

URBAN TRAFFIC MANAGEMENT and CONTROL SYSTEMS

What are UTMC systems?

Urban Traffic Management and Control (UTMC) Systems link together several different computer applications to improve traffic management. They are a development of existing urban traffic control systems (UTC) and will form the next generation of traffic systems. Within a UTMC framework several traffic management and control applications are able to exchange data freely by using a common specification for the storage and transfer of data. By integrating the technology a wide range of traffic management options will become possible.

The following are examples of applications that could be integrated to form a UTMC system:

- urban traffic control;
- public transport priority;
- pollution monitoring;
- real-time public transport and traffic information;
- enforcement measures monitoring;
- incident detection;
- active traffic restraint based on on-line data
- variable message signs providing route diversions and car parking information; and
- vulnerable road users' priority

Another characteristic of a UTMC system is that data from different applications can be organised into a common database with two key purposes:

- to provide management tools for system operators, and,
- to inform policy makers of trends (for example, the relationships between congestion, pollution, traffic levels, and weather).

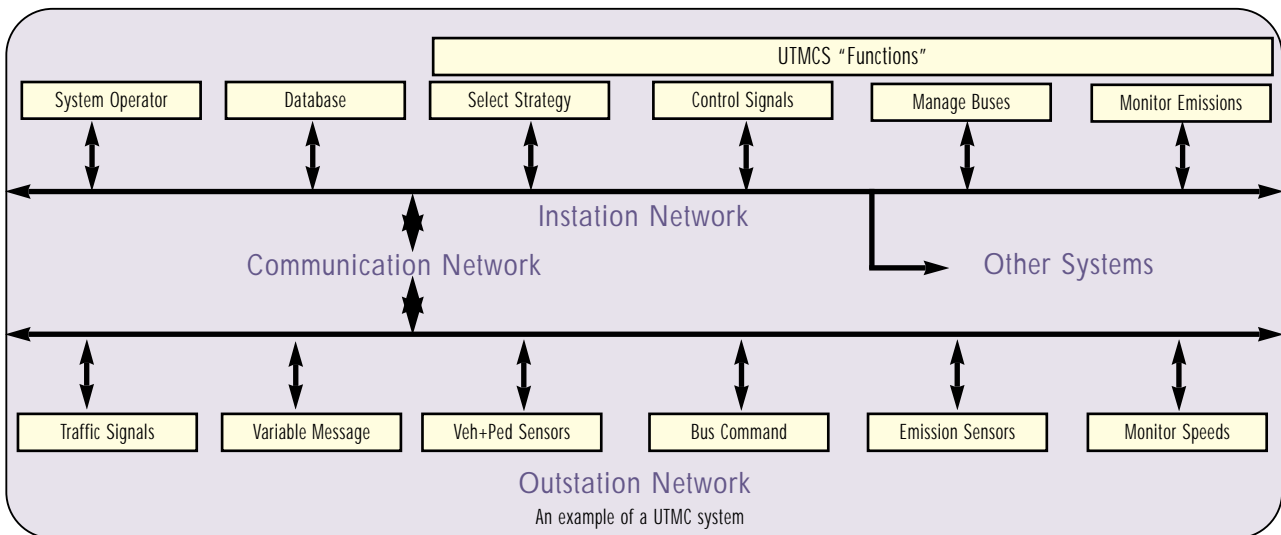
This "information" function is likely to be of increasing importance.

Traffic management policies are changing. As congestion has increased, transport polices have moved away from minimising delays to vehicles, to policies for demand management, improved safety for vulnerable road users, selective vehicle priority, and provision of information for multi-modal trips. As an important component of the growing Intelligent Transport Systems toolbox, UTMC systems will be able to help highway authorities achieve their transport policy goals. Using the latest advances in computing and communications technology, UTMC compliant applications will be able to provide efficient, real-time, integrated traffic management and control, benefiting highway authorities, transport operators and the travelling public.

There are additional benefits that can be obtained from integrating applications including better services, reduced costs, and increased flexibility. By using an "open systems" specification, the UTMC specification allows network managers to expand and develop their systems to implement the new policies. New applications, or new functions within applications, should be more easily added to, or integrated with, existing UTMC system applications. In addition, the UTMC specification will enable different manufacturers' equipment to work together, increasing competition and innovation.

