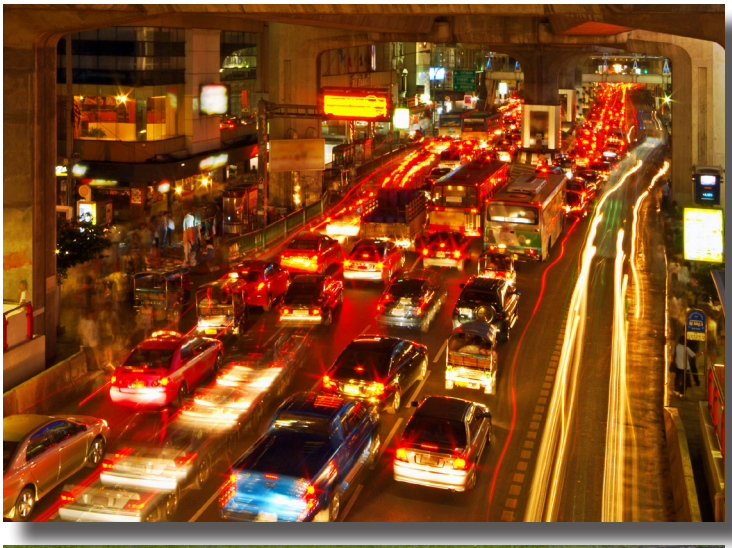
The Institution of Engineering and Technology

ITS United Kingdom
Better transport through technology

Can we really do more at less cost with the **UK road network**?

A Factfile provided by the Institution of **Engineering and Technology** and **ITS (UK)**



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ITS United Kingdom is the UK organisation for all who work in ITS. It is a not-for-profit public/private sector association financed by members' subscriptions. ITS (UK) provide a forum for all organisations concerned with ITS.

ITS (UK) works to bring the benefits that ITS can offer in terms of economic efficiency, transport safety, and environmental benefits to the United Kingdom. The membership, over 160 organisations, comprises Government Departments, Local Authorities, Police Forces, transport operators, consultants, manufacturing and service companies, and academic institutions.

New members are always welcome and benefit from activities including seminars, workshops and regular news dissemination. ITS United Kingdom encourages discussion on issues such as public/private co-operation, standards, legislation, information provision and new technology.

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Cover images (clockwise from top right)

- Congestion charge sign (Central London)
- Car exhaust fumes
- A UK GATSO speed camera
- Traffic congestion in Bangkok, Thailand

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Introduction

In 2011 the UK is faced with a period of austerity as the Government takes steps to reduce the national debt. Following the Comprehensive Spending Review, the Department for Transport (DfT) announced that it will reduce overall spending by 15%, including an 11% reduction in capital spending. Yet DfT's Business Plan 2011-2015 describes a vision where transport is the engine of economic growth while being greener, safer and improving the quality of life in communities. Can this be done adequately with the reduced budgets? Can we find new ways to manage our assets and minimise the impact of the cuts?

Taking transport funding decisions usually means trying to balance many different pressures including:

- Supporting the economy with reliable and efficient transport;
- Reducing congestion;
- Improving safety;
- Minimising environmental impact and energy consumption;
- Sustaining and extending accessibility;

Analysis shows that alternative measures and schemes can help to address the pressures listed above, at less cost than traditional measures. For example:

- The Active Traffic Management 'Managed Motorways' Scheme on the M42 reduced congestion, journey times, fuel consumption and emissions all at £12.4m less per km than traditional motorway widening
- The implementation of Average Speed cameras on the A14, saw a 21% reduction in the rate of collisions in the first year, with savings from the reduction in accidents totalling approximately £9m over the first five years at a cost to implement of £4.6m over the same period

A brief examination of UK transport pressures

Reliability

A major concern for businesses is the lack of predictability of travel times and the reliability of the road network[1]. Logistics companies allow extra time between deliveries in order to account for unreliable networks which may cause late delivery, yet on days with little or no delays the drivers can return early, but they cannot deliver more goods, which does not benefit the company. Having predictable journey times would make it possible for logistics companies to optimise their delivery routes and number of trips taken. The same is true for the public travelling for work. Departing early is no benefit to either the company or the employee, but is required to ensure punctual arrival.

Congestion

The links between growth in GDP and road traffic have long been recognised. The Eddington Transport Study[2] estimated that eliminating existing congestion on the road network would be worth some £7-8bn of GDP per annum and concluded that if left unchecked congestion would waste an extra £22bn of time in England alone by 2025. By then 13 % of traffic would be subject to stop-start travel conditions.

