Energy Efficient Cities Initiative

GOOD PRACTICES IN CITY ENERGY EFFICIENCY

London, United Kingdom – Congestion Charges for Urban Transport

Project title	London Congestion Charges for Urban Transport
Sector	Urban Transport
Type of project	Congestion Charges
City and country	London, United Kingdom
City population	8.59 million (in 2008)
Capital Cost	US$242.8 million (Phase 1, 2002/3) US$189.5 million (Phase 2, 2006/7)[1]
Annual % of energy reduction	3% (44-48 million liters annually)
Project status	Ongoing; Phase 1 completed 2003, Phase 2 completed 2007

Project Summary

In February 2003, London, the capital city of the United Kingdom (U.K.), introduced a daily congestion fee for vehicles travelling in the city's central district during weekdays. This fee was meant to ease traffic congestion, improve travel time and reliability, and make central London more attractive to businesses and visitors.

According to analysis by the City, the program has largely met its objectives. After four years of operation, traffic entering the charge zone was reduced by 21 percent; congestion, measured as a travel rate (minutes per kilometer), was 8 percent lower; and annual fuel consumption fell by approximately 44-48 million liters or about 3 percent. These changes translated into 110,000-120,000 tons of carbon dioxide (CO_2) reductions annually, a 112 ton reduction in nitrogen oxides (NO_x), an eight-ton reduction in particulate matter (PM_{10}), and some 250 fewer accidents. In terms of the program cost-effectiveness, the identified benefits exceeded the costs by more than 50 percent. In addition, the scheme brought a steady net revenue stream for transport improvements, of which 80 percent has been reinvested in improving public bus operations and infrastructure.

Among the first programs of its kind, London's congestion charging scheme was successfully developed and implemented. The city proved to be innovative and resourceful by ensuring key elements of the scheme were in place including technical design, public consultation, project management, information campaign and impact monitoring. London's innovation has helped other cities around the world assess this as a policy option in meeting their urban transport needs.

1. Introduction

London is a leading global city by any measure, with strengths in the arts, commerce, education, entertainment, finance, healthcare, media, professional services, and research and development. As one of the largest metropolitan areas in Europe, London had a population of 8.59 million and an area of 1,572.1 square kilometers in 2008, with a gross domestic product (GDP) estimated at US$565 billion.[2]

[1] According to a Bow Group report, the capital costs incurred amounted to £162 million in 2002/3 and £103 million in 2006/7. The exchange rate of 0.667 (£ per US$) was applied to the costs in 2002/3 and 0.543 in 2006/7.
[2] Hawksworth, Hoehn and Tiwari, 2009.

Central London has an extensive public transportation system, with a large number of commuters traveling in and out of the city during the week. On a typical weekday, almost 1.1 million people enter central London between 7:00 a.m. and 10:00 a.m., but only 12 percent of people travel by car and over 80 percent use the Underground (or Tube), rail, and/or bus.[3] Despite this extensive public transport system and high transit ridership, London has long suffered from chronic congestion and low vehicle speeds. All-day network speeds have gradually declined from 17 kilometers per hour (km/hr) in 1986 to 14 km/hr in 2002[4]. Surveys of attitudes toward transport in London in the late 1990s revealed "public and business concerns over transport, in particular road traffic congestion, public transport and air quality."[5]

Over the years, studies have been conducted to investigate the potential of using road pricing for congestion management purposes. The first idea of modern road use charging was developed in the Smeed Report of 1964, prepared on behalf of the then U.K. Ministry of Transport. It quantified the externalities incurred by road users on others. In the early 1990s, the U.K. Government carried out the London Congestion Charging Research Program, which explored several charging schemes and looked at alternate aspects of operation. The research concluded that a congestion charge could be feasible in downtown London to reduce traffic congestion during peak times, but that there would be substantial technological and political risks from such a scheme.[6]

Over time, as congestion on the London road network grew worse, the idea of a congestion charging scheme gained support, with the caveat that such revenues would be reinvested in the city's public transportation system. In 1999, London's political system established a directly-elected Mayor of London, with the power to manage the city's transport system and raise taxes to fund transport improvements. Soon thereafter, a working group of technical experts, known as ROCOL (Road Charging Options for London) was established to examine a range of options for a road use charging scheme in London. The group published a 2000 report which concluded that an area charging scheme for central London, with a daily charge of UK£5 for cars and UK£15 for heavy commercial vehicles, could reduce traffic in central London by around 12 percent.[7] The report was the basis for the central London congestion charging scheme of today.

