



Date: 11 April 2014

Item 8: Rail and Underground International Benchmarking Report

This paper will be considered in public

1 Purpose and Decision Required

- 1.1 This paper presents London Underground's performance on a range of metrics in comparison with other metros who are members of CoMET (the Community of Metros). It also provides an update on recent benchmarking activity that TfL has been leading through CoMET, including case studies and workshops that seek to understand and promote best practice.
- 1.2 The analysis is attached at Appendix 1.
- 1.3 The panel is asked to note the improving trends London Underground (LU) is making on key performance indicators for international metro benchmarking, particularly in reducing operating costs and improving service reliability.

2 Recommendation

- 2.1 **The panel is asked to note the conclusions of the International Benchmarking Report and provide any comments.**

3 Key Messages

- 3.1 LU's Key Performance Indicators show sustained and significant improvement in all areas.
- 3.2 **Cost recovery** – This is the second year in which LU's total revenues exceed its operating costs. LU no longer needs government subsidy to deliver its train services and is the only Western European metro in this position.
- 3.3 **Total operating costs** – LU's operating costs are relatively high, but its trend is undergoing one of the most significant reductions of all members – three per cent in 2012/13 and 15 per cent since 2008/09, while the average reduction across all other metros was less than one per cent. LU is delivering more for less, as the investment in line upgrades has enabled new timetables, which deliver more car kilometres.
- 3.4 **Maintenance costs per car km** – In 2012/13 LU's maintenance unit costs decreased by two per cent from the previous year and 17 per cent since 2008/09 (when the TfL efficiency plans were drafted and two of the three large PPP contracts came in-house). LU's rolling stock maintenance costs are lower than the average of other metros, but infrastructure maintenance costs, which include track and signalling, are higher. This is due to a number of structural and explanatory factors, such as signalling asset density, city wages and track characteristics, which have been explored in greater detail in two detailed studies undertaken by LU on signalling and

track maintenance.

- 3.5 **Labour productivity** – LU's overall labour productivity in 2012/13 was one of the best in the world on a car km basis, and 59 per cent higher than the CoMET average. It also improved by four per cent from the previous year and 11 per cent since 2008/09. High productivity is expected where labour is expensive. Compared to other metros, LU's overall capacity utilisation is low. Therefore, labour productivity measured on the alternative basis *per passenger journey* is relatively low.
- 3.6 **Reliability** – LU is one of the fastest improving metros in the world in this area. The time between incidents which caused more than five minute delays improved by 32 per cent from the previous year and 61 per cent since 2008/09. Some other European and North American metros achieve higher overall levels of reliability, though recent performance on the Victoria line is now approaching such standards. Equipment related incidents have reduced significantly for LU.
- 3.7 **Environment** – London performs relatively poorly in terms of CO₂ emissions per passenger kilometre compared to its international peers, with the mix of energy sources available a major explanation of this (Paris for example is predominantly supplied from nuclear power). LU continues to diversify its energy sources and has improved on this measure at a faster rate than most other metros.
- 3.8 **Staff and customer safety** – Imperial College London (who facilitate and manage the CoMET group) note that LU has a strong record of ensuring that staff are properly trained and follow strict health and safety rules and processes. They state that LU is considered to be best practice in many areas of safety management.

List of appendices to this report:

Appendix 1: Benchmarking Report – Summary Analysis.

List of Background Papers:

None

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INTERNATIONAL METRO BENCHMARKING REPORT 2014

Summary Analysis



This report presents the performance of London Underground (LU) over the last ten years and compares LU to metros around the world. Performance is presented against seven key areas:

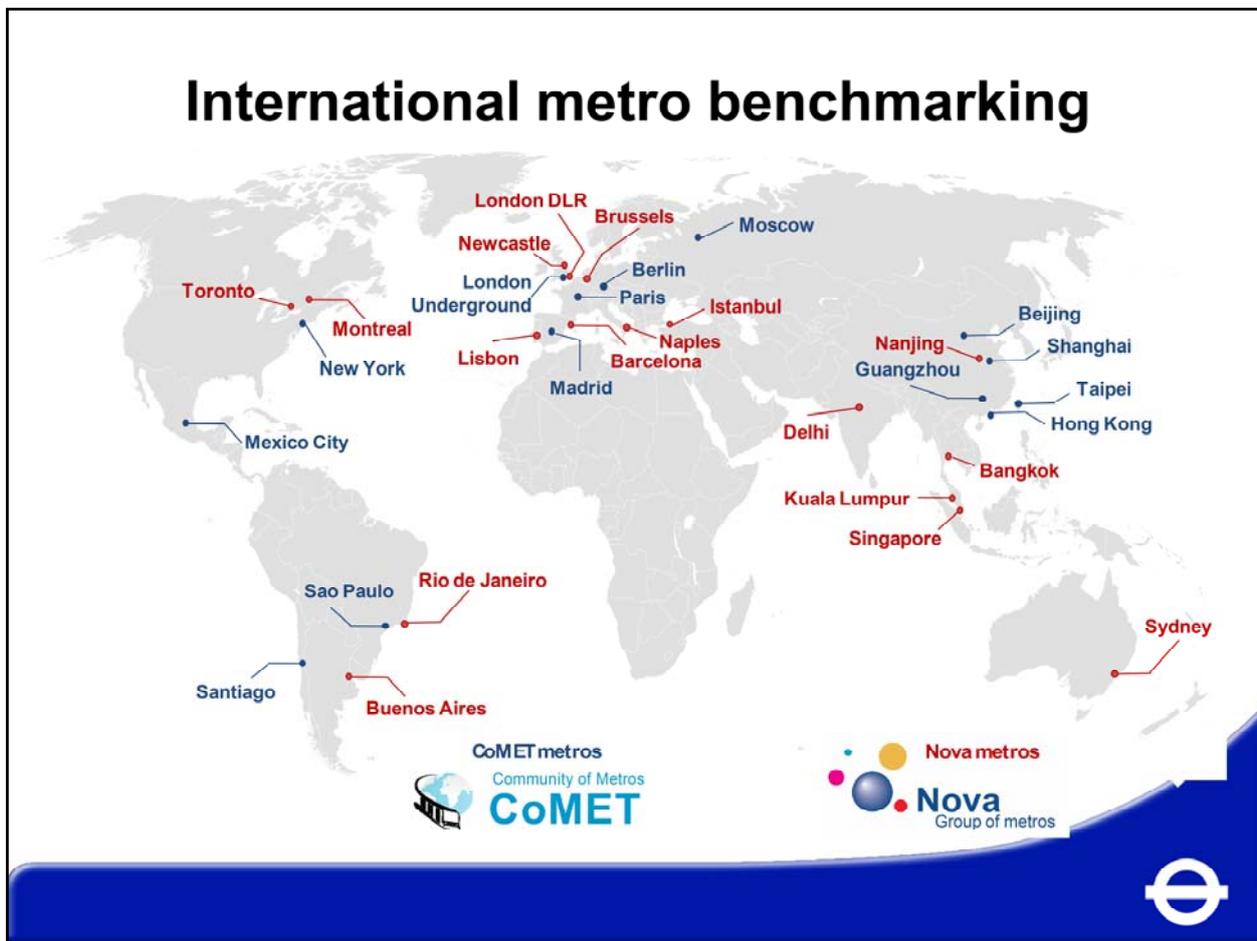
- Operating cost recovery ratio – a measure of the level of Government subsidy required by metros to cover the cost of operations;
- Total operating costs per car kilometre – a measure of cost efficiency;
- Maintenance costs per car kilometre – a measure of cost efficiency;
- Car kilometres per total staff and contractor hour – a measure of staff productivity;
- Car kilometres between incidents causing more than 5 minutes service delay – a measure of reliability;
- Grams of CO₂ per million passenger kilometres – a measure of environmental performance; and
- Staff and customer safety - staff hours lost to accidents which is a measure of the productivity impact of safety, and fatalities due to accidents or illegal activity per billion passenger kilometres which is a measure of customer safety.

High level explanation is provided as to why LU is performing relatively well or less well in specific areas, including considering contextual factors (for example, relative city wages or the impact of heritage assets).