Road traffic accidents

There were 38,875 deaths on EU member State roads in 2008 of which 2,645 (6.8%) were on UK roads[3]. Those accidents affect hundreds of thousands of lives and cost the EU economy around €200bn each year[4]. The Cabinet office estimated that the total annual cost of road accidents in the UK is £19bn with urban areas accounting for £9bn of those costs[5].

Emissions

We need to reduce the emissions from transport. Air pollutants from transport have negative effects on health in both the short and long term. The estimated health cost of particulate pollution alone is between £5-10bn each year [6]. The short term effects are mainly respiratory leading to increased hospital admission and use of medication. In the long term, air pollution can lead to reduced lung capacity, higher rates of lung cancer and heart disease, contributing to an average reduction in overall life expectancy of 7-8 months per person[7].

In the UK, road transport accounts for about 92% of domestic transport emissions and just over half of those emissions stem from passenger cars[8,9].

Congestion increases this problem. Vehicle emissions per km on motorways increase three to four times in congested areas – a vehicle travelling at 60 km/h emits 40% less CO_2 than one travelling in stop start conditions at 20 km/h[10]. Thus, reducing congestion and improving traffic flows considerably diminishes the environmental impact of road transport.

Accessibility

Accessibility may actually be the single best measure of the economic value of transportation. There is a strong link between improved access and the economy with studies finding that a ten percent improvement in access generates a more than two percent gain in overall economic productivity[11].

This paper sketches a way to accommodate reduced overall spending while maximising the productivity and safety of networks while minimising environmental impact. It shows how technology can be used to deliver consistent journey times, better information services and informed demand management which are crucial from both a societal and economic point of view.

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Funding appraisal

Last year the Chancellor of the Exchequer instructed Government Departments to prioritise their main programmes against nine key criteria for ensuring value for money of public spending[12]. The "Osborne" tests signal the Government's adoption of a new approach to infrastructure investment which needs to be developed alongside new thinking on its operation.

Planning transport investment solely in terms of passive provision of expensive capital infrastructure alone is no longer sufficient. Our transport asset is finite and it needs to be actively managed to maximise value from it. Well-planned management of infrastructure can improve its productivity and thus postpone further capital investment in new construction with considerable cost savings.

Technology options for maximising value from the network

A number of technologies have been proven to address one or more transport challenges without the need for expensive new-built infrastructure. Information and communication technologies can make various modes of transport more efficient while minimising the negative effects on health, the environment, the economy and quality of life.

Case study Active Traffic Management on the M42
The ATM scheme on the M42 monitors road conditions and as flows build up it switches on overhead signals to allow traffic to use the hard shoulder as an additional live traffic lane and adjusts the maximum prevailing speed limit. The temporary increase in the motorway's capacity and the variable speed limits keep traffic moving, thus reducing congestion, but there are also significant gains for motorists, the environment and the economy.

Average journey times fell by more than a quarter on the northbound M42 carriageway, overall fuel consumption reduced by 4% and vehicle emissions fell by up to 10%[13]. On top of that accidents can be automatically detected and validated using CCTV allowing a more rapid response to accidents and other incidents to remove the problem and return roads to full capacity. The pressure for additional road capacity has been eased for many years.

Financial Benefits
The scheme has a Benefit/Cost Ratio of 7.6 compared to a ratio of 2.3 for standard motorway widening; the pilot scheme had costs of £5.6m per km compared to £18m per km for conventional motorway widening. Overall the Active Traffic Management Scheme on the M42 cost £6.2bn less to build than widening the motorway with comparable traffic objectives to traditional motorway widening being realised[14].

The EU Commission has estimated[15] that the costs of traffic congestion can be reduced by 10% through the deployment of intelligent transport systems technology. At a time when money is limited, technology to 'sweat the assets' can deliver consistent journey times, information services and informed demand management.

Predictability of journey times

Urban traffic management and control (UTMC) combines automatic number plate recognition cameras, in-road and roadside flow sensors, variable-message signs, traffic signals, air quality monitoring stations and meteorological data with database and communications technology to effectively inform drivers and manage urban traffic. UTMC systems are designed to allow the different applications used within modern traffic management systems to communicate and share information with each other to optimise the use of the network and reduce overall congestion. UTMC is a development of techniques for controlling a small network of roads that now allows very large areas to be managed as a whole.

