

# **URBAN CONGESTION AND EMISSION BASED CHARGING – AN OVERVIEW OF DEVELOPMENTS IN THE UK**

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## **ABSTRACT**

Concerns about the predicted rise in congestion in the UK and the increasing contribution of road transport to greenhouse gas emissions are stimulating the debate within the UK as to the most appropriate measures to reduce both levels of congestion and vehicle based emissions. The issues are most acute in urban centres, 2 congestion charging schemes have already been introduced and the Department for Transport is providing TIF pump priming to 10 Urban authorities to investigate the potential introduction of demand management schemes. This paper provides an overview of the current initiatives in the UK to tackle the issue and provides a summary of the development and implementation of congestion and emissions based charging schemes in the UK.

## **INTRODUCTION**

The UK is a nation of 60 million people with more than 30 million cars on the road and as a result suffers from chronic congestion especially in city centres and congestion hotspots on the inter-urban network. Traffic forecasts predict that by 2015 congestion could rise by 25% if nothing is done to reduce car usage. By then, 13% of traffic will be subject to stop-start travel conditions.

Transport demand in the UK is predominantly local and is concentrated within urban areas and their surrounding catchment areas. The majority of journeys are local – 69% of business journeys and 84% of commuter journeys are shorter than 15 miles. Of the 30 million commuters, 55% of their journeys are destined for large urban areas; over 31% of freight vehicle kilometres are in urban areas. Perhaps surprisingly, over 52% of business journeys start or end in the 22 largest urban areas. In most urban areas, all three types of users (freight, commuter and business) compete for the same pieces of infrastructure.

The Transport Act 2000 gave powers to local traffic authorities to introduce congestion charging scheme, the revenues generated in the first 10 years can be

used to fund local public transport improvements. To date only 2 congestion charging schemes have been introduced in the UK, the first in Durham in October 2002 and the second in London in February 2003.

Emissions from the transport sector are a significant and growing contributor (around a quarter in 2004) to the UK's overall greenhouse gas emissions, although the growth in emissions is forecast to plateau in 2010. Those emissions impact on long-term economic growth by contributing to global climate change, transport will therefore need to play an important role in an economy-wide response to that challenge.

Urban transport networks are particularly complex systems, with a high degree of interaction between policies and modes. In order to identify the best policies, decision makers need therefore to understand all the characteristics of the local economy, and an area's physical environment and urban geography.

New EC directive for air pollution (PM<sub>10</sub>) forces European Cities to take measures to reduce the traffic. This results in an increased interest for Congestion Charging systems.

## **EMERGING REQUIREMENTS FOR URBAN SCHEMES**

Electronic fee collection (EFC) systems that use dedicated short range communication (DSRC) have been implemented traditionally on inter-urban highways (motorways and expressways) in Europe and beyond, and at some tolled crossings in the UK and abroad.

However, urban areas are very different and can be highly constraining on the design of systems, for example, in terms of the existing built environment. These constraints may affect the specification and implementation of DSRC EFC systems in these areas by presenting challenges to the design assumptions existing products.

The key differences between urban and inter-urban contexts for EFC:-

- Complex Traffic – complex patterns of movement and behaviour
- Diversity of Road Users – wide range of powered and un-powered vehicles, pedestrians and static objects
- Highly variable topology – wide range of site characteristics
- Aesthetics – physical appearance of the roadside installations is important
- Challenging Installation – constraints placed on the location of equipment due to existing infrastructures
- Interference – presence of structures and radio sources that make the Electromagnetic environment more varied and complex.
- Wider policy context - management of urban road networks takes place within a broader social and transport policy context

The Department for Transport (DfT) and Transport for London (TfL) conducted a joint consultation exercise with the European DSRC supply industry to refine a draft set of initial urban requirements for schemes in the UK

In October 2006 DfT published the DSRC Charging Application Specification for the UK and the accompanying conformity assessment specification.