The report also highlights the actions the business is taking to continuously improve its performance, learning from other metros internationally.

The information presented is a summary of the annual Key Performance Indicators reported by the members of CoMET and Nova for the year 2012/13. The information is independently collated by Imperial College's Railway and Transportation Strategy Centre.

International metro benchmarking



London Underground was a founding member of CoMET (the Community of Metros), a group of 14 of the largest metros from around the world, in 1995. Nova is a group of 17 medium sized metros, and DLR joined in 2013. The two groups work closely, with mutual sharing of data and practices. In recent years several new metros have joined the CoMET and Nova groups, and the metros have improved their data collection processes, yielding a more mature, broader dataset.

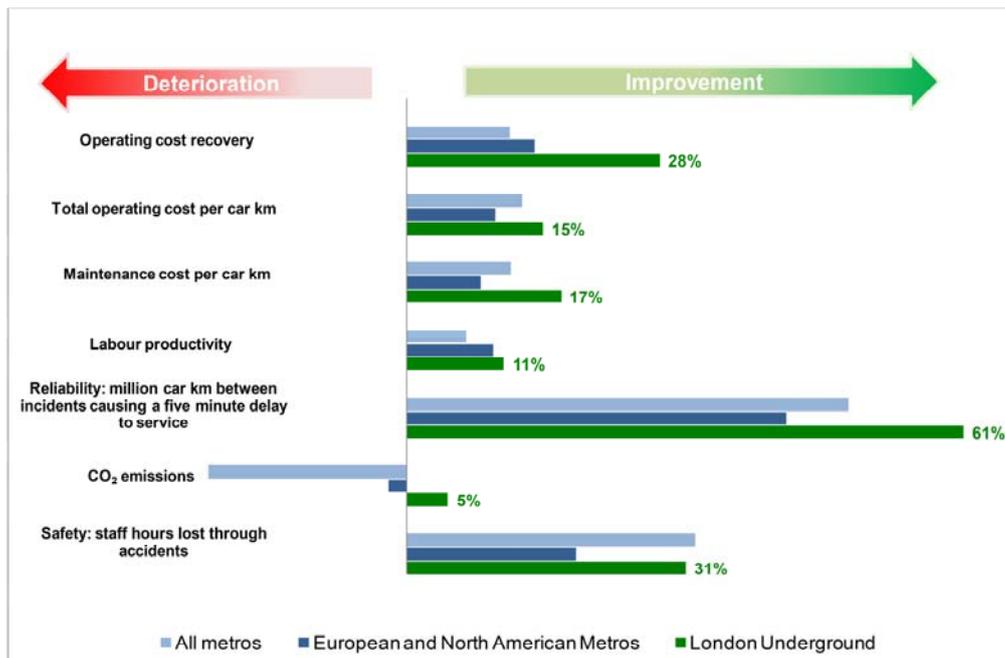
Before cost comparisons are undertaken, the cost data was first normalised using Purchasing Power Parity (PPP) from the World Bank. PPP normalisation takes account of the different currencies and levels of purchasing power in each country, based upon a basket of comparable goods and services. The benefit of using PPP is that it equalises the purchasing power of different currencies, so that a unit of currency of one country will have the same purchasing power as another. However, it does not fully account for regional wage differentials.

All CoMET activities are carried out within a framework of confidentiality, to ensure open and honest information exchange among the member metros. Any information that is released externally is therefore anonymised.

A key benefit of London Underground's membership of CoMET is access to diverse annually refreshed KPI data from member metros. Given that LU is unique in the UK, comparison with international peers provides valuable insight and the opportunity to share best practice thus aiding LU's continual improvement.

The process of putting the International Report together involves discussing aspects of performance with colleagues, who may not have encountered this international comparator data before. These discussions are useful to disseminate the benefits of LU's membership of CoMET across the organisation, providing further impetus to improve performance.

LU compared to other metros

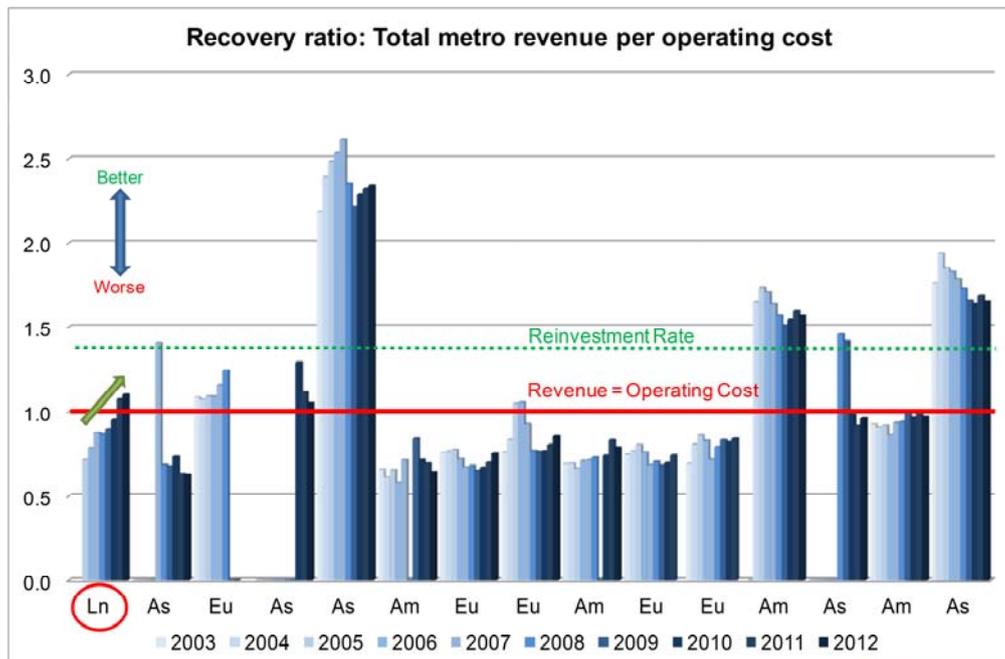


Analysis of the KPI data for 2012/13 shows that LU's relative strengths continue to be in safety, operating cost recovery and labour productivity. Compared to other metros, particularly modern Asian metros, LU's performance is weaker for infrastructure maintenance, carbon emissions and reliability. The data also shows that LU has made significant improvements in the years 2008/09 to 2012/13, across all seven lead metrics.

London Underground has improved at a faster rate than the average of Western European and North American metros in all areas, and for all areas except safety (where LU remains better than the average) when compared to the average of all metros:

