

Inter-Urban Traffic Management Systems

Inter-urban traffic management can be considered at two levels, the local (tactical) level and the regional (strategic) level. Local traffic management systems target improved capacity, the prevention of flow breakdown and the enhancement of road safety. Strategic traffic control operates on the regional network and has a much stronger emphasis on savings in journey time.

Until the 1990s, inter-urban traffic management in the UK was largely the domain of the police who deal with accidents, incidents and emergencies on the network. As traffic volumes increased a few dedicated control centres (see box) were established for heavily trafficked parts of the network. The need for strategic traffic control across a regional inter-urban network also emerged. Scotland and Wales established dedicated strategic control centres and in England, the Highways Agency's (Regional) Traffic Control Centres initiative (TCCs) is central to these developments, building on the Midlands Driver Information System (MDIS).

What are Inter-Urban Traffic Management Systems?

Motorway and roadside signals

Traffic control centres need the means to communicate and direct vehicle drivers. At the tactical level matrix displays in the motorway central reserve warn of lane closures, advisory speed limits and the presence of fog.

At the strategic level the new text-based Variable Message Signs (VMS) comprise two or three rows of 18 characters to form an appropriate message. The new generation MS3 VMS incorporate a matrix area. They can advise drivers of congestion ahead and give directions for alternative routes. VMS can be augmented with lane control signs and mandatory speed limit roundels or pictograms.



Electronic Variable Message Sign (VMS). (Highways Agency).

By John Miles MSc PhD CEng MICE MIHT MCIT and
Julian Steed CEng FIEE FIHT

John Miles is a specialist in transport policy analysis and intelligent transport systems (ITS), particularly the legal, organisational and institutional aspects. He is part of the Carl Bro IBI team advising the Highways Agency on the contract specification for Traffic Control Centres.

Julian Steed has over 20 years experience in the design and implementation of various interurban traffic control systems both at home and abroad. The majority of this time has been spent with WS Atkins. He has been project director for implementing intelligent transport systems on major parts of the Malaysian motorway network and advising on institutional and operational standards for their use.

(This Network Management Note is one of a series to be published.)



Impression of MS3 installation. (Rolls Royce).

Driver information systems

Information needs to reach the driver before setting out as well as during the trip in order to influence trip timing, choice of route, and in some cases the travel mode. Travel information systems in the home, office, and in-vehicle are therefore an important tool. *Trafficmaster* is the UK's longest running driver information system, giving real-time information on the inter-urban network for journey planning purposes. *Trafficmaster* uses a unique network of speed detectors and journey time monitoring covering motorways and trunk roads.

Network Control in the UK

Currently operating:

- National Network Control Centre for Scotland (NADICS Glasgow)*
- M4 corridor South Wales (M4NTAIS Cymru Newport)
- M2/ M20 Kent corridor (Maidstone)
- M25 Godstone Heston
- Midlands Driver Information System: Birmingham – Nottingham – M25 envelope (MDIS Perry Bar)

*Note: NADICS grew out of the Forth Estuary Driver Information System (FEDICS) and the Glasgow motorway control system (CITRAC)

Planned for 2002:

Traffic Control Centres: England

"The aim of RTCCs** is to improve reliability on the network; reduce the disruption caused by major incidents, provide re-routing advice to minimise the effect of congestion and incidents, minimise delays due to roadworks, (and) influence pre-trip decisions on route, times and mode by providing reliable and accurate information."†

**Now called TCCs

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For further details contact: Roger Stainforth, Business Manager or
John Raffles, Sales Manger. R-R Industrial Controls Ltd,
Kingsway, Team Valley Trading Estate, Gateshead, Tyne & Wear NE11 0QJ

☎0191 487 0811 Fax: 0191 482 0006

E-mail: traffic@rrtms.co.uk Website: www.rrtms.co.uk

The UK is also involved in the development of RDS-TMC (the Radio Data System – Traffic Message Channel) which will deliver comprehensive traffic and travel information, with user choice on the announcements he or she wishes to receive.

Ramp metering

Ramp meters reduce the likelihood of flow breakdown by preventing traffic levels on the motorway reaching unstable levels. Traffic is held on the ramp to be released at a rate controlled by volumes on the main carriageway². The objective is to prevent queues developing on the main line. Traffic flow is monitored on the motorway upstream and downstream of the merge point and signals control the flow entering. Some countries (eg, Japan), practice an extreme form of ramp metering by closing some on-ramps completely during peak hours.

Controlled motorways

Controlled motorways prevent bunching and flow breakdown and, thus, increase safety and throughput. A controlled motorway system has been operating on the M25. Its purpose is to smooth traffic flow by imposing a mandatory speed limit, which is varied automatically in response to flow conditions. Following the successful trials on the M25 further extensions to the system will take place.

