Beating the DRUM for faster roadworks

A combination of technologies is leading to major congestion and cost reductions during roadworks on the UK's motorway network.

Innovative construction programme scheduling technology and the deployment of moveable barriers has achieved substantial savings of money and time on UK motorway roadworks managed by the Highways Agency (HA). This combination has set the scene for a new generation of road usage analysis tools.

The HA's objective was to reduce the congestion caused by lane closures during roadworks, while also enabling the work to finish as quickly as possible. To do this the technology is providing greater accuracy in the prediction of traffic flows and in matching current demand to capacity in a range of scenarios.

Named DRUM (Dynamic Roadspace Utilisation Manager), the traffic management system models a number of custom traffic layout options within the roadworks. It operates by collecting live traffic flow information from web-connected portable radar sensors and comparing that data with historic traffic flows. The system then assesses the optimum times for lane closures, predicting times when lanes should be opened and closed depending on traffic demand, thereby helping to ensure reliable journey times through the roadwork section.

This new approach replaces the conventional use of rigid lane closure timetables in favour of flexible working windows that are derived from historical profiles and responds to actual traffic flows. In doing so it allows lane closures to begin earlier and finish later, with work continuing whenever conditions allow and providing useful opportunities to progress the scheme faster. As DRUM produces information about when traffic flows will increase and require running lanes to be reopened for traffic, the system helps reduce the likelihood of congestion.

Originally the technical challenge was to create a reliable traffic model using real-time traffic flows for a scheme on the southern approaches to the Dartford Crossing over the River Thames on London's orbital.

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<tr>
<th>CONTRACT VALUE</th>
<th>US$6.6 million</th>
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<tr>
<td>PREDICTED SAVING</td>
<td>US$99,825</td>
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<tr>
<td>ACTUAL SAVING</td>
<td>US$412,500</td>
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Barrier Systems' QMB moveable barrier system was used to open and close lanes in response to DRUM's predictions.

Wavetronix high-definition side-fired microwave radar sensors were used to gather data (picture MTS UK).

MTS's trailer-mounted battery-powered and solar-recharged T25 platform provides energy for the mobile radar sensor.
Cost Benefit Evaluation

Motorway, the M25. The system needed to provide easily accessible information covering junctions 3 to 1B which allowed the contractor to open and close running lanes using the movable barrier system as demand changed in order to prevent unnecessary congestion.

The desired result was to speed up the construction programme by benefitting from extended working hours by restricting lane closures to periods when the full capacity was needed and resulted in transport consultancy TRL and construction contractor Costain developing DRUM. The original version used Moorway Incident Detection and Automated Signalling (MIDAS) traffic monitoring system loop data from outside the works area (see panel). This led into a web service, hosted at TRL, to provide live traffic counts that could be used to present timetables for potential lane closures.

The latest iteration uses the Quick-change Moveable Barrier (QMB) system supplied by traffic barrier specialist Highway Care, to speed up lane opening and closing. It deploys a linked chain of concrete sections that can be moved across a carriageway by a self-propelled barrier transfer machine, which quickly creates a safe working area without needing a wide buffer zone and the resulting traffic impacts.

Since the pilot, DRUM has expanded to incorporate additional information inputs and outputs. By working with radar sensor equipment providers MTS UK the DRUM system is now configured to be useable without pre-existing traffic data.

Where there is no historic data, early deployment of sensors enable the collection of relevant data prior to the commencement of the construction. Contractors can view planning, operations and assessment tools using a bespoke web service, developed to be accessible via any internet-enabled device.

**COOPERATIVE DRIVING – CHALLENGES AHEAD**

Following initiatives including the publication of the European i-Mobility Forum’s road map, the International Benefits, Evaluation and Costs Working Group is keeping a watchful eye on developments in cooperative and automated driving. ITS practitioners belonging to the Working Group warn that, without first mastering the full potential of V2X (networked vehicle) technology, the disbenefits of cooperative and automated driving could outweigh the benefits.

The organisation is also concerned about how to estimate the benefits of cooperative and automated driving. Greater driving comfort and convenience are the most directly achievable benefits but these are hard to quantify in practice. While traffic flow smoothness, increased road capacity, reduced emissions, and other environmental benefits can only be maximised with full V2X cooperative automation, there are indications this could mitigate traffic shockwaves. Safety benefits will be the hardest to achieve, quantity and cost as there is not an existing credible approach and there also remains the issue of where to place the blame for accidents – on drivers or equipment suppliers.

**MIDAS**

MIDAS is a distributed network of traffic sensors designed to alert control centres to traffic flow and average speeds and, in active traffic management zones, set variable message signs and advisory or mandatory variable speed limits, with minimal human intervention. Traffic information providers such as TomTom and Google access this data using the HA National Traffic Operations Centre’s DATEX II set of European specifications.

The planning tool shows two weeks’ worth of predicted timetables which are updated as live data is processed, to allow contractors to adjust schedules ahead of time. A traffic light icon in the operations tool indicates if and when a lane can be opened or closed and is the live system most use from the roadside to support existing information and safety checks. Within the assessment tool is a queuing model that allows users to forecast sets of lane closures and study predicted effects on queuing.

The whole system can be used globally on any trunk road where there is mobile data availability. DRUM has been used on six schemes to date, including the pilot. Over the initial two-year programme on the M25, it helped the contractor’s team deliver more than 20 additional working hours a week. This resulted in the construction period being cut by six months and a saving of £1.171.500 (US$1.933.000). More recently DRUM has been deployed on the M61 in North West England. Before the scheme began, the team predicted a conservative net saving of £60,500 (US$99.825) based on shortening the programme by two weeks.

In the end, the £4.1 million (US$5.6 million) scheme gained an additional 135 working hours, finished four weeks ahead of schedule and saved £250,000 (US$142.500).

Other benefits of allowing the traffic management to be installed on the network earlier and removed later included:

- Elimination of queuing during the construction programme, including periods when lane closures were in place outside conventional roadwork operating hours.
- Reduced noise complaints from members of the public about the traffic management.
- The use of daytime working at weekends allowed noisier activities to be completed during the day, resulting in fewer noise complaints from the public.

Additionally, the radar sensors, provided by MTS UK, did not require recalibrating during the scheme as top-up charging from solar panels enabled the batteries to last for the full duration of the works without recharging.

As a DRUM records all received data for audit purposes, the M61 scheme also provided speed information to prove that the safety cameras being used were effective in lowering motorists’ speeds through the work zone.

TRL believe that DRUM’s biggest benefits will be identifying locations where traffic flows are low enough to justify lane closures across the weekend and the overnight working window can be extended. However, the benefits reduce as two or more lanes need closing, because traffic flows need to be lower to reduce the chance of queuing on the remaining running lanes.

**Looking ahead**

TRL is currently looking to expand DRUM’s potential and has developed system tools for contractors including a smartphone application which can send SMS message alerts at designated times to the staff on site giving notice that the lane is about to be opened or closed.

Another potential variation is the use of alternative sources such as satellite-derived data. This could be useful on dual carriageways, allowing contractors to monitor congestion in the surrounding area on local roads. TRL is also conducting new research into traffic patterns using modelling and microsimulation tools and is continuing its partnership with Costain.