

Date: 12 February 2015

Item 8: Rail and Underground International Benchmarking Report

This paper will be considered in public

1 Summary

- 1.1 This paper presents London Underground (LU) and Docklands Light Railway's (DLR) performance on a range of metrics in comparison with other metros who are members of the metro benchmarking groups CoMET (the Community of Metros) and Nova (Nova Group of Metros).
- 1.2 The analysis is attached at Appendix 1.
- 1.3 The Panel is asked to note the significant improving trends LU and DLR are making on key performance indicators for international metro benchmarking, particularly in covering operating costs, reducing maintenance unit rate costs and improving service reliability. LU and DLR are the highest performing Western European metros in terms of operating cost recovery trends.

2 Recommendation

- 2.1 The Committee is asked to note the Rail and Underground International Benchmarking Report.

3 Key Messages

- 3.1 Over the last three years, LU and DLR have both improved at a faster rate than the average of all metros for all seven lead metrics. They have also improved more rapidly than the average of other Western European and North American metros in the time period 2010/11 to 2013/14. This has been achieved through significant focus across the business on systematically improving reliability, driving down costs via the efficiency programme, whilst ensuring the highest levels of safety for our customers and staff.
- 3.2 **Operating cost recovery** – This is the third consecutive year that LU has covered operating costs from revenues. DLR has also joined LU as the only two Western European metros that do not need government subsidy to deliver their services. DLR outperforms LU here due to its lower cost base and the faster pace of change for DLR reflects the DLR three car deployment, which has a significant impact on operating costs. DLR's trend is undergoing one of the most significant improvements since 2010/11 at 27 per cent, whereas the average improvement across all other metros was five per cent.
- 3.3 **Total operating costs per car km** – LU's total operating costs are relatively high, whilst DLR's costs are just below average. LU and DLR have improved

significantly however, by six per cent and 29 per cent respectively, against an improvement rate of all other metros of two per cent since 2010/11. DLR continues to reap the efficiency benefits of the three car train deployment showing a consistent downward trend. LU has already made significant progress in reducing its cost base since 2008/09 and Rail and Underground has an extensive efficiency programme in place with £2.1bn net operating cost reductions secured for the period 2014/15 to 2020/21.

- 3.4 **Maintenance costs per car km** – DLR’s maintenance costs are below the average of other metros, and these reduced further between 2012/13 and 2013/14 by one per cent. Although LU’s total maintenance costs per car km are above average, these have significantly and continually reduced since 2008/09 by 17 per cent. LU’s rolling stock maintenance unit cost is however lower than average and LU has completed a number of studies to inform approaches to bring further improvements. Our analysis shows that London’s wage levels and the LU network’s length, reach and age are significant factors in LU’s maintenance unit rate costs.
- 3.5 **Labour productivity per passenger journey** – DLR is the third best metro in this peer group and improved by four per cent. LU performs lower than the average of the Western European and North American metros, however between 2012/13 and 2013/14 it improved on this metric by two per cent. Continued investment in new technology and associated process improvements will further improve LU’s productivity.
- 3.6 **Reliability** – Between 2010/11 and 2013/14, LU and DLR have been amongst the fastest improving metros in terms of reliability with 54 per cent and 210 per cent improvement respectively. The modernisation of the Victoria and Jubilee lines has enabled reliability improvements of 74 per cent and 67 per cent respectively on these lines since 2010/11, highlighting the value of these enhancements to customers. In 2013/14, the mean distance between incidents which caused more than five minutes delays increased by six per cent for LU and by 68 per cent for DLR. Currently, LU and DLR are similarly reliable and both perform better than the average North American and Western European metro. Equipment-related incidents have reduced significantly for LU and DLR and we expect this to reduce further as we continue to modernise our network.
- 3.7 **Environment** – LU and DLR’s CO₂ emissions per passenger km are similar, and they are higher than the average of their international peers. This is largely because of the UK’s national grid mix (which has a smaller proportion of low CO₂ energies than other countries). However, since 2010/11 LU and DLR have improved by 25 per cent and 19 per cent respectively, following the introduction of regenerative braking on some lines. LU and DLR continue to embed sustainability considerations across processes and activities. LU’s energy sourcing strategy will deliver carbon savings through a number of initiatives, including optimising Greenwich Power Station.
- 3.8 **Safety** – LU and DLR perform better than average in terms of staff safety, and have improved by 13 per cent and 36 per cent respectively between 2010/11 and 2013/14. They also perform significantly better than average for customer safety related to accidents or illegal activity. In 2013/14 LU improved by 81 per cent and

DLR again had no fatalities. The Office of Rail Regulation (ORR) noted in its Health and Safety Annual Report 2013-14 that 'TfL continues to maintain a high level of safety for its passengers and workforce as passenger numbers and services grow' (July 2014, page 22).

List of appendices to this report:

Appendix 1: International Metro Benchmarking – Final Report

List of Background Papers:

None

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International Metro Benchmarking

Final Report



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

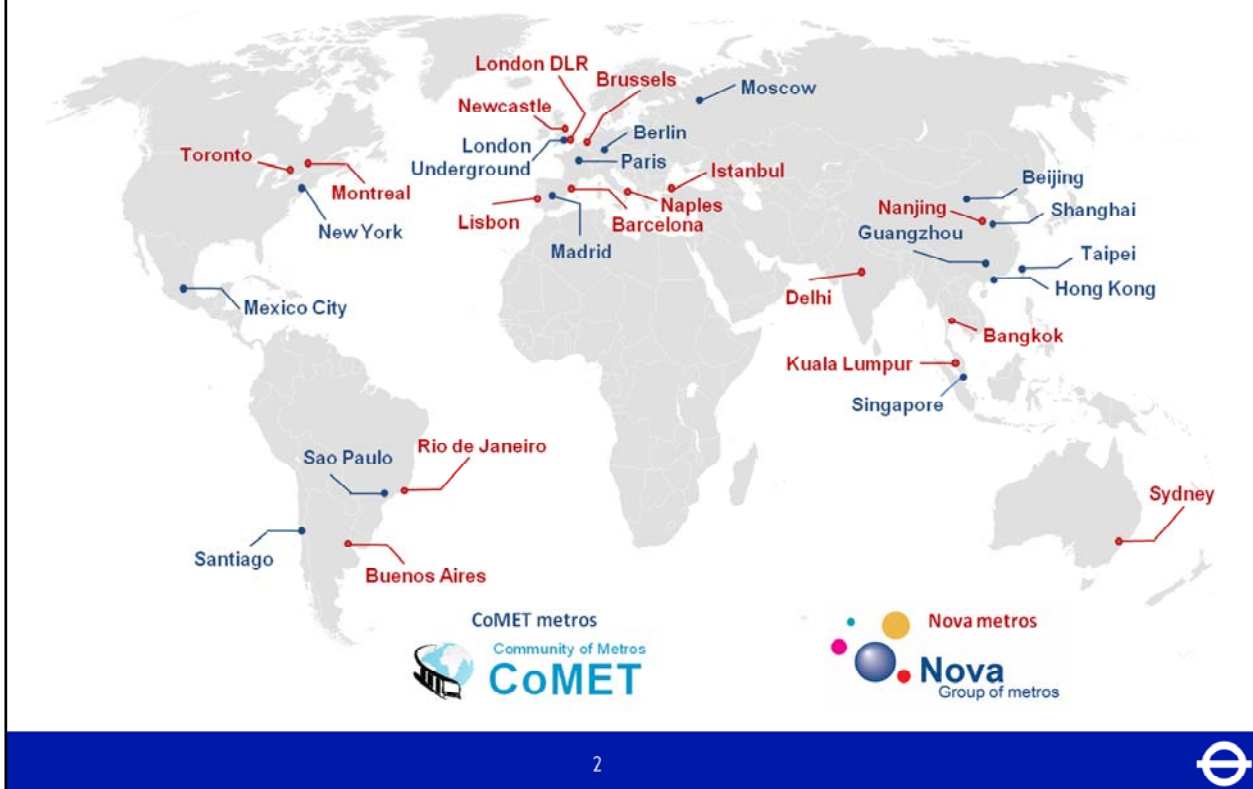
- Operating cost recovery ratio – a measure of the level of Government subsidy required by metros to cover the cost of operations;
- Total operating cost per car km – a measure of cost efficiency;
- Maintenance cost per car km – a measure of cost efficiency;
- Passenger journeys per total staff and contractor hours – a measure of staff productivity;
- Car km between incidents causing more than five minutes service delay – a measure of reliability;
- Grams of CO₂ per million passenger km – 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 journeys, which is a measure of customer safety.

A high level explanation is provided as to why LU and DLR are performing relatively well or less well in specific areas, including considering contextual factors (for example, relative city wages or the impact of older 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 (KPIs) reported by the members of CoMET and Nova for the year 2013/14. The information is independently collated by Imperial College's Railway and Transport Strategy Centre.

