Annex to the State of the Underground report, September 2011

Introduction

This annex presents findings from the detailed analysis of performance data requested by the Transport Committee as part of the State of the Underground investigation. It is structured into two parts: the reliability of the Tube; and, overcrowding, journey times and the quality of service. This reflects the structure of the main report which draws on the analysis in this technical annex.

Data in this technical analysis was provided by TfL and we have made it available in the London datastore.

Part 1: Reliability

The analysis of reliability is based on Lost Customer Hours data, a measure of reliability that captures all Tube delays over two minutes. This measure reflects whether or not Tube assets are available for customer service and was the primary measure, used by the PPP Arbiter, for assessing the infracos' performance in improving the day-to-day availability of the Tube.

TfL analyse Lost Customer Hours in the PPP Performance reports, which have been produced since the end of the PPP.[1] This analysis looks at the proportion of all days where Lost Customer Hours was deemed to be high and the specific reasons given for delays. The analysis in this document breaks down the total Lost Customer Hours on each line by cause and over time focussing on specific points such as the increase in delays since 2009/10.[2]

This section of the analysis first looks at network level delays since 2003/04 before drilling down to the causes of delays at the line level, particularly the extent to which this relates to problems with infrastructure assets. 'Infrastructure assets' refers to the main parts of TfL's operations being upgraded: signals, track, automatic train systems, stations, and fleet.

It then looks to support the analysis of Lost Customer Hours with that of another indicator of tube reliability, the percentage of scheduled services operated. It also examines delays since TfL took over both Metronet and Tubelines.[3]

Network wide reliability

- Across the network, Lost Customer Hours reduced by 27 per cent from 54 million in 2003/04 to 40 million in 2010/11.

[1] Most recent 4-weekly PPP Performance report covered the 4 weeks to 5 February 2011
[2] Lost Customer Hours measures delays against scheduled services, so does not include services lost due to planned closures for upgrades.
[3] Metronet went into administration in July 2007 and TfL took over in May 2008. TfL then took over Tubelines in June 2010.

- Lost Customer Hours peaked at 63 million in 2005/06 as a result of an additional 14 million hours of delays in the month of July 2005 following the London bombings.

- In 2010/11, Lost Customer Hours were 20 per cent higher than 2009/10.