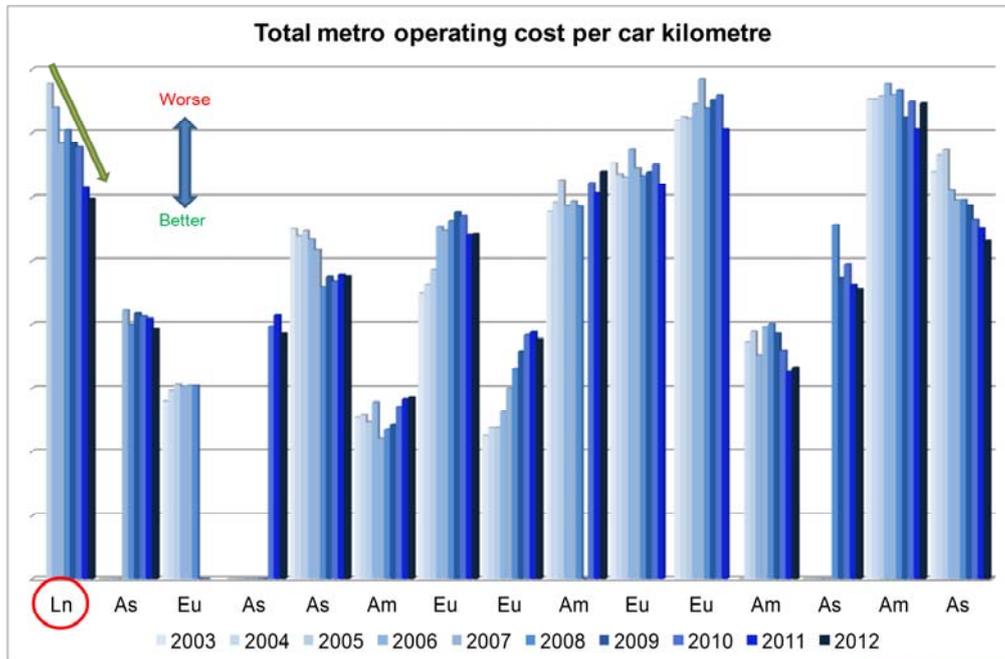
- **Operating cost recovery** - Total revenues per total operating costs. LU improved by **28%** (Western European and North American metros improved on average by 14% and all metros improved on average by 11%).
- **Total operating cost** – Total operating costs per car kilometre (including service operations, maintenance, administration and other). LU has improved by **15%** (Western European and North American metros improved by 10% and all metros by 13%).
- **Total maintenance cost** per car kilometre. LU improved by **17%** (Western European and North American metros improved by 8% and all metros by 11%).
- **Labour productivity** – Car kilometres per total staff and contractor hours. LU improved by **11%** (Western European and North American metros improved by 10% and all metros by 7%).
- **Reliability** – Million car kilometres between incidents causing a five-minute or more delay. LU improved by **61%** (Western European and North American metros improved by 42% and all metros by 49%).
- **Environment** – Grams of CO₂ per million passenger km. LU improved by **5%** (Western European and North American metros deteriorated by 2% and all metros deteriorated by 22%).
- **Safety** – Staff hours lost through accidents per thousand staff hours. LU improved by **31%** (Western European and North American metros improved by 19% and all metros by 32%).

Operating cost recovery trends



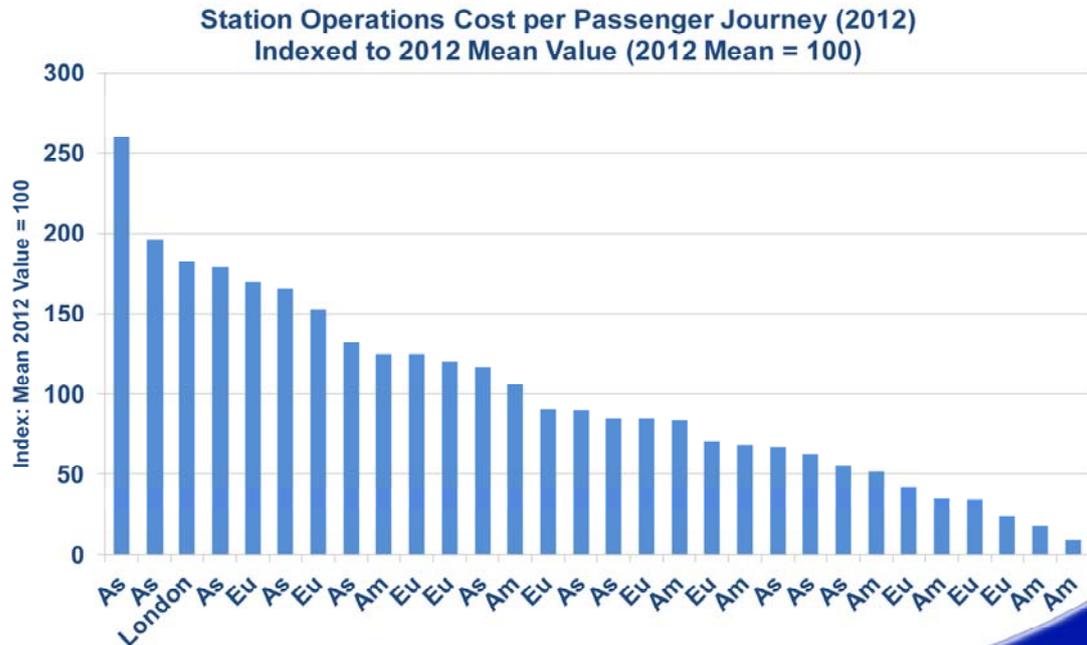
- This is the second year that LU's total revenues have exceeded total operating costs – i.e. has not needed government subsidy for non-capital activities. LU no longer needs government subsidy to deliver its train services and is the only Western European metro in this position.
- Since 2008/09 LU has improved by 28% on this measure. LU's improved performance can be attributed to increased ridership, cost reductions resulting from efficiency initiatives, as well as fare policy. Non-fare revenue also increased.
- In 2012/13 **LU improved its recovery ratio by 2.5 percentage points against 2011/12**: were London to continue to increase its recovery ratio by 2.5% year on year, it would take just under 10 years for London to achieve a ratio of 1.40. This is the level observed by Imperial College as the rate at which asset renewals can, on average, also be covered by revenues (the reinvestment rate).
- Fare revenues continue to grow as a result of the introduction of extra services following the investment in increased capacity (new trains and signalling) and therefore lower journey times, as well as higher fares.
- LU's non-fare revenue increased by 4% in real terms in 2012/13.
- LU has also committed to a comprehensive efficiency programme that will deliver net cost reductions of £8.1bn over the 12 year period 2009/10 to 2020/21; 70% of these efficiencies will be achieved from operating costs.
- Cost reductions have been and will continue to be achieved through a range of initiatives, including improved contract terms for traction power, improved utilisation of engineering possessions, modernisation of maintenance regimes (taking advantage of the investment in asset renewal and the introduction of preventative maintenance and increased remote condition monitoring) and Fit for

Total operating cost trends



- LU's operating costs were historically among the highest of CoMET metros, but **these costs continue to fall**, albeit at a slower rate than since 2011.
- **Since 2008/09 LU has improved by 15% on this measure.** While increasing car km by 7% over this period, LU has reduce real costs by 9%, delivering more for less.
- Most CoMET metros show an improving trend on this measure this year, although none match London's sustained improvement over the last decade.
- In absolute terms LU performs relatively less well on this measure – it was the third most expensive CoMET metro for those that submitted data in 2012/13, although several of the more expensive metros are yet to submit data for this metric.
- LU will continue to deliver more for less, as line upgrades deliver increased car kilometres through longer and more frequent trains. Planned cost reduction across LU's operating costs, investment in technologies and improving works access will also enhance productivity. The Fit for the Future Stations project will reduce costs, subject to consultation.

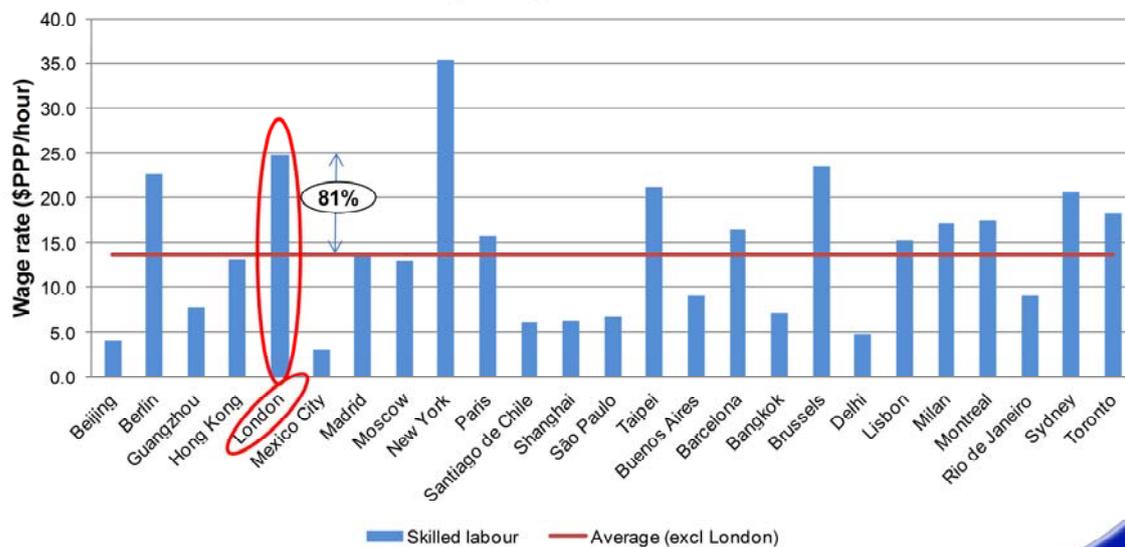
LU station operating costs are high relative to peers



- LU's station operating costs (excluding maintenance) are high relative to its peers, as a result of high (but declining) station staffing levels and high wages.
- This KPI has been independently prepared by Imperial College London and shows metro station operating cost per passenger journey, one of the main constituents of service operations costs. Due to the strict CoMET and Nova confidentiality protocol this KPI has been indexed to the 2012 mean value. It excludes stations maintenance costs.
- It is notable that there is no contracting out of station staff in London. Some European metros do not staff their station at all, except for roaming staff.