International metro benchmarking

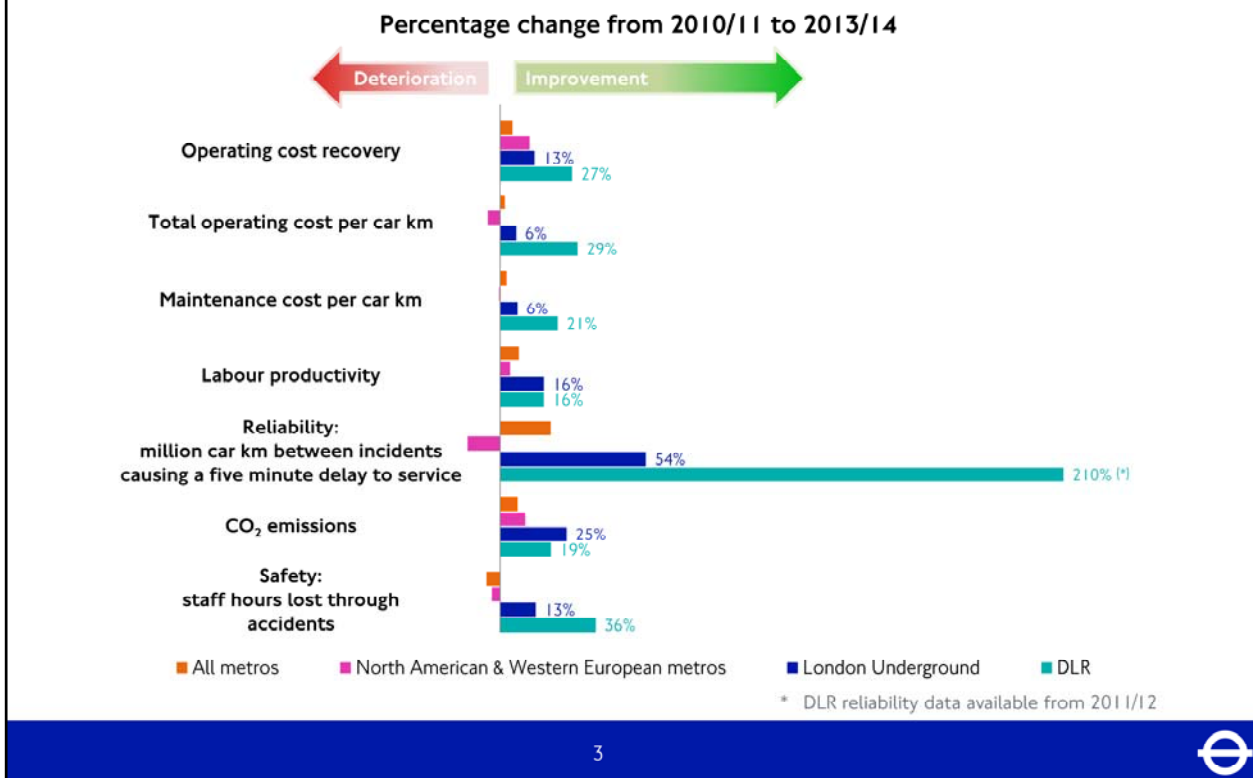


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- LU was a founding member of CoMET (the Community of Metros), a group of 16 of the largest metros from around the world, in 1995. Nova is a group of 16 medium sized metros, and DLR joined in 2013. The two groups work closely, with mutual sharing of 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 normalised using Purchasing Power Parity (PPP) from the World Bank. This 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 this 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. Hence, when applicable the metros names have been replaced by codes according to their geographical location ("Am" for America, "As" for Asia and "Eu" for Europe).
- A key benefit of LU's and DLR's membership of CoMET and Nova is access to diverse annually refreshed KPI data from member metros. Given that LU and DLR are unique in the UK, comparison with international peers provides valuable insight and the opportunity to share best practice thus supporting our 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 and DLR's membership of CoMET and Nova across the organisation, providing further impetus to improve performance.
- The most relevant innovation of this year's report is the availability of historic data from DLR for all the relevant indicators. This has made it possible to produce a fully joint LU and DLR report for the first time.

LU and DLR compared to other metros



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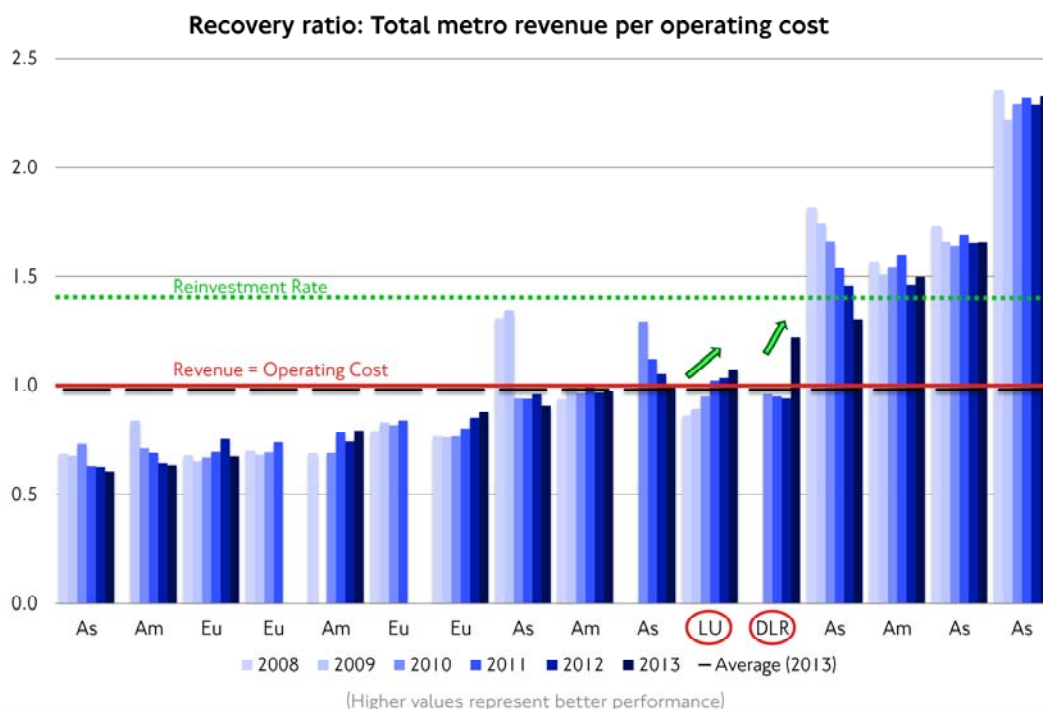
Over the last three years for all seven lead metrics, LU and DLR have both made remarkable progress. They have improved at a faster rate than both the average of all other metros and than the average of other Western European and North American metros.

DLR joined Nova in late 2013. Today's DLR is significantly different to the pre-2009 era with major expansion projects now operational; therefore its historical benchmarking data gathered starts from 2010/11. Thus, for comparability with LU and other metros, this summary page presents the changes from 2010/11 to 2013/14:

- **Operating cost recovery** – Total revenues per total operating costs. LU improved by 13% and DLR by 27% (other Western European and North American metros also improved on average by 11% and all metros improved on average by 5%).
- **Operating cost** – Total operating cost per car km (including service operations, maintenance, administration and other). LU improved by 6% and DLR by 29% (Western European and North American metros deteriorated by 5%, whilst all metros have improved by 2%).
- **Maintenance cost** – Total maintenance cost per car km. LU improved by 6% and DLR by 21% (Western European and North American metros remained unchanged and all metros improved by 2%).
- **Labour productivity** – Passenger journeys per total staff and contractor hours. LU and DLR improved by 16% (Western European and North American metros improved by 4% and all metros by 7%).
- **Reliability** – Million car km between incidents causing a five-minute or more delay. LU improved by 54% and DLR by 210% (Western European and North American metros deteriorated by 12% and all metros improved by 19%).
- **Environment** – Grams of CO₂ per million passenger km. LU improved by 25% and DLR by 19% (Western European and North American metros improved by 9% and all metros improved by 7%).
- **Safety** – Staff hours lost through accidents per thousand staff hours. LU improved by 13% and DLR by 36% (Western European and North American metros deteriorated by 3% and all metros by 5%).

Analysis of the KPI data for 2013/14 shows that the relative strengths of LU and DLR continue to be in safety-related productivity, operating cost recovery and labour productivity. Compared to other metros, particularly modern Asian metros, LU and DLR's performance is less strong for administration costs, carbon emissions and reliability.

