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PRE-RELEASE VERSION

Congestion Charging in London

Road Pricing to Reduce Emissions

04/2010-5690

This case was prepared by David Kitterick, Nicholas Obolensky and Eli Senerman, MBAs 2008, under the supervision of Ioana Popescu, Associate Professor of Decision Sciences at INSEAD. It is intended to be used as a basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

Introduction

As Boris Johnson sat in his office in City Hall, he wondered what the future held for the Congestion Charge introduced by the former Mayor of London, Ken Livingstone, his predecessor. Although it had been a great success to date, Johnson could not help wondering whether more could be done. The latest annual monitoring report published by Transport for London (TfL) had shown that CO_2 emissions had only slightly decreased in the past couple of years, despite the increased Congestion Charge.[1]

Johnson recalled a speech that he had given in March regarding his vision for TfL,[2] in which he had promised he would scrap some of the measures imposed by his predecessor, on the grounds that their impact on reducing CO_2 emissions would be negligible. But how was he going to improve air quality and congestion in the city of London, while maintaining the financial viability of the Congestion Charge?

Background on the Congestion Charge

The Congestion Charge imposes a levy (currently £8 per day) for motorists travelling inside specified zones in London (see Exhibit 1) on weekdays between 7am and 6pm. The charge is aimed at encouraging people to use other forms of transport (such as buses or subway services) rather than their vehicles in central London, thus reducing congestion and CO_2 emissions. Low carbon emission vehicles receive a discount or an exemption from the charge.

The Congestion Charge system is run using CCTV (closed-circuit television) and Automatic Number Plate Recognition (ANPR). Over 700 hundred hi-tech cameras located at entrances, exits and around the zone (see Exhibit 2) record vehicles license plates and match them to a continuously updated database of individual payers. Drivers can pay the charge online, by phone, mobile text message or post, as well as at specified retail locations.

The charge came into operation in February 2003 and initially covered a 21 square kilometer area bounded by the Inner Ring Road in central London. The congestion charge was increased from £5 to £8 in July 2005, and extended to west London in February 2007. Although not the first scheme of its kind, it is now one of the largest in the world.

Recent Developments

By July 2008, Johnson was becoming increasingly frustrated with the performance of the Congestion Charge. Since its introduction, the number of cars travelling within the charging zone had gone down.[3] In theory, this should have resulted in an increase in the cars' average speed. However, the average driving speed in the zone had actually fallen in the past few years, since the increase of the Congestion Charge. Knowing this, he wondered what, if anything, could be done to reverse this trend?

1 Transport for London, Central London Congestion Charge Impact Monitoring, Sixth Annual Report, July 2008
2 Boris Johnson, Launch of Transport Manifesto, 3 March 2008
3 Transport for London, Central London Congestion Charge Impact Monitoring, Sixth Annual Report, July 2008

Recent research by TfL had showed that there was increased demand to enter the charging zone between 7:00 and 9:00 am, and 4:00 and 6:00 pm ("peak hours"). In addition, the research revealed a difference between users' willingness to pay for peak and off-peak periods. (Exhibit 3 gives details of the survey – the full data is available in the associated file LCCdata.xls). Johnson wondered whether TfL could exploit these findings by increasing the Congestion Charge during peak hours. By introducing such a charge, those commuters with a lower willingness to pay for peak travel might not enter the charging zone during these times. (A summary of market segments by travel purpose is provided in Exhibit 4).

Average Speed of Cars and CO_2 Emissions

As he considered the implications of reduced congestion, Johnson reviewed a spreadsheet which had recently been prepared by the Department of Environment. The data provided information on the relationship between the number of cars, average driving speed and volume of CO_2 emissions, implying a negative relationship between the number of cars entering the charging zone and the average speed in km/h:[4]

$$\textit{Average Speed} = 30 - 0.0625 * \textit{(Thousand Cars)}.$$

In addition, by setting a target average speed, his environmental advisers had been able to estimate the level of emissions generated by the cars travelling within the charging zone. Average CO_2 emissions per car can be estimated using the following relationship between speed (in km/h) and CO_2 emissions (in g/km), as illustrated in Exhibit 5:[5]

$$\text{If speed} < 25 \rightarrow CO_2 \text{ Emissions} = 616.6 - 16.7 * \text{Speed}$$

$$\text{If speed} > 25 \rightarrow CO_2 \text{ Emissions} = 235.7 - 1.4 * \text{Speed}$$

The Decision

The reduction of CO_2 emissions featured high on Johnson's agenda. He now had a decision to make. He figured that exploiting the difference in commuters' willingness to pay could lead to reduced congestion within the charging zone and that such a reduction in congestion would reduce CO_2 emissions. Most importantly, he knew that whatever decision he made, the Congestion Charge had to generate sufficient revenues to cover daily operating expenses.[6]

4 Case writers approximation using the model by Paul Emmerson on "Estimating Fuel Consumption in Traffic Models", CONTRAM (http://www.contram.com/download/forum/2007/Fuel.ppt)

