In-vehicle Traffic Information Systems in Europe: Never Mind the (Band)Width, Feel the Quality

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The ever-increasing number of vehicles on the road has created a serious demand for traffic information not only on the move but also at the planning stage of a journey. While on the move, the driver will be able to re-route his/her journey avoiding traffic congestion, but this information could be even more valuable before starting the journey. Today there are differences between the three main ITS markets (USA, Japan and Europe). Japan is leading the way, with the introduction in 1995 of the Vehicle Information Communication System (VICS), which is a free service. Vehicles are equipped with VICS receivers taking information from a network of road beacons installed on main roads, transmitting traffic flows by infrared rays, wave beacons, and FM multiplex broadcast. Europe has been involved in driver information systems from the early '90s when RDS was developed, which is another free service, and most of the car radios sold in Europe are able to process RDS signals. Since then, new free services have been developed – for example, RDS-TMC. In the UK, the private sector has been heavily involved recently, its major player being Trafficmaster. The Trafficmaster system is based on a network of traffic detection sensors, which covers all major UK motorways and most of the major A roads, with plans to expand into the continent. Trafficmaster collects road traffic flows and disseminates this information to its subscribers via a range of technologies, including GSM. The quality of the information supplied by the free and subscription services can be improved by being fully integrated with on-board navigation systems and by providing more detailed and wider types of information. All current methods are described/analysed and compared in this paper, with future enhancement highlighted. One of the main limitations lies in current data transmission routes, which are not fast enough to support the data required for an optimal use of the system. Some technologies available will potentially allow the many service providers to transmit information.

KEY WORDS

1. Road. 2. Telematics. 3. Communications. 4. Traffic Information.

1. INTRODUCTION. This paper discusses the market for in-vehicle traffic information, data dissemination technologies, the convergence of information and entertainment services and the impact of quality services on the willingness to pay for this information.

2. POTENTIAL MARKET FOR TRAFFIC INFORMATION SERVICES. Currently there are several providers of traffic information in the UK and Europe. The market for traffic information has significant potential for development and growth; however, for this potential to be realised, services have to be tailored to

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Table 1. Potential for Traffic Information Systems (US$m).

Region	2000	2005	2010	2015
Europe	185·3	568·5	2232·9	12520·5
US	115·1	386·2	1584·7	8176·4
Japan	2165·8	3513·2	5412·8	7963·0
Others	62·2	172·4	587·9	2701·1
Total	2528·4	4087·3	9818·3	31361·0

specific market segments. In addition, to realise the full potential of this market, traffic information will have to be fused with other location-based data.

Table 1 shows one prediction by First Research of the potential market for traffic information systems. It should be noted that there are a myriad of different predictions for potential market size. Growth is dependent on the quality and pricing of the service offered and the presentation of that service to the public.

3. CURRENT DISSEMINATION METHODS.

3.1. *Introduction*. There are several mechanisms for delivering traffic information to the public. In Europe these include:

(a) Radio AM/FM (FM using Radio Data System Enhanced Other Networks (RDS-EON) and Radio Data System Traffic Message Channel (TMC);
(b) Television (analogue and digital);
(c) The Internet;
(d) Global System for Mobile Communications (GSM), Short Message Service (SMS), Voice, Wireless Application Protocol (WAP), Cell Broadcast.

Spoken radio broadcasting is a simple, but relatively crude technology, which does not easily allow the provision of filtered, highly tailored and, in the future personalised, information services. These limitations have meant that value-added service providers have begun to use differing technologies to deliver traffic information including WAP and SMS (Crawford, 1999). The differing delivery mechanisms for traffic information are briefly described below.

