

## REAL TIME TRAFFIC INFORMATION DELIVERED TO THE DASHBOARD

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### INTRODUCTION

Trafficmaster are the UK's premier supplier of traffic congestion information and off-board satellite navigation services. Since the founding of the company in the late 1980's, the collection and dissemination of the most accurate real-time traffic information in the UK has always been part of the company's service provision. More recently the provision of off-board satellite navigation with traffic impacted routing has also been added to the company's portfolio of product and service offerings, extending the delivery mechanisms for the real-time traffic information and offering a unique navigation product for all road users.

This paper discusses the methods that are available and employed by Trafficmaster for the collection and dissemination of real-time traffic information for UK road users.

### Collecting Traffic Information

Trafficmaster are well known for their sensor network of "blue poles", these are Passive Target Flow Measurement (PTFM) sensors and not, as popular myth would have it, speed cameras. What are less well known are the bridge cameras that Trafficmaster have installed covering the UK motorway network measuring traffic speeds. There is also a joint venture with the RAC (RAC Trafficmaster Telematics; RTT) that provides manual reporting of traffic incidents and congestion, plus the company have collaborative deals and interfaces with many other local council and highway agency bodies in the UK that provides non-sensor network coverage of the UK road infrastructure.

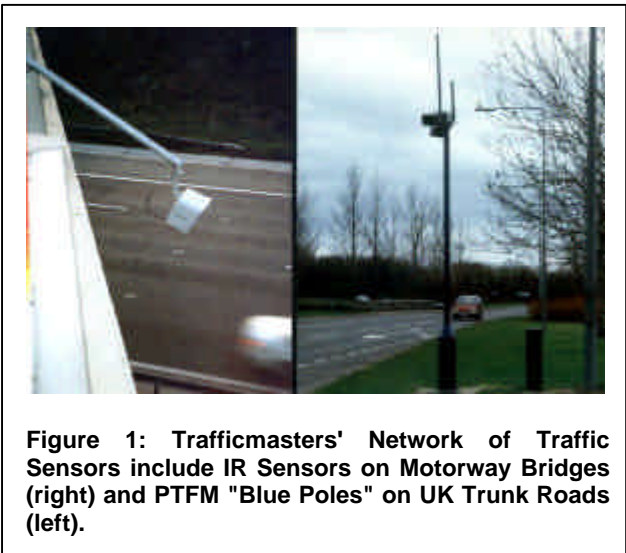
### Motorway Bridge Sensors

On most UK motorway bridge Trafficmaster have a sensor to measure the speed of vehicles travelling on the carriageway below. These sensors are relatively simple dual infra-red (IR) beam devices that determine a vehicle's road speed from the time between beam breaking (i.e. time of flight between two beams). The result is an analogue speed measurement that is sent back to the Trafficmaster control centre via the either mobile communications (GSM) for remote sensors or the public switched telephone network (PSTN) where accessible.

### Passive Target Flow Measurement Sensors

The PTFM sensor network covers the majority the UK truck roads (A-roads) and are partial number-plate recognition devices, which is where their "urban myth" of being speed cameras has originated. These cameras are not good enough to use for speed camera work, for one thing they are looking for slow traffic so are not designed to detect high-speed traffic. The number plate recognition software also eliminates some of the characters if it obtains a full plate, to avoid data protection act implications of identification of a vehicle, hence these cameras are not capable of being employed as speed cameras.

The number plate "tags" (usually consisting of 5 digits of the registration) are transmitted to the control centre and the direction of travel of the vehicle is determined by the position of the camera reporting the "tag". If the next camera in the network captures a matching "tag" then the time-of-flight between cameras is calculated and the speed of that section of network is processed by the control centre.