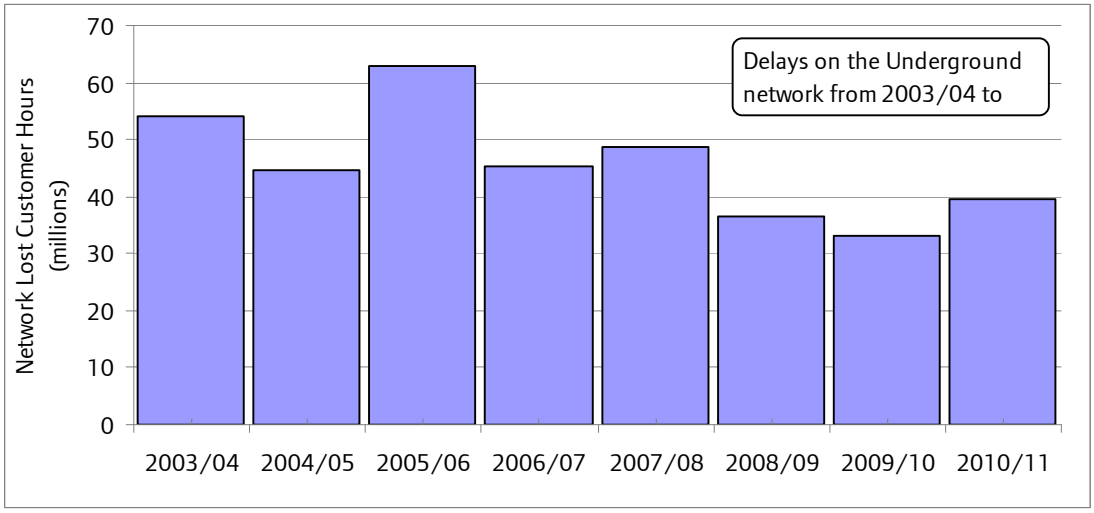

Figure 1

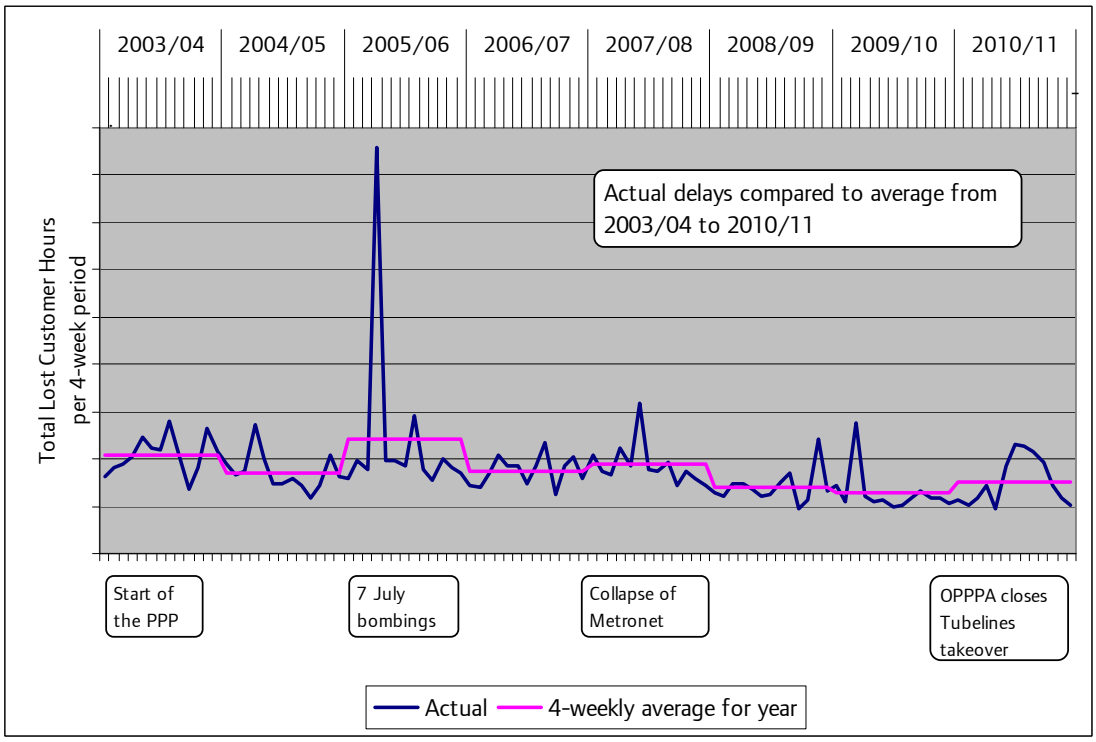

Figure 2

The cause of delays

- Lost Customer Hours caused by infrastructure assets reduced by 44 per cent from 35.7 million hours in 2003/04 to 20 million hours in 2010/11. However, since 2009/10 there has been an increase of 11 per cent.

- In 2010/11 there were 6.5 million more Lost Customer Hours across the network than the previous year. The main cause of this was industrial action which resulted in an additional 3.3 million compared to 2009/10 levels. Three lines saw a reduction in delays caused by industrial action: Hammersmith & City, Waterloo & City, and Victoria.

- The exception is 2005/06 where the London bombings saw a temporary increase to 16.8 million hours in Lost Customer Hours caused by safety/security issues.

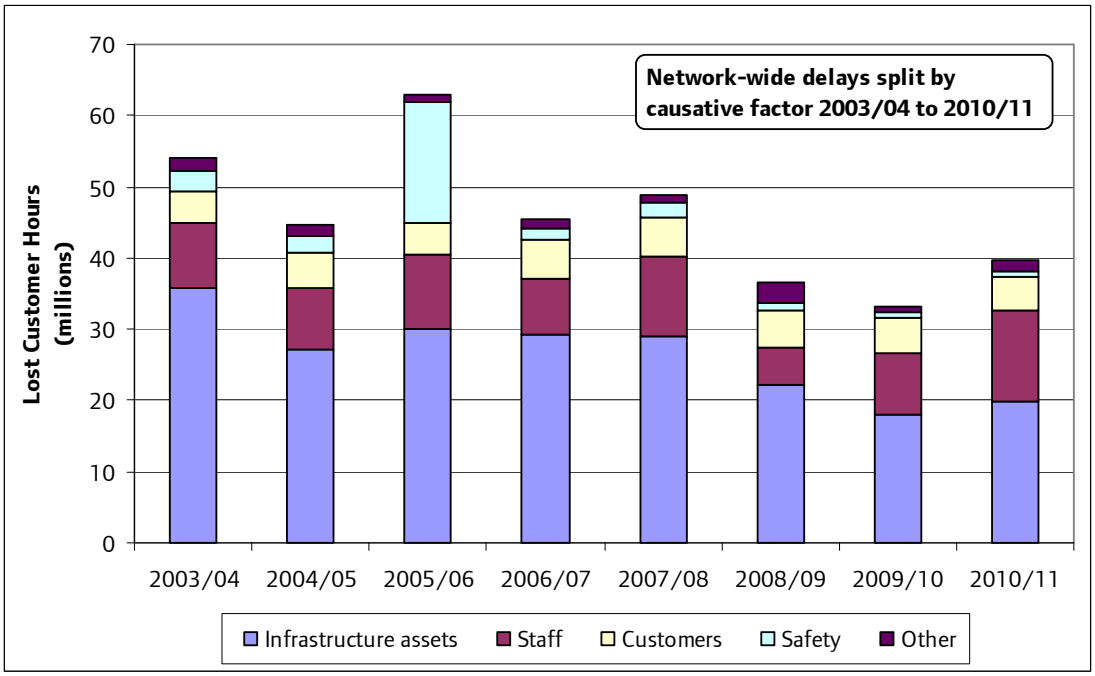

Figure 3

Figure 4: Key to categories	**Includes delays caused by:**
Infrastructure assets	Automatic train operation, fleet, signals, track, and stations.
Staff	sickness absence, refusal to work on health and safety grounds, industrial action, etc.
Customers	holding doors open, suicides, lost children, etc
Safety	vandalism and fire and security alerts, including unattended bags, evacuations, etc.
Other	weather, bridge strike, power failure, etc.