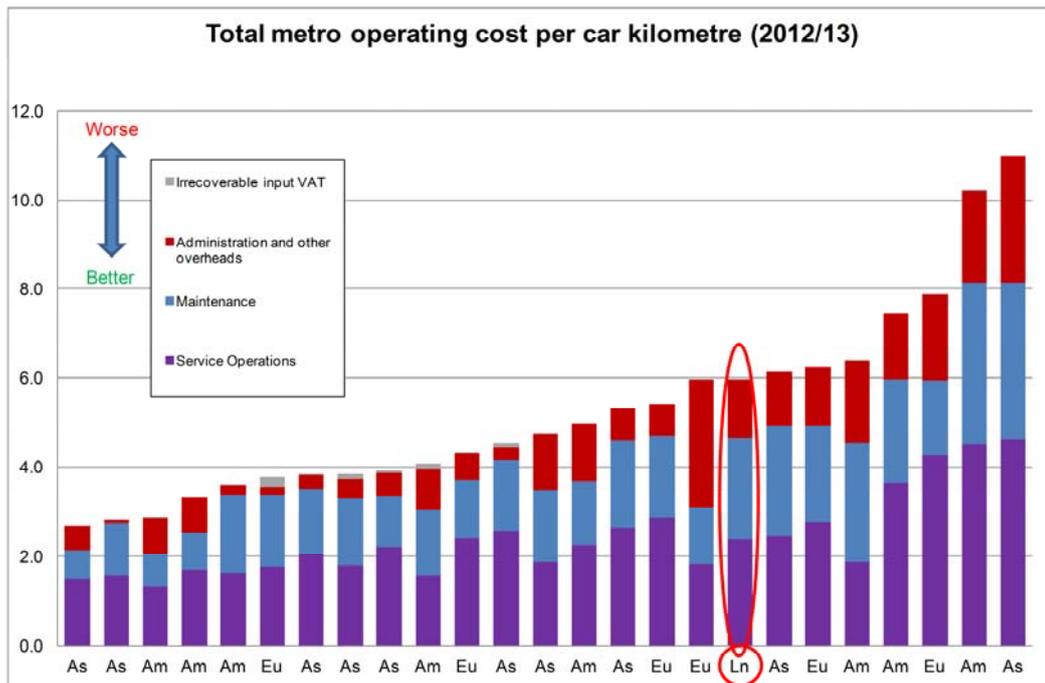
City wages are a key cost driver

Skilled labour city wage rates: CoMET and Nova



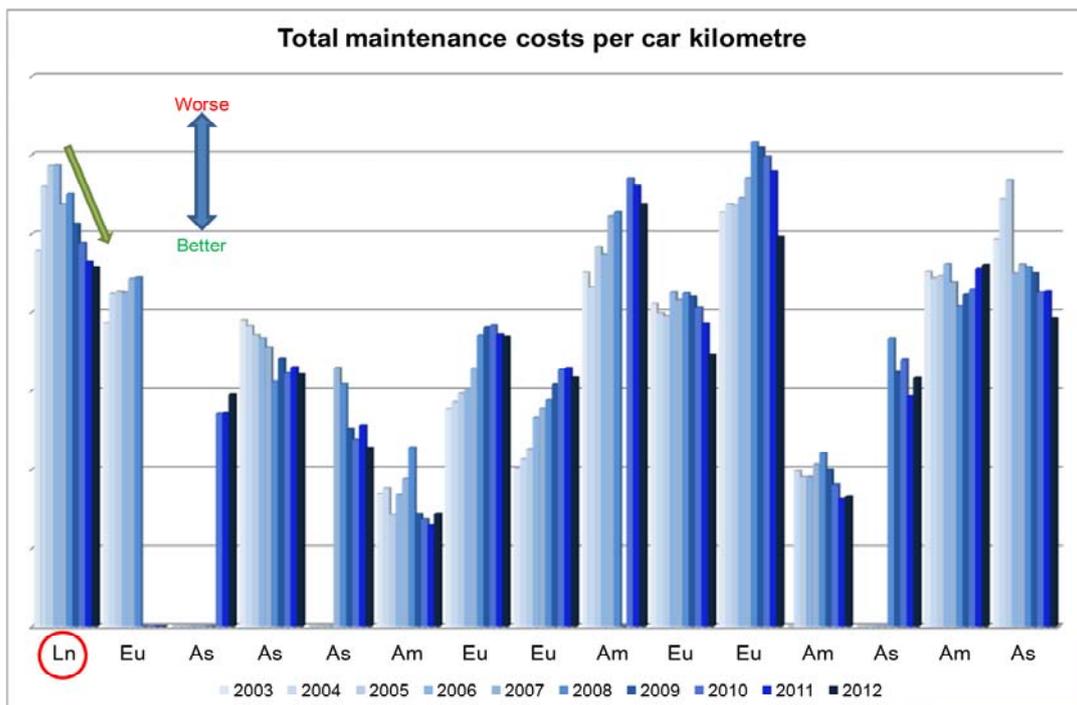
- Any comparison between LU and international metros must be viewed in the light of relative city wages.
- **Recent analysis by the bank UBS demonstrates the challenge LU faces.**
- The graph shows average hourly wage rates for skilled labour in the home cities of CoMET and Nova metros, normalised using Purchasing Power Parity (PPP) and quoted in US dollars.
- **Wage rates across the whole of London are around 80% higher than the average of the cities where other CoMET and Nova metros operate.**

Total operating costs



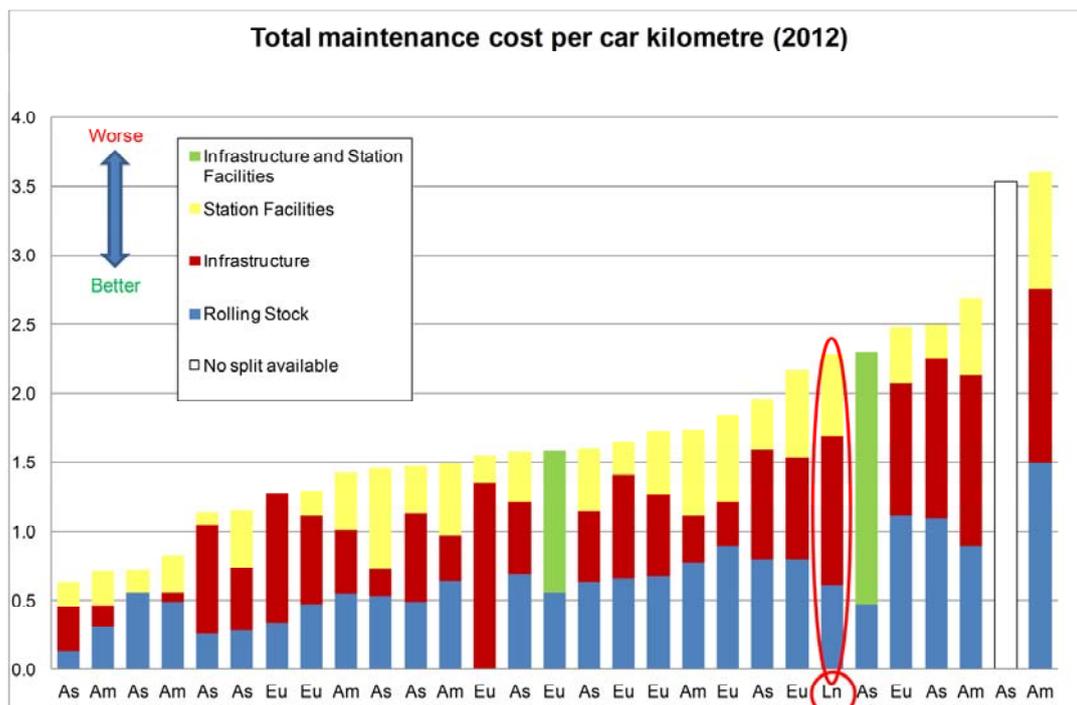
- Like most metros LU's maintenance and service operations costs continue to be its most significant operating expenses.
- LU's service operations costs per car kilometre are 1.1% lower than the average of the other metros, though LU's maintenance costs continue to be above average.