3.2. *RDS-EON* (*Radio Data System – Enhanced Other Networks*). The RDS-EON system has been in use for more than 10 years, and is widely available in Europe. Almost all new cars are fitted with RDS-EON equipped radios and most FM radio stations broadcast RDS signals. The RDS-EON system was designed for alerting drivers to traffic reports being broadcast on a public service radio station. The RDS system is based on the transmission of data on a 57 KHz sub-carrier on FM broadcasting. When the radio station reports a traffic message, the receiver will retune the radio or deactivate the compact disc player and activate the radio tuner to allow the listener to hear the traffic information. At the end of the traffic report, the receiver will return to its prior state. This is a low investment option, but does not provide personalised traffic reports. The driver only receives messages as and when they are being broadcast and often the information is not related to the needs of the individual (Kopits, 1994; Graham and Jones, 1999).

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3.3. *RDS-TMC* (*Traffic Message Channel*). TMC is a radio technique whereby information is transmitted together with a normal radio broadcast. This is similar to the broadcast of teletext alongside a television broadcast. Traffic information in coded format is continually broadcast. On receipt, the TMC-receiver decodes the TMC message, providing a description of the event together with its location, duration, direction and severity.

These messages can be displayed as text, synthesised as speech or displayed on a graphical interface. TMC is a pan-European system that covers much of mainland Europe, as is shown in Figure 1. The coding protocol consists of two standards, Alert-

Figure 1. Coverage area of RDS-TMC in Europe.

C and Alert Plus. The Alert-C protocol is used to transmit event-orientated messages while the Alert Plus protocol allows the transmission of status-orientated messages.

The main benefits of TMC are that the system provides up-to-the-minute traffic information in the drivers' own language, independent of the country in which they are travelling.

A recent study carried out for the DETR has shown that if TMC is implemented as expected, there are likely to be 3·1 million TMC subscribers in the UK by 2005. This equates to 11 % of all cars at that time being equipped with TMC receivers (UK-DETR leaflet). This study shows there is great potential for TMC services in the UK. In light of this research, two commercial services are planned for launch during 2001.

3.4. *Mobile Phone Technology – GSM*. The Global System for Mobile communications (GSM) is a digital two-way radio communication medium. This is the technology that most UK mobile phones use to communicate. GSM is currently

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available in most of Europe. GSM offers digital and encrypted speech, Fax and Short Messages Service (SMS) facilities. SMS consists of text messages up to 160 characters in length. Personalised traffic information alerts can be sent using SMS. With some services, the user can tailor the information they receive on the Internet. The key limitations of SMS in relation to traffic information are the cost of sending SMS messages, and the display options currently available.

3.5. *Mobile Internet – Wireless Application Protocol (WAP) over GSM*. Wireless Application Protocol is a global specification that enables mobile users to access and interact with information and services from their mobile handsets. It is compatible with multiple operating systems including PalmOS, Windows CE, and JavaOS (Crawford, 1998). WAP technology allows the service provider to deliver real-time traffic information to users wherever they are. This information can be displayed as text, or overlaid on a simple map. Webraska is one company developing map-based information services delivered using WAP technology.

Newly emerging services based on WAP technology will allow the user to request location-specific information including directions from their current location to another address. The potential for WAP applications is, in theory, enormous. In practice, the opportunities are severely curtailed by slow access speeds and regular data transmission failures. This will be addressed by the advent of new data transmission technologies discussed later. However, with the additional bandwidth available, WAP is likely to be superseded by different presentation protocols (e.g. XML and MPEG 4).

4. FUTURE DISSEMINATION METHODS.

4.1. *Digital Audio Broadcasting*. Radio broadcasting is now entering the digital era. In the UK for example, BBC Radio 1 FM is broadcast using both analogue and digital technology. Digital Audio Broadcasting (DAB) means that the radio programme is broadcast as a series of digital data 'bits'. The DAB receiver places the bits in their correct order and converts the data to an audible signal. DAB brings a number of benefits, the most obvious being that reception is improved. This is because the signal is transmitted on many different carrier frequencies, and the same digital bits are broadcast more than once, some with a time lag.