Operating cost recovery trends

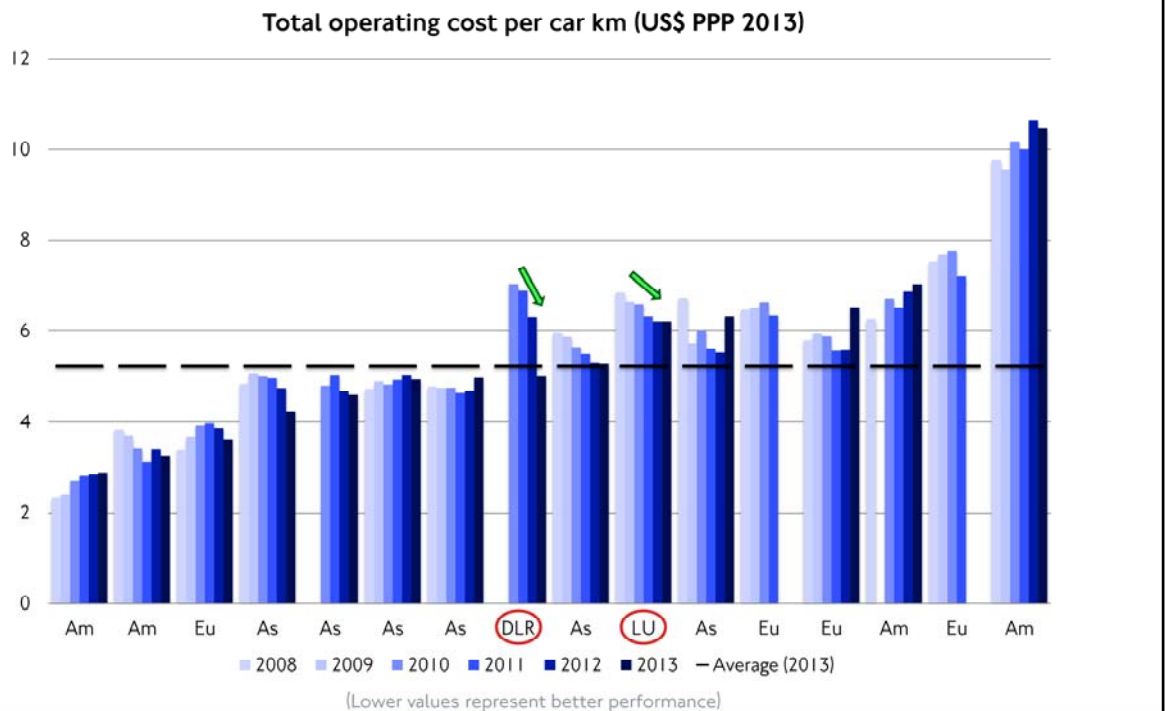


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- This graph indicates the operating cost recovery ratio of CoMET metros and DLR from 2008/09 to 2013/14. The ratio is the result of dividing total metro revenues by operating costs.
- This is the third consecutive year that LU's revenues have exceeded its operating costs, meaning that it has not needed government subsidy for non-capital operational activities. In 2013/14 DLR's revenues also exceeded its operating costs; in previous years, recovery ratio was lower than 1.0 due to the higher costs incurred for the mobilisation (and delivery) of the London 2012 Games.
- LU has improved by 13% since 2010/11 in this metric, while DLR has improved by 27%.
- For both metros these improvements can be attributed to increased ridership, cost reductions resulting from efficiency initiatives and fare policy. LU's non-fare revenue (e.g. advertising, retail) has also increased over this period, reflecting the increased business focus on this area.
- In 2013/14 LU's recovery ratio improved by 4%, whilst DLR improved by 29%. Their current operating cost recovery ratios are 1.07 and 1.22 respectively.
- For the rest of Western European and North American metros in CoMET and Nova, the average recovery ratio is 0.84, indicating that the majority need government subsidies to fund their operating costs. On average, their recovery ratio has improved by 12% since 2010/11.
- Further improvement in operating cost would take both LU and DLR closer to the recovery ratio of 1.40, which is the level observed by Imperial College as the rate at which metros can, on average, also cover asset renewals with their revenues (the reinvestment rate).
- Growth in DLR's fare revenue is expected to continue from new ridership due to increasing urban density around the Docklands. Crossrail will alter the volume and profile of DLR ridership when it opens in 2018/19.
- For LU, fare revenues will continue to grow as a result of the introduction of extra services, made possible by our investment in maximising capacity (new trains and signalling). Crossrail will also have a significant impact. At the same time, cost reductions will continue to be achieved through various initiatives. These include: improved contract terms, improved utilisation of engineering possessions, modernisation of maintenance regimes (taking advantage of the investment in asset renewal, the introduction of preventative maintenance and increased remote condition monitoring) and changes to station staffing models.
- LU has committed to a comprehensive efficiency programme. Under this, £2.1bn net operating cost reductions have been secured for the period 2014/15 to 2020/21.

Total operating cost trends

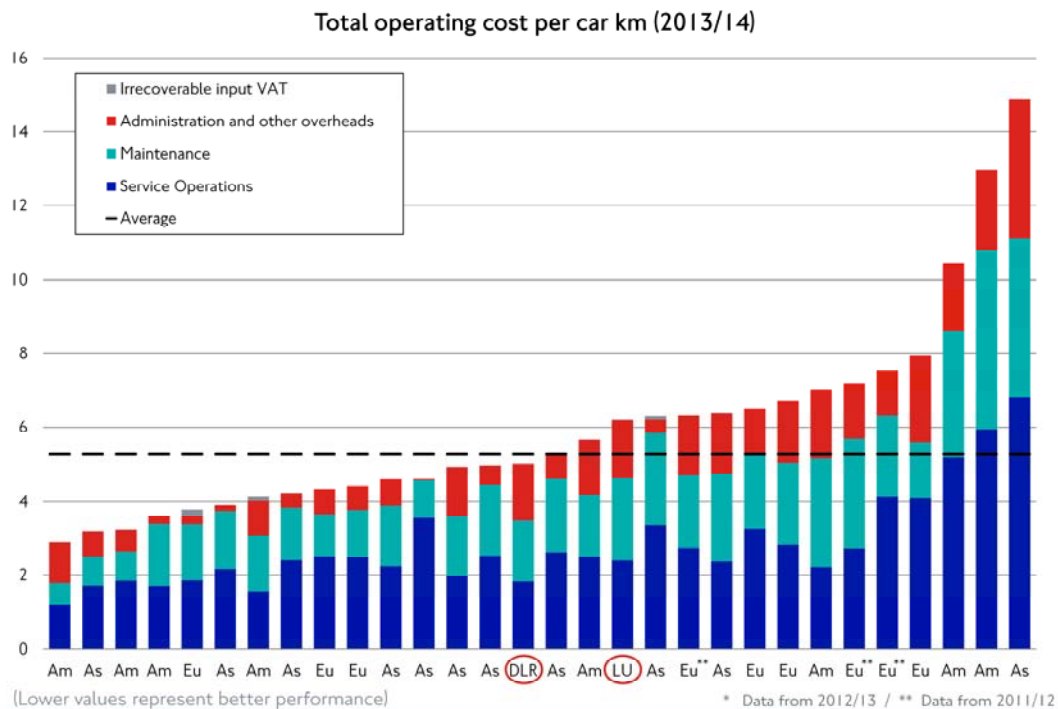


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- This chart shows the trends of operating cost per car km between 2008/09 and 2013/14 for the CoMET metros and DLR. Operating cost includes the costs of service operation, maintenance, administration and other overheads. It excludes the costs of heavy renewals and capital investment.
- Since 2010/11 LU has reduced its operating cost per car km by 6%. It has accomplished this by delivering 12% more car km whilst increasing real costs by 5%.
- DLR operating cost per car km has reduced by 29% since 2010/11. DLR has continued to increase capacity by providing 46% more car km for only 5% more cost. The major factor in achieving this has been operating longer trains, through the gradual addition of a third car across the railway. The extension to Stratford International in 2011/12 has also been significant.
- Between 2010/11 and 2013/14 the rest of CoMET metros reduced their operating unit cost by 2% on average.
- In 2013/14 LU's operating unit cost remained unchanged. It is providing 1% more car km for 1% additional real cost. Real cost grew mainly because of an increase in the number of staff, above-inflation pay rises for operational staff, a change in the methodology for apportioning TfL costs and higher electricity prices.
- DLR's operating unit cost improved by 20% in 2013/14. It provided 1% more car km whilst reducing its real cost by 20%. The unusually steep reduction curve from 2011/12 to 2012/13 reflects moving back to normal operations after the resource intensive Olympics period.
- LU's unit cost remains 21% higher than the CoMET average, while DLR is 2% lower than average.
- LU has plans to keep delivering more for less, in line with the long term trend, as line upgrades deliver increased car km through longer and more frequent trains. In future, 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 programme will improve customer service whilst reducing costs (subject to consultation).

