

A78 Fairlie, an innovative approach to encouraging speed compliance using traffic signals

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JCT Symposium 2015 paper.



On the 14th February 2013 a Heavy Goods Vehicle crashed into a residential property close to the existing signalised junction on the A78 within the village of Fairlie, North Ayrshire, killing the house inhabitant and causing a large amount of damage and disruption.

The local community were extremely concerned about road safety within the village and campaigned for improvements to be made. Transport Scotland instructed their operating company for the South West Unit, Scotland TranServ to carry out a number of traffic surveys. Evidence taken from these traffic surveys identified that there were driver behaviour issues within the village of Fairlie.

As a result an innovative scheme was devised to slow drivers down when driving through the village. This design implemented by Clearview Traffic Group Ltd., with supply chain partners Imtech Traffic and Infra UK Ltd. and Coeval Ltd., incorporated the use of advanced wireless vehicle speed detection, vehicle speed activated signs and the traffic signals to penalise drivers in excess of the 30mph speed limit by stopping them on purpose at the signalised junction and in turn increasing their journey time.

Fairlie and the A78 trunk road

The small village of Fairlie, with a population of just over 1,500, sits on the eastern shore of the Firth of Clyde in North Ayrshire on the western edge of Scotland.



The A78 trunk road runs between Greenock in the North, where it links to the A8 and onwards to Glasgow; and to the South, West Kilbride and ultimately Monkton, where it joins the A77 near Glasgow Prestwick Airport. The single carriageway road that dissects the village has a speed limit of 30mph within the boundaries of the conurbation and has an average traffic flow in excess of 9,000 vehicles a day.

On the 14th February 2013 a Heavy Goods Vehicle laden with coal crashed into a residential property close to the existing and only signalised junction in the village where Main Road is joined by The Causeway. Tragically the 55 year old female inhabitant of the property was killed. The incident also caused heavy damage to the property leaving it structurally unsound with associated prolonged disruption whilst repairs have been carried out.

In 2013 a fatality occurred due to an HGV crashing at speed into a residential property



This resulted in the Community Council requesting a meeting with the Scottish Minister for Transport and Veterans. At the meeting it was agreed that Transport Scotland would carry out a number of investigations into personal injury accidents as well as speed of vehicles.

A campaign group 'Fairlie Safer Roads' then started a campaign and Transport Scotland presented the findings of their traffic surveys carried out during August 2013 that highlighted driver behaviour issues as there was a regular issue with drivers passing through the village in excess of the 30mph speed limit. Agreement was subsequently sought with all the relevant stakeholders, which also included: Police Scotland, Fairlie Community Council, Kenneth Gibson MSP and North Ayrshire Council, on the proposed measures in late 2013.

Initially on the very outer approaches to the village vehicle activated signs and new road markings including: dragon's teeth, speed limit roundels and 'SLOW' markings; along with 'SLOW' markings on red surface dressing patches at repeated strategic locations through the town were implemented. These measures alone following post implementation speed surveys showed the 85th percentile speeds within the village itself were still in excess of the 30mph limit being at various locations between 34 and 36mph.

Traffic Surveys highlighted the issue of speeding vehicles

These traffic survey figures demonstrated that other safety measures would ideally be required to further improve the safety of this section of the busy A78 through the village of Fairlie.

Putting safety first at Fairlie: 'Speed Related Force'

Scotland TranServ the operating company responsible for the management and maintenance of the trunk road network in south west Scotland on behalf of Transport Scotland invested in an innovative scheme, the first of its kind in the United Kingdom, using the existing traffic signals to help slow down speeding drivers.

Therefore rather than opt for the more obvious 'big stick' approach of the installation of speed enforcement cameras this scheme is designed to impede a speeding driver's journey time by changing the existing traffic signals at the junction between Main Road and The Causeway to red. Therefore the scheme aimed solely at positively influencing driver behaviour and is more of a 'carrot' for speed compliance, as has already been used to good effect in some European countries such as France, Portugal and Spain.

Clearview Traffic Group Ltd. managed the installation and implementation of this scheme working with supply chain partners Imtech Traffic and Infra UK Ltd. and Coeval Ltd.