If the signal is lost for a short period of time, the receiver is still able to recover the original signal using that broadcast with a time lag. This subsystem is known as Coded Orthogonal Frequency Division Multiplex (COFDM). DAB also removes the need for re-tuning receivers when travelling in a car, as each transmitter uses the same frequency per station. The available capacity for transmission of information services via DAB is large. Many EU countries have already begun DAB broadcasts, and receivers are gradually becoming available, although none have dedicated traffic facilities yet. The map at Figure 2 shows current DAB availability in the UK with the BBC broadcasting trial services. 70% of the UK population can theoretically receive digital radio services given appropriate receivers although some key areas are not well covered. One of the many possible services supported by DAB is the transmission of traffic and travel-related information using the Transport Protocol Experts Group (TPEG) protocol. The TPEG protocol has been established by the European Broadcasting Union (EBU). One of the main advances of this traffic information protocol is that it will provide the location of the incident by latitude and longitude, locating an incident within 2 metres. The protocol facilitates the delivery of a large

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Figure 2. Coverage of Digital Audio Broadcasting in UK.

amount of detailed information including information about: accidents and incidents, the weather, petrol prices and motorway tolls, destinations and train delays.

4.2. *General Packet Radio System* (*GPRS*) *and Enhanced Data rate for GSM Evolution* (*EDGE*). Mobile phone technologies are continually developing. The next developments will mean conventional GSM networks will be upgraded with the introduction of GPRS and EDGE. This technology will significantly enhance data transmission speeds and will allow the transmission of much more information to mobile users; however, new handsets will be required. This development is closely followed by the advent of the Universal Mobile Telecommunications System (UMTS), which is discussed in the next section. The major telecommunications companies have already invested billions of pounds sterling in the UK alone, in the auction of UMTS licences, and this may have a bearing on the amount of additional investment made in GPRS and EDGE.

4.3. *Universal Mobile Telecommunications System* (*UMTS*). UMTS is a global telecommunications standard which is broadcast at a higher frequency than GSM and therefore provides additional bandwidth, but with a reduced transmission range. More transmitters are required in order to provide the same level of coverage as the existing GSM service. UMTS is currently being implemented in the Isle of Man in a large-scale test. Commercial UMTS operations are expected to begin from 2002 with full coverage and commercial services beginning in 2004 (Holley and Costello, 1998). UMTS will have a global potential of 2 billion users. Forecasts suggest that UMTS will be implemented worldwide by the year 2010. It will, in theory, deliver a low-cost, high-capacity digital telecommunications service for millions of users at up to 2 Mbit/sec (Website, UTMS).

5. QUALITY SERVICES – THE TMC EXPERIENCE. Oscar Faber has managed a two-year demonstration and evaluation of TMC services within the UK. Partners in this demonstration were: the DETR, the Highways Agency, C&MT (a broadcasting company), the AA and the RAC. This demonstration was completed at the end of 2000 and has now reported results. The research has shown that the

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demonstration service appealed to a significant number of users and, as such, could be developed commercially.

A comprehensive market research exercise was carried out on over 500 motorists. These motorists had either Bosch Viking radio receivers or Volvo navigation systems, which could receive the TMC service. This exercise found that by the end of the trial, over 60 % of users were prepared to pay between £72 and £143 per year for the TMC traffic information service. The navigation system users were more likely to subscribe to the TMC service than those with Bosch Viking radios and had, on average, stated they were willing to pay £91 per year for the service.

Initial feedback from users in the first two months of the evaluation was used to fine tune the TMC services provided. Having experienced this improved service, more subscribers said that they would consider subscribing to TMC. They were also prepared to pay more for the service as shown in Figure 3.