## **DURHAM**

Durham was the first city to introduce a congestion charging scheme under the provisions of the Transport Act 2000 in October 2002.

The scheme controls access to the World Heritage site on Durham's peninsula which is accessed by a single road subject to a charge of £2. The road gains access to the Market Place, Cathedral, and castle. It serves access to the Cathedral Chorister School and some Durham University colleges.

The charge is payable on exit from the area between 10.00am and 4.00pm Monday to Saturday, entrance and exit from the area is free at all other times. Exit during the restricted period is controlled with an automatic bollard, which is linked to payment and permit detection apparatus. Permanent vehicle mounted detection apparatus has been issued to a limited number of essential regular users such as Public Transport vehicles and residents.

The scheme had the following impacts in the nine months following its introduction [1]:-

- 85% reduction in vehicular traffic
- 10% increase in pedestrian activity
- 48% reduction in the number of delivery vehicles entering Saddler Street between 9.00 am and 5.15pm.
- Steady increases in use of Cathedral Bus
- 10% increase (to 78%) in number of people who consider Durham City Centre to be a safe place to visit.
- 21% increase (to 70%) in number of people who believe the Road User Charge is a good idea.

## **LONDON**

### **Central London Congestion Charging**

The Mayor of London introduced the Greater London (Central Zone) Congestion Charging Scheme in February 2003.

The Congestion Charging zone operates in the centre of London across eight square miles. The charging zone is bounded by the 'Inner Ring Road' linking Euston Road, Pentonville Road, Tower Bridge, Elephant & Castle, Vauxhall Bridge Road, Park Lane and Marylebone Road. The 'Inner Ring Road' provides a route around the charging zone and charges apply only to vehicles travelling inside it – not those travelling on it.

The Congestion Charge is an £8 daily charge for driving or parking a vehicle on public roads within the Congestion Charging zone between 7.00am and 6.30pm, Monday to Friday, excluding weekends and public holidays, and the Christmas

period. Payment of the charge allows you to drive around, leave and re-enter the charging zone as many times as required in one day.

The scheme has had the following impacts [2]:-

- Traffic circulating within the charging zone in the first year of operation reduced by 15% and the traffic entering the charging zone during charging hours was reduced by 18%.
- Traffic patterns in the subsequent years have remain broadly similar
- Delay values in the congestion zone have been reduced from 2.6 min/km in 2002 to 1.8 min/km
- The combined effect of charging and improved vehicle technology is that in 2005 NOx emissions within the charging zone are 13% less than 2002 and total PM10 emissions 15%
- Net revenues from the scheme since its commencement are greater than £390M

### Western Extension

On the 19<sup>th</sup> February 2007, the Congestion Charging zone extended to the west to cover the areas of Bayswater, Notting Hill, North and South Kensington, High Street Kensington, Knightsbridge, Chelsea, Belgravia and Pimlico.



**Figure 1 Extended London Congestion Charging Zone**

The expanded congestion charging areas operate as a single zone with a charge free route between the 2 areas. Charging hours within the zone have been shortened by 30 minutes from 7.00am – 6.30pm to 7.00am – 6.00pm.

### Low Emission Zone

On 13<sup>th</sup> November 2006 TfL launched a consultation on the proposed Low Emission Zone.

The objectives of the proposed Low Emission Zone are two-fold:

- To move London closer to achieving national and EU air quality objectives for 2010
- To improve the health and quality of life of people who live and work in London, through improving air quality

It has been indicated that from as early as February 2008, diesel engine lorries, coaches and buses that fail to meet a minimum pollution standard would have to pay a charge if they drive within Greater London. Such a charge would be designed to act as an effective incentive for operators to modify or replace dirty vehicles. It is also proposed that by 2010 the scheme would be extended to heavier diesel engine light goods vehicles and minibuses. From 2012 the emissions standard for Heavy Goods Vehicles, buses and coaches would be tightened to Euro IV standards for particulate matter.

