

**Date:** 13 July 2017

**Item:** TfL International Benchmarking Report

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**This paper will be considered in public**

**1 Summary**

- 1.1 The purpose of this paper is to provide a high level overview of TfL's performance in customer-centric areas against domestic and international benchmarks.
- 1.2 This is primarily achieved through comparisons with the Community of Metros (CoMET) for Underground and the DLR, the International Suburban Railways Group (ISBeRG) for Overground, and the International Bus Benchmarking Group (IBBG) for Buses.
- 1.3 The paper highlights successes as well as areas for improvement, and signposts subjects for potential benchmarking focus in the coming 12 months.
- 1.4 The report also provides an introduction to how benchmarking is undertaken in TfL, and how outputs are utilised to drive value for money and improved service.
- 1.5 Benchmarking comparisons are never perfect, however they help to set our performance and progress in context, and prompt questions and ideas as to how we can improve.

**2 Recommendation**

- 2.1 **The Panel is asked to note the paper.**

**3 Key Findings**

- 3.1 The paper is structured thematically around seven of our Business Plan commitments. Key findings are listed below.

**3.2 Affordable Transport**

- 3.2.1 Underground and DLR fares are amongst the most expensive in the world. The Mayor has recognised this and taken action. Affordability will improve for all customers as fares are frozen for the whole mayoral term. Average bus fares have already decreased with the introduction of the hopper fare.
- 3.2.2 Our Tram fares are domestically best-in-class, and 38 per cent below the average of UK tram and light rail networks.
- 3.2.3 We perform very strongly across all modes for financial sustainability – that is the extent to which we are able to fund operations and maintenance expenditure,

including the cost of financing, through our own income. Both London Underground and the DLR are able to cover their operating costs through income. Few international comparator organisations have as little dependence on operating subsidies as TfL.

### **3.3 Public Transport, Walking and Cycling**

- 3.3.1 Two in every three journeys in London are walked, cycled or completed using public transport. This places London fourth out of eleven European capitals. However, of this two-thirds, London has a relatively small share of trips made by walking or cycling (23 per cent against an average of 33 per cent). We are committed to encouraging a modal shift towards more active and healthier travel. To accomplish this we will reduce traffic and make walking, cycling and public transport safer and more attractive.
- 3.3.2 Ridership growth on the DLR and Overground has significantly outstripped that of international peers. Underground has also performed exceedingly well to keep pace with international comparators, especially as peers include new and often swiftly expanding networks in Asia. Bus performance has been below the average of peers in IBBG, with ridership decreasing from 2013/14.
- 3.3.3 Our highest peak hour rail frequency, 36 trains per hour on the Victoria line from May 2017, compares favourably with global best-in-class.
- 3.3.4 Bus reliability is the fourth best in IBBG, but has deteriorated since 2013/14. Our Buses also provide a lower average commercial speed than most international comparators. We recognise these are issues. Our Bus Priority Strategy will look to address this by introducing continuous bus priority in key corridors and automatic bus detection at traffic signals.

### **3.4 Making Transport More Accessible**

- 3.4.1 The Underground network has a lower percentage of step free access stations than the majority of international comparators. This has been recognised by the Mayor, and plans are in place to invest £200m in around 30 step free access schemes over the next five years.
- 3.4.2 The DLR and Trams are both fully step-free. They will be joined by the Elizabeth line when it enters full service in 2019.
- 3.4.3 Our entire bus fleet is comprised of low-floor vehicles. We are on track to hit our targets of making 95 per cent of our bus stops accessible for wheelchair users by the end of 2017/18, and introducing an extra 100 accessible taxi ranks by 2020.
- 3.4.4 London has the second highest density of metro, train, bus and tram routes of 23 cities surveyed by the European Metropolitan Transport Authority.

### **3.5 Safer London**

- 3.5.1 Overground is the second safest suburban rail network in ISBeRG, and shows a consistently improving trend. DLR performance is also better than average. Underground performs slightly worse than average for its peer group, but has a clear improving trend.