Case study: Average speed cameras on the A14
A speed enforcement camera system measures average speeds of vehicles over a road section to enforce the posted speed limit. An entry camera logs vehicle number plates as cars enter a controlled zone and starts a timer. When the same car leaves the zone the exit camera records the number plate again. If there is a match with the entry camera the average speed is calculated and if over the speed limit the evidence is passed on to the police.

Thanks to average speed cameras, the overall rate of collisions on the A14 between Cambridge and Huntingdon has dropped by 21% in 2007-2008 compared with the previous year[16]. Average speed enforcement systems also yield proven benefits in the form of reduced emissions.

Financial Benefits
The scheme cost £2.8m to implement and its first year of operation saw gains of £2.18m derived from the reduction in costs associated with accidents. Over the first five years, total gains expected from the reduction in accidents totals £9.648m at a cost to implement of £4.6m over the same period, maintenance costs for the scheme beyond the first year total £0.45m showing the diminishing costs of the scheme beyond year 1[17].

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Road safety

The European Commission estimated that intelligent technology in cars and trucks deployed across the EU could help prevent more than 5,000 deaths in road accidents each year and therefore save billions of pounds to the economy. A number of technologies have been implemented to assist the driver in difficult situations.

- Devices can automatically detect if vehicles are overweight, have poor tyre pressure, poor tyre tread depth and hot or cold brakes. Those technologies can help to reduce breakdowns, accidents and subsequent congestion caused by HGVs on major roads.
- Automatic lane departure detection, blind spot detection and safe headway detection all help the driver to stay within lanes and change lanes safely.
- Automatic driver behaviour devices for detecting tiredness and warning the driver to pull over and take a break by monitoring the driver's eye movement and blink rates.

Environmental impacts and health impacts

A number of technologies can help ease congestion in urban areas thus giving a direct impact on air quality and emissions from transport. Adaptive traffic signal control continuously adjusts the timing of traffic signals based on the changing arrival patterns of vehicles at intersections. Implementation of this technology has resulted in a decrease in traffic delays by 20% and a reduction in vehicle emissions of 5%[18].

Fleet management can also provide significant environmental benefits. Fleet managers regularly use satellite navigation services to monitor where their lorries are in order to avoid congestion or to plan routes to deliver stock to shops in response to changes in customers' demands. With fuel costs typically accounting for 25–30% of the total operating costs of a fleet, managing fuel makes sound commercial sense. Since fuel use depends on factors such as vehicle type, driving style and mileage, changes in fleet management can reduce cost by as much as 10% and deliver time savings.

Implementation

Many Local Authorities have only small technical support teams for transport and so are not well placed to take maximum benefit from some of the solutions described. One way to harness the potential that the implementation of new technologies can offer, and at the same time cut the cost of procuring and implementing new technologies, would be much greater use of local authority consortia. Collaboration can harness the economic, health and environmental benefits of their transport network.

Local Authorities are buying too many dedicated single-function stand alone products. A more powerful approach, which would fit well with the "Osborne Tests", would be to handle transport project selection in a new way, deploying systems that, while specialised, are built to open standards. These can then sit on common platforms that can be integrated, representing a major move towards a more combined transport management environment.

A world of connectivity means that sharing information could enable everyone to gain better quality, reduced emissions, reduced congestion, cheaper and more consistent public transport. For example, a bus information service for the city centre of a local authority could link to the traffic management network run by the Highways Agency, allowing better quality information to be provided to drivers and bus passengers who are making multimodal journeys involving both car and bus. Such links rely on common standards which minimise future cost and maximise sustainability of those systems.

Case study: London congestion charge

Vehicles that enter a defined area in central London, known as the London Congestion Charge Zone, are charged a daily rate for driving and parking vehicles on public roads between 7 am and 6 pm Monday to Friday. To enforce the scheme, Transport for London operates 340 cameras across London which monitor the zone exit and entry points[19].

Since the congestion charge scheme was introduced traffic entering the original zone remains 21% lower than pre-charge levels and a 6% increase in bus passengers during charging hours was recorded[20].

Conclusion

As this paper shows, more can be done at less cost with the UK road network, to achieve transport policy objectives such as reducing congestion, road traffic accidents and emissions.

The targeted application of technology can provide effective improvements in shorter timescales to transport networks, whilst helping to boost the economy and support policy objectives. New methods of procurement need to be implemented so that new technology not only performs its function but also offers further benefits from integration with existing systems. This will secure real community wide benefits at less cost.

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