2. Project Description

Public consultations. In May 2000, Ken Livingstone was elected Mayor of London. He proceeded with consultations on the congestion charging scheme based on the ROCOL proposal. The initial Mayoral consultation was advanced in the discussion document "Hearing London's Views" published in July 2000. It aimed at getting feedback from key stakeholders—such as local councils, businesses, and road user representatives—on the boundary of the charge zone, level and structure of charges, hours of operation, exemptions and discounts, penalty charges, and possible uses of net revenues. More than 85 percent of stakeholders who responded showed support for the idea of a central London congestion charge.[8] The Mayor made a number of modifications to the original ROCOL proposal based

[3] TfL, June 2003.
[4] TfL, June 2003.
[5] Review of Charging Options for London (ROCOL) Working Group, 2000.
[6] TfL, July 2007.
[7] TfL, July 2007; Dix, 2002.
[8] Santos, 2008.

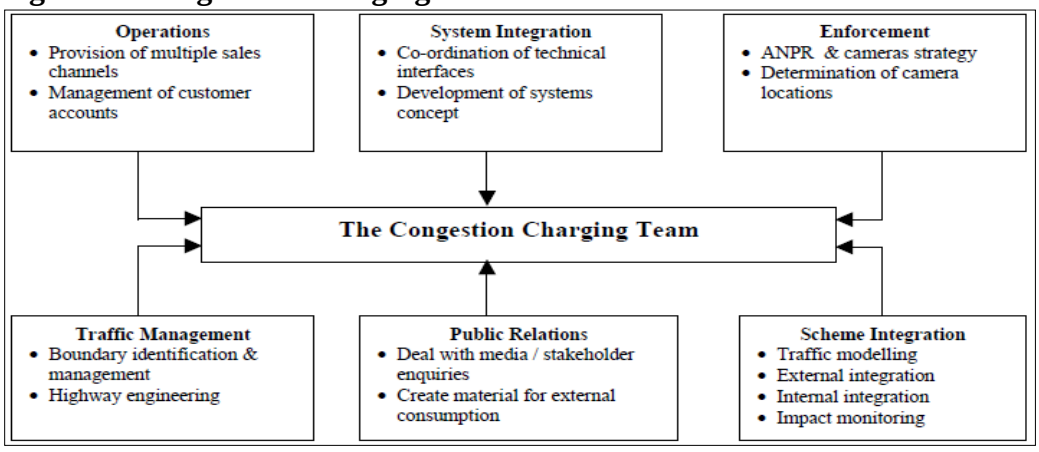
on responses received. These modifications include a reduction in the originally proposed £15 charge for heavier goods vehicles to £5 and a 90 percent discount for residents in the congestion charge zone.[9]

Transport for London (TfL), London's integrated transport authority, was charged with developing and implementing the scheme. In 2001, TfL published "The Greater London (Central Zone) Congestion Charging Order 2001," which specified the details of how, where and when the congestion charging scheme would operate. The Order was presented for public consultation from July until September 2001. Responses received generally reflected how the proposed charge would affect the various groups represented. For example, residents within the congestion zone were prone to support the idea of the charge but asked for a full exemption; boundary residents were likely to ask for buffer resident discounts, and; business group representatives, among others, felt that all commercial and delivery vehicles should be entitled to an exemption. The results of public consultation, especially in the area of exemptions and discounts, resulted in a number of changes in the proposal.[10] Based on the responses, the revised Scheme Order was published in December 2001 for further consultations.