Total maintenance costs trends



- LU's maintenance costs per car kilometre have decreased by 17% since 2008/09, when the TfL efficiency plans were drafted and Metronet was brought into TfL.
- Between 2011/12 and 2012/13 maintenance unit costs decreased by 1.7%, continuing the trend in the previous years.
- LU's maintenance costs remain above average, without allowing for structural factors such as high labour costs, asset condition and age, and the business should especially focus efforts on reducing infrastructure maintenance costs.
- Most other metros also recorded improvements both between 2008 and 2012: London's improvement was better than the average for this period.
- LU continues to develop its detailed analysis of maintenance unit costs, which is used to inform efficiency initiatives.

Total maintenance costs 2012/13



- LU's distribution of maintenance costs differs from other CoMET and Nova metros. Its infrastructure maintenance costs, which include track and signalling, are 64% higher than the average of other metros' infrastructure costs, and its station facilities maintenance costs are 44% above the average of its peers. LU's rolling stock maintenance costs are however just below the average of other metros.
- LU has carried out detailed studies into these areas and now has an enhanced understanding of the structural factors and opportunities to improve: these are explained overleaf.

Understanding cost drivers: Signalling

Time to repair:
*London is on average
8 min shorter than
other metros*



Asset density:
*higher density of line
side assets leads to
higher costs*



11

To gain a better understanding of the structural and explanatory factors that affect our infrastructure costs, a drill-down study was undertaken by LU on the maintenance of modern signalling systems. LU included two of its lines in the study which have recently gone through an upgrade: Victoria and Jubilee Lines.

Key findings from the study are as follows:

- 1) City wages: regression analysis has shown these to be a significant cost driver. London has a **significantly higher city wage rate** than the home cities of the other metros in the study group, for example **twice as high** as Guangzhou.
- 2) Metros that have built an incident response organisation to resolve faults more swiftly, have higher costs. The London lines perform better than the rest of the study group, with only Hong Kong achieving a comparable Mean Time to Repair (MTTR). There's a wide range of MTTR and London is on average **8 minutes faster** than other metros.
- 3) Lines with a higher density of line-side assets (such as LU) have higher maintenance costs.

Understanding cost drivers: Track

Power rails and equipment on the track increases cost



London has four times the CoMET average of jointed track



In addition to the signalling study, LU also undertook a study on track maintenance, covering all lines on the network.

Key findings from the study are as follows:

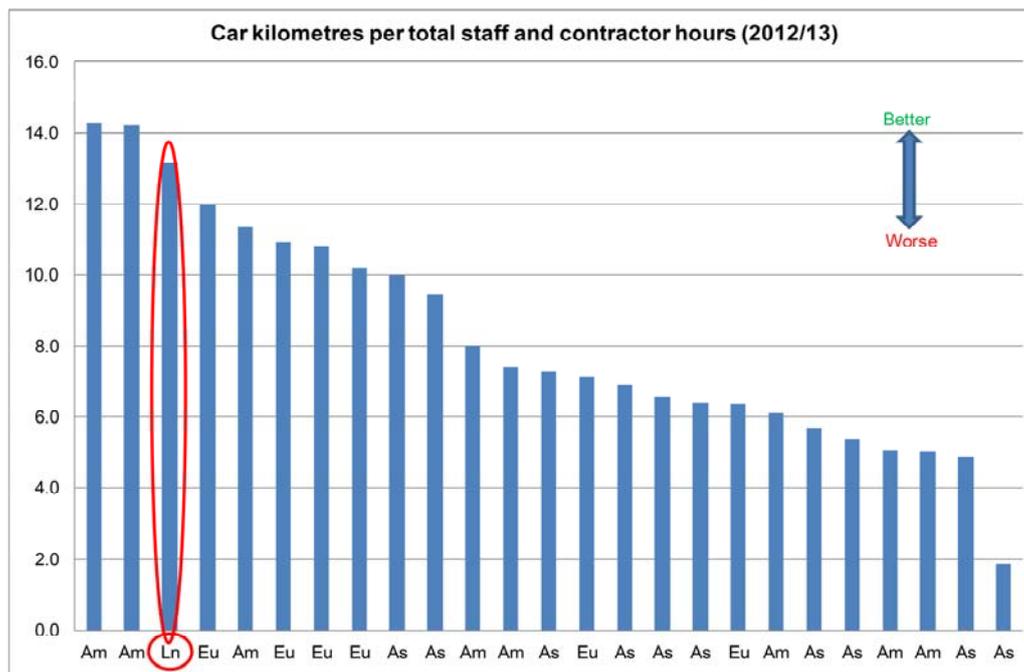
- 1) For track maintenance again there is a wide range in the cost of labour in cities of metros participating in the study, from \$3 per hour to \$18 per hour. This is the **most significant explanatory factor** for the difference in costs. **Between 50-85% of track maintenance cost is for labour, varying by country.**
- 2) **Metros with a 3rd (or 4th) rail power system, are more expensive than those with an overhead catenary.** This is partly an accounting issue: the cost of maintaining power rails is typically included in the track budget, while the cost of maintaining catenary power lines is not. Nonetheless the power rails are close to the running rails and impede track maintenance, making the work harder, longer and costlier.
- 3) **Traditional track form** (jointed bull head rail on wooden sleepers) **is more expensive to maintain than modern designs** of track form (typically continuous flat bottom rail on concrete sleepers). LU has four times the CoMET average of jointed track. LU is replacing jointed track and so would expect this cost driver to reduce over time.

Giving assurance to TfL's efficiency programme

By comparing LU's current and planned unit costs for signalling and track, and by accounting for local structural factors, LU has been able to give assurance that its efficiency programme will bring its costs in line with other high performing metros.

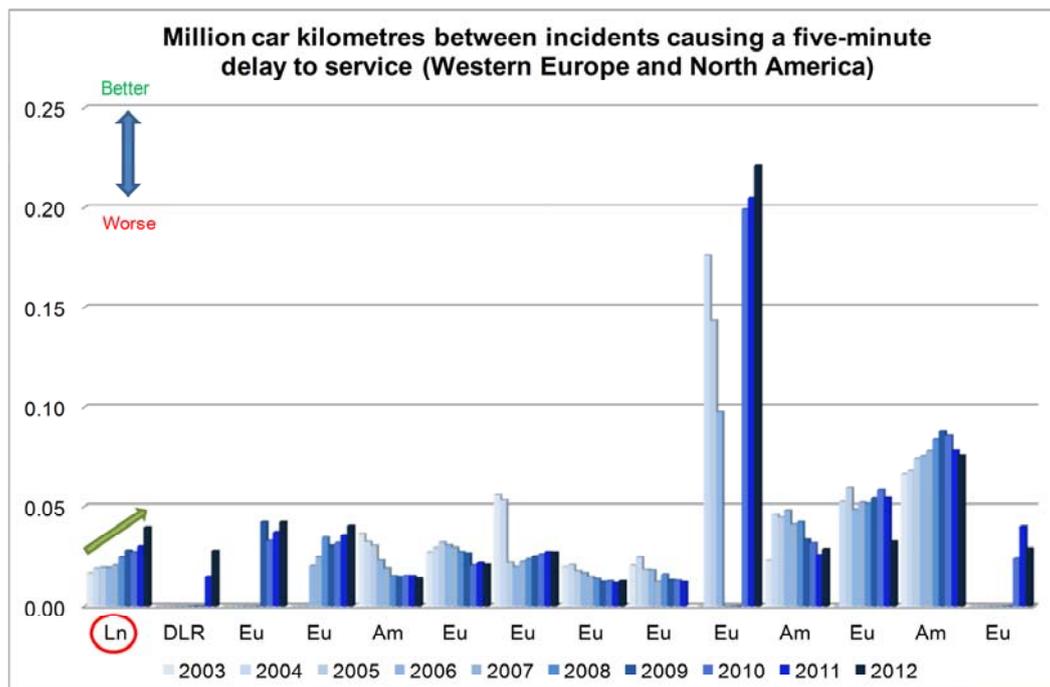
LU has a comprehensive efficiency programme for tube maintenance and **has already delivered over £190m of cost reductions, with action taken to secure a further £1.6bn to 2021/22.**