5 *Ibid.*

6 For your calculations, assume a total population of 192,000 cars and £500,000 daily operating costs.

Exhibit 1
London's Charging Zone

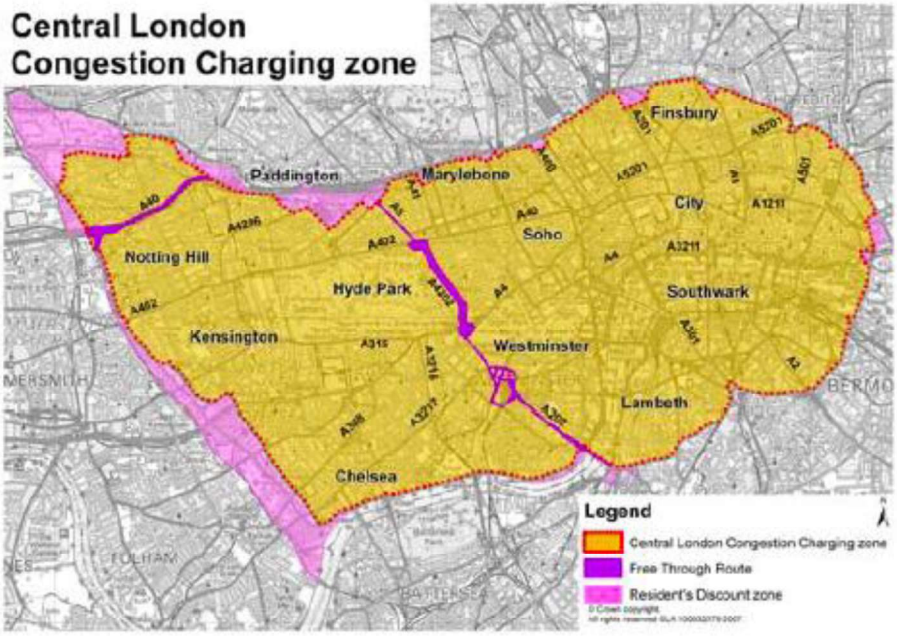


Exhibit 2
Signs Marking the Charging Zone and Video Cameras

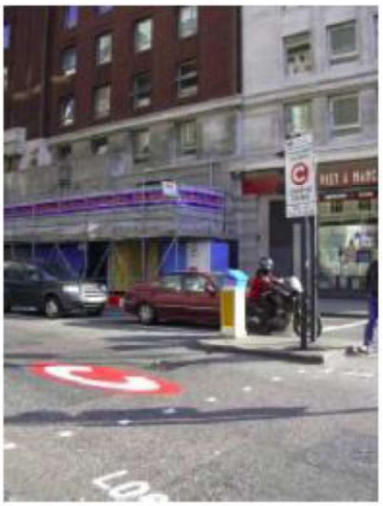


Exhibit 3

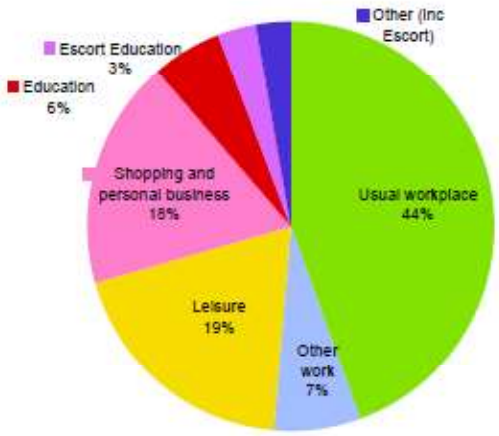
Snapshot of Willingness to Pay Data (in £) from the Survey
(see LCCdata.xls file for the entire data set)

	Average WTP	
	peak	off-peak
Average	8.0	5.0
Max	13	8

Client ID	MAXIMUM WTP peak	MAXIMUM WTP off-peak	Max.WTP Both
1	5	5	5
2	5	8	8
3	5	5	5
4	6	-	6
5	5	4	5
6	13	6	13
7	5	8	8
8	11	4	11
9	4	4	4
10	11	5	11
11	6	4	6
12	8	5	8
13	8	8	8
14	8	8	8
15	8	8	8
16	13	5	13
17	11	5	11
18	5	4	5
19	8	4	8
20	11	5	11
21	5	5	5
22	8	8	8
23	6	8	8
24	5	5	5
25	13	8	13
26	13	8	13
27	11	-	11
28	13	8	13
29	4	-	4
30	8	8	8
31	13	8	13
32	4	4	4
33	13	4	13
34	5	4	5
35	13	4	13
36	11	4	11
37	4	-	4
38	5	4	5
39	11	4	11
40	5	4	5
41	13	5	13
42	5	6	6
43	5	5	5
44	13	8	13

Exhibit 4

Customer Segments (by Travel Purpose)



Source: LTDS 2006/07 Household Survey

Exhibit 5

Estimated Parametric Relationship Between Emissions and Speed