Overall, gaining public acceptance for the congestion charge, which was considered by many as another "tax," was a challenge. Ever since the plan was first conceived, it was criticized by some politicians and various interest groups, including motorist groups and some labor organizations. Many of the daily newspapers in London were skeptical or opposed to the program. Concerns over the scheme include practical administrative issues, insufficient capacity of public transport, and the potential negative impacts on businesses within central London. However, through this public consultation process a number of adjustments to the scheme were made relating to the amount of the charges, operating times, and zone limits which helped to alleviate some of the initial opposition.

Implementing the Scheme. In February 2003, TfL developed a strategic plan and appointed a dedicated team (Figure 1), along with two Assistant Directors who managed the scheme and participated in all key policy and procurement decisions. The team consisted of six sections —operations, system integration, enforcement, traffic management, public relations, and scheme integration, and includes general procurement capability.

Figure 1. Congestion Charging Team



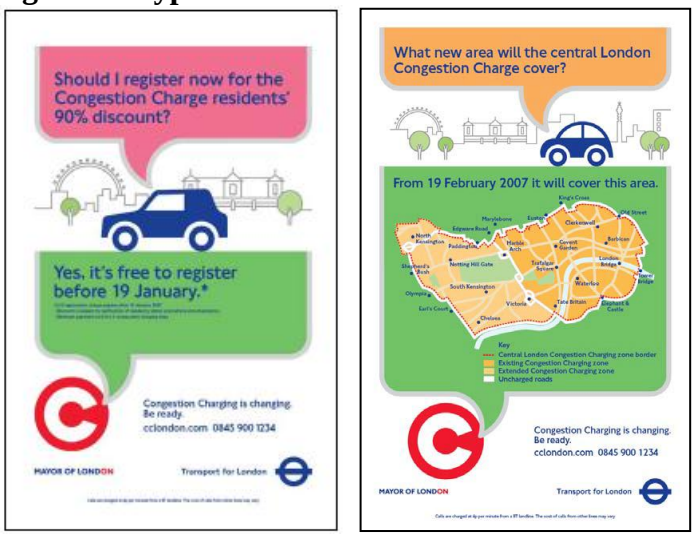
Source: Dix, 2002.

[9] TfL, July 2007.
[10] Santos, 2008 .

TfL started the procurement for key services with advertisements in the Official Journal of the European Union (OJEU). A Technical Design Study for the Core Services contract was conducted in Fall 2001. In December 2001, TfL awarded the contract to Capita Business Services.[11] Further procurements for infrastructure such as camera equipment and telecommunications proceeded in parallel, with the resulting contracts also being awarded to Capita Business Services to create a single, consolidated supplier for the key operational elements of the scheme. Separate contracts were secured for enforcement and other services.[12]

Information Campaign. In Fall 2002, an extensive public information campaign was launched to inform Londoners and others about the nature and details of the scheme. The information was communicated through multiple outlets (e.g., TV, press, posters, radio, online activity, ambient media and leaflet delivery). Key messages about the scheme were delivered in simple and easy-to-understand messages (Figure 2), at various phases before and immediately following the scheme launch. This method of communication provided a phased briefing of the scheme to citizens and allowed them time to digest the information and take appropriate actions.[13] Two weeks prior to implementation, awareness of the scheme was at saturation levels—at 97 percent of Londoners—indicating a successful campaign.[14]

Figure 2. Typical Print Media and Poster Advertisements



Source: TfL, 2008.

Scheme Adjustments. The central London congestion charging scheme was introduced on schedule in February 2003, with no major operational, traffic or technology difficulties. The basic charge was £5 daily for driving a vehicle within the congestion charge zone between 07:00 and 18:30 during weekdays. Payment of the daily charge allows drivers to make an unlimited number of trips to, from, and within the charge zone. Certain categories of

[11] Since 2009, IBM took over the day-to-day operation of the charging system from Capita Group, while Siemens Traffic Solutions provides and operates the physical enforcement infrastructure.
[12] TfL, July 2007.
[13] TfL, July 2007.
[14] TfL, July 2007.

vehicles are exempted from the charge.[15] Any change to the original scheme is subject to consultation and the Mayor's confirmation.[16]

Since February 2003, a number of variations have been made to the original scheme. Major modifications, including the extension and removal of the West Extension, are summarized in Table 1. The West Extension of the original zone was introduced in February 2007. In 2008, TfL carried out an informal consultation and commissioned two public surveys to gauge attitudes from the general public, businesses and stakeholders in the West Extension. Results showed strong negative feedback for the extension.[17] Subsequently, Mayor Boris Johnson removed the West Extension from the scheme. In addition, TfL streamlined aspects of the scheme operations, including improvements to the processing of registration, discounts, payment and enforcement.