3.5.2 Bus collisions are slightly worse than average for the peer group, having unfortunately increased in recent years. Reducing collisions is a priority and we have set ourselves the target of zero fatalities on the bus network. A new Operator Safety Scorecard will come into operation in 2017, and new enhanced safety technology will be incorporated into our fleets including Intelligent Speed Assistance and Automatic Emergency Braking.

3.5.3 London's road fatalities per resident were, in 2015, the lowest among 13 comparator cities. London also has a lower number of fatalities per kilometre travelled by car, bicycle or on foot than Manchester or the West Midlands, along with improving year-on-year trends.

### **3.6 Cleaning Up Air Quality**

3.6.1 London places seventh best amongst 30 world cities for air pollution. However, we perform poorly for nitrogen dioxide concentration in built up areas. The Mayor is leading a drive to clean up London's air.

3.6.2 Our bus and rail modes have extremely low CO<sub>2</sub> emissions and energy consumption levels when compared with international peers. While not contributors to air quality, more efficient energy consumption and lower CO<sub>2</sub> emissions from our modes can have a large positive impact on the carbon footprint of London.

### **3.7 Raising Commercial Revenue**

3.7.1 The scale of our commercial revenue is not world-leading. The Mayor has recognised that we can improve and ambitious plans are in place. We are investing £82.9m to improve our advertising estate and will make better use of retail spaces at stations and exploit opportunities in our railway arches.

### **3.8 Harnessing Technology to Improve Journeys**

3.8.1 Of the metros surveyed, Underground has the fifth highest use of smart ticketing, and was the only participant to utilise both contactless bankcard and mobile wallet payment methods.

#### **List of appendices to this report:**

Appendix 1 – TfL International Benchmarking Report

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# TfL International Benchmarking Report

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# Purpose Of The Report

## *Benchmarking TfL's Customer Service & Performance Against Best in Class*

The TfL International Benchmarking Report has been created at the request of the Customer Service and Operational Performance Panel and provides a high level overview of performance in customer-centric areas against domestic and international benchmarks. The report highlights successes and areas for improvement, as well as signposting subjects for potential benchmarking focus in the coming 12 months.

The report also provides an introduction to how benchmarking is undertaken in TfL, and how the outputs are utilised to drive value for money and the provision of a continuously improving world class service to our customers.

The report is aligned with our Business Plan and structured thematically around seven of its key commitments as illustrated below:



For each commitment one or more lead metric is used to compare cross-modal performance with best-in-class. Every effort has been made to be as comprehensive as possible in our coverage, however where gaps exist we will work to fill these for future iterations.

Some of the metrics used differ from those on which the business usually reports. For instance metro reliability is measured in five rather than two minute delays or lost customer hours. This reflects a common challenge of benchmarking in that we can only include metrics for which we have meaningful and truly comparable information from a good range of comparators. Gathering data from peers also takes time, consequently the majority of metrics show performance to 2015/16.

Benchmarking comparisons are never perfect, however they help to set our performance and progress in context, and prompt questions and ideas as to how we can improve.

# Why Do We Benchmark?

## *To Improve Our Business*

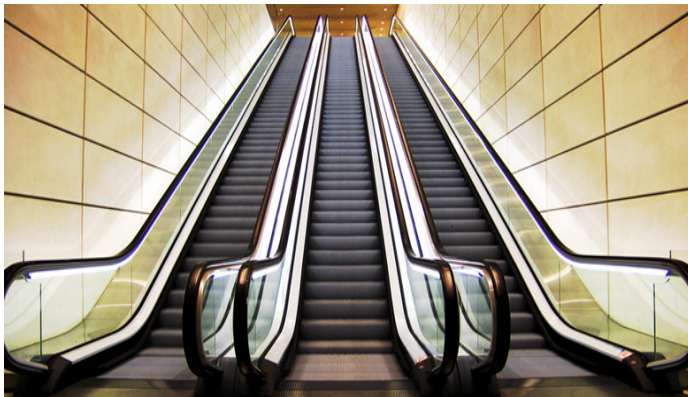
We are committed to improving value for money, year-on-year. Benchmarking is an important element of this, helping to identify best practice, prompt innovation, monitor trends and understand the drivers of performance.

