

# **Use of Automatic Traffic Counters for Event Monitoring**

## **Executive Summary Report**

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## Executive Summary

### *Project Overview*

This report summarises the findings of the Event Monitoring Study, undertaken by WS Atkins Consultants Ltd in conjunction with Datagen Ltd, on behalf of the Scottish Executive Development Department (SEDD), co-funded by STREETWISE (Seamless Travel Environment for Efficient Transport in the Western Isles of Europe). This project has been undertaken in parallel with on-going projects within the SEDD in relation to Congestion Monitoring and Accident Investigation and Prevention (AIP).

The study was conducted to establish the viability of adapting existing automatic traffic counter (ATC) sites to provide operational data to assist in the management of events on the trunk road network. In terms of network management, events can be defined as temporary reductions in road network capacity as a result of:

- ◆ incidents, ranging from minor vehicle breakdowns to multiple injury accidents;
- ◆ debris/obstructions on the road network;
- ◆ maintenance activities;
- ◆ recurrent congestion; and
- ◆ any combination of the above.

The SEDD has over 400 ATC sites spread over the trunk road network. These sites form a small proportion of the total counter sites across the network, which include 107 automatic traffic classifier system (ATCS), 162 junior automatic counters / classifiers (JACC) and 450 NADICS traffic counter sites.

### *Dissemination of Event Monitoring Data*

A main element of this study was to recommend a method for relaying the event monitoring data to the network operator and to identify the requirements to facilitate the presentation of event monitoring information to the general public.

The brief identified speeds of 50% and 75% below the norm as indicative of an event. These would be presented graphically on the operator's screen with amber and red flags representing 50% and 75% below respectively.

It was agreed by all parties that these situations were commonplace during peak hour at various locations throughout Scotland and would hence result in false counter 'alarms' flooding into the in-station. In these situations the ability to identify network events is masked by the effects of recurrent congestion. It was therefore concluded that two event monitoring processes were required, the Network Operator Event Monitoring Process and the Public Event Monitoring Process.



The “Operator” process in the counter, compares the current speed (an average of a user-defined number of vehicles) to the historic average speed (over a user-defined number of days) for the current day type (7 day types per week – Monday, Tuesday etc). When the speed drops below a user-defined percentage (e.g. 50%) of this average an Amber alarm is raised and the counter carries out an action (e.g. dialling into the in-station – note that the event could just as easily be switching on a VMS or hazard warning lights). If the speed rises to a smaller percentage drop (specified by the user) from the average speed then the Amber alarm is cleared. However, if the drop in speed goes on to diverge from the average speed by an even larger percentage (again, user-specified) then a Red alarm is raised.

The ‘Public’ process is similar, but much more simple to understand. In this the user simply specifies two boundary events – i.e. speed values which, when breached, cause either Amber or Red alarms to be raised. These boundaries could easily be based on 50% and 75% of the speed limit. It is envisaged that the presentation of this information would be disseminated to the public via a map-based website. From the web-site the public could then view (in real time) areas of the trunk road network which were suffering delay. This would act as an informative pre-trip medium and form the basis for trip planning.

### *Telemetry*

It is envisaged that the event monitoring counter will be required to transmit data to the in-station PC when traffic speeds fall below a predetermined threshold. This information is then relayed to the network operator via the user-interface by the presentation of flag green, amber or red. The telemetry requirements for the event monitoring system are therefore as follows:

- ◆ Real time data (alarms) to be received at the in-station within 60 seconds of the alarm being raised; and
- ◆ Circuit or packet switched ‘on demand’ connection.

Given the above, the study considered GSM (Global System for Mobile Communication), GPRS (General Packet Radio Service) and PSTN (Public Switched Telephone Network) communication options. The following table summarises the reliability of each communication medium.



System Reliability		
GSM	GPRS	PSTN
GSM Coverage available across most of the trunk road network.	Relatively new communications technology.	Reliable hard-wired based transmission medium.
Coverage limited in Remote locations e.g. valley floors, high altitudes.	Currently GPRS coverage not as geographically extensive as GSM.	Modems required at both transmission and reception ends of PSTN circuit.
Black Spots at various roadside locations	Remote rural locations may not have sufficient coverage at present.	The inherent limitations of twisted pair copper circuits as a mid-to-long range transmission medium, a bandwidth limit of 4kHz, and the power limitations imposed by PTOs (Public Telecommunications Operators) mean that the ability of the PSTN to accommodate high-speed data transmission is somewhat limited.
Each site will require to be assessed for network coverage on an individual basis.	Network coverage compromised during adverse weather or during a traffic incident in the vicinity of the counter installation.	
Network coverage compromised during adverse weather or during a traffic incident in the vicinity of the counter installation.	Further liaison required with GPRS network operators to confirm service availability.	