Table 1. Major Modifications of the Original Congestion Charging Scheme

Date	Description
February 2003	The original scheme requires a basic daily charge of £5 daily for driving a vehicle within the charge zone between 07:00 and 18:30 during weekdays.
July 2005	The basic daily charge was increased to £8, with a discount for monthly and annual payments, and for vehicles registered on the TfL "fleet scheme."[18]
June 2006	The Pay Next Day facility was introduced, allowing drivers to pay up to midnight on the next charging day at an increased charge of £10.
February 2007	The Western Extension of the original charge zone was implemented. The charging hours have been reduced to between 07:00 to 18:00.
January 2011	Major changes included the removal of the Western Extension, a charge increase from £8 to £10, and the introduction of an automated payment system.

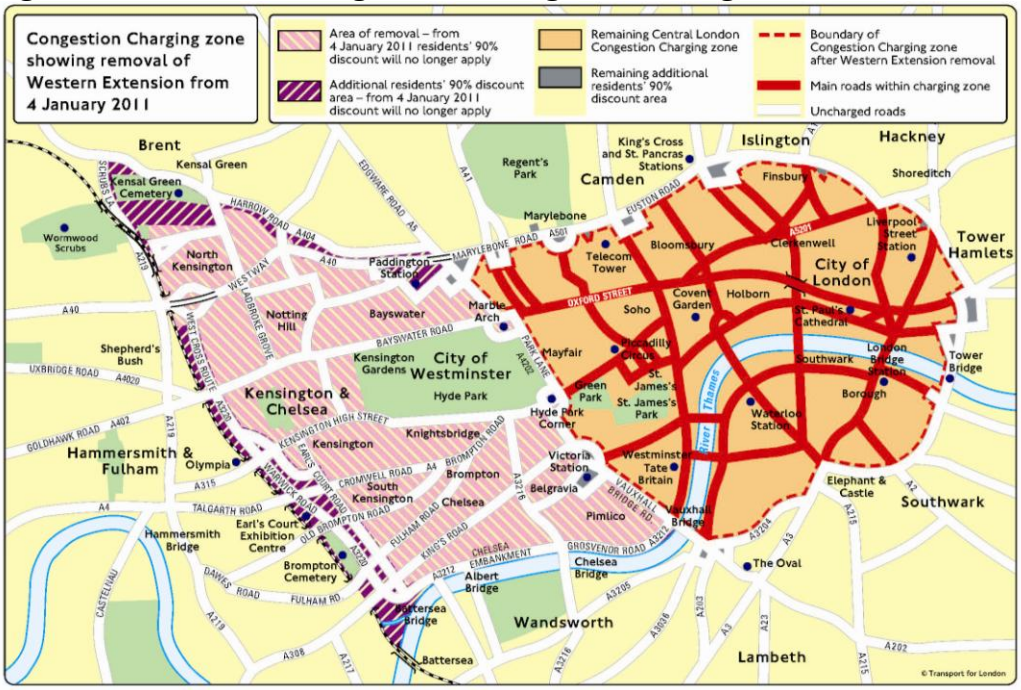
Source: Compiled from TfL annual reports and TfL website.

Current Scheme. Currently, a daily congestion fee of £10 is required for each vehicle travelling within the congestion charge zone between 07:00 and 18:00 (Monday-Friday only). Other vehicles and their users can register for discounts, with an annual registration fee of £10. For example, residents of the zone are eligible for a 90 percent discount[19]; disabled persons' Blue Badge holders are eligible for a 100 percent discount; certain low-emission vehicles[20], vehicles over a certain size, electric vehicles and plug-in hybrid electric vehicles are eligible for an exemption.