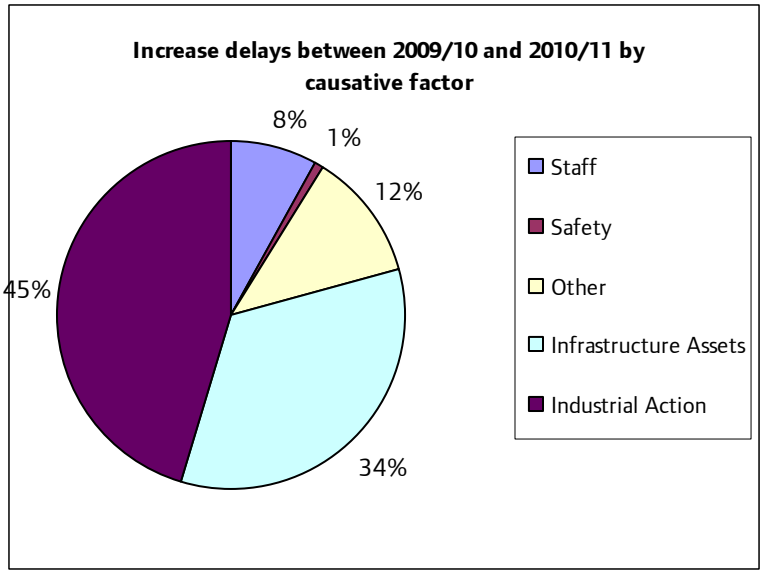

Figure 5

Analysis of Lost Customer Hours caused by faults with 'infrastructure assets' at the line level

- Across the network Lost Customer Hours caused by problems with infrastructure assets increased by 1.9 million (11 per cent) between 2009/10 and 2010/11. However, this has been mainly caused by problems experienced on four lines.[4] All other lines have seen continued improvements in the reliability of infrastructure assets into 2010/11.

- The main causes of the increase in delays were problems with automatic train operation systems (64 per cent) and those associated with fleet (28 per cent).

- The lines that contributed most to this increase were the Victoria line (31 per cent), and the Jubilee line (29 per cent).

[4] The Waterloo & City line has also seen a slight increase of 18,546 Lost Customer Hours since 2009/10.

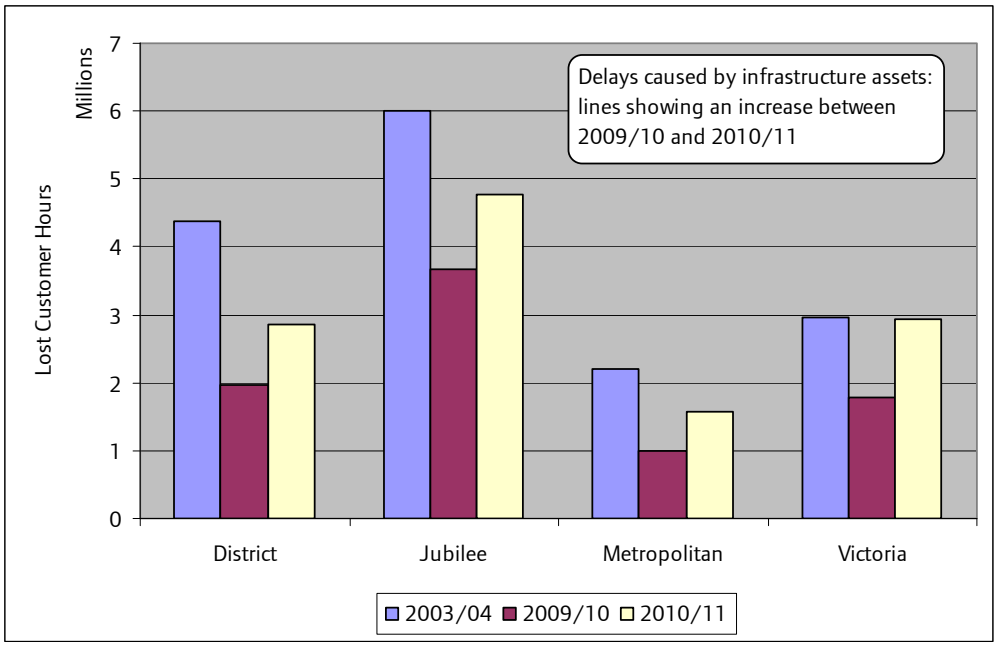

Figure 6

Reliability indicated by the percentage of scheduled train services operated.

The percentage of scheduled train kilometres is an indicator of reliability as it shows the extent to which the service ran as planned.[5] This is a key measure of reliability for TfL which is reported both on the TfL website and to the Rail and Underground Panel.[6]

- The percentage of scheduled kilometres operated increased from 93.1 per cent in 2003/04 to a peak of 96.6 per cent in 2009/10.

- It has since reduced to 95.3 per cent in 2010/11, largely as a result of strike action.

The number of train kilometres operated indicates the level of service provided by London Underground over time. This measure indicates the reductions to operated services as a result of factors such as planned closures for upgrade works.

- Operated train kilometres increased from 67.7 million kilometres per annum in 2003/04 to a peak of 70.6 million kilometres per annum in 2008/09 (an increase of 4 per cent).

- It has since then reduced to 68.9 million kilometres per annum in 2010/11.