Approaching vehicle speeds are calculated within the Imtech PTC-1 Lite traffic controller using two Golden River M100 magnetometer wireless vehicle sensors spaced 3.3 metres apart at 136m from the stop line northbound and 144m from the stop line southbound.

The signals from the M100 magnetometer wireless vehicle sensors are passed to the traffic signal controller via a Golden River M110 Access Point, M115 Repeater Unit (2 off southbound) and M120 Interface card located in an Imtech MTS4E backplane for each approach.

One of the advantages of this wireless detection technology is that it eliminated the need for 280 metres of costly ducting and trenching that along with its associated traffic management would also have had an adverse impact on traffic congestion and disruption in the village for such civil works that would have taken a number of weeks to complete.

Speed Related Force demand

Four thresholds for speeding vehicles are configured within the traffic signal controller on the A78 Main Road approaches but only one threshold per approach is in use at time, the other three being pre-configured to provide operational flexibility.

Threshold	Vehicle Speed	
	mph	kph
1	30	48
2	34	55
3	38	61
4	42	68

Vehicle speeds detected by the M100 sensors are calculated within the Imtech PTC-1 Lite controller

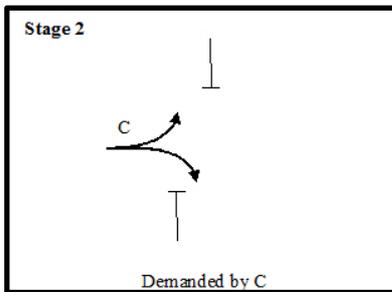
Excess speeding vehicles are detected and create a new 'Speed Related Force' demand

The default speed threshold used is option 2, set to 34mph, to apply the special demand, named for this project "Speed Related Force" demand.

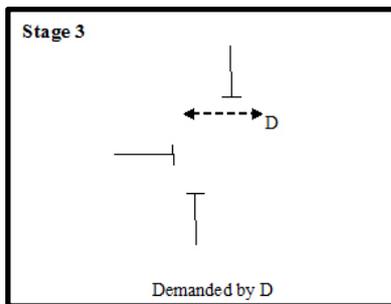
When an excess speed vehicle is detected the Speed Related Force (SRF) demand is triggered and forces the signals, subject to any existing demand to change to either:

The SRF demand actions gives red signals to the A78 Main Road

- Stage 2 - the side road



- or Stage 3 - the Pedestrian crossing,



- or if neither demand above, Stage 4 - a special all red stage, to prevent the vehicle passing unabated through the junction.

If Stages 2 or 3 are already running the 'intergreen' is increased by a user adjustable timer, initially set at 5 seconds for Stage 2 (Side turning) and 10 seconds for Stage 3 (pedestrian crossing)

The all red Stage 4 will revert to Stage 1 (A78 Main Road) after the pre-set stage time initially set to 20 seconds.

Should a speeding vehicle be detected as the controller is changing to Stage 1 for the A78 Main Road and the all red cannot be extended or it is within the Stage 1 starting amber or minimum green time then for safety reasons Stage 1 is held for a duration of a supplementary timer initially set to 15 seconds and the speed detection event will be ignored.

Under normal circumstances the junction runs under Vehicle Activation (VA) via Stop line M100 wireless magnetometer sensors and Microwave Vehicle Detectors (MVD).

Additional Safety Measures

In addition to the system outlined above three Coeval 600mm Speed Activated Signs were installed, two southbound and one northbound. These signs are located 115m from the junction stop lines to warn drivers of the traffic signals ahead via a fixed diagram 543 'traffic signals ahead' warning triangle symbol; and if the speed threshold of 34mph is breached flashing LED amber warning lights along with an illuminated "Slow Down" message.

These signs operate independently of the traffic signals and the Speed Related Force demand system. The Coeval signs also contain a logger for speed and number activations data that can be downloaded via Bluetooth.

Coeval Vehicle Speed Activated Signs warn drivers of the Traffic Signals ahead and to "Slow Down"

To further improve the safety and visibility of the junction, additional offside secondary signal heads were supplied and installed by Imtech, on the A78 Main Road approaches. The existing road markings were refreshed and both A78 approaches to the traffic signalised junction further upgraded with a high friction surface dressing.