Total operating cost 2013/14

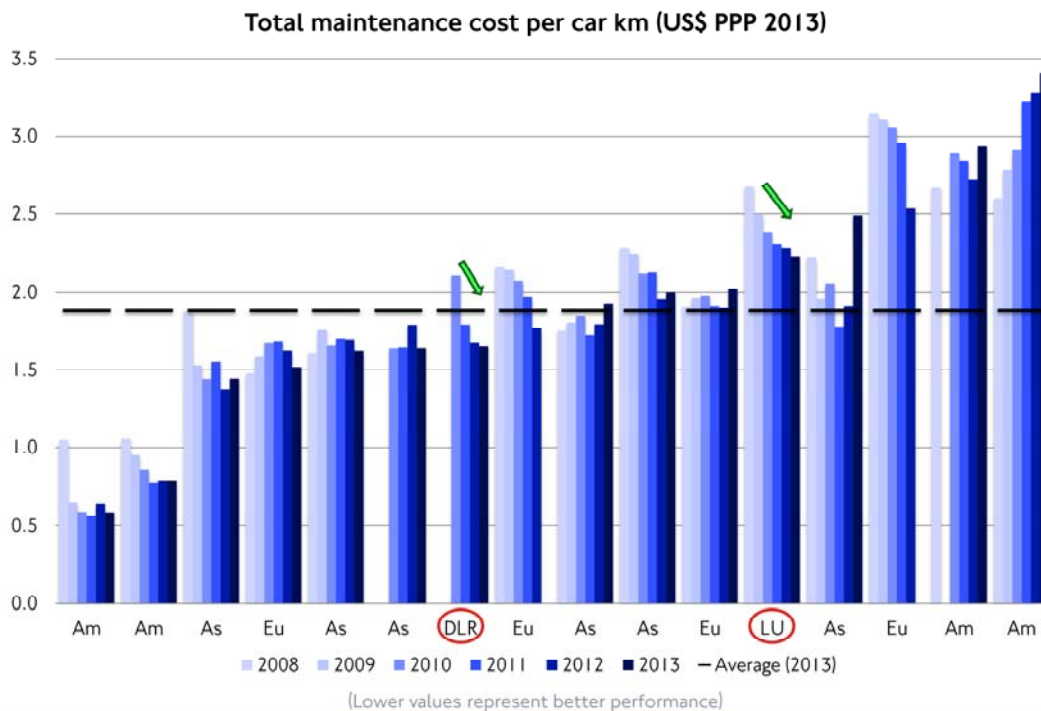


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- This graph presents the breakdown of operating cost per car km in 2013/14 for all CoMET and Nova metros.
- As for most metros, for both LU and DLR, service operations and maintenance costs continue to be the most significant operational expenses.
- In 2013/14 LU's service operations unit cost rose by 2%. The main reasons for this were additional recruitment and increased electricity prices. LU's service operating unit cost is comparable to the average of the other metros.
- In 2013/14 DLR had the sixth lowest service operations cost per car km of all metros, improving by 24% in this metric. DLR's relatively low level of staffing makes its service operations cost particularly low. The unit cost had been higher than usual in 2012/13, when extra staff were deployed for the London 2012 Games.
- LU's maintenance unit cost decreased by 2% in 2013/14, whilst DLR's decreased by 1%. In the following pages maintenance cost trends are examined more closely.
- LU's unit cost of administration and other overheads remained unchanged in 2013/14, while DLR's decreased by 31%. LU's costs did not reduce mainly due to a change in the methodology for apportioning TfL costs. DLR continues to reap the efficiency of the three car deployment showing a consistent downward trend. The cause of the unusually steep gradient versus 2012/13 correlates to returning to business-as-usual after the cost intensive London 2012 Games period.
- The outsourcing business model of the DLR makes administration and other overheads costs higher, especially when compared to modern Asian metros. However, this model also helps achieve efficient operations, infrastructure and station facilities maintenance.

Total maintenance cost trends

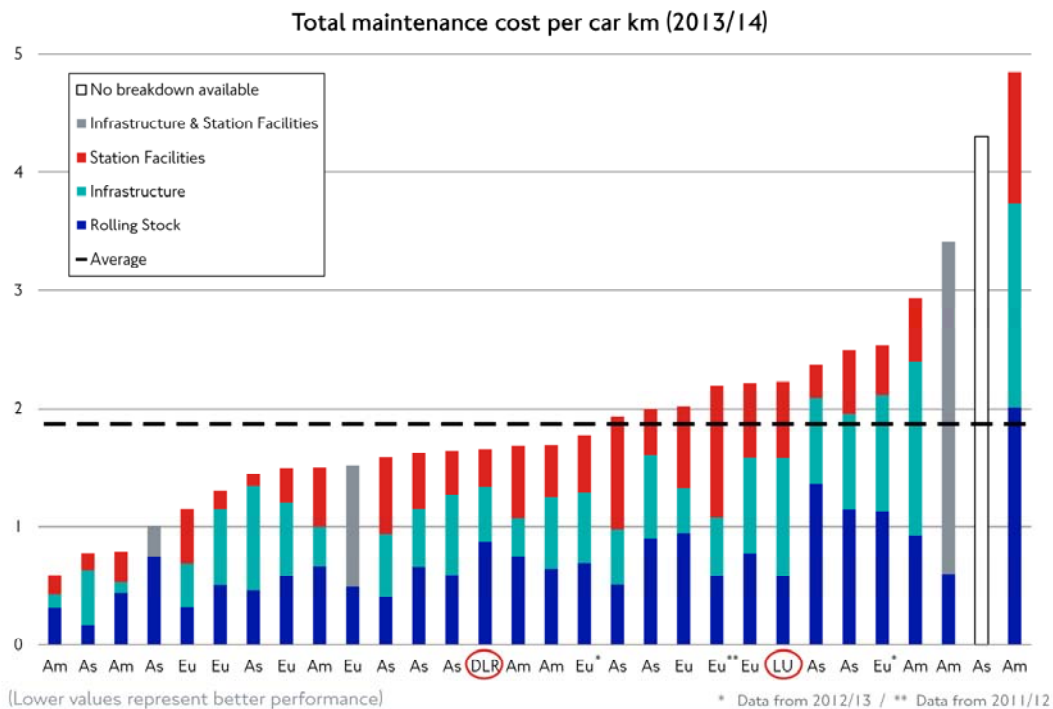


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- This chart indicates the maintenance unit cost trends since 2008/09 for the CoMET metros. The measure used is maintenance cost per car km.
- LU's maintenance cost per car km has decreased by 6% since 2010/11. As the chart shows, it has followed the positive trend started in 2008/09, when TfL efficiency plans were drafted and Metronet was brought into TfL.
- Since 2010/11 DLR has reduced its maintenance unit cost by 21%. Real maintenance cost has increased by 15% mainly due to more vehicle exams necessitated by additional mileage. However, this has been offset by 46% extra car km achieved by running longer 3-car trains resulting in a more efficient vehicle utilisation.
- In 2013/14 LU's maintenance unit cost decreased by 2%, continuing the improving trend from the previous years. This reduction was an improvement on 2012/13, when maintenance unit cost decreased by 1%.
- DLR maintenance unit cost decreased by 1% in 2013/14. This is the result of a decrease in infrastructure and facility unit costs partially offset by an increase in fleet maintenance (see overleaf).
- LU's maintenance unit cost is 19% higher than the CoMET average, although this cost has not been normalised for structural factors such as high labour costs, asset condition and age. The relevance of these structural factors is reviewed later in this report.
- DLR's maintenance cost is 11% lower than the CoMET average.
- The maintenance unit cost of other CoMET metros has not followed a consistent trend since 2010/11. On average, their maintenance unit cost has reduced by 1% over this period.

Total maintenance cost 2013/14

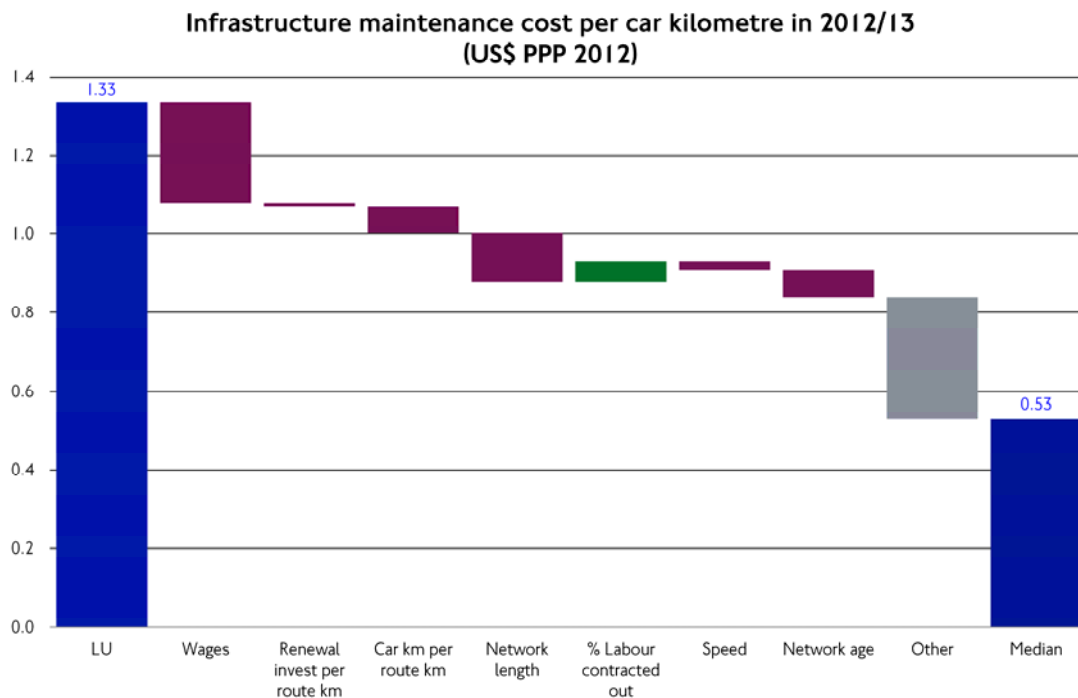


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- This graph presents maintenance cost per car km in 2013/14 for all the CoMET and Nova metros. Maintenance unit cost is broken down by asset type where feasible, including rolling stock, infrastructure and station facilities.
- LU's reduced maintenance unit cost in 2013/14 reflects improvements in all three areas: unit cost decreased by 2% for both rolling stock and infrastructure maintenance and by 3% for station facilities.
- As the chart indicates, the distribution of LU's maintenance unit cost differs from other CoMET and Nova metros. LU's station facilities and infrastructure maintenance unit costs are higher than the average of all metros. LU's rolling stock maintenance unit cost is however lower than average.
- Following the maintenance backlogs experienced during the Private Public Partnership era, LU has been investing heavily to bring its infrastructure assets to an optimal condition. Baker Street and Embankment have had their assets refreshed in the past year and similar station works will continue at other locations, with Crossrail interchanges prioritised. Major station modernisations are in delivery at Tottenham Court Road, Victoria, Vauxhall, Bond Street, Finsbury Park and Bank. Additionally LU is modernising the tracks and signalling systems of various lines. It is expected that as the new assets stabilise into service, maintenance works will become less frequent and increasingly mechanised, thus further reducing costs.
- LU has carried out detailed studies into maintenance costs and now has an enhanced understanding of the structural factors and opportunities to improve. An example is given on page nine.
- DLR overall maintenance unit cost decreased by 1% in 2013/14. Its rolling stock maintenance unit cost is higher than average and it increased by 10%, as heavy exams for the newer B2007 fleet started. This pattern will still be seen through 2014/15 as the programme delivery completes its first cycle in April 2015.
- DLR's infrastructure maintenance unit cost reduced by 13% and remains significantly lower than the average of all metros. DLR's station facilities maintenance unit cost has improved by 9% and it is one of the best metros for this metric. These reductions follow increased spending on the railway to ensure it was ready to welcome the London 2012 Games.

