INTEGRATED TRAFFIC MANAGEMENT AT THE URBAN / INTER-URBAN INTERFACE

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1. INTRODUCTION

In Northern Ireland, the Department for Regional Development (DRD), Roads Service, is in a unique position amongst network operators in that it is currently the sole roads authority, and as such is responsible for the design, procurement, deployment and operation of control systems for urban and inter-urban traffic management.

DRD (NI) Roads Service is a partner in the Euro-Regional Project called STREETWISE. The other partners in this project are the Department of Transport (GB), Highways Agency, Transport Scotland, Traffic Wales and the National Roads Authority (Republic of Ireland). STREETWISE is one of 7 Euro- Regional projects whose objective is to provide seamless traffic control facilities and travel information across the Trans European Road Network (TERN). Within STREETWISE each of the partners follows their national ITS Strategy but in a co-ordinated and networked manner.

One of the principal objectives of the Roads Service ITS Strategy is to establish a fully integrated system for the management of traffic and the delivery of traffic information to the public. Significant progress has been made in delivering this objective, largely through the use of common standards and protocols such as Urban Traffic Management and Control (UTMC) and the Travel Information Highway (TIH).

Within the Traffic Information and Control Centre (TICC) in Belfast, a traffic management and control system, based on a UTMC compliant common database acts as a central focus for a number of otherwise disparate systems deployed in both the urban and inter-urban domains. Data from the connected systems is stored within the UTMC and is used to determine and implement suitable traffic management strategies which span both the urban and inter-urban systems. The data stored in the common database is made available to the traffic operators through a geographical interface, and, in conjunction with information from the CCTV network, is used to refine the integrated traffic management strategies.

Progress has also been made towards the provision of a fully integrated traffic information service, principally through the centralisation of the roadworks and incident reporting process, and the use of the data exchange functionality of the UTMC database to integrate information. This emerging work includes significant developments which allow regional roadworks data to be entered into a central database through a common system, thereby ensuring standardisation in the way such information is recorded and presented to travellers.
This paper provides an overview of the UTMC implementation by Roads Service in Northern Ireland, and describes the connected systems and the information that flows between them. The emerging work undertaken to improve the provision of traffic information through the integration of UTMC data with incident and roadworks information is also described. Throughout the paper the focus is on the benefits these developments bring to the travelling public and to the Roads Service traffic operators.

2. UTMC IMPLEMENTATION

Overview

Within the Traffic Information and Control Centre (TICC) in Belfast, the two principal traffic systems are for Urban Traffic Control (UTC) and the control of traffic on the motorway network. The UTC system is used to optimise the traffic flow in the Belfast Metropolitan Plan Area through the control of traffic signals and urban variable message signs (VMS). It also acts as the 'master' for a satellite UTC system in Craigavon, approx 30 miles distant. The motorway control system is a Control Office Base System (COBS) and used for inter-urban traffic management through the control of variable speed signals and VMS located at strategic points on the network. Work is also underway on the design of system based on Active Traffic Management /Controlled Motorways and to be installed on the M1/Westlink by the DBFO Co. This system will be an extension and enhancement of the existing COBS system. Both the existing and enhanced systems will have the capability for signs and signals to be either manually set by traffic operators or automatically set by the MIDAS motorway automatic detection and signalling system.

The COBS and UTC systems are complemented by a CCTV network of cameras covering the urban and inter-urban networks, and a journey time system based on Automatic Number Plate Recognition (ANPR) camera technology. Also, recently installed is a Bridge Management System on the Foyle Bridge in Londonderry, approx 80 miles from Belfast. To provide a secondary level of support to this system, consideration is being given to integrate it with the other systems in TICC.

Prior to the implementation of the UTMC solution, the UTC and COBS systems were linked via a software mechanism that enabled traffic management plan deployment in an integrated manner, generated either automatically or manual operator intervention. This led to a requirement to establish a common repository where the information generated by the systems could be integrated and stored. A traffic management system in accord with the UTMC specification defined by the Department for Transport was chosen to meet this requirement. The UTMC standard defines a data model and communications protocol which is ideally suited to the management requirements of the network information being provided by the control systems.

System Implementation

The original facility for data communication between the UTC and motorway control systems has been enhanced and extended by UTMC and the development of additional interfaces. This now allows data to be incorporated from all the principal traffic management systems in operational use by Roads Service staff in the Traffic Information and Control Centre. These systems include UTC, COBS, ANPR journey times and urban and motorway VMS.