The M100 Wireless vehicle detection system

The Golden River M100 magnetometer based vehicle detection sensor uses three magnetic detection sensors to measure the X, Y and Z axis of the earth's natural magnetic field. When no vehicles are present the sensor will calibrate itself by measuring the values of the background magnetic field and establishing a reference value. The passage and presence of vehicles are detected by measuring deviations from that reference value. Each sensor automatically self-calibrates to the specific installation site and to any long term variations of the local magnetic field by allowing this reference value to change over time.

This ensures that operation accuracy is maintained despite external factors such as movement of the sensor due to road surface wear, tear and it shifting over time.

It is this ability to calibrate to the local environment that also gives flexibility of installation allowing the sensors to be located close to any existing ironwork and also within carriageway surfaces containing reinforcing bar.

The M100 magnetometer sensor is a compact size, being only 74mm x 74mm x 58mm deep, including an internal battery with an operational life in excess of ten years.

M100 sensor is compact and including an internal battery with a 10 year operational life

Mechanically the M100 magnetometer sensors are designed to survive being embedded within a road, operating over a temperature range of -40C to +85C. They are constructed to withstand more than the full weight of passing traffic should they drive directly over it, however, to some extent the sensors compact size and how it is typically used generally installed in the middle of a lane also helps to further prolong its operational life.

The M100 magnetometer sensor communicates wirelessly using a low power, highly secure and unique radio protocol, to send time stamped detection data to the M110 Access Point, within an approximate range of 30m away that forms the heart and communications hub of the system.

M100 uses low powered highly secure two way radio communications

The M110 Access Points, capable of collecting data from up to 48 M100 sensors, are usually mounted on top of suitably positioned signal heads. The M115 Repeater Units, where needed, are battery powered, with either two or seven year replaceable battery options available. Each repeater can support up to 10 sensors, also within a 30m range,

relaying the detection data back to Access Point and extends the range of an M110 Access Point by up to 300m.

The wireless radio communication is two way and any signal from the sensor is acknowledged back from the Access Point, and buffered within the sensor and resent until the acknowledgement is received ensuring continuity and completeness of the detection data.

Finally for traffic signal control the Golden River M120 contact closure card is located within the traffic light controller and is linked to the M110 Access Point by an external grade Cat 5 cable, this carries both power to the M110 Access Point from the card and also the communications. The M120 interface card is a direct replacement for a typical, 3U rack size, loop pack card and is therefore traffic light controller manufacturer independent to ensure compatibility with all systems currently in use. The M120 interface card simply replicates traditional loop inputs and has four detection output channels per card. Multiple M120 interface cards, up to 16, can be daisy chained together to provide the required number of output closure channels.

M100 system is traffic controller manufacturer independent

The M100 magnetometer sensor is simply and quickly installed in a small 100mm x 66mm deep hole and requires no specialist slot cutting and more importantly no ducting or trenching, it sits approximately 4 to 6mm below the surface of the road and in the centre of the carriageway or lane. A durable two pack epoxy resin is used to complete the installation. This means that typically a sensor can be installed in only 15-20 minutes, including the resin cure time, resulting in greater productivity when installing the sensors compared with inductive loops.

M100 is simply and quickly installed in a small 100mm x 66mm deep hole

The Golden River M100 range also includes two further sensors: the M100D that can be installed in the carriageway up to 175 mm deep, to allow for future resurfacing of the carriageway without disturbing the detector, and also the M100BR a radar based detector designed specifically for bicycle detection either within dedicated cycle lane approaches or advanced stop lines at signalised junctions. Both version utilise the same wireless network and can be used alongside the standard M100 sensor.

One of the main benefits of utilising the M100 magnetometer based vehicle detection system with wireless communications is the reduced installation costs, due to the elimination of the amount of additional ducting typically associated with detection especially with respect to advanced detection associated with a scheme as outlined above or more traditional detection required for MOVA, SCOOT and also Speed Discrimination / Speed Assessment. The added complication in urban areas such as the A78 Main Road in Fairlie, or where SCOOT is more likely to be deployed, is that due to the sheer amount of other utilities etc. generally such ducting would need to be hand dug, further increasing the potential costs. Additionally considerably less disruption to traffic and local residents can be achieved, eliminating any potential need for night time working and long periods of traffic management as the M100 magnetometer wireless vehicle sensors can be installed quickly and easily during the daytime, even at junctions on busy main arterial routes.