## *To Inform Our Stakeholders*

Funders, customers and other stakeholders have a keen interest in understanding whether funds are efficiently and effectively invested, and that the service we deliver is truly world class.

## *Because It Works*

We have a good track record of utilising benchmarking to improve effectiveness and efficiency, as illustrated by the examples below:



### **Case Study 1: Driving Value for Money**

Over **£100m** of savings will be delivered in the next thirty years, and a projected **£500m** over the whole life of our escalator fleet, thanks to the adoption of industry standard designs, refurbishment cycles and improved maintenance practices identified by benchmarking.

### **Case Study 2: Maximising Staff Performance**

Assessing TfL's graduate schemes against 15 comparators has driven a number of changes in the way we attract, recruit, develop and integrate our graduates into the business, making our schemes more focused, better aligned to business needs and better value for money. Further benchmarking of apprenticeship schemes is currently underway.



### **Case Study 3: Enhancing Operational Service**

Thirteen metros already operating a night service shared best practice guidance with Underground. This influenced our strategy for stakeholder communications, service patterns, customer safety, noise management and demand forecasts. Applying these lessons learnt contributed to the successful launch of Night Tube.

# How Do We Benchmark?

## *Benchmarking Specialists*

We have benchmarking specialists who analyse cost and performance data and conduct in-depth drilldown studies to identify best practice within the business and from industry peers and make recommendations for implementation into TfL.



## *Membership of Benchmarking Organisations*

In addition to strong bilateral relationships with organisations such as Network Rail and Highways England many of our modes are members of international benchmarking groups such as ISBeRG (the International Suburban Railways Group) and IBBG (the International Bus Benchmarking Group).



These groups are managed by our colleagues at the Railway and Transport Strategy Centre at Imperial College London. These associations provide us with KPI data, forums for Q&As and knowledge sharing workshops, as well as more detailed surveys and studies.



It is through working with these organisations that we are able to provide much of the benchmarking material contained in this report. Operators agree to share confidential information about their organisations for benchmarking analysis. To respect the confidentiality of these third parties we are required to report their data in an anonymised form.

The world-leading comparators against which this report benchmarks each mode, and anonymity details, are briefly described below.

## Comparators and Comparator Data

### *Underground and DLR:*

Underground is one of 17 members of the Community of Metros (CoMET), whilst the DLR is one of a further 17 members of CoMET's sister organisation Nova (which covers smaller metro networks). Both groups provide the same KPI data so both are shown on the same graphs. Underground and DLR graphs are shown in **blue** in this report. To fulfil anonymity obligations metros are referred to as: Am = American Metro, As = Asian Metro, and Eu = European Metro. In some cases it has not been practical to include all 34 metros in a single graph, and in others there are good reasons for excluding certain comparators. Where data includes only a subset of CoMET and Nova metros this is clearly stated.

### *Overground*

Overground is one of 14 members of ISBeRG. Overground graphs are shown in **orange** in this report. To fulfil anonymity obligations the same anonymisation process and codes are used as for Underground and DLR, with the addition of SH = Southern Hemisphere network. TfL Rail is not included in Overground figures unless otherwise stated.

### *Buses*

Buses are one of 15 members of IBBG. Buses graphs are shown in **red** in this report. Due to additional sensitivities regarding franchising and contracting-out of operations, IBBG has more stringent anonymity rules than CoMET, Nova or ISBeRG. Comparators are referred to merely as A, B, C, etc, and the scale has been removed from all graphs.

In order to ensure breadth of coverage the report also includes data from a range of additional sources, these include PwC's Cities of Opportunity Report and the European Metropolitan Transport Authority's (EMTA) Barometer Report. In each case the origin is clearly stated.



# How Do We Benchmark?

## Benchmarking Maturity

Whilst all modes are included in this report, and in our pan-TfL strategy and programme for benchmarking, it should be noted that benchmarking is more developed in certain areas than others. The table below provides a summary of benchmarking maturity, and the completeness of data in this report.