- TfL have stated that this reduction "reflects an increased level of weekend engineering possessions, notably on the Jubilee line".[7]

[5] Percentage of scheduled services operated compares actual to planned services and therefore does not include reductions owing to planned closures for upgrade works. Engineering overruns are included.
[6] http://www.tfl.gov.uk/tfl/corporate/modesoftransport/tube/performance/
[7] Explanation given in data provided for TfL's March 2011 presentation 'Tube Upgrade Plan'.

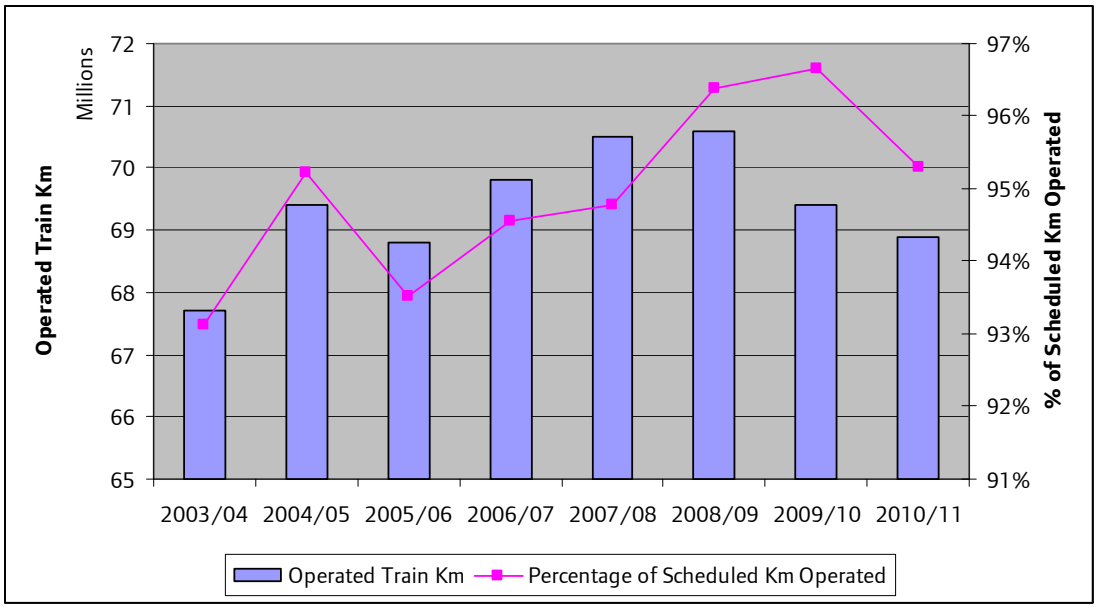

Figure 7

Reliability before/after Metronet takeover[8]

- In the 12 months prior to July 2007, when Metronet went into administration, the average number of Lost Customer Hours attributable to problems with infrastructure assets was 1.5 million hours per 4-week reporting period.

- In the second year under TfL control this had reduced by 43 per cent to 0.85 million hours per 4-week period on average.

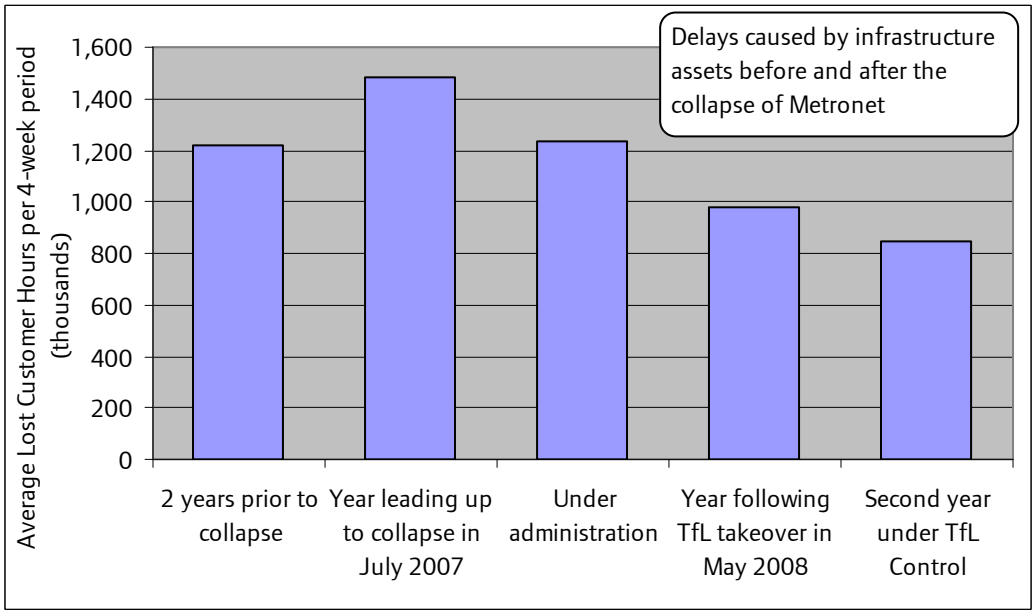

Figure 8 – relates to the lines for which Metronet previously had responsibility

[8] Metronet had responsibility for the upgrade, maintenance, and renewal of the following lines until its collapse in July 2007: Bakerloo, Central, Victoria, Waterloo & City, District, Circle, Hammersmith & City, Metropolitan.

Reliability before/after Tube Lines takeover[9]

- Data on Lost Customer Hours is only available for the first 11 months following the takeover of Tube Lines.