The influence of structural factors on LU

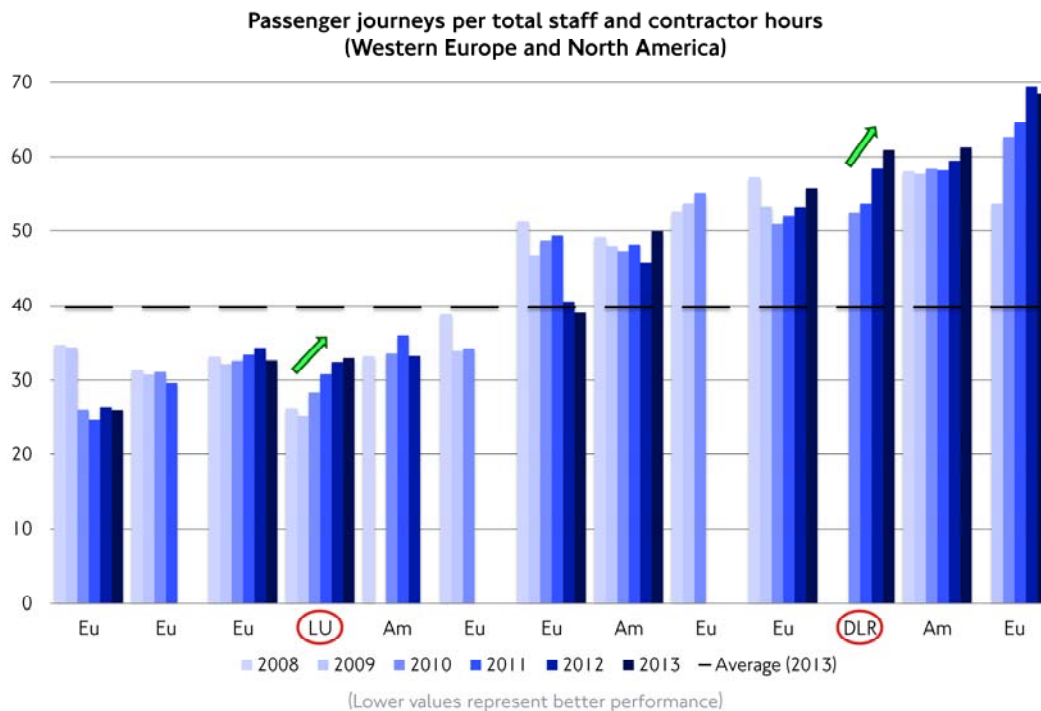


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- Simple unit cost comparison between metros does not consider local cost drivers, such as the local operating environment, network characteristics and asset reliability, which all vary between metros.
- Commissioned by LU, Imperial College London developed an econometrics model that sought to explain the reasons behind a metro's operating costs via statistical analysis. LU has used this model to compare the weights of these factors in the operating costs of the different metros.
- This chart shows the result of comparing LU's infrastructure maintenance cost per car km in 2012/13 to CoMET's median metro for this metric, indicating the weight attributable to each factor (wages, renewal investment per route km, network length and so on).
- The results reveal that 32% of the cost difference arises from London's city wage level, which is 80% higher than that of the median metro. LU's network reach and network length account for another 23% of the cost gap. A further factor is LU's higher investment in renewals per car km.
- The model is underpinned by various assumptions and a portion of the gap remains unexplained. Nevertheless, it confirms that structural factors such as wage levels and network length significantly influence LU's infrastructure maintenance cost. It also identifies other non-structural factors that influence operating costs and could be easier to address. Econometrics analysis can thus be a powerful tool for identifying areas where efficiencies can be gained to further reduce operating costs.

Labour productivity trends

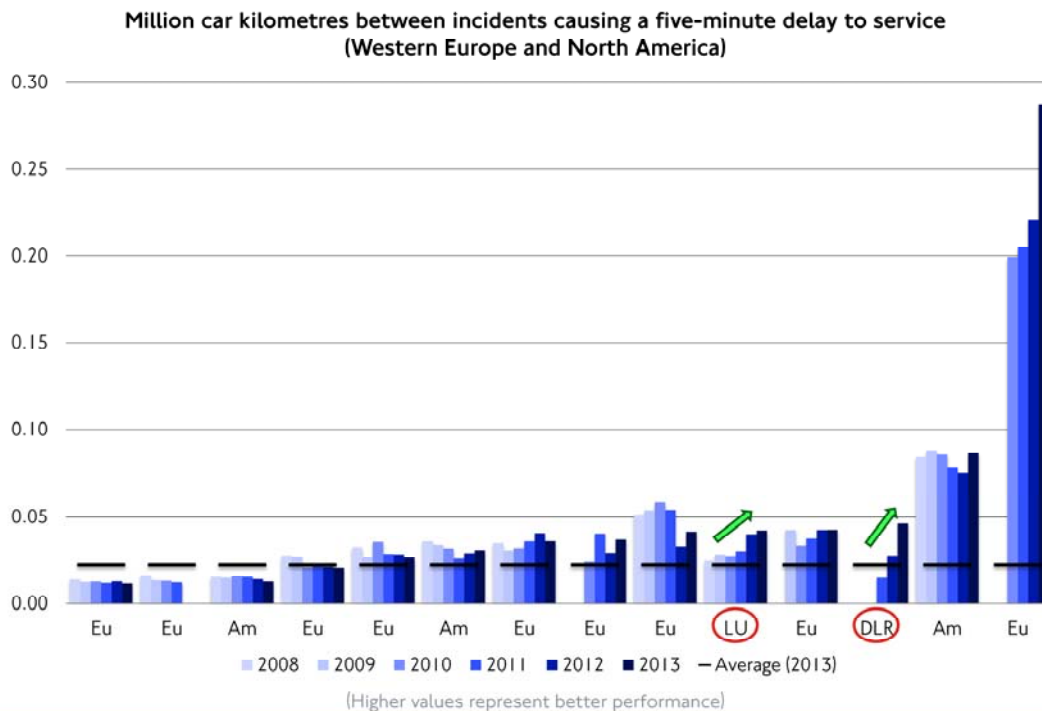


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- Historically LU has compared labour productivity with other metros in car km per total staff and contractor hours. However, this metric does not reflect capacity utilisation which for the LU network is relatively low, especially on the outer parts of the network and during the off-peak. Therefore the car km metric is not reflective of our passengers' demands on our staff, given the usage patterns on our network. Following some consideration and discussions with Imperial College, we have judged it appropriate to consider labour productivity according to passenger journeys this year. This metric considers staff productivity when at work; it does not include comparison of working hours or annual leave provision across metros.
- Given their labour costs and levels of mechanisation, labour productivity tends to be higher for Western European and North American metros. This analysis therefore focuses on this peer group.
- Both LU and DLR's labour productivities have improved by 16% for this metric since 2010/11. Passenger journeys increased by 15% and 30% respectively, whilst staff hours decreased by 1% for LU and increased by 12% for DLR.
- On average, labour productivity has improved by 4% for the other Western European and North American metros since 2010/11.
- In 2013/14 only, LU improved by 2% and DLR improved by 4%. Passenger journeys grew by 3% and 2% respectively, whilst staff hours increased by 1% for LU and decreased by 3% for DLR. This reduction of staff hours for DLR in 2013/14 relates to the high levels of staffing deployed for the 2012 London Games.
- DLR is the third best metro in this peer group.
- LU has a relatively high ratio of spare train operators compared to other metros. Some of this is required to maintain train service reliability and cover events where operators are not available. Continued investment in new technology and associated process improvements will further improve LU's productivity. In addition, LU's Access Transformation Programme will continue to redesign the way in which the railway is accessed for maintenance and engineering work, removing barriers in order to deliver significant productivity gains.
- LU is also developing its station staffing model through the Fit for the Future Stations programme.