M100 reduces installation costs by eliminating ducting and trenching

M100 limits the amount of traffic management and therefore traffic disruption during installation

The M100 system is Type Approved to Highways England specification TR2512A in accordance with procedure as defined in TRG 0600A. It is also fully registered with the latest Traffic Open Products and Specifications (TOPAS) scheme under TOPAS 0600 and Specification TOPAS 2512A

M100 system widely deployed across the United Kingdom

The M100 magnetometer based vehicle detection sensors since their introduction in 2009 has been widely deployed across well over 1000 junctions in the United Kingdom. A large number of Road Authorities have benefitted from the reduced initial capital and overall lifetime costs of the M100 system ranging from: Transport for London, Aberdeen City Council, Shropshire County Council, Lincolnshire County Council, Blackburn with Darwen Council, Reading Borough Council, City and County of Swansea and many motorway junctions for Highways England.

A large number of Road Authorities have benefitted from the reduced initial capital and overall lifetime costs of the M100 system

The system, in conjunction with the Golden River M150 interface card, is also approved in accordance with Highways England standard MCH1529 for use with MIDAS on the motorway network.

Conclusion

Scotland TranServ's road safety team will further analyse the data from the Imtech PTC-1 Lite traffic signal controller and also the data on speed and number of activations that can be downloaded from the Coaval Vehicle Activated Sign. Once fully reviewed the intention is to develop the concept further for other junctions across Scotland.

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As the scheme was the first of its kind in Scotland, the designers had to effectively write anew the specification for the operation and timings of the traffic signals, hence the inclusion of additional optional threshold settings and the use of adjustable supplementary timers.

Issues experienced with the initial implementation of the scheme were minimal; to minimise the impact on the travelling public the resurfacing was required to be carried out on a Sunday; there was initially a slight issue with the M100 wireless sensors studs at the stop lines giving the correct information, but the configuration of these have subsequently been investigated and adjusted by Clearview Traffic and Imtech.

Initially there was some feedback that raised a slight concern with respect to red light running by drivers that had been stopped with no vehicle demand being visible on the side turning or pedestrians waiting to cross, however supporting surveys subsequently undertaken have shown that such instances have not significantly increased.

Vincent Tait, Road Safety Manager for Scotland TranServ said: "We are delighted to be the first in Scotland to introduce these vital road safety measures on the A78 within the south west trunk road network. The safety of motorists and pedestrians is of the upmost priority and Scotland TranServ is pleased to have worked with Clearview Traffic to develop this concept to improve road safety within local communities in which we live, visit and work."

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The initiative has also been applauded by motoring organisation such the Institute of Advanced Motorists, their Policy and Research Director, Neil Greig commented: "Law abiding drivers have nothing to fear from this system. It also offers the opportunity to penalise speeders quickly and fairly. If nothing is gained by speeding, then that can only help reinforce the safety message."

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About the Clearview Traffic Group

Clearview Traffic brings together over 60 years of combined road safety and traffic data collection expertise in our multi-award winning brands: Astucia and Golden River. Astucia is the market innovator for intelligent road studs, with a focus on reducing road accidents and road casualties. Golden River is well established in the field of vehicle detection, automated traffic counting, vehicle classifying and intelligent transport systems.

Our brands are known and respected worldwide as pioneers and leaders in the field of Intelligent Transportation Systems (ITS), delivering innovative solutions that help reduce casualties on the world's roads, alleviate congestion and safely increase the capacity and effectiveness of road networks.

Whilst inductive loops clearly have a place in specific applications and we remain a key player in this market, Clearview Traffic Group Ltd have continually demonstrated that the M100 offers a high performing, robust alternative that dramatically lowers the total cost of ownership as well as extending the overall operating life of traffic signal installations.

Clearview Traffic also have introduced the Golden River M300 Occupancy Detector range that has been designed to accurately detect the presence of a vehicle in a defined zone including over prolonged occupancy. The M300 is suitable for a wide range of applications, such as; car parking space occupancy, parking bay monitoring, dynamic parking payment schemes, lorry parking applications; through to Emergency Refuge Areas, taxi ranks and monitoring 'No Parking' zones.

As a leading wireless vehicle detection technology, it is a key strand of our on-going strategy and has a number of applications that we will continue to develop and explore over the coming years.