- In the year leading up to the TfL takeover of Tube Lines in June 2010, the average Lost Customer Hours attributable to problems with infrastructure assets was 0.5 million hours per 4 week reporting period.

- In the eleven months since the takeover this average has increased by 33 per cent to 0.66 million hours per 4 week period. The Jubilee line upgrade has been in the final stages of completion during this period.

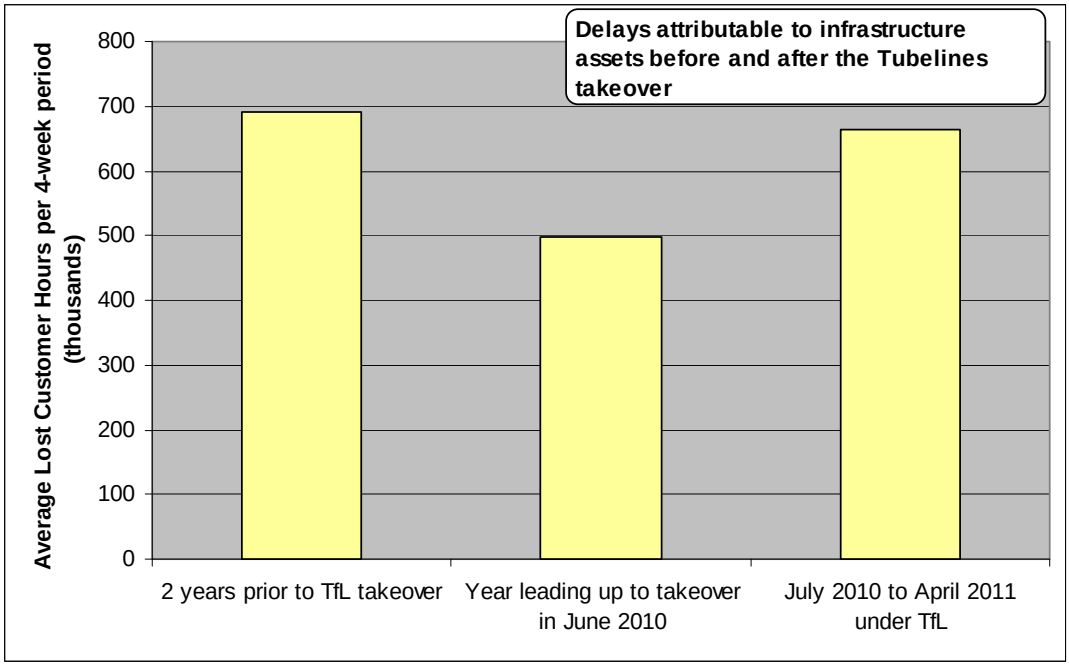

Figure 9 – relates to the lines for which Tube Lines previously had responsibility

Annual delays per line since 2003/04

Network

- Over the course of 2003/04, there was a total of 49 lost customer minutes per operated train kilometre. In 2010/11 this had reduced by 29 per cent to 35 minutes.

Line examples

- Over the course of 2010/11, there was a total of 75 lost customer minutes per operated train kilometre on the Jubilee line. The Northern line had a total of 20 lost customer minutes per operated train kilometre.

[9] Tube Lines has been a wholly owned subsidiary of TfL since June 2010 and is responsible for the upgrade, maintenance and renewal of infrastructure assets on the following lines: Jubilee, Northern, and Piccadilly.

- The Piccadilly line has improved the most since 2003/04 as the annual lost customer minutes per operated train kilometre has reduced by 47 per cent.

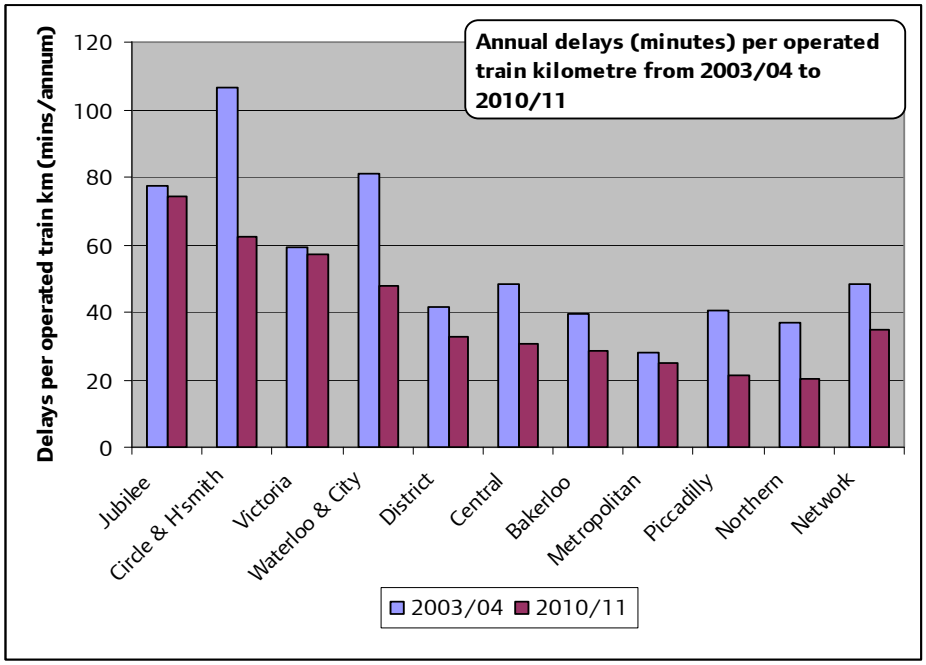

Figure 10

Part 2: Overcrowding, journey times and the quality of service

This section of the analysis is based on the capability improvements delivered by the upgrade and maintenance programme. Capability is defined as the potential that can be delivered from the Tube assets in terms of the capacity of a line and journey time for customers. Under the PPP, infracos were monitored for delivering improvements to capability alongside improving day-to-day reliability. They were also expected to improve the ambience, or quality, of the customers' travelling environment.[10]