Reliability trends

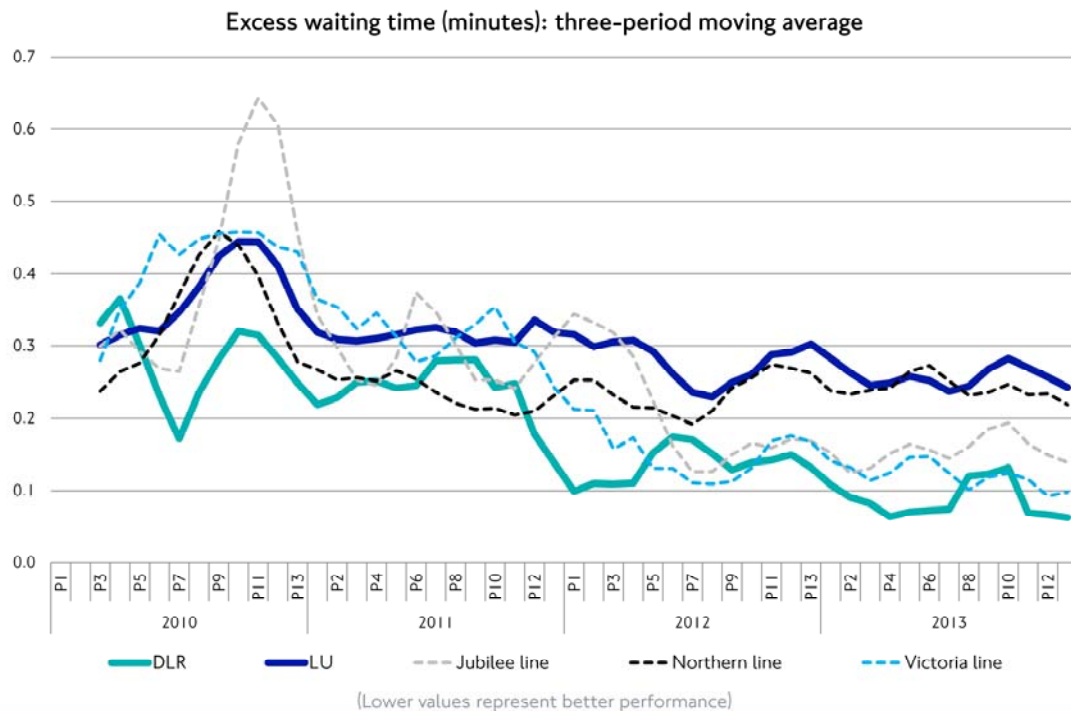


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- In general, the metros in Asia and South America are the most reliable in CoMET and Nova, with a significant gap when compared to older metros on other continents. In addition to their structural differences in operating environment, these metros have built a majority of their lines in recent decades, meaning they have fewer legacy challenges than their older peers in Western Europe and North America.
- Hence, for better comparability this chart analyses the reliability of Western European and North American metros since 2008/09. The metric chosen to measure reliability is million car km between incidents causing a delay of five minutes or more.
- Since 2008/09 LU's reliability has improved by 71% in this metric. DLR has improved by 210% since 2011/12.
- In 2013/14 LU's reliability improved by 6%, whilst DLR improved by 68%, both continuing their positive trends from the previous years. The modernisation of the Victoria and Jubilee lines has enabled reliability improvements of 74% and 67% respectively since 2010/11.
- For the included metros that returned data for both 2008/09 and 2013/14, LU was the fastest improving, whilst DLR was the fastest improving between 2011/12 and 2013/14.
- LU has undertaken a range of initiatives to improve reliability; these have included DLR implemented a governance and a culture change programme in 2010, intended to improve output prior to the London 2012 Olympic and Paralympic Games. This encouraged all parties to focus on key priorities and take ownership of their specific contribution to performance.
- LU and DLR perform better than the average of other Western European and North American metros and are making significant improvements to come closer to the best performing metros in this peer group.

Alternative metrics for comparing reliability

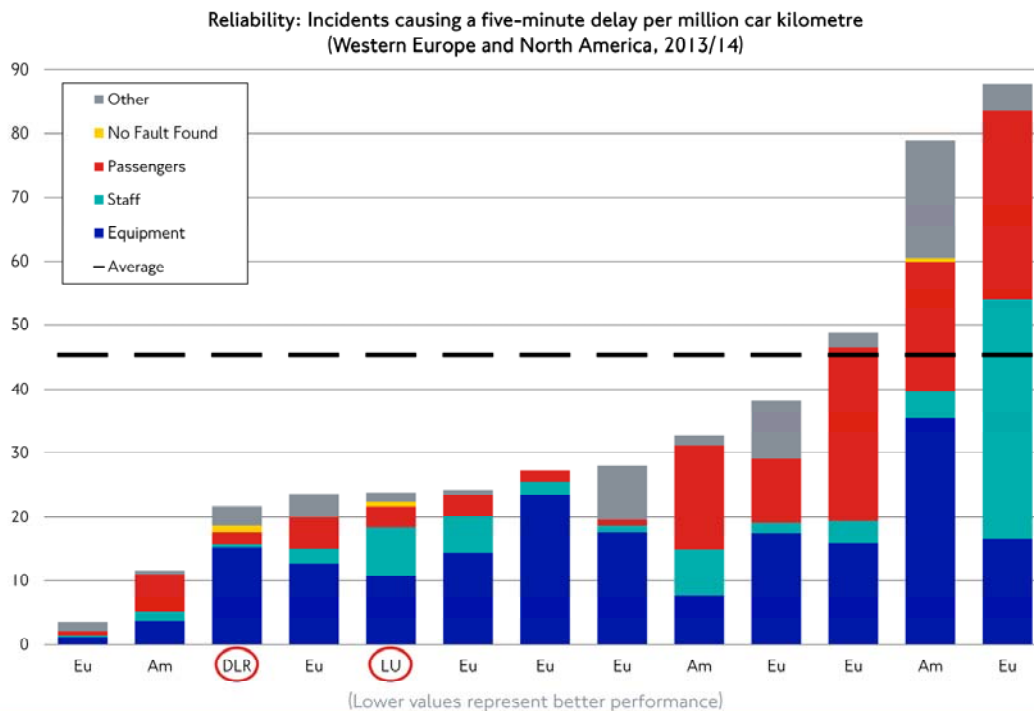


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- The KPIs available in the CoMET and Nova database consider delays of five minutes or more. On DLR only circa 15% of individual services operate on a headway of five minutes or less. Therefore, for 85% of DLR services any cancelled train is automatically a five-minute delay to customers. This metric is therefore more challenging for DLR than for those metros that operate with shorter headways on most of their network, such as LU.
- An alternative reliability metric is platform “excess waiting time”. This provides a weighted average of the length of time customers wait for a train versus how long they should wait according to the timetable; longer delays are weighted exponentially higher than shorter ones.
- LU and DLR both calculate excess waiting time, so it is possible to compare their reliability using this measure.
- The chart presented above shows the three-period moving average excess waiting time performance of DLR from 2010/11 to 2013/14 and compares it to the overall LU network as well as lines with similar signalling systems to DLR: the Jubilee, Northern and Victoria lines.
- The Victoria line performs similarly to DLR, however the LU network generally is less reliable than DLR on this metric. Both DLR and LU show an improving trend on this metric and the position of the LU network average relative to the LU lines shown underlines the value to passengers of installing modern signalling equipment.
- The Victoria and Jubilee lines were modernised during this period. Against a backdrop of increased ridership, excess waiting time on these lines has reduced by more than 60% suggesting the high reliability value of this investment.

Reliability 2013/14



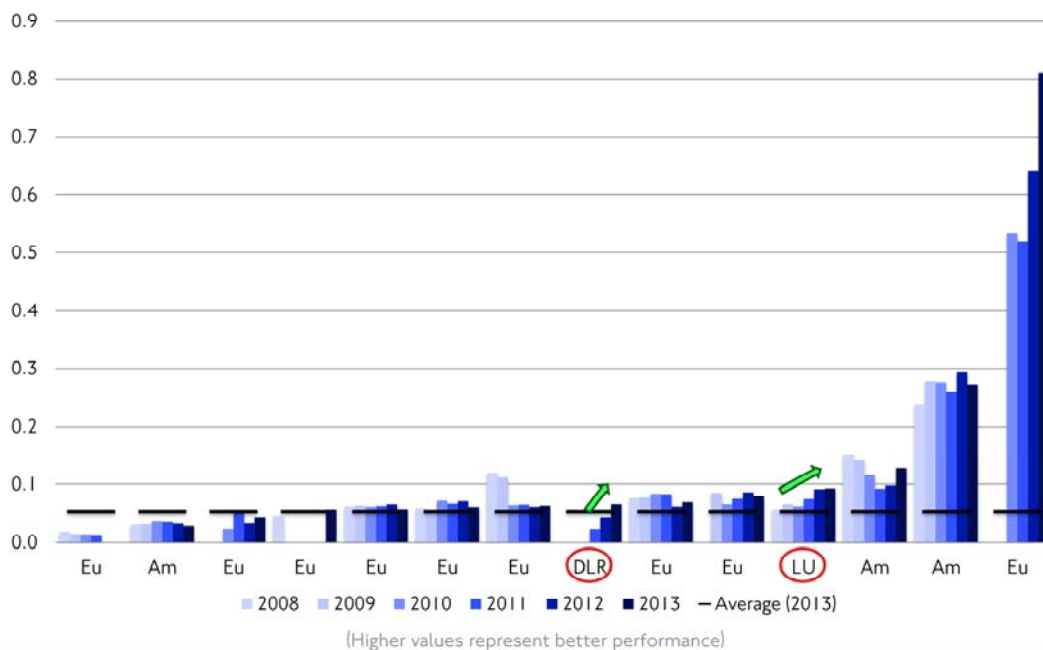
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- For further insight on the 2013/14 reliability figures presented on page eleven, this graph considers the incidents according to their cause: equipment, staff, passengers, no fault found and others. The metric used is incidents causing a delay of five minutes or more per million car km.
- In 2013/14 LU's reliability improved across all categories for this metric.
- LU has the second highest number of staff-related incidents per car km. However, it improved by 9% in this metric. These incidents are primarily caused by non-availability and are a focus of LU's reliability programme. Amongst other initiatives, LU is spreading the practices of the best-performing depots across the lines.
- LU performs better than average in terms of the volume of passenger-related delays per car km, and it improved by 7% on this metric in 2013/14. Simple ideas such as installing covers on Platform Emergency Alarms on our trains to reduce accidental or malicious use, have helped decrease the number of delays. The reliability programme is using a range of media communications with passengers to achieve further improvements in this area. Also, through engaging with station staff, LU has improved its incident response capability.
- DLR's reliability also improved in all the categories with the greatest percentage improvement for staff-related incidents per car km, which reduced by 75%. In absolute numbers, DLR's staff-related incidents decreased from 55 in 2012/13 to 14 in 2013/14. Training programmes delivered to all operational and maintenance staff made a significant difference in this sub-category.
- The highest volume of incidents per car km related to equipment for both LU and DLR. This category is analysed separately in the following pages.