**Figure 1: Trafficmasters' Network of Traffic Sensors include IR Sensors on Motorway Bridges (right) and PTFM "Blue Poles" on UK Trunk Roads (left).**

### Vehicle Mounted Traffic Probes

If vehicles are equipped with methods to communicate with roadside equipment, or via mobile telephony with a control centre, then vehicles themselves can be used as congestion probes. There are essentially 2 methods of using vehicles in this manner; Floating Car Data (FCD) and Advanced Floating Car Data (AFCD). These

are essentially similar with the intelligence off-board for FCD and on-board for AFCD.

In an FCD probe the car is continually reporting its' position on the road network, the frequency of reporting is usually determined by the resolution of data required and the method of communication. The off-board intelligence then determines if the vehicle is in congested traffic by its' progress and position as plotted on an off-board map (clearly when negotiating inner city roads a lower speed is expected even without congestion).



**Figure 2: In-vehicle products for vehicle probe data may be hidden "black-box" units or integrated with other driver information systems (Smartnav satellite navigation unit shown above).**

Advanced FCD (AFCD) places intelligence on-board (i.e. in-vehicle) and some of the map matching is performed by the on-board electronics. Consequently the cost of the in-vehicle hardware is greater, but the communications costs can be minimised.

The electronics required in-car for either FCD or AFCD is relatively similar and both require a positioning system (usually GPS) and a means of communication (GSM being the most obvious ubiquitous solution). AFCD requires a more advanced processing capability and more on-board memory and typically would have to include some method of being able to update its on-board map-matching function (these units do not need to have full road maps on-board).

There is little obvious gain to the driver in having a vehicle probe, since these will only start generating congestion information once the driver is actually in congestion. However, by combining the probe function with some other application such as Automatic Vehicle Location (AVL) for fleet vehicles, Stolen Vehicle Tracking (SVT) for

insurance purposes, satellite navigation and of course traffic congestion information systems, the in-vehicle device can operate the probe function on the back of a genuine driver enhancement.

The problem with vehicle probes includes the cost of installation and communications, plus the number of vehicles required to achieve a critical mass of road users to generate valid traffic information. The cost associated with the communication, especially if using GSM data calls, is being eroded with the uptake of GPRS services. The installation and critical mass issues can be addressed via the piggy-backing of the probe function on other driver services, plus use of vehicle probe data as a supplement to roads not covered by the fixed network reduces the number required for critical mass.

### Manual Reporting Methods

There are up to 1500 RAC patrols on the UK roads at any time. These report traffic congestion, road accidents, road closures, road works etc. to the RAC Trafficmaster Telematics control centre. This adds manually qualified data to the traffic network information, particularly useful for those roads not covered by the sensor network (e.g. city and town centre, rural roads etc.).

This manual input stream also allows Trafficmaster to take information from local council road closure notifications, police incident reports, utility company roadwork schedules and any other sources that provide road incident information.

### Collaborative Working

Trafficmaster have various collaborative ventures with local councils and highway agencies that have either installed Trafficmasters' sensors into their town and city centres and/or exchange visual camera information with the Trafficmaster sensor information. This permits Trafficmaster to collect further traffic data from various sources that again adds to the quantity and quality of the traffic information, particularly for off-network locations.

### COLLATION AND DATA VALIDATION

The data from all these traffic congestion, incident and accident reports are collected at a single point, the Trafficmaster Control Centre in Cranfield. The data is collated and checked for validity before disseminating to road users and other subscribers to the Trafficmaster information service.

### Network Checking and Fault Tolerance

The sensors in the network are checked automatically and when necessary manually for operational health. In the event of a fault the sensor can be omitted from the network until a maintenance crew have visited and repaired the sensor.

In the case of the IR bridge sensors the sensor can simply be removed from the network reporting structure until it is repaired. In the case of a PTFM sensor the faulty sensor can be omitted from the network and the "tags" assessed between sensors on either side of the faulty unit. Hence the network is tolerant of faults in both types of sensors in the network and can operate without full coverage and without generating false traffic information.