Journey time

This section looks at the change in the average weighted total journey time on each line since 2003/04. Weighted total journey time is used by TfL as a measure of the typical length of an average journey, and journey time reductions are a key deliverable for the upgrade programme.[11]

- At the network level average weighted total journey time is relatively unchanged since 2003/04.

- Variation in performance is, however, evident at the line level when comparing average weighted total journey times to those recorded in 2003/04:

[10] TfL PPP & Performance Report 2009/10, p10
[11] This journey time analysis is based on data provided by TfL on weighted total journey times. Journey times are weighted to reflect a number of factors including overcrowding (i.e. a journey feels longer on a crowded train). Therefore, with an increase in demand it is feasible that actual journey time has not deteriorated but the weighted journey time has.

- The Bakerloo, Central and Northern lines have seen a lower average weighted journey time than 2003/04 in almost every year since then.

- The Waterloo & City line is the most improved line where average weighted journey time in 2010/11 was over seven per cent lower than 2003/04. Weighted journey times first improved in 2007/08 following the addition of 25 per cent capacity to the line.

- The Jubilee, Piccadilly, Metropolitan, and District lines have had higher average weighted journey times than 2003/04 in almost every year since then.

- The District line is currently the least improved line, and has deteriorated over the last two years when average weighted total journey time was seven per cent higher than in 2003/04.

- Average weighted total journey time on the combined Circle & Hammersmith line category was largely unchanged until 2010/11 when it was 6 per cent higher than in 2003/04.

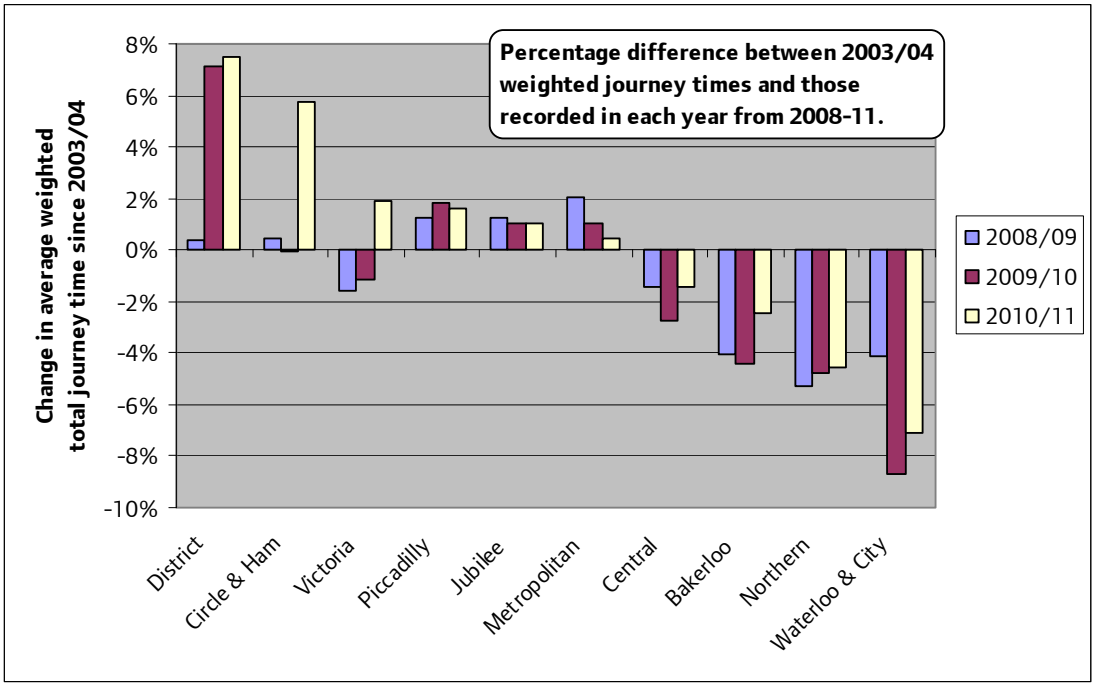

Figure 11

Long term comparison of growth of passenger demand and train kilometres

The following section looks at capacity, another key deliverable of the upgrade programme. This highlights how the growth in passenger demand is has been greater than that of operated train kilometres over the last 35 years.

Data is available on passenger journeys and operated train kilometres back to the 1975/6 financial year. Passenger kilometres are not available over the same period.

- Passenger journeys have grown at nearly twice the rate of operated train kilometres since 1975.

- In 1975/6 there were 601 million passenger journeys. By 2010/11 this had grown by 84 per cent to 1,107 million.

- Over the same period, operated train kilometres increased by 44 per cent from 48 million kilometres per year to 69 million.