Equipment reliability trends

Million car kilometres between equipment-related incidents causing a five-minute delay to service (Western Europe and North America)

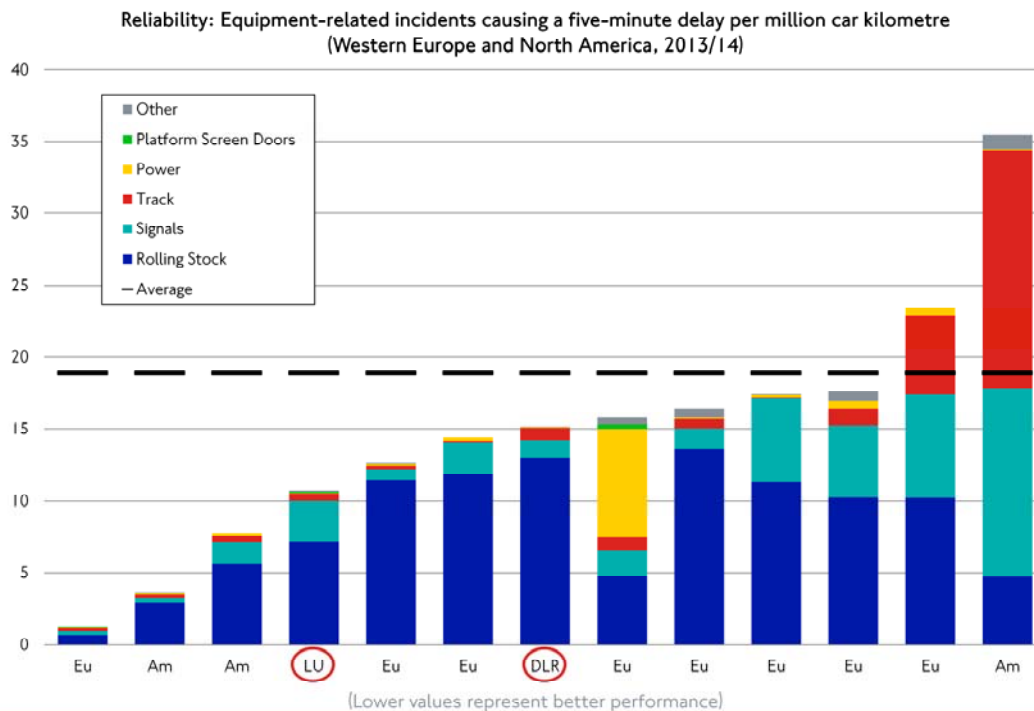


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- This graph analyses equipment reliability trends since 2008/09. Reliability is measured in million car km between equipment-related incidents causing a delay of five minutes or more.
- LU has improved by 63% on this equipment reliability measure since 2008/09. DLR improved by 180% since 2011/12.
- In 2013/14, LU and DLR kept their improving trends. LU improved by 2% and DLR by 54%.
- The average of the other Western European and North American metros deteriorated by 8% since 2008/09.
- LU generally performs better than the average of the rest of the peer group, which reflects sustained improvement since 2011/12, when LU performed better than average in half of these equipment-related categories. As obsolete equipment is replaced via line upgrades, and maintenance shifts to a Predictive and Preventive approach, LU expects equipment-related incidents to reduce further.
- Amongst the 14 Western European and North American metros in CoMET and Nova, LU is the fourth best performing in this measure.
- LU has outlined far-reaching plans to meet the Mayor's commitment of reducing Lost Customer Hours by a further 30% between 2011 and the end of 2015. Lost Customer Hours is an LU-specific measure, which differs to the metrics described above and other metros do not produce equivalent statistics.
- Future reliability improvement does not only depend on the continued investment in new assets. LU's Predictive and Preventative Maintenance Programme will transform how the business monitors and manages its assets (by adopting initiatives such as remote condition monitoring), with a focus on reducing the number of equipment-related failures.

Equipment reliability 2013/14

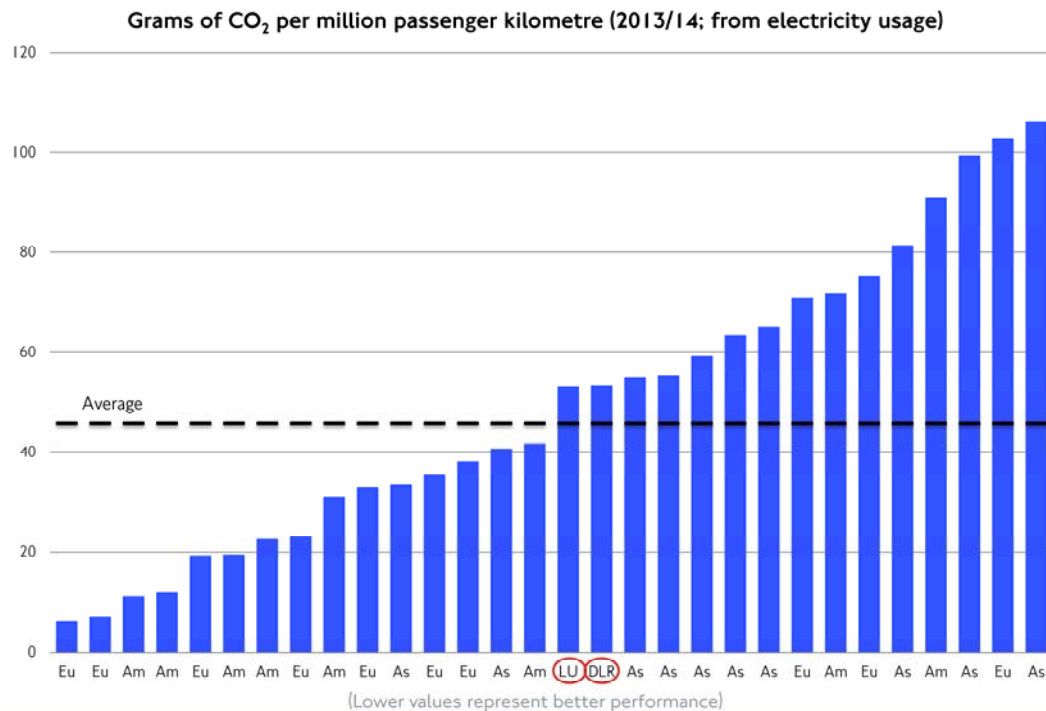


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- This chart breaks down the 2013/14 equipment reliability figures according to their cause. The metric used is number of incidents causing a delay of five minutes or more per million car km.
- In 2013/14 LU and DLR equipment reliability improved for most categories giving an overall reduction for both metros.
- LU's rolling stock incidents per car km, its most significant category, increased by 1%. Reasons for this were the bedding-in phase of the new rolling stock on the Sub-Surface lines and increased failures on the Central line. The latter will remain challenging as the Central line stock ages, although Central line fleet stabilisation works have been proposed to mitigate worsening reliability.
- Signalling incidents per car km are the second most common category for LU, and fell by 4% in 2013/14. The Victoria and Jubilee line upgrades of the previous year gave a direct reduction of incident related disruption and also provided lessons which enabled a smoother Northern line upgrade.
- LU track incidents per car km reduced by 2% in 2013/14. A factor in this is LU's rail defects programme, which was implemented in non-central sections of the network, providing a sustainable grinding regime that reduced track-related incidents.
- LU significantly reduced Platform Screen Door (PSD) incidents (from 117 in 2012/13 to 50 in 2013/14). This reflects the work done in anticipation of the London 2012 Games, when LU encouraged PSD operators, maintainers and suppliers to collaborate to better understand and address the reasons behind PSD failures.
- In 2013/14 DLR's rolling stock reliability improved by 25%. It has achieved this by improving its failure response process (for example more First Line Response Technical teams and Rolling Stock Technicians stationed in Control Centre), upgrading its on-board software and making quality improvements in systems that tend to generate high proportions of incidents (such as train doors).
- DLR's rolling stock-related failures per car km remain amongst the highest of the peer group. All issues relating to the automatic train control system are categorised as rolling stock; this system replaces drivers (for example slip-slide problems) and represents the interface between rolling stock and signalling. As such, higher failure rates here are not always 'traditional' rolling stock issues. In the ongoing CoMET/Nova KPI system review, we have raised the possibility of introducing a separate 'ATO' category to improve clarity.
- DLR's signalling-related failures per car km improved by 66%. This has been mainly due to software improvements derived from best-practices achieved in joint working with Jubilee line, significant improvements in the approach to incident response, pre-emptive maintenance (including Remote Condition Monitoring of assets) and making the governance structure for signalling performance improvement more integrated.
- DLR's track-related failures reduced from 52 in 2012/13 to 28 in 2013/14.