The area of the central congestion charge zone covers about 22 square kilometers in the heart of London and includes centers of government, law, business, finance and entertainment. The Inner Ring Road forms the boundary of the zone, and no charge applies to vehicles using this road. At the time of inception there were about 136,000 residents living within the zone, although the zone is mostly a commercial area. Figure 3 shows the areas of the central congestion charge zone as well as the removed West Extension.

[15] These exempted vehicles include buses, minibuses (with nine or more seats), London-registered minicabs and taxis, ambulances, fire engines and police vehicles, motorbikes, mopeds, bicycles and certain vehicles used by disabled persons.
[16] TfL, July 2007.
[17] TfL, 2008.
[18] Companies that manage a fleet of 10 or more vehicles are eligible to register for the fleet scheme discount.
[19] Some residents living just outside the charging zone may also be eligible for the Residents 90% discount because they live so close that their day-to-day travel will be affected.
[20] A "Greener Vehicle Discount" of 100% is eligible for cars that emit 100 g/km of CO_2 or less and that meet the Euro V standard for air quality.

Figure 3. Areas and Changes to the Congestion Charge Zone



Source: TfL website (http://www.tfl.gov.uk/assets/downloads/cc-zone-showing-removal-4Jan2011-map.pdf)

All access points into the congestion charge zone are well-marked so that drivers know when they are entering it (Figure 4). There are no barriers or tollbooths. Instead, the scheme is enforced using a network of Automatic Number Plate Recognition Cameras (ANPR) within the zone. The ANPR cameras record vehicles entering and exiting the zone. Number plates are identified and delivered to the billing system via a network, and are checked against the list of paid users by a computer. In cases when a number plate has not been recognized as a paid user, they are checked manually. Those vehicles that have not paid and are identified by the ANPR cameras are fined.

Figure 4. Signs in the Congestion Charge Zone

Source: TfL, 2008.

The daily charge can be paid before or on the day of travel, online, by telephone, text message, at selected shops, petrol stations, by post or through registered auto payment. Drivers have until midnight on the day of travel to pay the £10 charge or £12 if they pay the next day after travelling in the zone. Users can register for the automated payment service "Congestion Charging Auto Pay," which records the number of days a vehicle travels within

the charge zone each month and bills the account holder's payment card at a reduced daily charge of £9. A penalty between £60 and £180 is levied for non-payment.

3. Costs, financing, benefits and results

Revenues and Costs. Table 2 shows the revenues and costs of the congestion charge program from TfL's financial year 2002/3 to 2009/10. In total, the scheme's operating costs represent about 60 percent of its operating revenue, resulting in a positive net operating revenue stream for TfL. According to a report from the Bow Group, capital costs incurred during 2002/3 and 2006/7 amounted to £162 million and £103 million, respectively. Including all the upfront capital investment costs[21], the net revenues from the scheme are lower, but the program still maintains a simple payback period of three years. Critics consider the scheme highly costly, as the operating costs and capital outlay represent a significant percentage of the operating revenue.

Table 2. Revenues and Costs of the Congestion Charging Scheme (unit: £million)

	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	Total
- Total revenue	18.5	186.7	218.1	254.1	252.4	328.2	325.7	312.6	1,896.3
- Total operating costs	76.8	141.4	121.7	147.8	163.3	191.2	177.2	154.5	1,173.9
Net operating revenue	**-58.3**	**45.3**	**96.4**	**106.3**	**89.1**	**137**	**148.5**	**158.1**	**722.4**
Capital costs	**162.0**				**103.0**				**265.0**

Note: Capital costs are extracted from the Bow Group report and all other figures are compiled from the audited TfL annual reports from 2002 to 2010.

By law, all net revenues earned from the congestion charging have to be reinvested in improving public transportation in London. According to TfL, about 80 percent of the annual net operating revenues were reinvested in bus network improvements, with the rest spent on other transport measures such as road safety, roads and bridges, walking and cycling programs (Table 3).