Passenger kilometres vs. operated train kilometres since 2003/04

- At the network level passenger kilometres increased by 20 per cent between 2003/04 and 2010/11 from 7,340 million to 8,788 million. Operated train kilometres increased by 2 per cent over the same period from 67.7 to 68.9 million.

- The Central line has seen the highest increase in passenger kilometres since 2003/04, increasing by 41 per cent from 1,151 million to 1,624 million. Over the same period operated train kilometres increased by 25 per cent from 9.3 to 11.6 million.

- On the Jubilee line passenger kilometres increased by 30 per cent from 862 million in 2003/04 to 1,122 million in 2010/11. Over the same period operated train kilometres reduced by seven per cent from 7.1 to 6.6 million. TfL have stated that this is due to an increase in engineering possessions since 2009/10.

- The District line has seen a 9 per cent increase in passenger kilometres from 1,020 million to 1,116 million since 2003/04. Operated train kilometres have reduced by 10 per cent from 9.7 to 8.8 million over the same period.

- The Metropolitan line has seen a 21 per cent increase in passenger kilometres from 558 million to 675 million since 2003/04. Operated train kilometres increased by 6 per cent from 6.7 million in 2003/04 to 7.1 million in 2008/09. Since then, however, operated train kilometres have reduced by 8 per cent to 6.5 million in 2010/11. This has been a result of the planned closures as part of the upgrade.

Passenger journeys per line

- The Central line has the most passenger journeys during peak hours with 100 million in 2010/11. This is followed by the Northern line with 98 million.

Line	2010/11 Peak Passenger Journeys (million)
Central	100
Northern	98
District	84
Jubilee	83
Victoria	74
Piccadilly	72
Bakerloo	42
Metropolitan	33
Circle	25
Hammersmith & City	19
Waterloo & City	10
Total	**639**

Figure 12

Tube crowding

A tube crowding proxy indicator has been calculated by dividing annual passenger kilometres by operated train kilometres. It should be noted that this gives an average crowding level across the length of the line, and may therefore not reflect the levels of crowding experienced over the busiest sections of the lines.

- At the end of 2010/11 tube crowding was 18 per cent higher than in 2003/04.

Year	Peak passenger kilometres per train kilometre operated	Off-peak passenger kilometres per train kilometre operated	Overall passenger kilometres per train kilometre operated
2003/04	180	81	108
2010/11	209	96	128
Percentage change	+16%	+18%	+18%

Figure 13

Crowding at the line level since the start of the PPP

- Peak crowding levels increased across all lines except the Circle and Hammersmith & City which are unchanged from 2003/04 levels.

- In 2010/11, peak crowding was highest on the Jubilee line which experienced 278 passenger kilometres per operated train kilometre. This is an estimated increase of 30 per cent from 2003/04 levels.

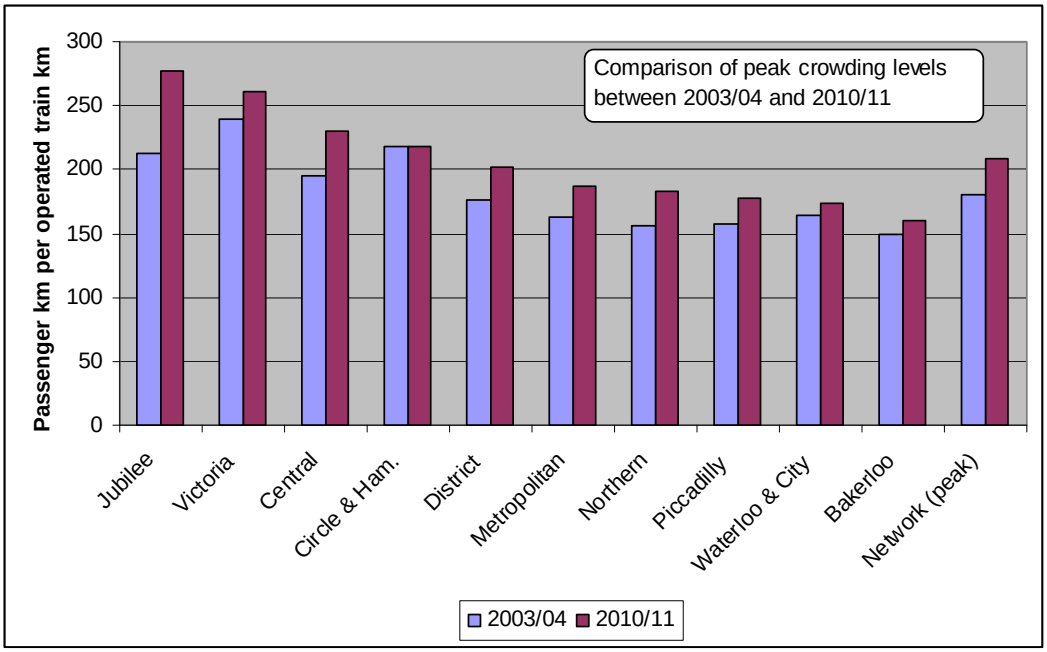

Figure 14 – For 2003/04 only the split of peak/off-peak passengers are based on estimates. TfL stated that the actual split is not available.

Customer satisfaction

Customer Satisfaction Surveys (CSS) are scored out of 100, and cover 21 categories. The performance portal on the TfL website reports the high level categories plus an overall evaluation. Surveys are undertaken by a third party once every 4-week reporting period.