In addition to providing a data storage facility for connected systems, the UTMC development allows operators to define traffic management strategies which are comprised of set patterns and configurations to be implemented through the connected systems. These strategies can be triggered by a combination of information from any of the connected systems. This enables events detected by one system to cause actions to

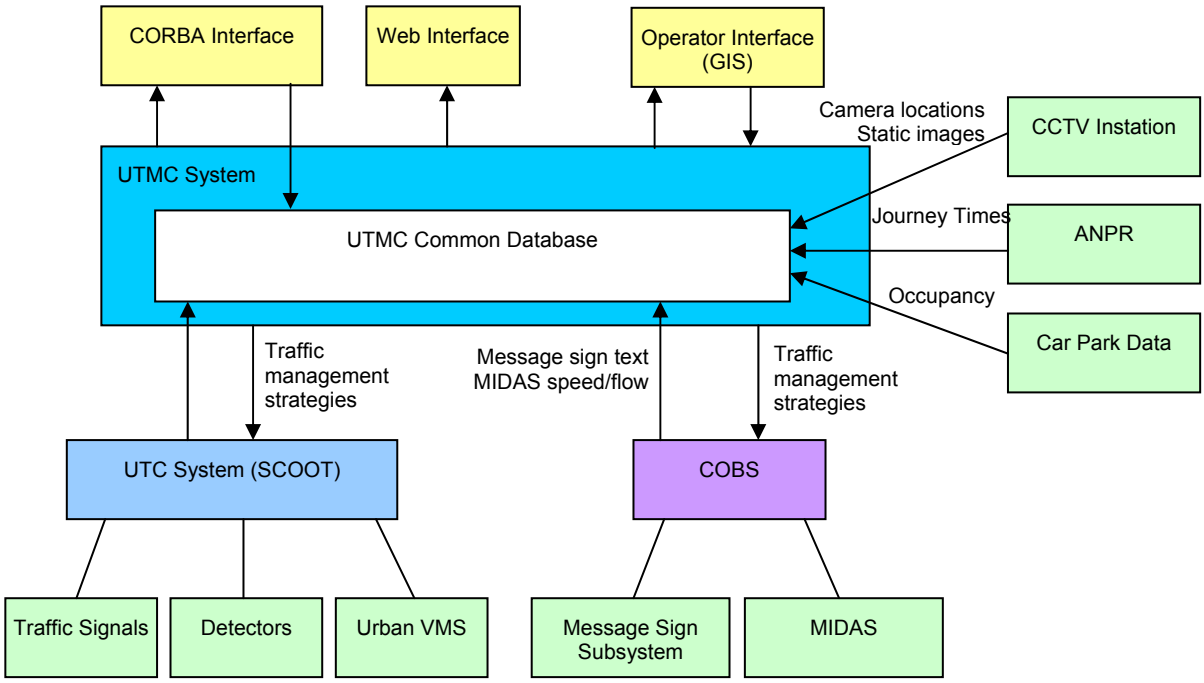
be implemented in other systems, enabling each component system to behave as a single complete entity and work to the benefit of the network as a whole.

The system offers three interfaces which cater for different levels of operation:

- A CORBA interface provides system –level interaction which allows the export of data for use by other systems and the import of external data into the system.
- An operator interface based around a Geographical Information System (GIS) is provided for operational users; this allows for the spatial representation of data, control of the connected systems and the definition and implementation of traffic management strategies.
- A web based system is also available which provides a channel for the distribution of information to the public.

The current level of implementation provides a fully integrated system offering a single point of contact between operators and the traffic management systems. A diagram of the integrated system is shown in Figure 1 below.

Fig 1 – Integrated System



Interface Extensions

The interface packaged with the UTMC system is based on the CORBA standard for interoperability between systems. This provides a high level of functionality permitting configurable access to real time data.

The TIH Principles recommend that an XML interface, accessible using HTTP GET, is used for publishing travel information unless the higher levels of functionality provided by CORBA are required. The TIH interface was therefore extended via an adaptor to offer an XML based interface in the DATEX2 format. VMS setting information, MIDAS speed and flow information and journey time information are provided by the adaptor.