### **Emissions based charging**

On 14<sup>th</sup> November 2006 the Mayor announced plans to consult on introducing emissions-based charging to the existing congestion charge scheme. Under the proposals vehicles which produce less than 120g or CO<sub>2</sub> per km would be exempt from the charge but the most heavily polluting vehicles which emit more than 225g CO<sub>2</sub> per km would be subject to a daily charge of £25. These new proposals will tackle pollution from private vehicles, and ensure that London is leading the way in the fight against catastrophic climate change.

In addition to the increased charge the current 90% discount for those living in the zone would be withdrawn for those vehicles which qualify for the £25 rate.

### **TRANSPORT INNOVATION FUND**

In July 2005, £18 million was made available to support preliminary scheme development by transport authorities between 2005-06 and 2007-08. The Transport Innovation Fund (TIF) 'pump priming' funding will be made available for three years, to support planning for local demand management schemes where pricing is a major element.

The schemes could then be funded from the main TIF, up to £200 million a year is ultimately available to support such local pilots. Local authorities that supply a business case for a congestion management pilot before July 2007, will receive a decision from the Department for Transport (DfT) before the end of the year. The TIF makes £290 million available in 2008-09 and is set to increase over time reaching some £2.5 billion by 2014-15.

The fund offers substantial, long term investment and will support smarter and better management of the capacity that already exists. The Government is committed to working closely with the successful authorities to deliver the work programmes set out in their pump priming bids, to support future decisions both on the main TIF fund and on road pricing more broadly.

In the first round of pump-priming 7 authorities were awarded funding and in November 2006 a further £7.5 Million was awarded to 6 of the original plus 3 new authorities areas to help develop innovative plans to tackle local congestion and inform the debate on a national road pricing scheme.

This brings the total to 10 areas in the UK that are giving serious consideration to local congestion pricing schemes.

| <b>Local Authority</b>                          | <b>TIF Pump-priming round 1</b> | <b>TIF Pump-priming round 2</b> |
|---|---------------------------------|---------------------------------|
| West Midlands                                   | £2,600,000                      | £600,000                        |
| Greater Manchester                              | £1,250,000                      | £1,950,000                      |
| Tyne and Wear                                   | £950,000                        | £750,000                        |
| Cambridgeshire (for Cambridge)                  | £385,000                        | £1,055,000                      |
| Shropshire County Council (for Shrewsbury)      | £480,000                        | £377,800                        |
| Bristol   | £1,495,000                      | -                               |
| Durham County Council (for Durham)              | £300,000                        | £50,000                         |
| East Midlands (Nottingham, Derby and Leicester) | -                               | £1,800,000                      |
| Reading   | -                               | £680,000                        |
| Norfolk (for Norwich)                           | -                               | £250,000                        |
| <b>Total</b>                                    | <b>£7,460,000</b>               | <b>£7,512,800</b>               |

**Table 1 TIF Pump Priming Funding**

The table below provides a summary of the TIF pump priming activities identified by the Local Authority in the bid and the types of RUC scheme options that are being considered.

| <b>Local Authority</b> | <b>Main TIF pump-priming activities</b>   | <b>Identified potential RUC scheme options</b>                               |
|------------------------|---|--|
| West Midlands          | Investigations in flexible RUC<br>In-depth feasibility study + public survey<br>Stakeholder involvement<br>Measurement of travel time variability | GNSS based “black box” for flexible RUC<br>Maybe participation in TDP trials |