High level category	Sub-category
TRAIN AND STATION INFORMATION	Ease of hearing PA Helpfulness of PA Signs and maps at station Train driver announcements Maps and information on train Usefulness of visual information in ticket hall
CUSTOMER SAFETY & SECURITY	Personal safety in station Personal safety on train
STATION STAFF HELPFULNESS AND AVAILABILITY	Station staff availability when needed Help and appearance of staff around station Help and appearance of ticket office staff
CLEANLINESS	Station cleanliness Train cleanliness
TRAIN & STATION SERVICE	Train crowding Journey time Wait for train Smoothness of journey Ease of using ticket gates Ease of getting to platform Ease of buying ticket/ oyster Platform crowding

Figure 15

- Overall, at the network level satisfaction scores have increased by three points from 76 in 2003/4 to 79 in 2010/11.

High level categories

- In 2010/11, the categories with the lowest rating were 'staff helpfulness & availability' and 'cleanliness' which both scored 76.
- The highest rated category was 'safety & security' which scored 84.
- The most improved category is 'cleanliness' where a score of 71 in 2003/4 improved to 76 in 2010/11.

CSS data provided by TfL across all 21 categories and lines

- At the network level, the lowest rated sub-category was 'train crowding' with a score of 72 in Quarter 4 of 2010/11.

- The highest rated were 'personal safety on train' and 'help and appearance of ticket office staff', which both scored 85.

- The Victoria line had the lowest overall evaluation score in the final quarter of 2010/11, scoring 77.

- Joint highest with a score of 81 were the Bakerloo, Metropolitan and Piccadilly.

Passenger satisfaction with tube crowding by line between 2003/04 and 2010/11:

- Customers on the Northern line are most dissatisfied with tube crowding scoring 68 in the final quarter of 2010/11.

- Dissatisfaction has grown since 2003/04 with the CSS score reducing from 76 since the first quarter of 2003/04 (-11 per cent). This is despite the fact that the Northern line is only the seventh most crowded line.

- Peak crowding has, however, increased by 17 per cent on the Northern line over this period from 156 to 183 passengers per operated train kilometre. This is the third largest increase in peak crowding over the period. The Northern line is also the second busiest line carrying 576 million passenger kilometres per annum (see Table 2) during peak hours.

- Despite experiencing the largest increase in peak crowding between 2003/04 and 2010/11 (+30 per cent), the CSS scores for 'train crowding' on the Jubilee line have not changed.

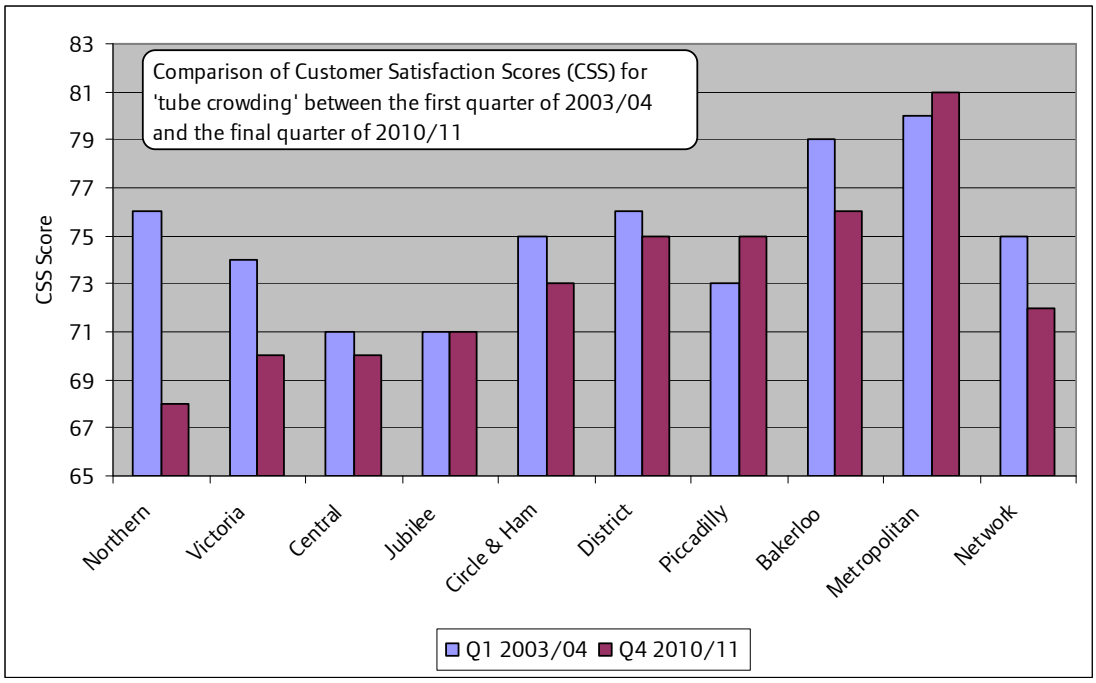
Comparison of Customer Satisfaction Scores (CSS) for 'tube crowding' between the first quarter of 2003/04 and the final quarter of 2010/11
CSS Score
83
81
79
77
75
73
71
69
67
65
Northern
Victoria
Central
Jubilee
Circle & Ham
District
Piccadilly
Bakerloo
Metropolitan
Network
Q1 2003/04
Q4 2010/11

Figure 16