Labour productivity



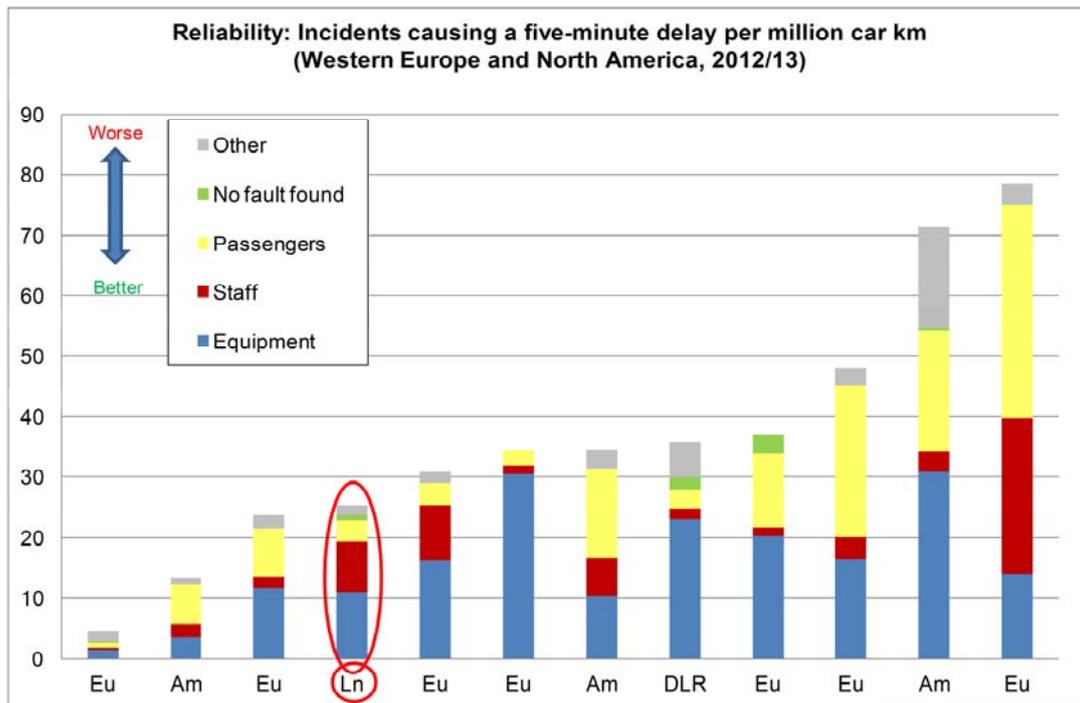
- LU's labour productivity has generally shown a **positive trend, increasing by 11% since 2008/09. LU's labour productivity improved by 4% from 2011/12.**
- LU's improvement since 2008 is **above the average improvement** in that time frame. LU's improvement since 2011 was matched by the Asian metros, which also increased by 4% on average. Mean labour productivity growth in American and European metros over the same time period was slower, at 0.1%.
- Improvements in LU's staff productivity relate to reduced or similar numbers of staff hours whilst car kilometres delivered have significantly increased.
- **The graph shows that LU is very efficient at delivering service measured in car kilometres.** However, compared to other metros, LU's overall capacity utilisation is low. Therefore, labour productivity measured on the alternative basis *per passenger journey* is relatively low. Given the high wage rates in London, achieving excellent labour productivity is important for LU.
- LU's capacity utilisation is relatively low due in part to the high off-peak service offered and the relatively low density of the outer zones served by the network.
- Continued investment in mechanisation and automation, such as the Automated Track Monitoring System which will provide real time information on track condition allowing LU to predict and prevent service disruption, will improve productivity further. LU will continue to deliver more for less as line upgrades deliver increased car kilometres through longer and more frequent trains.
- LU is developing its station staffing model through the Fit for the Future Stations programme. LU also has a relatively high ratio of spare train operators, required to maintain train service reliability and cover events where operators are not available.

Reliability trends



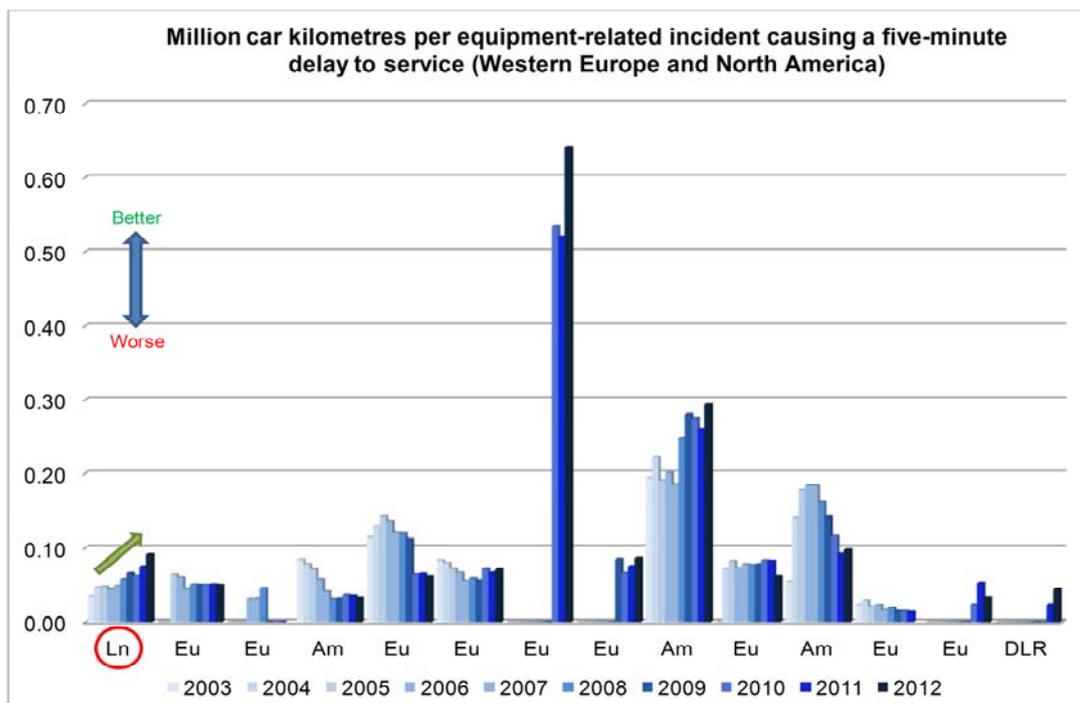
- LU's reliability improved by 32% in 2012/13, which was an advance on its 11% improvement between 2010/11 and 2011/12.
- **Since 2008/09 LU has improved by 61% on this measure.**
- For the included metros that returned data for both 2011 and 2012, half improved their reliability whilst half reported worse reliability. **LU is one of the fastest improving metros in this area.**
- As can be seen from the graph, LU now performs well relative to other Western European and North American metros – it is currently better than the median. It must still make significant further improvements to come closer to the best performing metros.