Diversion routes

Local diversion routes are imposed as and when required by the police in response to incidents. Some are signed using symbols (circle, triangle, etc). Nevertheless, as traffic volumes increase the only tactic during an incident may be to keep traffic queuing on the carriageway to avoid causing much wider disruption. Strategic control introduces the possibility of network-level diversions with re-routing strategies for the benefit of long-distance traffic. In this way a more balanced use of the network can be achieved.

Lane control

Lane control is normally associated with tidal flow schemes on urban routes such as the Aston Expressway, Birmingham and the Blackwell tunnel approach. Other kinds of lane control schemes are now being introduced, such as high occupancy vehicle lanes, goods vehicle-only lanes, or lanes reserved for buses and coaches. One example is the M4 spur into the central area of Heathrow Airport where a bus-only lane has been introduced linked to traffic signal priority for buses.



Ramp meters control access to the motorway. (Highways Agency).

How do Inter-Urban Traffic Management Systems Work?

Monitoring the network

Control centres depend absolutely on reliable traffic data being available to keep track of network conditions. The TCC must also keep track of events which will affect the performance of the network. These include roadworks and accidents that close off parts of the carriageway, the movement of abnormal loads, and severe weather conditions such as fog, snow, ice, heavy rain, low sun and high winds. There are also events that raise traffic demand to unusually high levels, such as holiday weekends, leisure, entertainment and sporting events.

As a result of successful trials on the M1, the Highways Agency is now rolling out the Motorway Incident Detection and Signalling System (MIDAS) based on arrays of detector loops placed in the carriageway at intervals of 500m.

Strategic re-routing

The objective of strategic re-routing is to monitor a wide area of the road network where route choice exists and to advise vehicles of the optimum route if there is congestion and delays. Network traffic assignment models, such as Motorway CONTRAM, can be used to decide when to initiate a strategic diversion route³.



A traffic control centre. (Highways Agency).



Speed-controlled motorway (M25). (Highways Agency).

Integration with Local Road Networks

More complex management systems require integration between the inter-urban control systems and those for local roads. The inter-linking of motorway control and UTC in Glasgow is one such example, which includes ramp metering and extensive use of VMS⁴. In Southampton, the ROMANSE project has successfully integrated systems for managing traffic on the M27 with local VMS⁵.

System architecture

As new traffic control functions are developed the total system architecture becomes increasingly complex. Software standards, eg, for data dictionaries and data communications protocols, as well as equipment standards, are increasingly important. In the UK, the requirements are currently being studied as part of the government's UTMC research programme (Urban Traffic Management and Control) in the light of international developments⁶.

What can Inter-Urban Traffic Management Systems do?

Safety and Efficiency

Traffic control and management systems have been implemented by government and justified in terms of accident reduction and travel-time savings. Ramp metering, incident detection, Closed Circuit Television (CCTV) and speed regulation are all justified in this way.

Strategic network control

Effective strategic re-routing and network control can significantly reduce delay, increase safety and reduce pollution. Studies in Paris have shown that even if a small proportion of drivers respond to advance information it can spread the load and prevent or delay the onset of flow breakdown.

Speed control

Variable mandatory speed limits smooth traffic flows and improve safety, so reducing stop-start conditions. The evaluation of the M25 trials by TRL shows there are positive benefits: traffic flows are smoother with more uniform headways. Nearside lane utilisation on the M25 improved by 15%⁷. Safety also improved with major reductions in injury and damage-only accidents.

Incident response

Automatic incident detection systems like MIDAS can contribute to rapid emergency response. They can also bring savings in secondary accidents because drivers are automatically forewarned of queues ahead and can be advised to slow to the recommended speed.

Conclusion

Against a background of increasing car ownership, trip making and trip lengths, further growth in traffic volumes on the inter-urban network is inevitable. Road building is no longer seen as an acceptable response. Every opportunity must therefore be used to operate the network to maximise



Use of VMS for strategic re-routing. (Highways Agency).



Variable mandatory speed limit signs (M25). (Highways Agency).

performance in terms of traffic capacity and minimise accidents and delays. The methods described in this note contribute to this objective. Traffic Control Centres will be at the hub of these future systems.

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M4 motorway, South Wales. (Rolls-Royce).



MDIS. (Rolls-Royce).

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NADICS VMS Scotland. (Rolls-Royce).

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For further details contact: Roger Stainforth, Business Manager or John Raffles, Sales Manger. R-R Industrial Controls Ltd, Kingsway, Team Valley Trading Estate, Gateshead, Tyne & Wear NE11 0QJ
 ☎0191 487 0811 Fax: 0191 482 0006
 E-mail: traffic@rrtms.co.uk Website: www.rrtms.co.uk

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