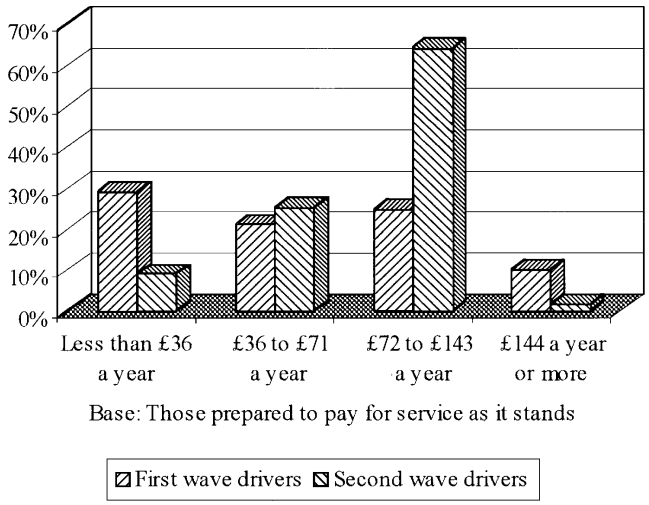

Figure 3. Willingness to pay.

Reaction to the TMC service was generally good, with just under half of the users saying they had changed their route or time of journey as a result of the information. Over 80 % said they were pleased with TMC in relation to saved time or stress. When the user was asked how they felt about receiving incorrect delay information once an incident had been cleared, the navigation system users were more critical about the quality of information received. 23 % were 'annoyed that TMC was incorrect', with only 15 % accepting that 'no traffic information system was perfect'. Of the Bosch Viking users, 44 % accepted that 'no traffic information system was perfect' and only 17 % were 'annoyed that TMC was incorrect'.

From the evaluation it is clear that willingness to pay is closely linked to quality of the service delivered, and that navigation information enhances the value of the traffic information. Given the information collected on 'willingness to pay', a prediction has been made suggesting that there could be 13 million subscribers to TMC services in the UK by 2010, of these, 9 million would be navigation system users.

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6. A VISION OF THE FUTURE. The research carried out during the TMC demonstration shows a significant interest and willingness to pay for high quality traffic information services once they have been experienced. The demonstration has also shown that data transmission capacity does not limit the delivery of an effective traffic information service. The result of this is a commitment to launch commercial TMC services by the AA and ITIS.

So what of the new dissemination technologies becoming available? Clearly each will bring significant opportunities for development of additional services. Some technologies, like UMTS, will provide a great deal of additional bandwidth, which can be used to provide many different applications. These may include information and entertainment services, concierge services, vehicle diagnostics and a host of other applications.

Irrespective of the amount of capacity available, all these services have to be tailored to the needs of the individual and to the mechanism for display of this information, otherwise few will be prepared to pay for the service delivered. In addition, it should not be forgotten that a driver can only absorb a limited amount of additional information while on the move.

There is an exciting future for telematics services, but success will be driven by the appropriateness of that service, not the capacity for information transmission. Technologies like UMTS offer exciting opportunities for development of new and innovative services, which must be successful in order to justify the expenditure on the Government licences. However, in developing these services, 'never mind the bandwidth, feel the quality' is definitely the answer to delivering a successful service, even though the temptation for swift service delivery may encourage a different approach.

REFERENCES

Tucker, P. (1997). A review of technologies markets and prospects. *Intelligent Transport Systems*.

Crawford, D. (1999). Traffic Information Systems. *Automotive Engineer*. June.

Kopits, D. (1994). The Radio Data System, RDS in Europe, the USA and elsewhere. *Proceedings of the first World Congress on Applications of Transport Telematics and IVHS*, *ERTICO*, France.

Graham, A. and Jones, H. (1999). What is RDS-TMC? How does it differ from RDS-EON? *Transport Telematics*, Spring.

UK-DETR Leaflet. *Traffic Message Channel* (*TMC*).

Crawford, S. (1998). Multimedia on the move. *Traffic Technology International*.

Holley, K. and Costello, T. (1998). The evolution of GSM data towards UMTS. *GSM World Congress*, *Cannes*, France.

Website, UTMS. *http://www.umts-forum.org/*

https://doi.org/10.1017/S0373463301001527 Published online by Cambridge University Press