Environment: CO₂ emissions 2013/14

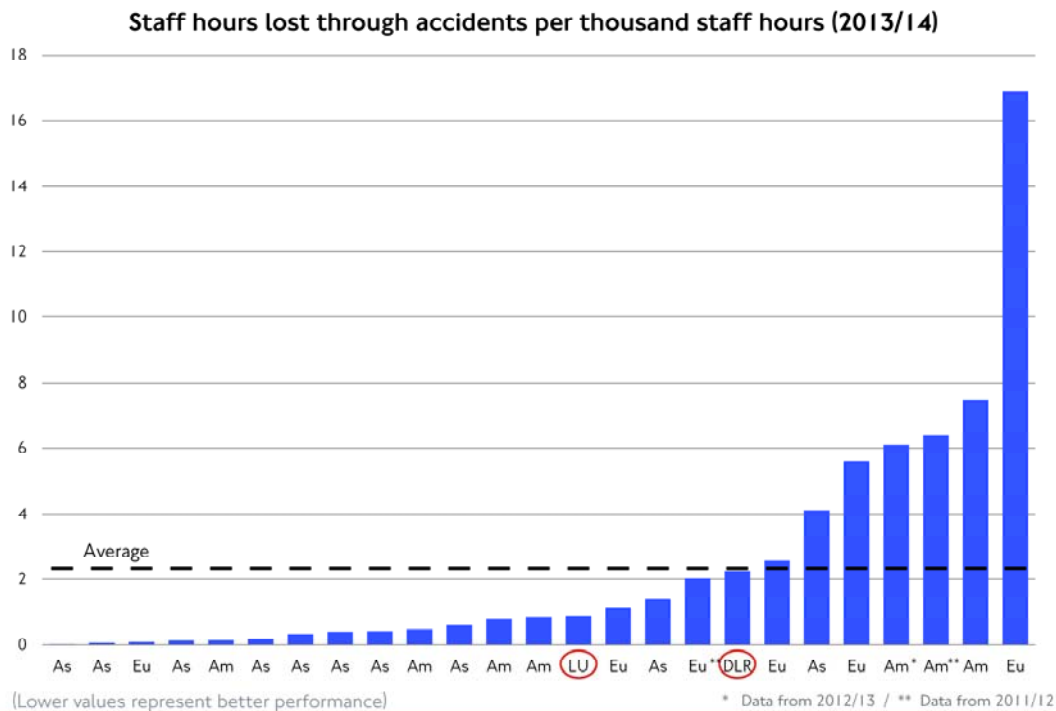


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- To analyse environmental performance, this graph presents their CO₂ emissions in grams per passenger km in 2013/14 for all CoMET and Nova metros.
- Since 2010/11 LU and DLR have improved by 25% and 19% on this metric respectively.
- In 2013/14 LU and DLR had similar CO₂ emissions per passenger km. They were higher than the average of other metros, largely because of the UK's national grid energy mix, though their relatively lightly loaded off-peak services are also a factor.
- Initiatives to improve traction energy efficiency continue. In 2013/14 regenerative braking was introduced on the Northern line as part of its line modernisation, and at an interim level on the majority of the Metropolitan line. As a result in 2013/14 LU improved by 8% for this metric, serving 3% more passenger km whilst producing 4% less grams of CO₂.
- DLR uses regenerative braking in all of its network to improve its energy efficiency.
- LU has conducted feasibility studies on the opportunity to install additional power generation at Greenwich Power Station, its emergency supply. Installation of new generation would provide a proportion of LU's electricity requirement from a lower carbon source than the national grid, improving performance in this metric.

Staff safety-related productivity



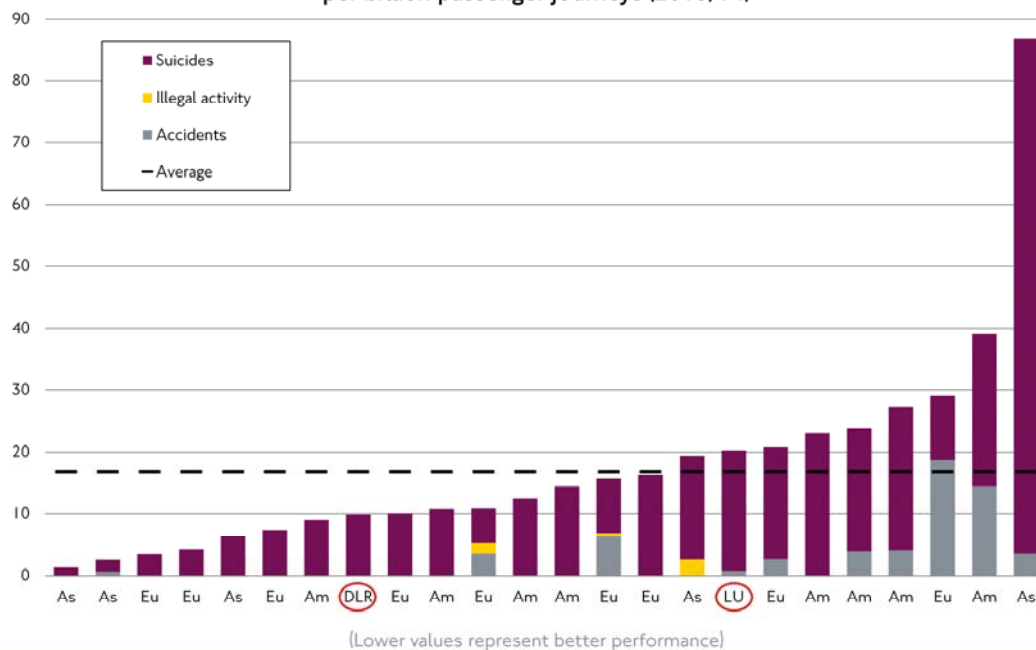
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- This chart shows the productivity impact of staff related safety for all CoMET and Nova metros. It is measured in terms of staff hours lost through accidents per staff hour. Therefore, it is not an absolute comparison of safety incidents.
- Since 2010/11, LU has improved by 13% for this measure, while DLR has improved by 36%.
- In 2013/14, LU continued improving for this measure. Whilst total staff hours increased by 15%, the time that staff lost through accidents grew by 9%, resulting in a 5% improvement in safety-related productivity.
- DLR performed less well in 2013/14, increasing by 190% for this metric. Any changes in staff time lost can have a big impact in this metric due to DLR's relatively lower level of staffing. In 2013/14 it had 11 more accidents, causing more staff time to be lost than in the previous year. Seven of these accidents resulted in more than 30 days lost, with the longest being over 142 days. DLR is promoting awareness of the requirement to notify of any lost time, which could have resulted in greater reporting of incidents.
- LU performed 62% better than average for this metric in 2013/14, whilst DLR was 3% better than average.
- 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.
- LU has carried out a best practice study in 2014/15 looking at how other organisations deploy Health Safety and Environment staff and foster continuous improvement. LU expects to implement a number of recommendations made by this study.

Customer Safety

Fatalities due to accidents, illegal activity and suicides per billion passenger journeys (2013/14)



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- This graph analyses customer safety in 2013/14 for all CoMET and Nova metros based on the number of fatalities due to accidents, suicides and illegal activity per billion passenger journeys.
- Both LU and DLR performed relatively better on this metric in 2013/14 compared to previous years, though LU remains higher than average.
- Both metros performed significantly better than average for fatalities due to accidents and fatalities due to illegal activity per billion passenger journeys. There was one accidental fatality across Rail & Underground in 2013/14.
- LU's fatalities due to suicides per billion passenger journeys were higher than average. There has been an increasing trend in attempted suicide events on London Underground.
- A work stream has been established to identify ways to reduce the number of incidents. This includes closer working with the Samaritans. A training programme has been developed to equip staff with the skills to identify vulnerable people, and give them the confidence to intervene if necessary. The training has run successfully for a number of other organisations including rail operators, British Transport Police the Department of Health and HM Prison Service.
- Our goal is to run a safe and reliable service. Work continues to identify potential safety issues to staff and customers, through specific work streams relevant to each area. Work is also underway to reduce the likelihood of customer accidents at key locations – on escalators, on stairs and at the platform-train interface (80% of all accidents on the LU network occur at these three locations). There is also extensive communication with customers on safety issues via announcements, posters, the website and social media. CCTV coverage is extensive and customer help points are widespread.
- The Office of Rail Regulation (ORR) noted in its Health and Safety Annual Report 2013-14 that 'TfL continues to maintain a high level of safety for its passengers and workforce as passenger numbers and services grow' (July 2014, page 22).