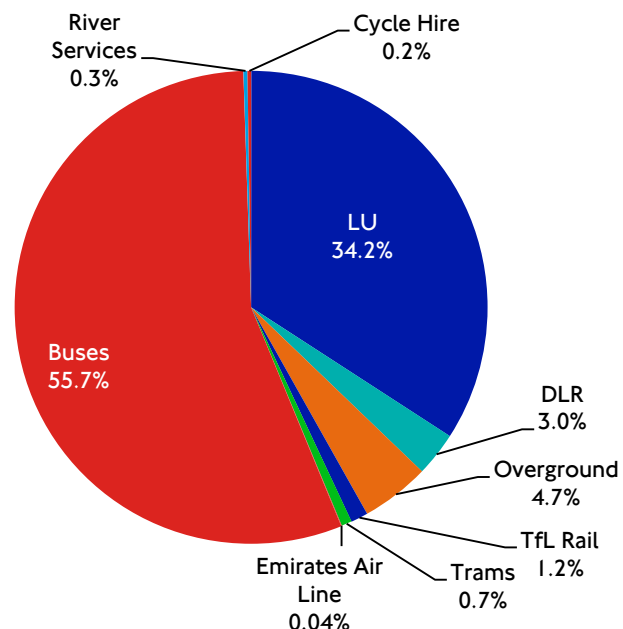
Mode	Affiliation to International Benchmarking Group	Access to Annual Performance Data	Strategy & Programme for Benchmarking	Coverage						
				Affordability	Public Transport	Accessibility	Safer London	Cleaner Air	Commercial Revenue	Technology
<b>Underground</b>	Yes (CoMET – founding member since 1994)	Yes (284 - metrics)	Yes	✓	✓	✓	✓	✓	✓	✓
<b>DLR</b>	Yes (NOVA – member since 2013)	Yes (284 - metrics)	Yes	✓	✓	✓	✓	✓	✓	
<b>Overground</b>	Yes (ISBeRG – founder member since 2010)	Yes (147- metrics)	Yes	✓	✓	✓	✓	✓	✓	
<b>Buses</b>	Yes (IBBG – founder member since 2004)	Yes (92- metrics)	Yes	✓	✓	✓	✓	✓	✓	✓
<b>Trams</b>	No	No	Yes	✓	✓					
<b>Roads</b>	In Progress (working with Singapore to create a group)	No	Yes		✓		✓	✓		
<b>Walking &amp; Cycling</b>	No	No	Yes		✓		✓	✓		

At present Underground is the most mature having been a member of the longstanding CoMET group since its inception in 1994. Buses, DLR and Overground are close behind. Modes such as Walking, Cycling, Roads and Trams are less mature. We are focused on developing benchmarking in these areas and following discussions with Imperial College and Singapore's Land Transport Authority (LTA), are taking steps to establish a new international roads benchmarking group. Imperial College has also recently formed a North American Light Rail Group which may, in future years, provide opportunities for more in-depth Trams benchmarking.

TfL Rail is currently only covered by one metric, we will look to expand this in the year ahead.

While benchmarking coverage is not 100%, by concentrating on Underground, DLR, Overground and Buses we are covering almost 98% of journeys on TfL's services.

**TfL Services Ridership by Mode (2016/17)**



# Affordable Transport

We reinvest all of our revenues in operating and enhancing our services. But we must provide affordability to our customers – fare price should not be a barrier to travel.

## Fares

This section shows the average fare paid per passenger journey in 2015 across different metro, suburban railway, and bus networks (this includes only fares paid directly by the customer).

### How Are We Performing?

*In 2015 Underground and DLR's average fare per passenger journey were the first and third highest in CoMET and Nova.*

Fares support financial sustainability, as well as the large-scale, long-term investment programme that is delivering significant additional capacity and improvement to our networks.

We have far lower levels of operational subsidy than most comparators. This necessitates higher fares. Underground and DLR also suffer from a number of structural factors which drive up operating cost (the importance of considering structural factors when examining benchmarking metrics is explained in greater detail overleaf).