Table 3. Application of Net Operating Revenue

	2004/5	2005/6	2006/7	2007/8
Bus network improvements	80%	82%	82%	82%
Roads and bridges		11%	11%	9%
Road safety	11%	3%	4%	3%
Walking and cycling	6%	3%	2%	3%
Others	3%			3%

Source: Compiled from TfL annual monitoring reports for the congestion charging from 2005 to 2008.

Impact Assessment. From 2003 to 2008, TfL published six annual monitoring reports detailing the impacts of the congestion on traffic, transport, economy, society and environment. After four years of operation, TfL found that traffic entering the charge zone (vehicles with four or more wheels) was 21 percent lower than in 2002; congestion, measured as a travel rate (minutes per kilometer), was 8 percent lower; and annual fuel consumption fell by 44-48 million liters or about 3 percent. These savings translated into 110,000-120,000 tons of CO_2 reduction per year, a 112 ton reduction in nitrogen oxides (NO_x), and an eight ton

[21] TfL's annual monitoring reports for the congestion charge do not include capital costs, as capital expenditure for the original scheme and the western extension were sourced from TfL's General Fund.

reduction in particulate matter (PM_{10}). It was estimated that the scheme avoided over 250 personal injury accidents, and did not adversely affect the central London business and economy.[22] In June 2007, TfL released a monetized quantification of these impacts. This evaluation brought together various previous estimates by TfL and others.

Overall the analysis reveals a benefit-cost ratio of 1.5:1 with the £5 charge and 1.7:1 with the £8 charge. With the £5 charge, the scheme generates net annual benefits of £216 million and costs of £140 million. With the £8 charge, the scheme generates slightly higher net annual benefits of £245 million and costs of £146 million. Under both scenarios, the principle benefits accrue from improved travel time and reliability, and the principle cost is the scheme's operating costs.

Table 4 summarizes the quantified impacts of the scheme for a typical year's operation with £5 charge and £8 charge.

Table 4. Quantified Program Costs/Benefits (*£ million per year, 2005 prices*)

	£5 charge	£8 charge
Benefits	**216**	**245**
Improved travel time and reliability		
Car, van and goods vehicle users	223	260
Bus passengers	43	43
Disbenefits to deterred trips	-20	-31
Society Impacts		
Accidents	14	14
CO_2	2	2
NO_x and PM_{10}	1	1
Charge payer compliance costs[23]	-22	-19
Charge infrastructure costs[24]	-25	-25
Costs	**-140**	**-146**
Scheme operating costs	-109	-109
Reduced vehicle operating Costs - fuel	15	16
Reduced vehicle operating costs - non fuel	11	12
Business-private sector providers: additional bus services, car park operators		
Bus revenues	19	19
Bus operating costs	-18	-18
Net private parking revenues	-10	-10
Other financial impacts to government		
Fuel duty	-25	-27
Value-added tax	-13	-14
Parking revenues	-10	-15
Benefit-cost ratio	**1.5**	**1.7**

Source: TfL, 2007.

[22] TfL, July 2007; Evans, 2007.

[23] Compliance cost represents the time and effort involved by charge payers in complying with the scheme, which can range from simple text messages to pay the charge to a business employing additional staff to handle the charge payments for a fleet of vehicles.

[24] Infrastructure costs are incurred for traffic management measures, communications, information campaign, systems set-up and management.

Since 2007, congestion in central London has intensified again, although the pattern of the scheme's impacts has largely remained the same. Today, congestion has risen back to pre-program levels, which has prompted some critics to declare the scheme a failure. However, TfL has argued that traffic congestion would be much worse without the charge. A major reason for the rise in congestion, according to TfL, is periodic water and gas main replacement work and traffic management measures, which have reduced road capacity.

4. Lessons Learned

Implementing a scheme of such scope and complexity was not easy. It required a combination of key factors to achieve successful implementation. First, London was well-suited for introducing a congestion charge system: average vehicle speeds were extremely low, public ridership was high, technical studies of London's traffic conditions and the congestion charging had been completed, and the city's Mayor was empowered by the political system to take decisions on such measures.

Second, the Mayor's determination to introduce such a scheme was key to its success. Mayor Ken Livingston took the political risk and acted as the scheme's champion. His leadership and engagement ensured commitment to funding and resources to deliver the scheme.

