Real Time Traffic Management

DETAILED

SECTOR | Transport and Energy
STAGE | Strategy & Planning; Operations and Maintenance
TECHNOLOGIES | Sensors, Smart Cameras, GPS, Bluetooth

SUMMARY

Real Time Traffic Management systems manage traffic behaviours in real time by utilising a network of technologies including sensors, smart cameras, GPS and Bluetooth/Wi-Fi. This can be used to efficiently reduce congestion, bottlenecks and other traffic issues. Real-time data can be used to suggest alternate routes to drivers when routes are congested and indicate to public transport operators and decision makers where user demand and supply is located. Technology improvements have allowed the development of sophisticated services to operate networks to resolve the conflicting demands of all road and transport users.

Advanced traffic management systems improve the quality and performance of road services, as they provide accurate real-time data from multiple sources such as sensors, GPS, smart cameras, dynamic message signs, traffic lights and road weather information systems. Without this traffic information, network improvements, integration of new transport modes, and infrastructure development will not be suitable for current and future transport needs (i.e. it will not provide the flexibility and adaptability required from new transport infrastructure to respond to changing demand).

Smart traffic management services enable integrated optimisation of road and transport networks to match infrastructure demand and supply in near real-time, managing speeds, frequencies, and prioritisation of vehicles while abiding by regulations and safety requirements.

As the population grows and moves to urban centres, more people utilise the road and transport network resulting in growing congestion and more frequent accidents. Road users need information to avoid busy intersections and bottlenecks. Another issue is transport agencies not having the necessary information to have a holistic view of the network, in order to make short-term decisions to adapt to events and incidents. Using real-time traffic management system, traffic data can be combined across a network to provide a holistic picture of the current traffic situation in an area. With the right tool, future traffic can also be predicted, allowing agencies to develop strategies simultaneously to realise the best scenario and prevent the congestion from getting worse, to create connected cities with seamlessly integrated and efficient transport networks.

VALUE CREATED

Improving efficiency and reducing costs:

- Improve efficiency of infrastructure utilization with real-time information guiding resource use and potentially enabling money to be saved on such resources
Enhancing economic, social and environmental value:

- Utilize data for decision-making to ensure public funds are spent where they are most needed
- Improve customer trip planning through live multimodal transport updates
- Enable better routing for drivers based on accurate real-time information
- Encourage innovation from technology companies through open data
- Enable prompt responses from authorities and prioritization of emergency response vehicles (via Emergency Vehicle Priority (EVP) system), reducing response time to incidents and improving safety at intersections (eliminating the need for emergency vehicles to enter intersections on red signals)
- Utilize real-time data for adaptive network control
- Utilize real-time traffic data for dynamic road pricing
- Utilize real-time traffic information to guide the development and planning of future and sustainable transport infrastructure decisions (e.g. building bike lanes) *(see also the Vehicle-to-Vehicle, Vehicle-to-Infrastructure and Autonomous Vehicles use cases)*
- Utilize traffic information to support schemes to encourage greater public transport use through incentivises

**POLICY TOOLS AND LEVERS**

**Legislation and regulation:** Transport objectives must be translated into public benefits and set the basis to ensure targeted data collection and processing for the traffic management system. Digitalisation and near real-time performance requirements will make such systems accountable to deliver the expected outcomes. The government should make policies regarding what and how information can be collected and retained, to ensure compliance with relevant privacy and other laws.

**Effective institutions:** Stakeholders collaboration is crucial to create the adequate regulations for data collection and analysis across multiple travel modes, as well as for their operations. Road and transport infrastructure consist of multiple means for information collection (sensors, GPS, etc.), which will need to be analysed jointly to give a holistic view of the transport network.

**Transition of workforce capabilities:** Digitalisation of services and remote monitoring/corrective actions of traffic situations will need to be implemented. This requires training for traffic control centre staff in the use of new systems. Additionally, governments should be able to review the performance of the systems and have the relevant legal/technical skills available to them to enable these reviews.