Overground fares are lower than the average of its ISBeRG peers. Similarly bus fares are lower than most comparator IBBG networks.

*In 2015 our Tram fares were domestically best-in-class, 38% below the average of UK Tram and Light Rail networks*

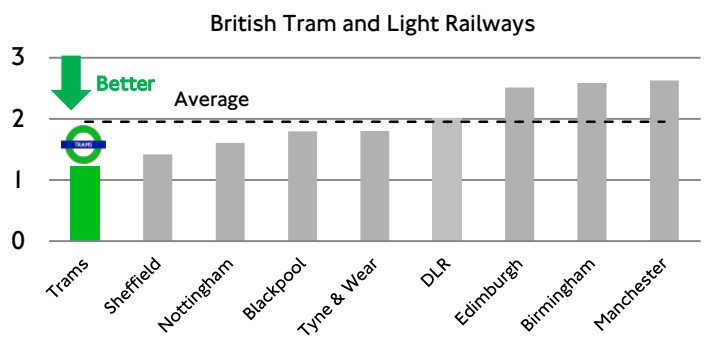
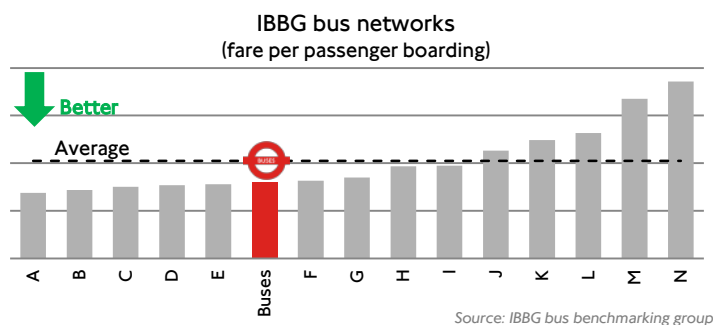
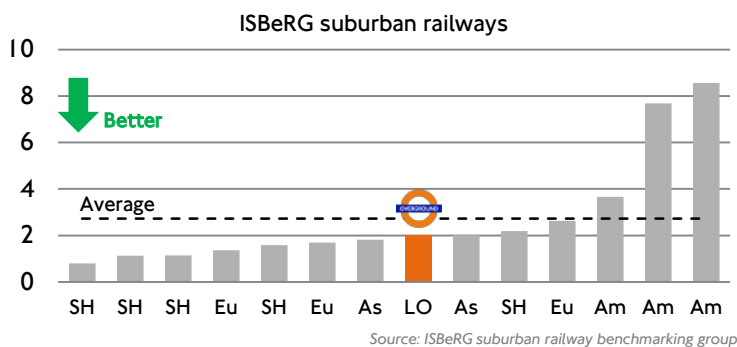
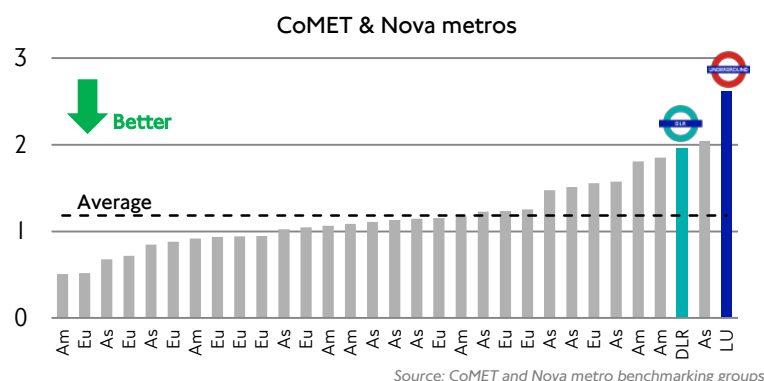
### What Are We Doing To Improve?

Our fares are comparatively high. The Mayor has recognised this and taken action. Affordability will improve for all customers as fares are frozen for the whole mayoral term. Average bus fares have already begun to decrease with the introduction of the Hopper fare.