### Counter Technology

A fundamental part of this study was to review the existing technology available to meet the needs of the SEDD. WS Atkins / Datagen undertook discussions with the three main traffic counter suppliers in the UK, namely, Golden River Traffic, Counters and Accessories and Applied Traffic. Golden River and Counters and Accessories showed no real interest in the subject area however staff from Applied Traffic had some very definitive ideas about how to approach the subject.

Though not forming part of the brief, and at no additional cost to the project, an existing counter (HI-TRAC 100) was developed / upgraded to provide the additional functionality required. Subsequently an ATCS site on the M8 has been configured to support the additional functional requirements required.

The HI-TRAC 100 was chosen for this trial as the firmware within the counter is advanced enough to enable it to be readily modified to the required specification. The HI-TRAC 100 is however not likely to be a mainstream 'event monitoring counter' thus discussions have been undertaken with Applied Traffic regarding development of the lower powered HI-TRAC 88 to provide the same functionality.

### Conversion of ATC and JACC Sites

In addition to the development of a counter with improved functionality, upgrades will be required to the existing loops and counters at each site. The coverage of sites considered for event monitoring upgrades is based on the current version of the SRTDb ATC counting plan (i.e. Version 3) plus all current JACC sites.

The ability of a site to collect speed data is a function of the counter and the loop configuration in use. In the ATC counting plan and the list of current JACC sites, not all sites have counters capable of speed data collection and not all have a loop configuration capable of speed data collection. However, for the purposes of this project the capability of the counters is not relevant since none are able to carry out event monitoring in any case.



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In accordance with the Brief, suitable ATC and JACC sites were priced for upgrading to event monitoring capability.

#### *In-station / User Interface*

At this stage the proposed event monitoring system would not be available on a public web site, however as a best practice guide, the user interface should comply with the standards and procedures set by the UK Government for web sites. These cover web management, data protection and security.

It is proposed that the system architecture would consist of an event monitoring in-station with communication gateways (communication option to be determined) to the outstations of each ATC.

The user interface menus will be developed in a web based style thus making them readily transferable to a web based server platform. It is anticipated that the user interface menu is in three parts: the “top” menu, the “network operator” menu, and the “public” menu. These will have links to specific maps across the Scottish highway network, where a display of the ‘problem’ site can be identified.

#### *Data Evaluation Procedures*

Data evaluation procedures must be developed to ensure the credibility of the system is maintained at all times. Data evaluation procedures will require to be developed to ensure the quality of the data being analysed within each counter is sufficient to determine if an event is present.

In order to develop the specific data evaluation procedures associated with the event monitoring system, the attributes that measure the quality of the raw data collected must be identified. Once these key attributes have been identified procedures need to be developed to enable the attributes to be measured and their quality determined. Measures of quality should be based on numerically quantifiable aspects of the data (e.g. accuracy of speed measurement).

#### *Conclusions and Recommendations*

This study has developed a theoretical based methodology, using speed measurements, to provide an event monitoring capability for use by both network operators and the general public. A suitable technology (HI-TRAC 88 counter) has been identified, which through minor modification, will lend itself to a possible trial of the system. Three possible communications technologies options are available for use within the event monitoring system. We recommend that the event monitoring system be compatible with each, thus providing flexibility and ensuring the most cost effective communications solution can be used. (This may be any combination of GSM, GPRS or PSTN).

Prior to any full-scale upgrading programme we recommend consideration is given to a pilot scheme, set up covering a length of trunk road network which is busy enough to experience sufficient numbers of “events” to allow fine tuning of the methodology, and is local enough to allow video and personal monitoring of these counter events. We would recommend that the A1 south and east of Edinburgh would be suited to



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this type of study incorporating approximately 20 sites. Within this pilot study, all three communication methods should be evaluated.

This would provide the opportunity to develop a thorough understanding of the actual performance of the proposed theoretical event monitoring methodology, obtain an accurate understanding of all the costs associated with the event monitoring system and allow an open specification for the procurement of the counter and communications technology required for a national system to be developed.

We also would also recommend the following:

- ◆ Cost estimates for the pilot study are developed based on a detailed understanding of the system's functional and data requirements;
- ◆ The telemetry software should be developed to enable configuration of the counters from the in-station;
- ◆ An in-station is provided with a web based user interface; and
- ◆ Detailed evaluation procedures are developed within the proposed pilot study. It would be our aim to develop automatic reporting of data quality attributes