|   |   |   |
|---|---|---|
| Greater Manchester                              | <p>Investigations in a demand management “toolkit”</p> <p>Finding the “tipping point” for road users by looking at the influence of cost savings on car usage</p> <p>Forecasting model for multi-modal traffic</p> <p>Investigations in a workplace parking package or supplementary business rate package</p> <p>Stakeholder management</p> <p>Preparation for a main TIF business case submission</p> | <p>GNSS based TDP system, Norwich Unions PAYD and Trafficmaster services for trials and usage research</p>  |
| Tyne and Wear                                   | <p>Investigations into distance based charging options</p> <p>Stakeholder involvement</p> <p>Investigations into the impacts of parking charges and workplace parking levy</p> <p>Preparation of a full TIF submission</p>  | <p>Distance based charging model, possible in combination with an outer cordon</p>  |
| Cambridgeshire (for Cambridge)                  | <p>Investigations in the feasibility of congestion charging zones for Cambridge</p> <p>Work on stakeholder management, technical studies and preparation of decisions for a main TIF application</p>  | <p>Zone based charging with a potential outer ring (cordon) similar to the existing central zone (which uses rising bollards)</p>   |
| Shropshire County Council (for Shrewsbury)      | <p>Investigations in existing congestion problem and modeling of future projections</p> <p>Feasibility studies leading to a technology selection in 2 phases</p> <p>Preparation of full TIF application</p>   | <p>Point / route or area based charging options, potentially 3 entry/exit points to central city area</p> <p>Potential use of ANPR and optionally tag and beacon technology as add-on</p> |
| Bristol   | <p>Scheme definition and design by 2008</p>   | <p>Appraisal on all possible charging methods</p>   |
| Durham County Council (for Durham)              | <p>Preparation of a full TIF business case until October 2007</p> <p>Household surveys</p> <p>Investigations in the effects of a point / cordon based charge</p>  | <p>Extension of existing “congestion charging” zone, point charge on through route (A690)</p> <p>Cordon based charge in combination with park and ride scheme</p>                         |
| East Midlands (Nottingham, Derby and Leicester) | <p>Identify congestion areas with GNSS and modeling work</p> <p>Stakeholder management</p> <p>Prepare final TIF business case submission until 2007/2008</p>  | <p>Collection of congestion data using GNSS technology</p> <p>TDP based charge</p>  |

|                       |  |  |
|-----------------------|--|--|
| Reading               | Transport modeling<br>Stakeholder involvement<br>Investigations into the “tipping point” for the implementation of demand management<br>Research into technical issues<br>Preparation of a TIF business case | Area/cordon/corridor based scheme<br>Usage of WiMAX and UTMC technology for in-vehicle information   |
| Norfolk (for Norwich) | Investigations in a GNSS based mileage approach to charging, feasibility studies<br>Investigations into smart card payment methods<br>GPS based trials in 2007<br>Stakeholder involvement                    | Cordon based “clear zone” with inner and outer ring road as boundaries<br>“park and ride credits”<br>Investigations into GNSS technology options |

**Table 2 TIF Pump Priming Activities**

## SUMMARY

The use of relatively simple point based charging in Durham and area based charging in London have been successful in reducing the number of vehicles and levels of congestion in the respective congestion charging zones which cover a relatively small geographic area.

However, as urban areas are very different, these approaches may not be suitable for tackling congestion in all urban areas or for larger geographic areas.

A number of the authorities involved in the TIF activities are considering other more sophisticated options including:-

- Cordon based charging
- Corridor based charging
- Distance based charging
- Combinations of time, distance and place charging (TDP)

As demonstrated by the current activities of the TIF authorities and the extensive public consultations by TfL it is important to achieve stakeholder buy-in and public support for any proposed scheme.

Congestion charging is a tool to influence travel behaviour, and in order to achieve the maximum benefits it should not be considered in isolation. Users need to have viable alternative transport modes to enable modal shift.

## REFERENCES

[1] Saddler Street Road User Charge Monitoring Report, available at <http://www.durham.gov.uk/durhamcc/usp.nsf/pws/Roads+-+Saddler+Street+Road+User+Charge+Monitoring+Report>

[2] Impacts Monitoring - Fourth Annual Report June 2006, available at <http://www.tfl.gov.uk/assets/downloads/FourthAnnualReportFinal.pdf>