The adaptor is also capable of extracting DATEX2 information from an external source and inserting it into the UTMC database. This provides the functionality required to support the

cross border sharing of travel information. In the first instance this will be with the National Roads Authority in the Republic of Ireland, for information exchange on the strategically important Belfast to Dublin corridor. Once inserted into the UTMC database, the cross border information can be used by the UTMC system to trigger the activation of traffic management strategies. It is also the intention of Roads Service to share data with others who adopt DATEX2 as their protocol for data exchange.

Benefits

Benefits are anticipated to include:-

- Reduced journey times brought about by the improved management and optimisation of the network
- Greater efficiencies and effectiveness for the tasks undertaken by Traffic Operators in managing an integrated multi-system configuration.
- The possibility of exploiting the common database and the interface options available in order to provide personalised information services to travellers, and enabling them to make smart choices.
- Opportunities for Value Added Service Providers.

3. INTEGRATED TRAVEL INFORMATION

Informing travellers has an important role in the effective management of a transport network. Provision of high quality and timely information can cause a reduction in the volume of travellers entering already congested conditions. Travellers can, therefore, make informed choices with regard to the time they make their journey or which mode of transport to choose. Timely and reliable information can assist in changing travellers transport modes from the private car to public transport. In order to maximise the benefits of travel information it is necessary to provide travellers with a complete picture of the information pertaining to their journey; as journeys often involve both urban and inter-urban parts of the network, the provision of information from the whole network is essential.

In addition to traffic and travel radio broadcasts from the Traffic Information and Control Centre, and other methods of information dissemination such as e-mail alerts, there is also roadside VMS and the www.trafficwatchni.com website. A recent development for Roads Service is the Information Kiosks which have been undergoing in-house trials.

The UTMC system described above is able to control all VMS on the network as part of the integrated traffic management strategies, and display both urban and inter-urban messages. Journey times from the ANPR system are also displayed on roadside VMS via the UTMC system.

The trafficwatchni.com website is Roads Service's primary platform for the delivery of traffic information via the internet. A range of information is made available through the site, including real time traffic information concerning specific incidents and general traffic conditions. There is also information about current and future roadworks. Real time information is entered directly onto the website by operators at the Traffic Information and Control Centre. Roadworks information is gathered from Roads Service offices across the province by a variety of different methods including e-mails, faxes and bespoke databases.

The Information Kiosks will shortly begin trials to assess the effectiveness of in-trip information delivery at strategic points on the network.
In order to facilitate the provision of an integrated traffic information service it has become necessary to consolidate the systems used for the entry of real time information and roadworks into a single centralised system. This system should be capable of recording all information, storing it in a common format and making it available to external systems. A traffic information database with a TIH compliant interface has been created to achieve this.

4. TRAFFIC INFORMATION DATABASE

The traffic information database aims to simplify the logging of roadworks information from the various Roads Service offices and combine this with real time incident information entered by operators at the Traffic Information and Control Centre.

The operator interface to the system is web based and can be accessed through a standard web browser. The web application communicates with the centralised database, allowing information to be added from any Roads Service office without requiring specific software to be installed. A dynamic map based interface is provided which allows operators to create spatially located events by clicking on the map to define the co-ordinates. Information within the database is stored according to the DATEX2 logical model with the WGS84 standard used for storing location details.

The database provides two levels of access. The standard access level allows operators to create events for approval by a supervisor. Events created in this way will not become “active” in the database until they have been approved by a user with supervisor level access. Operators with supervisor level access can review any outstanding events on the system and change their status to “approved” and then they will become active in the database. This procedure permits data to be entered from any location whilst still ensuring control of the active information ultimately resides with the personnel in the Traffic Information and Control Centre.

Active information within the database can be viewed by operators within the web based interface, and information is also made available as an XML file accessible over HTTP which conforms to the DATEX2 model. This makes the information available for use by other systems, and use of the DATEX2 format greatly reduces the development time necessary to make use of the information on an external system such as a website.

A screenshot of the Traffic Information Database entry page is shown in Figure 2 below.