**Procurement and contract management:** Where traffic management is contracted to the private sector, contracts will need to be developed in a way that implements outcome-based performance. The contract also should enable performance to be monitored in a more frequent way according to a KPI regime that will be set by the transport objectives of the authority or government. Operators must ensure the reliability and validity of their data as well as incorporating any necessary reporting and controls to demonstrate the performance of their systems against the set of contractual KPIs.
### IMPLEMENTATION

**Ease of Implementation**

Real-time traffic monitoring technologies have been integrated into the transport network for many different uses throughout the past two decades, however the development of connected cities (utilising assets communicating data in a connected near real-time way) is relatively new. Cities will inevitably change overtime, as population and traffic conditions are constantly varying. Therefore, real-time traffic data uses and collection methods must continuously adapt to this change to maximise the efficient use of existing infrastructure.

**Cost**

The cost of implementing and developing such systems is high, in part due to the degree of testing and commissioning required. Each individual element of the system will require a corresponding specification. These elements will need to be tested individually to ensure they meet the requirements of the specification. They will also need to be tested together, to prove the overall value of the system. This process can be labour and time intensive. Operating costs are also high but can be optimised in the mid- to long-term, as specific contextual response programmes are developed in addition to the basic ones, using machine learning for example.

The systems will need to consider licensing and managed services costs, as the maintenance of the traffic management systems (in addition to implementation costs of the systems and supporting monitoring technologies) will need to be captured. This will also impact the operating models and costs, in a way to optimise them over time.

**Country Readiness**

Traffic management systems rely on the availability and accuracy of traffic data and the communications systems to transfer them and to receive corrective actions. Most of the underpinning technologies are not already fully implemented nor connected, thus impacting the readiness for such solutions in both advanced and developing countries.

**Technological Maturity**

Sensors, cameras, GPS and Bluetooth are all developed and widely used technologies. However, use on such a large scale will require further improvement. For example camera and sensor repair detection and notification systems need to be developed, along with establishing a data hub accessible by analysts that is manageable and secure. Maintenance of sensors and cameras is key for the assurance of reliability. Algorithms reflecting the area transport objectives should be well developed and integrated in the real-time traffic management services to ensure reliability.

### RISKS AND MITIGATIONS

**Implementation risk**

Risk: The government needs to address the following questions: who has access to the data? Will the information be stored and if so for how long? Data sharing between public and private parties will support the efficient implementation of holistic traffic management systems.

Mitigation: Develop and implement data sharing regulations as well as public private partnership contractual arrangements.

**Social risk**

Risk: Individual data privacy will be an important consideration, as well as tax-related issues that might be raised through the investments in such solutions.
Mitigation: Government and traffic management operators need to develop public communication and engagement strategies. It is important to explain and engage with the community on the benefits of the real-time traffic management solutions, such as higher safety, decreased congestion, increased productivity and transport experience enhancement benefits as well as potential tax optimisation.

**Safety and (Cyber)security risk**

Risk: There is some scepticism towards camera footage and sensor information being available to the government and private companies, for fear of their privacy being threatened. A cybersecurity breach is a particular concern, as real-time traffic monitoring involves the collection of sensitive data on user and vehicle location.

Mitigation: To address this concern, cybersecurity and data privacy must be adequately addressed. Users should be made aware of these security measures, and the positive impact the data collection could have on their livelihoods. Data collection, storage, analysis and distribution must be carefully planned and adhere to all necessary security measures.

**Environmental risk**

Risk: If network coordination is not properly planned, with corrective actions focusing on improving safety and decreasing congestion, there is a risk of worse traffic and associated emissions.

Mitigation: Forecast models and environmental impacts assessment should be made for all response programs launched by the traffic management centre that will modulate the traffic operations to ensure environmental requirements are met.

**EXAMPLES**

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<tr>
<th>Example</th>
<th>Implementation</th>
<th>Cost</th>
<th>Timeframe</th>
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<tr>
<td>Active Traffic Management Approach, UK</td>
<td>The development of a fully remotely controlled motorway with variable message signs, in order to manage traffic flow and lane use, even more precisely with the use of V2I (See also the Smart Motorways use case).</td>
<td>High and required multiple operations review, as business needs should have been defined in more detailed from the beginning.</td>
<td>Still being improved to meet congestion and productivity objectives, while already partially providing them.</td>
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<td>The Urban Lab Dynamic Traffic Forecasting, Barcelona</td>
<td>Increase or decrease the number of green lights for available parking spaces, according to the level of traffic/demand.</td>
<td>Improved operational costs for traffic management and traffic signal coordination.</td>
<td>Implemented.</td>
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