**Figure 3: The Trafficmaster control centre collects all the Sensor network and manually Entered Data to construct an integrated picture of the traffic flow for the whole of the UK.**

### Road Conditioning

As there are manual entries into the system this also feeds into the network in a form of road conditioning, hence if a road is closed and sensors are consequently showing free-flowing traffic (i.e. no congestion), this can be compensated for in the information integration and omitted from use in route planning and traffic reporting.

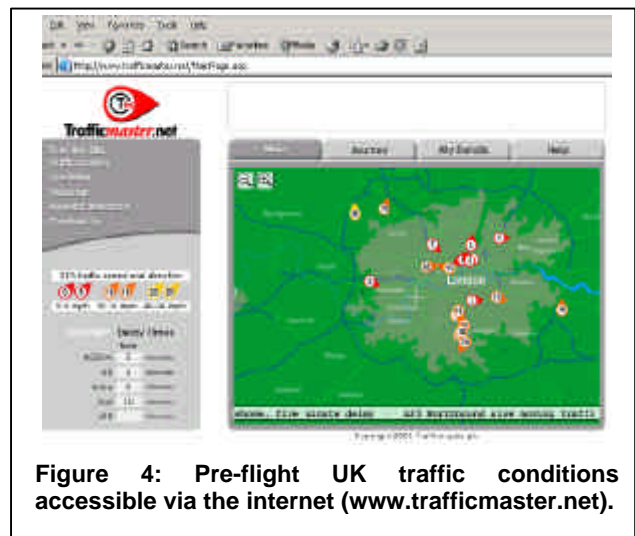
### DISSEMINATION

Once you have all the UK's traffic information, its' been validated and checked, you have to determine the best methods of delivering this to your service subscribers by cost effective means. In many respects Trafficmaster have left no stone unturned in its' ability to provide traffic information

via almost any cost-effective delivery portal available.

### Internet Subscription

For pre-flight checks on the traffic condition Trafficmaster offer an Internet portal service providing UK wide scaleable displays of the road traffic conditions ([www.trafficmaster.net](http://www.trafficmaster.net)). These could also be displayed in-car with a suitably equipped PDA and GPRS connection, but the site is currently not specifically designed for this application and the displayed information may not be optimised for a PDA screen.



**Figure 4: Pre-flight UK traffic conditions accessible via the internet ([www.trafficmaster.net](http://www.trafficmaster.net)).**

### Location Based Traffic Congestion Service via Mobile Telephony

One of the most popular services, as it is available on a pay-per-use basis, is Trafficmasters' Interactive Voice Response (IVR) service over GSM via most of the UK mobile phone service providers. The service delivers location based traffic information, determined from the cell location at which the GSM connection is made. Access to wider UK traffic information can be accessed via the IVR service (e.g. "press 1 for M1") and clearly can be used for both pre-flight and en-route updates. This service tends to be predominately used pre-flight and although it is possible to use it in a real-time scenario, the cost of maintaining an open GSM connection is prohibitive for a truly real-time application and dedicated in-vehicle products are a more suitable platform for such a service.

### Real Time Traffic Information to the Dashboard

The most obvious place to receive traffic information is clearly the. There has been a range of display and voice base products over the years

since Trafficmaster first entered the traffic information business, but here only those products that are still commercially available will be considered.

The dashboard products fall into 2 relatively distinct categories; voice and display based. Voice based products have the benefit of minimising distraction from the road itself, whereas the display products offer the capability to view more detailed traffic information and in a non transient manner.



**Figure 5: Display products featuring traffic congestion information. Top: the MG Rover Clock showing simple "road ahead" information. Bottom: the YQ can display the Trafficmaster UK road network traffic congestion information.**

#### Display Products

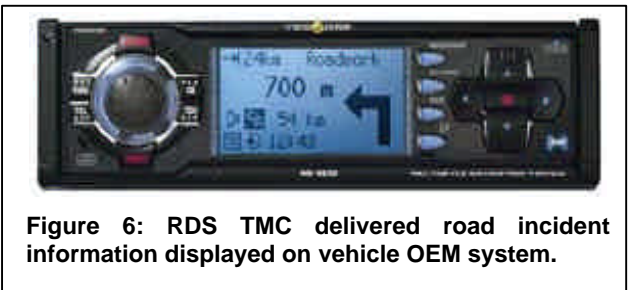
The level of sophistication available from the display products is relatively wide ranging, from a complete UK map of the road traffic conditions to a simple icon based "road ahead" indicators.