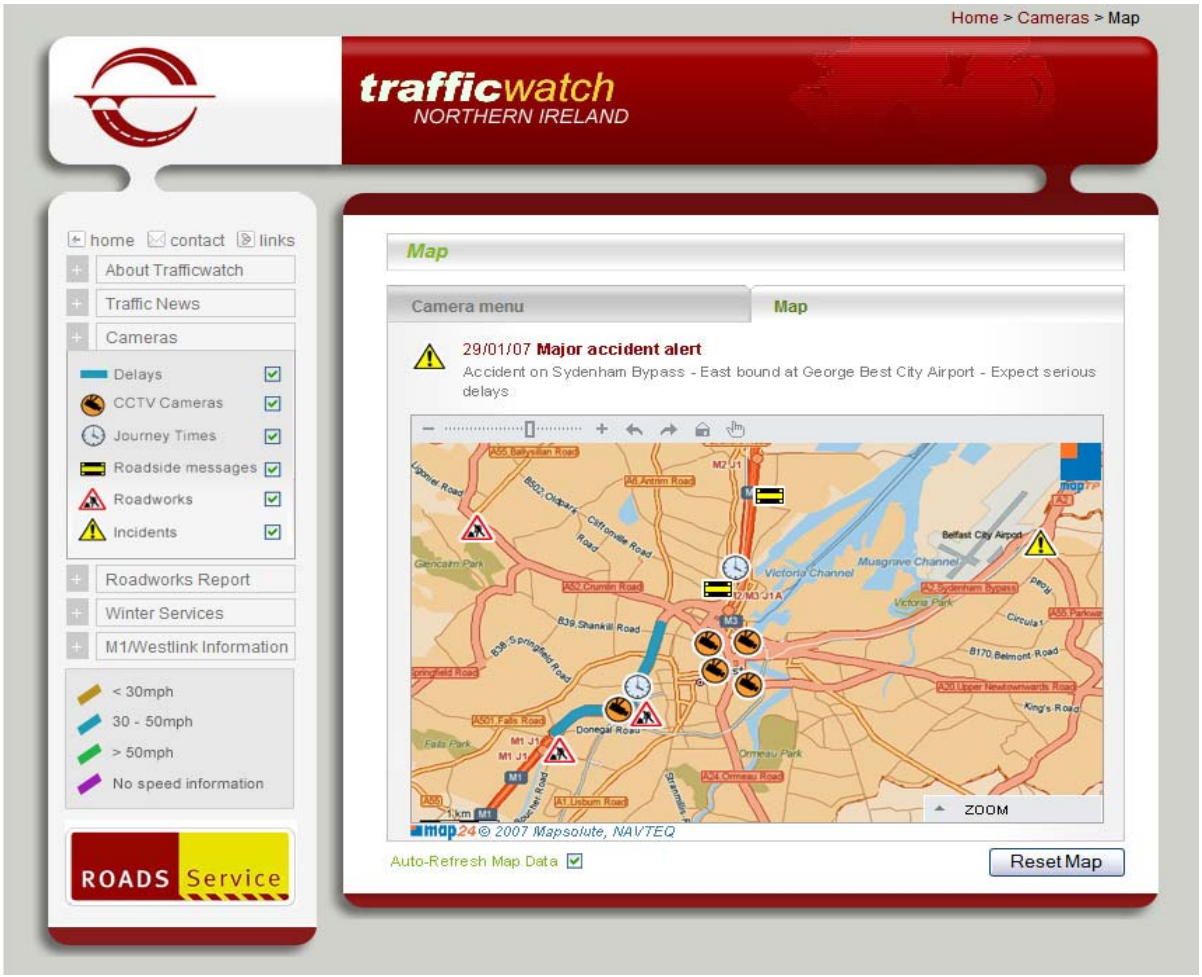
Figure 2 – Database Entry Page

5. WEBSITE DEVELOPMENTS – www.trafficwatchni.com

The trafficwatch NI website has been enhanced to take the data available from the DATEX2 interfaces of the UTMC system and the Traffic Information Database. Information from both systems is made available through a dynamic map based interface. Information provided comprises incident and roadworks data from the traffic information database, and VMS settings, journey times and speed information from the UTMC system. The key benefit from the enhanced website is that the information is provided through a single unified interface; from the users perspective there is only one system.

A screenshot of the enhanced trafficwatchni website is shown in Figure 3 below.