Third, the comprehensive stakeholder and public consultation process was also important in gaining acceptance of the scheme. Consultations were a consistent element throughout the process as TfL held numerous meetings with Londoners on the proposed charging program. Feedback received through these consultations led to various modifications of the scheme, demonstrating that the stakeholder responses did, in fact, influence the program. Further, the mandate to reinvest the net revenues in London's transportation system helped offset some resistance to the charge.

Fourth, the program had a very effective communications campaign. TfL communicated the scheme to a large audience through an integrated, easy-to-understand, multi-media campaign. The communication also helped counterbalance a negative editorial environment, providing timely facts to the public.

Fifth, TfL's effective project management arrangements underpinned the successful implementation of the scheme. The project planning office ensures adherence to key delivery milestones and alignment across all parties, internal to TfL as well as external. Strong budgetary management ensures that costs were contained broadly within the anticipated budget. Effective procurement and contractor management ensured satisfactory performance of contractors at competitive prices. In addition, the technologies employed were carefully selected to serve the program needs without placing an undue burden on operating costs.

5. Project Innovation

The central London congestion charging scheme was a groundbreaking transport initiative and one of the first of its kind. A traffic management scheme on such a large scale had never before been introduced. Developing the full scheme, from the fee scale to technology to enforcement, thus had to be designed without the benefit of similar schemes to use as reference. TfL has been truly innovative and resourceful in putting key elements in place such as technical design, public consultation, project management, information campaign and impact monitoring.

6. Financial Sustainability, Transferability, and Scalability

Financially, the scheme has generated net income, which it has used to reinvest in transportation improvement measures throughout the city. However, the operating costs and capital outlay, despite strong financial management, represent a significant percentage of the operating revenue.

The project is an important testament to the political feasibility of congestion charges in a major city. London's experience illustrates that a congestion charging scheme is technically feasible and it is possible to overcome political resistance and gain public acceptance. Its implementation and well-documented impacts provide a good case study from which other cities can learn.

Before London, Singapore was the first city in the world to implement an electronic road toll collection system for purposes of congestion charging. London's case boosted the interest of many other cities in such schemes, particularly those facing acute congestion with relatively good public transport alternatives in place. Many have referred to London's experience when considering their own options: Stockholm implemented a congestion charge in August 2007 after a seven-month trial in 2006.[25] The New York State Assembly considered a congestion charging scheme proposed by the city mayor, but later rejected it in 2008.[26] San Francisco is the latest American city moving forward with a congestion pricing proposal, following completion of an early feasibility study.[27] In April 2011, Beijing announced that it initiated the technical preparation for implementing a congestion charging scheme within the city.[28]

[25] San Francisco County Transportation Authority, 2010.
[26] Orla Ryan and Guardian News, 2008.
[27] San Francisco County Transportation Authority, 2010.
[28] Deng and Yan, 2011.

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ANNEX: CITY AND PROJECT PROFILE

CITY PROFILE

1. Name of the City	**London, United Kingdom**
2. Area	**1,572.1 square kilometers**
3. Population	**8.59 million (in 2008)**
4. Population Growth Rate	**3.5 % (during 2003-2008)**
5. GDP of the City	**US$565 billion (in 2008)**
6. GDP Growth Rate	**4% (in 2008 compared to 2007)**
7. GDP per Capita	**US$65,800 (in 2008)**

PROJECT PROFILE

1. Project Title	**London Congestion Charges for Urban Transport**
2. Sector	**Urban Transport**
3. Project Type	**Congestion Charges**
4. Total Project Capital Cost	**US$242.8 million (Phase 1, 2002/3) US$189.5 (Phase 2, 2006/7)**
5. Net Fuel Savings	**US$28 million (in 2005)** [29]
6. Simple Payback	**3 years**
7. Project Start Date	**February 2003**
8. Project End Date	**Ongoing**
9. % of Project Completed	**100%**

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[29] The amount in US$ is derived based on the average fuel savings under the £5 and the £8 charge (Table 4) and the exchange rate of 0.550 (£ per US$).