Reliability 2012/13



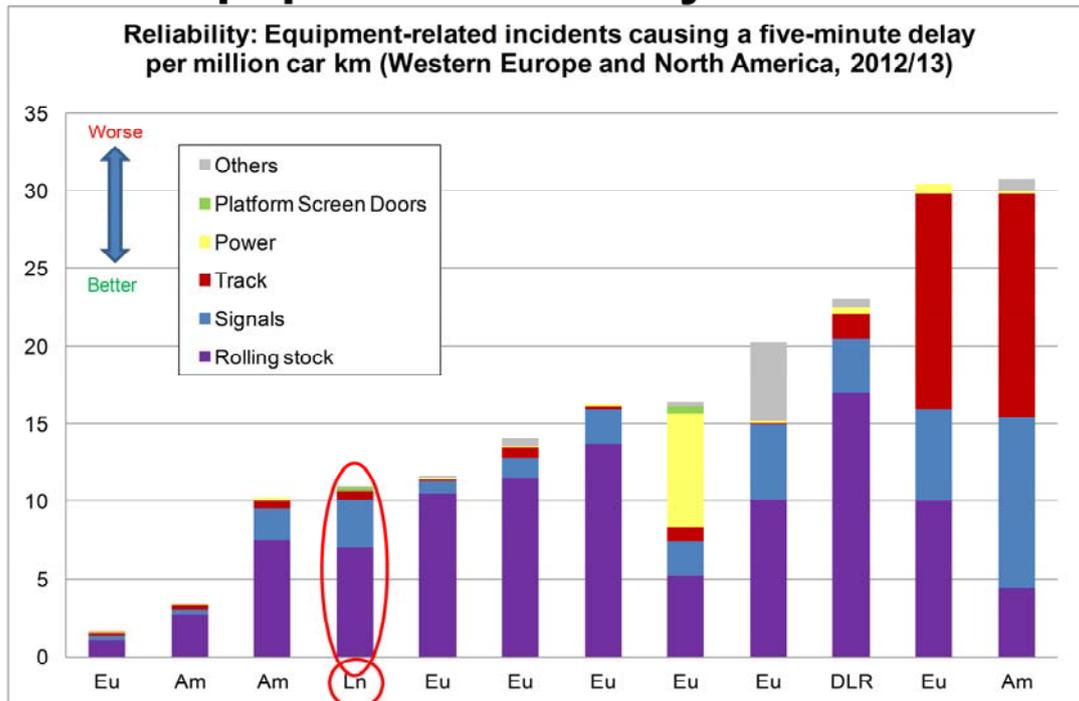
- LU improved across all attribution categories of incidents causing a five minute delay, with the greatest improvements in percentage terms in incidents attributed to staff and no fault found.
- Staff-related delays fell in 2012/13 by 33% with better performance and attendance during and before the Olympics, accounting for **some** of this trend. There was exceptional staff performance during and immediately after the Olympics. Longer running improvement trends in reduced staff-related delays continue to be observed.
- LU has the third highest number of staff-related delays per million car kilometres, which is an improvement since last year's report.
- Staff-related delays, which are primarily caused by non-availability, are a focus of LU's reliability programme.
- LU performs better than average in terms of the volume of passenger related delays. The reliability programme is using a range of media communications with passengers to achieve further improvements in this area.

Equipment reliability trends



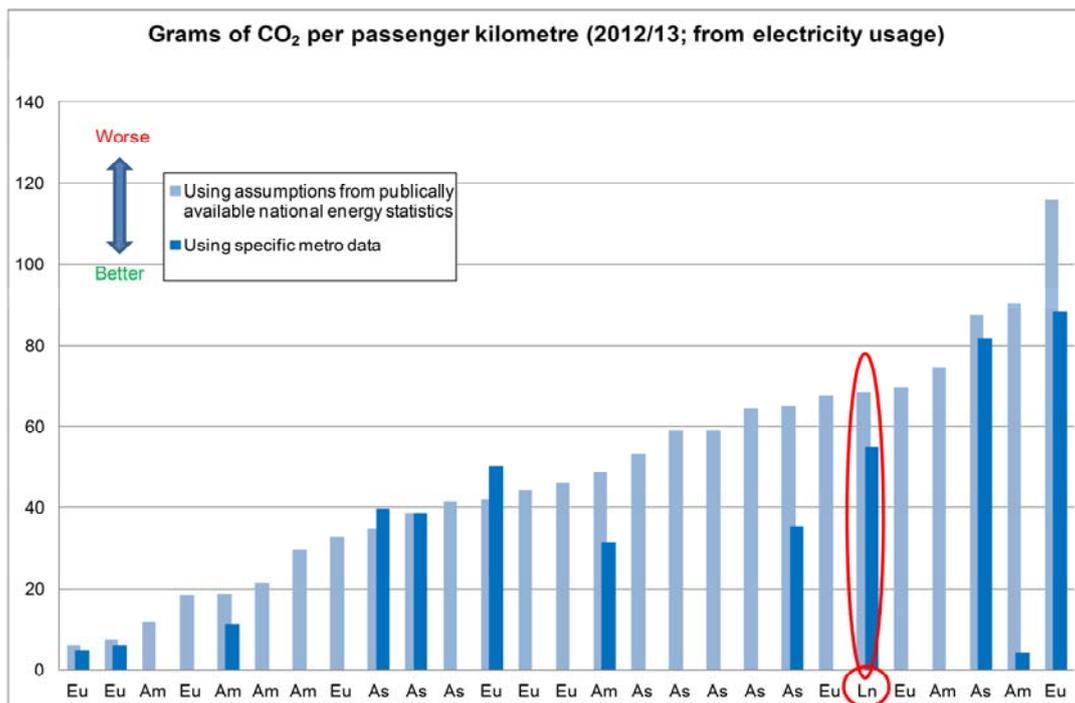
- LU has been able to improve its reliability with fewer disruptions due to equipment related incidents in 2012/13 compared to any of the previous 10 years.
- LU improved on incidents due to equipment by 22% in 2012/13; which compares favourably to its 21% improvement between 2010/11 and 2011/12.
- LU has improved by 60% on this measure since 2008/09.
- LU has outlined far-reaching plans to meet the Mayor's commitment of reducing Lost Customer Hours by a further 30% by the end of 2015. Lost Customer Hours is an LU-specific measure, which differs to the metrics described above and other metros therefore do not produce equivalent statistics. These plans do not solely rely on continued investment in new assets to improve reliability. However, future reliability improvement is also highly dependent on the continued investment in new assets.

Equipment reliability 2012/13



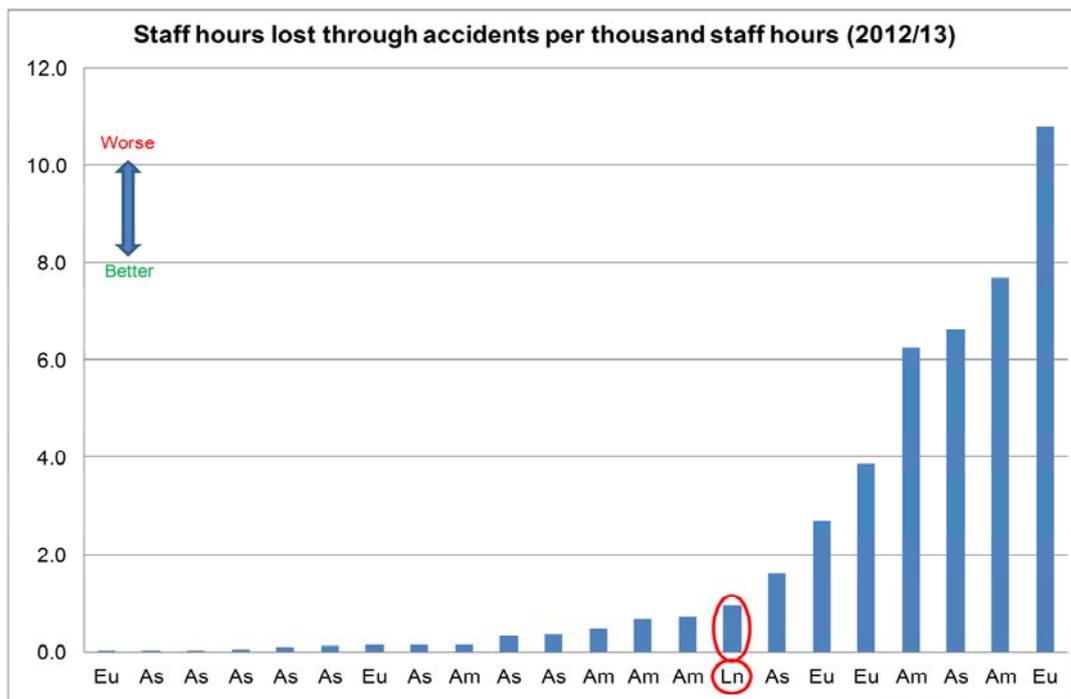
- LU generally performs better than the average of the rest of the peer group here, which reflects an improvement on 2011/12, when LU performed better than average in half of these equipment-related categories. **As obsolete equipment is replaced via line upgrades, LU should be able to improve further on these measures.**
- LU's overall reduced equipment related disruptions in 2012/13 was based on improvements in most types of equipment related failures.