The diagram (below) illustrates a possible (UTMC) system. The system comprises three principal parts; an instation network, a communications network, and an outstation network.

The *instation network* would contain several computer applications providing appropriate traffic management functions. Common operator terminals and central databases



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Growth in information technology

- Highway authorities should investigate the opportunities, provided by the rapid growth of information technology, for network operators to collate and disseminate traffic information for the benefit of the public.

simplify operations and data management. The different applications exchange data by using common data communication standards and protocols.

The instation network collects data from the highway environment and implements control strategies via the *communication network*. The UTMC specification permits many different communication methods such as leased telephone lines, radio, short range beacons, private cable networks, etc. UTMC compliant outstations can manage the data collection and data transfer for several applications at the same time, thereby reducing the amount of equipment required.

The final components are the on-street data collection and control applications. These make up the *outstation network*.

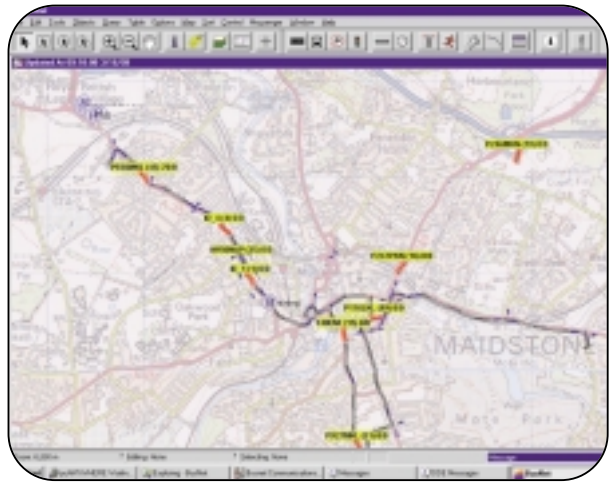
What is the UTMC Technical Specification?

A UTMC system must comply with the “Technical Specification for UTMC Systems” currently being developed by the Department of the Environment, Transport and the Regions (DETR). The Technical Specification for UTMC Systems describes the necessary components of UTMC systems. These components provide the language and grammar for the communications between the system applications. The detail of the applications, and the means of communications are left for the system purchaser and applications designers to define.

Many of the traffic management systems currently available are propriety systems – a single supplier provides all the equipment and software. These propriety systems are generally not designed for other suppliers to add extra functions or extract data from. A key characteristic of the UTMC specification, however, is the use of “open” standards whereby equipment from different manufacturers will have easy communication.

Open system standards are standards in the public domain, which means that application developers have full access to the information that they need to design application interfaces. The two standards being used within the UTMC specification to enable an easy interface between equipment are:

- NTCIP – National Transportation Communications for intelligent Transport Systems Protocol, and
- the DATEX Traffic and Travel Data Dictionary.



Tracking bus locations using GPS.

The specification also permits the continued use of existing systems (called “legacy systems”), and also provides a means of expanding these systems using UTMC compliant equipment. This will ensure that highway authorities will not have to scrap their existing systems to obtain the benefits of UTMC.

While UTMC allows for the continued use of legacy systems, total integration may not be possible without a communications path upgrade, potentially increasing costs. Legacy systems such as SCOOT were designed around the communications technology of the time. The design made the most of the low data transfer rates then available by using simple networks and protocols to achieve second-by-second communication. This design reduced the systems data content in a message. Modern open systems technology can manage more complex networks, but messages require more routing information to ensure the data reaches its correct destination. This design increases the length of messages, and therefore, if the data is time critical, the communication path must have more capacity. However, the UTMC specification will allow systems to continue to use existing legacy communications paths, but these paths will be limited to their existing functions. New high bandwidth communications paths will be required for full UTMC flexibility.

For some applications timeliness of data is critical. Examples are SCOOT (Split Cycle Offset Optimisation Technique) detector data and public transport priority demands, for which second by second communications are critical. For others security of data is important – for instance the transfer of evidence or financial information. Real time video requires very high bandwidth, this level of bandwidth is not normally required for general data transfer. The UTMC specification takes account of these varying requirements by providing three different



Bus priority using GPS technology in Maidstone, Kent.

communication methods. These can be specified individually or in combination. Expensive communication methods can therefore be avoided.

