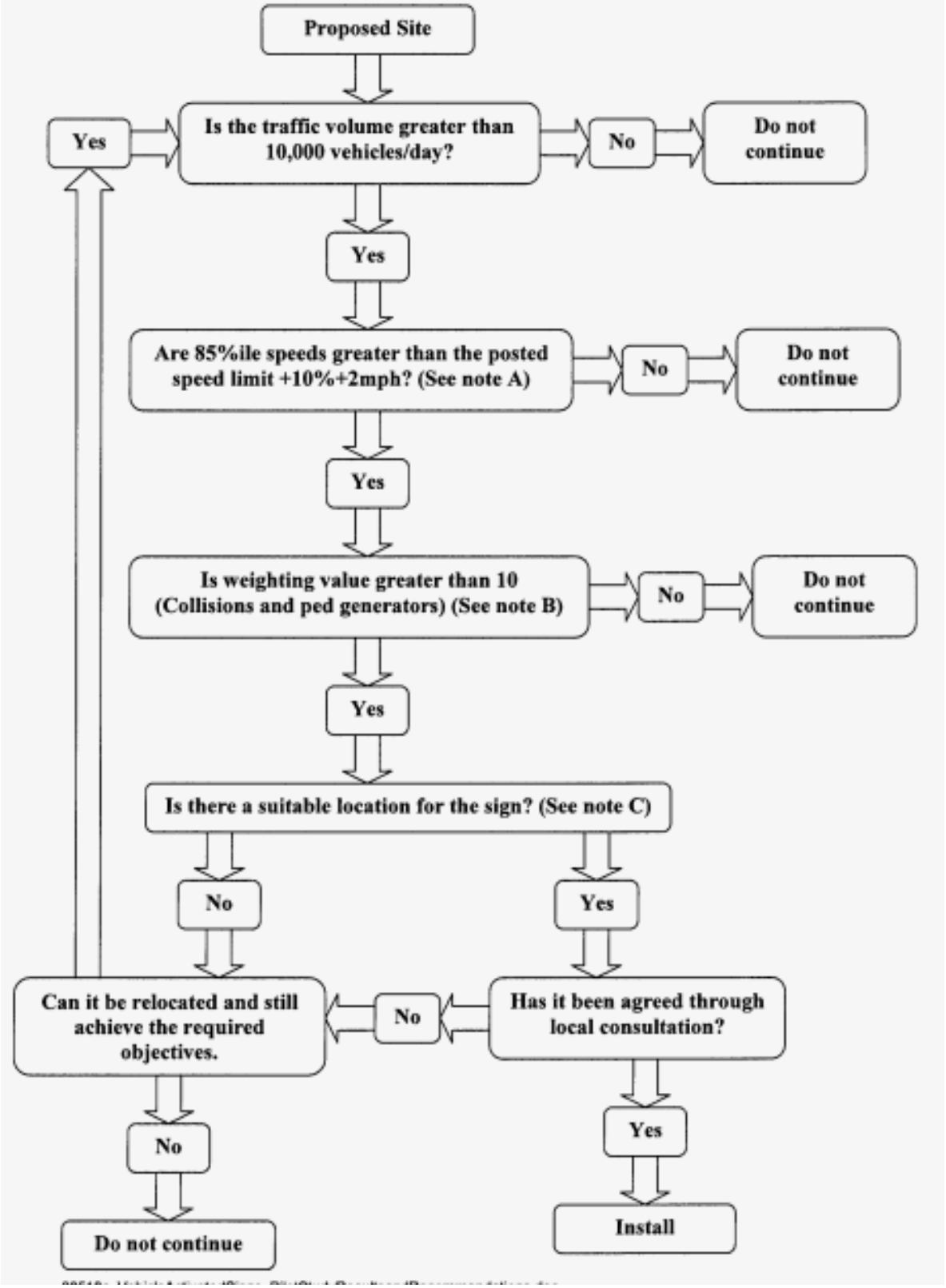
C.3.2. The proposed criteria have been incorporated within a flow chart to simplify the investigation process for future use of these signs. The flow chart breaks the process down into easily followed stages with numerical values that have to be met for a new site to be considered. This includes traffic volume and speeds, collision history and the vicinity of pedestrian generators (e.g. Schools, Nurseries, Health Centres, etc).