Environment: CO2



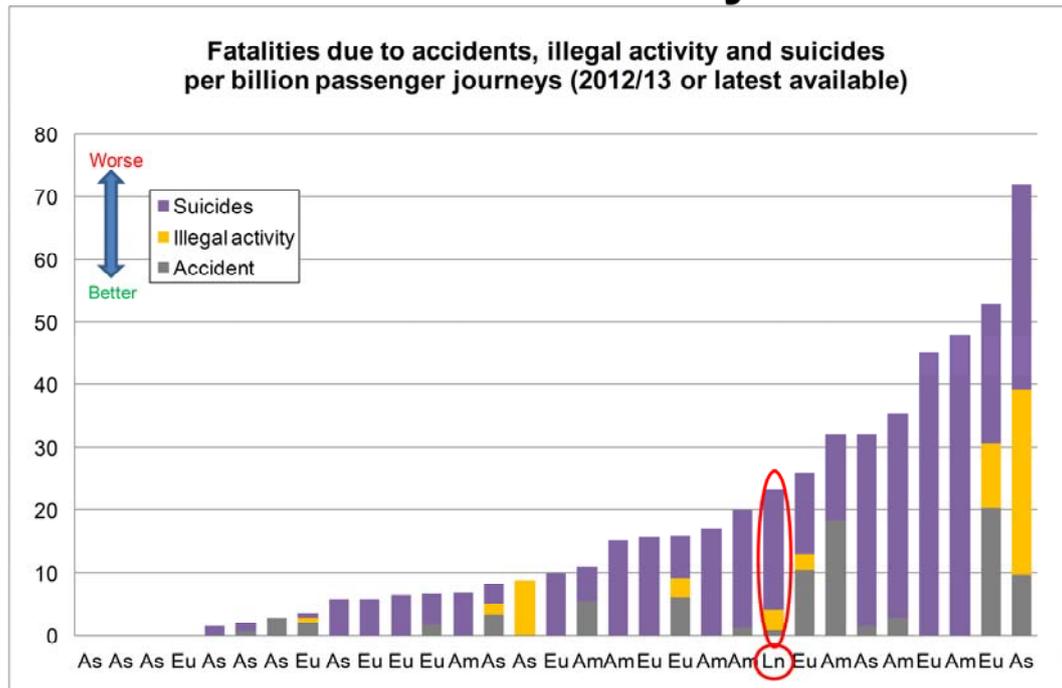
- The major structural factor for this metric is the make up of each metro's national grid mix. In 2013 the Department for Energy and Climate Change (DECC) and Department for the Environment and Rural Affairs (Defra) changed the calculation methodology for CO₂ emissions from grid-delivered electricity. As a result LU's total CO₂ emissions have reduced in comparison with previous CoMET reports and thus multiyear analysis for the different metros is not presented here. Backdating historical emissions using the revised Defra/DECC methodology results in LU's total emissions changing little in recent years, as increases in electricity consumption from capacity improvements are balanced by reductions in the grid emissions factor.
- London performs relatively poorly in terms of CO₂ emissions per passenger kilometre compared to its international peers largely because of the UK's national grid mix, though LU's relatively lightly loaded off-peak services are also a factor.
- Initiatives to improve traction energy efficiency continue in line with LU's programme of line upgrades. On the Victoria line, regenerative braking combined with larger power sections saves 34% in traction energy usage. LU is investigating modifications to further optimise traction energy efficiency.
- TfL has placed more responsibility on its projects to manage their energy and carbon impact. Under TfL's Pathway Project Management Framework all major projects must calculate the changes in energy consumption of their deliverables and investigate opportunities to improve energy efficiency.
- LU are continuing to consider opportunities to source a proportion of its power requirements from low carbon, decentralised energy sources.
- The improvement rate chart earlier in this pack shows a 5% improvement for LU on this metric, though LU's own re-based metrics calculated according to DECC/Defra guidance state that LU has improved by 18% over the same time period. Methodological differences in the calculations mean that we cannot compare our own metrics to the CoMET metrics for the other metros therefore we have used the CoMET calculations throughout in order to be able to compare LU's rate of improvement with that of other metros.

Staff safety related productivity



- This graph shows the productivity impact of staff related safety. It is not an absolute comparison of safety incidents.
- When comparing against revised data for 2011/12, **LU improved by 18% for this measure since 2011/12**. Since 2008/09 LU has improved by 31%.
- **LU performs better than average for this metric.**
- LU saw fewer incidents in 2012/13, but the average time lost per incident increased. LU saw less staff time off due to accidents in 2012/13 than in 2011/12. During the last 10 years LU's absolute numbers of hours lost have remained low.
- It should be noted that this metric is complex, as it reflects the staff accident rate, severity of workplace accidents and employer policies on providing time off to staff following accidents. It is desirable to have a low rate of staff accidents and especially of serious accidents. Generous leave provision may however be desirable to staff welfare and provide long-term financial benefit through staff retention, though it is not clearly valued in this measure.
- LU will continue to prioritise the safety of staff and customers. LU's defined and robust safety management system sets out clear roles and responsibilities across the organisation. Incident investigations focus on understanding causes to prevent similar accidents in the future. Safety is discussed every week at meetings of different levels and safety performance is continually monitored and reviewed, with actions taken to improve.
- In addition, LU plans to carry out a best practice study in 2014 looking at how other organisations deploy Health Safety and Environment staff and foster continuous improvement.

Customer safety



- This metric shows the number of fatalities due to accidents, suicides and illegal activity for 2012/13.
- LU performed relatively less well on this metric in 2012/13, though it is not far below average.
- It performed better than the average for fatalities due to accidents and for the sum of fatalities due to accidents and illegal activity.
- It performed worse than the average for fatalities due to illegal activity and suicides.
- **LU will continue to prioritise the safety of staff and customers.** LU's asset maintenance standards and monitoring are a key part of ensuring customer and staff safety. Station checks help to identify and resolve issues. There is also extensive communication with customers on safety issues via announcements, posters, the website and social media.
- Person under train incidents are thankfully relatively rare and unfortunately not unique to the Underground of London. Each incident is traumatic for everyone involved: the families, friends, staff and the emergency services. We continue to work closely with the emergency services to reduce the time these sort of incidents take to deal with. Additionally, there has been a notable improvement in medical intervention in these cases which enables paramedic first aid to be given on site and enhance the survival rate.
- The safety of all our customers, staff and others involved in travelling or working on our network, is always TfL's overriding priority. All stations have staff on duty throughout traffic hours, almost all stations are gated to prevent unauthorised access, CCTV coverage is extensive and customer help points are widespread.
- We provide training to our staff on how to identify and give the appropriate support to any customers who appear to be in distress or who are acting in a way which would identify them as high risk of suicide. TfL works with Network Rail and other train operating companies to share information and approaches to managing incidences of suicide on the railway. We are launching a new training programme for suicide prevention with the Samaritans which will give staff even more knowledge about the signs to look out for and the confidence to intervene.