UTMC systems will usually be based on urban areas but the specification considers how they may be extended by interfacing with adjacent inter-urban regional systems. For example these systems could:

- monitor flows and congestion on a ring road;
- restrict flow entering or leaving motorway ramps;
- operate Variable Message Signs, and
- link to the Highways Agency's proposed Traffic Control Centres.

Control Centres.

Managing Future Traffic Patterns

Highway authorities should consider what new applications they will need to manage future patterns of traffic and transport demand efficiently and safely and in accordance with local and national transport policies.

What can be achieved in UTMC systems?

Within UTMC systems all applications can share the data communications network with other applications to reduce total costs. The wide range of information stored in the UTMC systems database makes it easier to implement and monitor different applications. Possible applications for UTMC systems include:

Access control by variable message signs.



Urban traffic control

Traffic control is a key measure in traffic management, and this is reflected in the number of UTC systems in use today. Urban traffic control is therefore a key application within UTMC systems. UTMC will support both fixed time and traffic adaptive systems such as SCOOT. It may also support other signal strategies such as MOVA (Microprocessor-Optimised Vehicle Actuation), and other developing strategies if they prove effective.

Selective vehicle priority

Public transport is receiving greater attention from policy makers, and encouraging its use is an important way to increase network capacity. The UTMC specification offers the opportunity of integrating existing and new systems to provide sophisticated bus priority measures.

Pollution monitoring

By analysing pollution records and relating them to traffic flow and congestion levels, pollution "hot spots" can be identified and suitable remedial action taken. This action may involve diverting traffic and/or banning entry to selected areas.

Sharing communication links

Highway Authorities should investigate opportunities for sharing data communication links and exchanging information between UTMC system applications to achieve more effective area-wide traffic management.

Gating

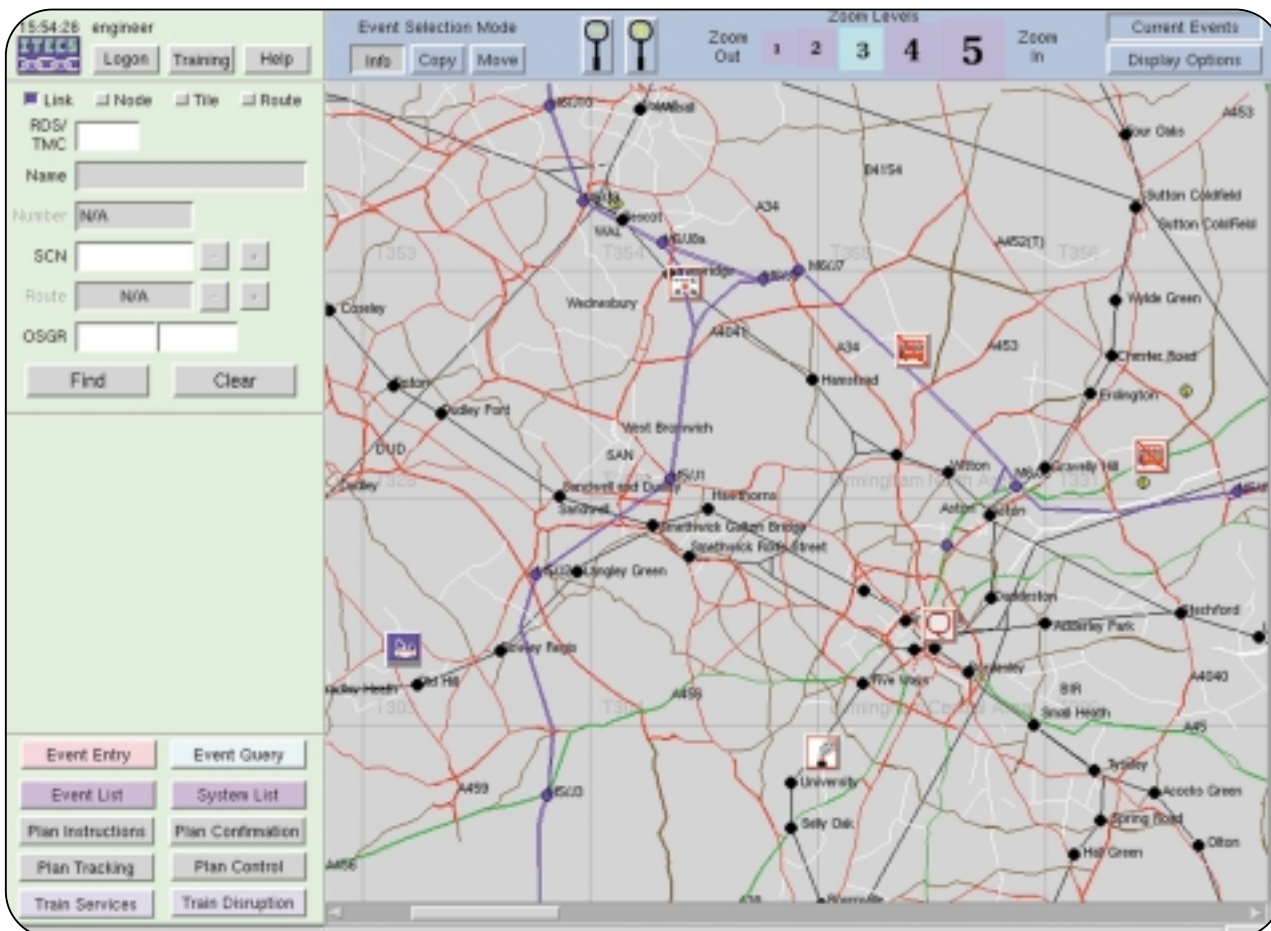
This technique alters the timing of one or more sets of traffic signals, to restrict the maximum flow along a route or into an area. This may be undertaken on-line for environmental reasons or to encourage diversion away from an accident hotspot. To be effective, gating usually causes significant increases in the queues at "gated" sites and careful study is needed to ensure that the overall impacts are as desired.