C.4. Selected Appendices from Report

Appendix 2 - Reduction in % of total vehicles travelling above the posted speed limit

Live Sites	Direction	PSL	Ave Daily Traffic Flow	% of vehicles exceeding posted speed limit			
				Before	After	5 months after	Reduction in % after 5 months
Hillhouse Road	Eastbound	40	38619	58.1	32.9	26.3	31.8
	Westbound			40.4	33.8	24.4	16
Lauriston Farm Road	Northbound	30	7889	60.1	58.8	44.6	15.5
	Southbound			40.8	30.6	34.1	6.7
Craigentinny Avenue	Northbound	30	4736	73.6	56	65.9	7.7
	Southbound			70.3	66.3	84.7	-14.4
Willowbrae Road	Northbound	30	20601	31.2	29.4	13	18.2
	Southbound			73.8	70	18.1	55.7
Redford Road	Eastbound	30	10347	80.9	45.9	40.3	40.6
	Westbound			85	65.8	52.2	32.8
Telford Road	Eastbound	30	22142	85.5	76.4	74.3	11.2

Appendix 3 - New Site Justification



Appendix D. Safety Camera Data Summary by Site

D.1. Summary of Safety Camera Data by Fixed and Mobile Sites

Site	Speed Camera Type	Speed Limit	Time period	Average Speed	Percentage Above Speed Limit	85th Percentile Speed	Percentage Greater Than 15 mph Above	Daily Traffic Flow
665	Mobile	30	Before	34.0	30.0	40.0	5.0	6085.0
			After	32.5	55.8	37.4	1.0	6579.5
			Change	**1.5**	**-25.8**	**2.6**	**4.0**	**-494.5**
			%	**4.3**	**-86.1**	**6.6**	**79.8**	**-8.1**
685	Mobile	30	Before	32.0	62.0	37.0	5.0	9000.0
			After	34.0	70.9	39.5	3.3	8028.5
			Change	-2.0	-8.9	-2.5	1.7	971.5
			%	-6.1	-14.3	-6.6	33.9	10.8
723	Mobile	30	Before	34.0	64.0	46.0	0.0	8946.0
			After	30.9	46.4	35.3	0.6	8705.4
			Change	**3.1**	**17.6**	**10.7**	**-0.6**	**240.6**
			%	**9.2**	**27.6**	**23.2**	**#DIV/0!**	**2.7**
730	Mobile	30	Before	31.0	51.0	33.0	1.0	13018.0
			After	31.7	50.0	36.0	1.2	11714.0
			Change	**-0.7**	**1.0**	**-3.0**	**-0.2**	**1304.0**
			%	**-2.1**	**1.9**	**-9.1**	**-17.0**	**10.0**
732	Mobile	30	Before	42.0	4.0	53.0	0.0	2980.0
			After	30.6	37.9	35.1	0.5	3498.2
			Change	**11.4**	**-33.9**	**17.9**	**-0.5**	**-518.2**
			%	**27.1**	**-846.8**	**33.7**	**#DIV/0!**	**-17.4**
790	Mobile	40	Before	43.0	65.0	49.0	2.0	15747.0
			After	36.0	25.5	41.9	0.3	13124.5
			Change	**7.0**	**39.5**	**7.1**	**1.7**	**2622.5**
			%	**16.3**	**60.7**	**14.4**	**84.6**	**16.7**
793	Mobile	40	Before	40.0	53.0	47.0	1.0	10300.0
			After	40.6	57.2	47.2	4.4	13329.9
			Change	-0.6	-4.2	-0.2	-3.4	-3029.9
			%	-1.6	-7.9	-0.4	-337.5	-29.4
817	Mobile	50 then	Before	50.0	49.0	57.0	1.0	16666.0
			After	47.0	33.1	54.3	1.2	20280.9
			Change	**3.0**	**15.9**	**2.7**	**-0.2**	**-3614.9**
			%	**6.0**	**32.4**	**4.7**	**-22.2**	**-21.7**
818	Mobile	50	Before	49.0	54.0	58.0	3.0	17911.0
			After	46.0	26.9	52.9	0.7	17755.9
			Change	**3.0**	**27.1**	**5.1**	**2.3**	**155.1**
			%	**6.1**	**50.2**	**8.7**	**75.5**	**0.9**
865	Mobile	30	Before	34.0	84.0	40.0	2.0	0.0
			After	31.5	62.9	36.2	1.1	6904.5
			Change	**2.5**	**21.1**	**3.8**	**0.9**	**-6904.5**
			%	**7.2**	**25.1**	**9.5**	**45.5**	**#DIV/0!**
962	Mobile	40	Before	42.0	64.0	48.0	2.0	0.0
			After	39.7	47.9	45.4	1.5	12288.9
			Change	**2.3**	**16.1**	**2.6**	**0.5**	**-12288.9**
			%	**5.4**	**25.1**	**5.4**	**26.7**	**#DIV/0!**
1160	Mobile	30	Before	29.0	45.0	35.0	1.0	12752.0
			After	29.8	42.9	35.1	0.7	10690.3
			Change	**-0.8**	**2.1**	**-0.1**	**0.3**	**2061.7**
			%	**-2.7**	**4.7**	**-0.3**	**34.1**	**16.2**