TfL Business Plan commitments:

- Keep all TfL fares frozen
- More journeys on the Hopper fare
- Protect all concessions

### Average fare per passenger journey (US\$ PPP-adjusted, 2015)



# Affordable Transport

## Structural Factors

### Impact of Structural Factors on Comparison

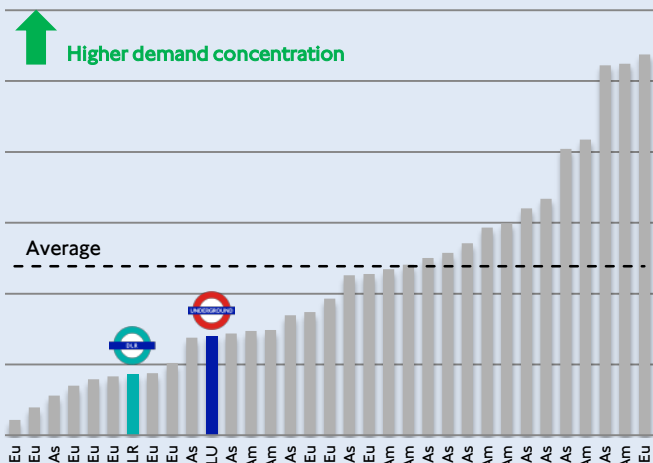
It is important to remember differences such as city wage rates, density of population, age of infrastructure, ownership of infrastructure, government grants, and health and safety standards when comparing our network with other cities, many of whom exist in very different environments.

These are known as structural factors, and are often very difficult to change without significant investment or reform. The below example illustrates how structural factors affect operating costs, and therefore fares, on the DLR and Underground. However they also affect (albeit to differing degrees) every metric used in this report. In some cases they make TfL look better, and in others worse.

 London Underground	 北京地铁 BEIJING SUBWAY	 SMRT
		
<b>London Underground Northern Line</b> 6-car 1995 Tube Stock Passenger capacity: 690	<b>Beijing Subway Avg Train (Most Lines)</b> 6-car Type B Train Passenger capacity: 1,100	<b>Singapore SMRT N-S / E-W Lines</b> 6-car C151B Train Passenger capacity: 1,400

Northern line train compared to trains in Beijing and Singapore metros (standardised capacity at 4 passenger / metre<sup>2</sup>)

### Passenger kilometres per route kilometre (2015) CoMET & Nova metros



Source: CoMET and Nova metro benchmarking groups

A large proportion of the Underground and DLR networks run through low population density areas, picking up fewer passengers per kilometre than most comparator metros

### Example: Underground and DLR Fares

The Underground and DLR have higher operating costs than most CoMET and Nova metros, and this is reflected in higher fares. In collaboration with Imperial College we have undertaken benchmarking research to better understand the key structural factors behind this:

- City wages in London are, on average, 84% higher than in the other CoMET and Nova cities.\*
- The deep tube lines of the Underground were built with narrow tunnels, and hence can only fit small trains. That means we need to run more trains to carry the same amount of customers;
- The Underground and DLR operate relatively high service frequencies during the off-peak and weekends. This provides an excellent service to our customers, but is expensive to operate;
- A large proportion of the Underground and DLR networks extend to areas with a relatively low population density (for a metro). This is more expensive per passenger journey;

These factors drive cost, and provide challenges to delivering world class affordability to our customers.

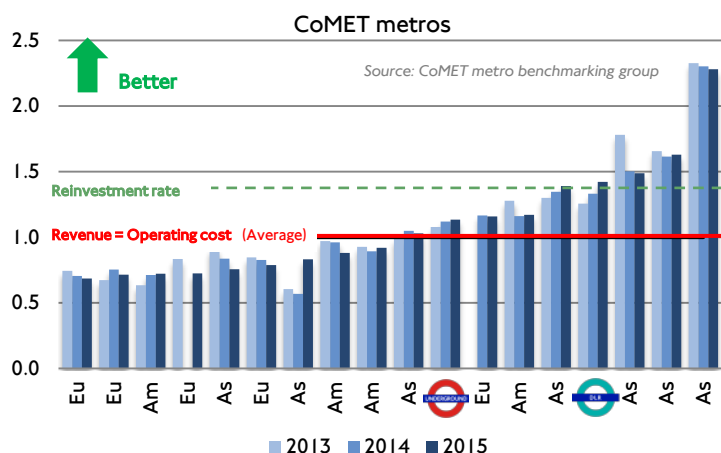
\*Source: Prices and earnings 2015 (UBS)