Strategy selection

UTMC systems can implement many different traffic management strategies so there is a potential for conflict between them. For example, reducing delay to all vehicles and giving priority to public transport are objectives that may conflict. Decisions on when and where to implement which strategies can have a major effect. The Technical Specification for UTMC Systems supports a variety of methods for helping to make these decisions. Four methods are possible: strategy switching, strategy priority ranking, combined strategies, and using a strategy selection function. Research on implementation of these different methods will be part of the third tranche of projects due to commence in 1999. A comprehensive research programme is underway (see box).

Current UTMC Research Projects

UTMC 01	Selected vehicle priority
UTMC 02	Traffic management across jurisdictional boundaries
UTMC 03	Strategies to minimise vehicle emissions
UTMC 04	Network monitoring, modelling and management
UTMC 07/17	Data input / information output requirements – quality and content
	UTMC 08 Suitability of NTCIP-based communications for UK UTMC users
	UTMC 09 Suitability of NTCIP applications messaging for UK UTMC users
	UTMC 10 Achieving UTMC integration through a common database
UTMC 14	Wireless communications to road users and within UTMC systems
	UTMC 18 Ownership cost model
UTMC 19a	Migration of UTMC systems
UTMC 22	Safety issues
UTMC 23	Security and enforcement issues



The Mattisse traffic and travel information system, real time information screen.

Transport operation

Transport operators can use the data in other UTMC applications to improve the efficiency of their fleets. Conversely, the data from vehicle location systems can be used as a measure of network performance.

Travel Information

An important feature of UTMC is that network managers can broadcast information to travellers and intending travellers. The public, either at home or during their journeys, can have access to real time public transport and traffic information via different media (eg, the Internet, TV) to suit their particular needs.

Implementation of UTMC systems

A UTMC system is a broad concept that embraces many different functions outlined above and others yet to be fully developed. Highway Authorities that wish to implement such a system will be able to use the UTMC specification that is currently under development. The specification has been sponsored by, and will be available from, the Department of the Environment, Transport and the Regions (DETR).

How can UTMC be funded?

Up to now, the DETR and the European Commission have funded much of the research and early development programme. The result of this work will be the "Technical Specification for UTMC Systems".

Conforming with standards

Highway authorities should ensure that suppliers of a UTMC system, and of any additional applications, conform with standards that promote "openness" in system design. Much national and international effort is being applied to develop and unify such standards.

In the future, the development of UTMC compliant systems will depend on the efforts of manufacturers and suppliers. This in turn will depend on potential users specifying UTMC compliant systems. In the UK, UTMC is seen as a very important tool for the achievement of many of the policies set out in the 1998 transport white paper, *A New Deal for Transport – Better for Everyone*. These policy objectives will be translated into proposed schemes in local authorities' Local Transport Plans.

Further details are available from: www.utmc.org.uk

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