Figure 3 – trafficwatchni.com website



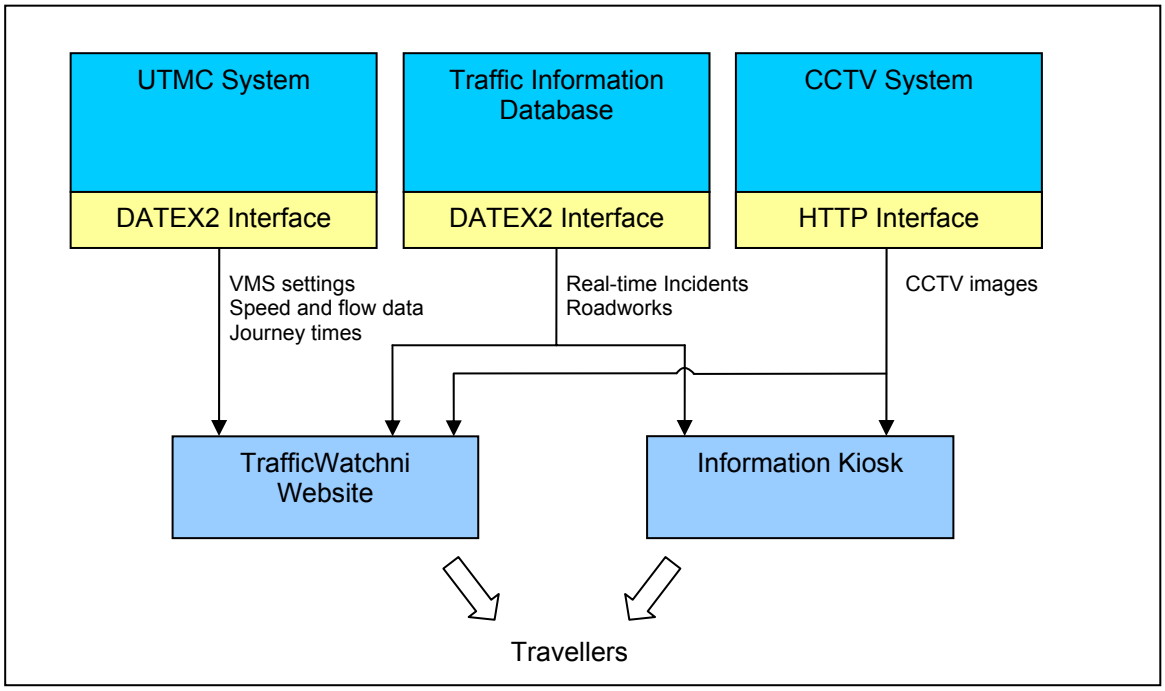
6. INFORMATION KIOSK

The Information Kiosk is for the delivery of traffic information to travellers at strategic points of their journey. Details of incidents and roadworks are displayed on two separate maps. The overview map is of Northern Ireland and displays inter-urban information. A map of the Greater Belfast area is also available which provides a more detailed display of urban information. A further map displays the locations of CCTV cameras and allows travellers to view static images or streaming video of current traffic conditions.

The Information Kiosk exploits the information sharing capabilities of the Traffic Information Database by obtaining details of incidents and roadworks from the DATEX2 interface. At this current stage of development, the Kiosk does not take advantage of the data available from the UTMC system but this is under consideration as a future development.

An overview of the system architecture for travel information delivery through the Information Kiosk and the trafficwatchni website is shown in Figure 4.

Figure 4 – Information System Architecture



7. CONCLUSION

Three separate developments by Roads Service have been discussed which have contributed towards the integration of urban, inter-urban, and cross border data. Integrated traffic control and travel information has now been achieved at three levels:-

- System level, where data is shared and actively used by the systems
- Operational level, where multiple systems are controlled through a single interface.
- Public traveller level, where information is disseminated in a common form through a single service.

Cross border/boundary sharing of journey times is now possible and the facility exists for Roads Service to store data from the Republic of Ireland, and other Regions, in the UTMC database where it will be available for operational use. The option will also be available to provide the data through the website www.trafficwatchni.com.

The benefits of this integrated approach are visible at the three levels described above. The sharing of data between systems allows control and management to be provided at a network level rather than a component level, such that the impact of strategies is considered across the whole network rather than just confined to the domain of an individual system. This holistic approach to network management has an immediate benefit to travellers in the form of reduced congestion and increased network optimisation. The traffic Operators also benefit from the ability to strategically control systems across the whole network through a reduced number of interfaces, thus their ability to manage the network is improved. Further benefits are provided to travellers in the ability to view information across the whole network through a single public interface.

Much of the progress to date has been achieved through the use of agreed principles and standards for the integration and exchange of urban and inter-urban information such as UTMC, DATEX2, and TIH principles. In addition to contributing towards a practical reduction in congestion and journey times, these developments also provide a showcase

which highlights how common standards can be exploited to the benefit of operators, organisations and the travelling public.