The simpler displays tend to feature an icon showing the distance to any congestion on the road ahead, and possibly some form of indicator of where this measure is taken from (e.g. 5m ahead, J8, M6). A complete UK map of the Trafficmaster sensor network with icons displaying either road speed or estimated delays at locations of

congestion is the other end of the spectrum on display sophistication.

Most display products supplied by Trafficmaster utilise local broadcasts from Trafficmasters Private Network Radio (PNR) for both position information and location specific traffic information. The more sophisticated map display product also receives paged data for the whole UK road network.

A more recent addition to the display product line is the provision of Radio Data Service (RDS) over the Traffic Message Channel (TMC) for suitably equipped vehicle OEM radio and satellite navigation systems. The OEM systems are supplied with a decoder table to receive the local FM broadcast RDS TMC congestion and incident reports, enabling the RDS receiver to display the information, as appropriate, on the available in-vehicle display.



**Figure 6: RDS TMC delivered road incident information displayed on vehicle OEM system.**

#### Voice Products

Many people are familiar with Trafficmasters' range of voice based spoken traffic information as these have been standard fit items in Vauxhall vehicles and currently in some UK Citroen models under the Oracle product line. There is also an aftermarket version of this product that has been available for quite some time, although with inferior quality speech to the line-fitted versions. These products give spoken information on "road ahead" conditions, it would be too confusing to the driver to give more than this level of information via spoken messaging. The Oracle products receive location-based information via the Trafficmaster PNR system as per the display products discussed above products.

There is a higher level of sophistication available in spoken traffic information, but this is only suitable for satellite-navigation routed users (i.e. those users on a pre-defined route). Trafficmasters off-board satellite navigation product can provide localised traffic reports covering any section of a route and include the option of being re-routed to avoid congestion on any part of the route ahead. The information, and route, is delivered by GSM data call, although soon GPRS may provide the delivery channel where this is available. This level of sophisticated congestion impacted routing is

currently only available on the Smartnav satellite navigation product.

on the route, delivered by GSM (and soon over GPRS).



**Figure 7: Aftermarket, dash-mounted voice based traffic information device (Freeway).**

## SUMMARY

Trafficmaster operate a network of over 8500 roadside sensors in the UK monitoring the traffic flow on all motorways and most major trunk roads (A-roads) in the UK. The traffic-monitoring network consists of 2 types of sensor; IR bridge mounted sensors and PTFM roadside sensors. The network is supplemented by vehicle probe data and collaborative ventures with other traffic monitoring agencies. Supplementary information includes manually reported incidents from RAC patrols, information on road closures and accidents as well as traffic information on roads not covered by the sensor network. All of the data is collected, collated, checked and disseminated from the Trafficmaster HQ in Cranfield.

Trafficmaster disseminate the collected information via a variety of means depending on the user requirements. For pre-flight congestion information the company provide an Internet delivery portal ([www.trafficmaster.net](http://www.trafficmaster.net)). Mobile phone users can access a location-based service based on the receiving cell location of the GSM phone (access to other locations is available via an IVR service). For the driver there are a series of dashboard mounting delivery options, including use of a private radio network delivering visual and speech based notification in-vehicle, a paged service for UK wide congestion overlaid on in-vehicle map based displays and RDS TMC for vehicle OEM installed receivers. Trafficmaster also provide an off-board satellite navigation solution that includes both congestion information at start of journey and an automated rescheduling capability for incidents occurring during journey if impacting