Site	Speed Camera Type	Speed Limit	Time period	Average Speed	Percentage Above Speed Limit	85th Percentile Speed	Percentage Greater Than 15 mph Above Speed Limit	Daily Traffic Flow
1161	Mobile	30	Before	34.0	75.0	41.0	4.0	9496.0
			After	32.4	60.3	37.4	1.5	10349.3
			Change	**1.6**	**14.7**	**3.6**	**2.5**	**-853.3**
			%	**4.8**	**19.6**	**8.8**	**62.2**	**-9.0**
1259	Mobile	40	Before	40.0	55.0	50.0	4.0	44390.0
			After	38.9	37.7	45.6	0.6	46833.8
			Change	**1.1**	**17.3**	**4.4**	**3.4**	**-2443.8**
			%	**2.8**	**31.5**	**8.9**	**84.3**	**-5.5**
1289	Mobile	40	Before	45.0	82.0	51.0	5.3	11771.0
			After	35.0	9.0	39.0	0.0	10700.0
			Change	**10.0**	**73.0**	**12.0**	**5.3**	**1071.0**
			%	**22.2**	**89.0**	**23.5**	**100.0**	**9.1**
812	Fixed	40	Before	36.0	12.0	40.0	1.0	4800.0
			After	37.5	18.5	41.8	2.0	9765.4
			Change	**-1.5**	**-6.5**	**-1.8**	**-1.0**	**-4965.4**
			%	**-4.1**	**-54.4**	**-4.5**	**-100.0**	**-103.4**
1131	Fixed	30	Before	32.0	45.0	43.0	12.0	21504.0
			After	26.7	4.5	29.9	0.0	18597.5
			Change	**5.3**	**40.5**	**13.1**	**12.0**	**2906.6**
			%	**16.6**	**89.9**	**30.5**	**100.0**	**13.5**
1165	Fixed	30	Before	32.0	42.0	46.0	16.0	18318.0
			After	25.7	3.3	29.8	0.0	11283.5
			Change	**6.3**	**38.7**	**16.2**	**16.0**	**7034.5**
			%	**19.8**	**92.1**	**35.3**	**100.0**	**38.4**

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