# Affordable Transport

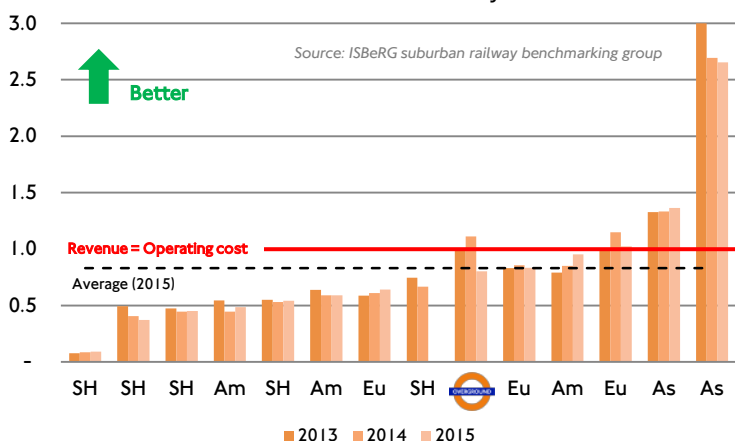
## Financial Sustainability

Our aim is to fully cover operations and maintenance expenditure, including the cost of financing, through income. But we must achieve this without increasing the cost of travel for our customers, or sacrificing reliability.

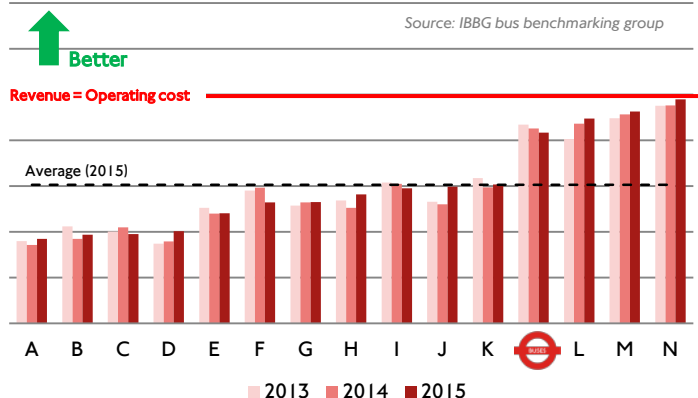
### Recovery ratio: total revenue per operating cost



### ISBeRG suburban railways



### IBBG bus networks



## How Are We Performing?

A good indicator of financial sustainability is operating cost recovery ratio. That is revenue (excluding concessionary fare subsidies) divided by operating costs. Underground and DLR are both achieving better recovery ratios than most metros in CoMET and Nova, and have consistently improved in recent years.

Underground's recovery ratio is greater than 1.0 meaning that, unlike most Western metros, it does not require government subsidy to cover operating costs.

*DLR's recovery ratio is above average and above 1.4, this is the approximate level observed by Imperial College at which a metro can also cover the cost of renewing and enhancing its assets.*

Overground is sixth out of fourteen suburban railways in ISBeRG. The drop in recovery ratio in 2015 was due to the cost of re-letting the concession, and inclusion for the first time of the West Anglia routes. Overground's recovery ratio is expected to once again exceed 1.0 before the end of the business plan.

Buses have one of the best recovery ratios in IBBG, with revenues only 17% below operating costs. Indeed it is worth noting that no bus network in IBBG achieves a recovery ratio of 1.0 or more.

*In terms of cost recovery TfL performs strongly across all modes. Comparator organisations, especially in the West, tend to have a far heavier dependence on government subsidies than TfL.*

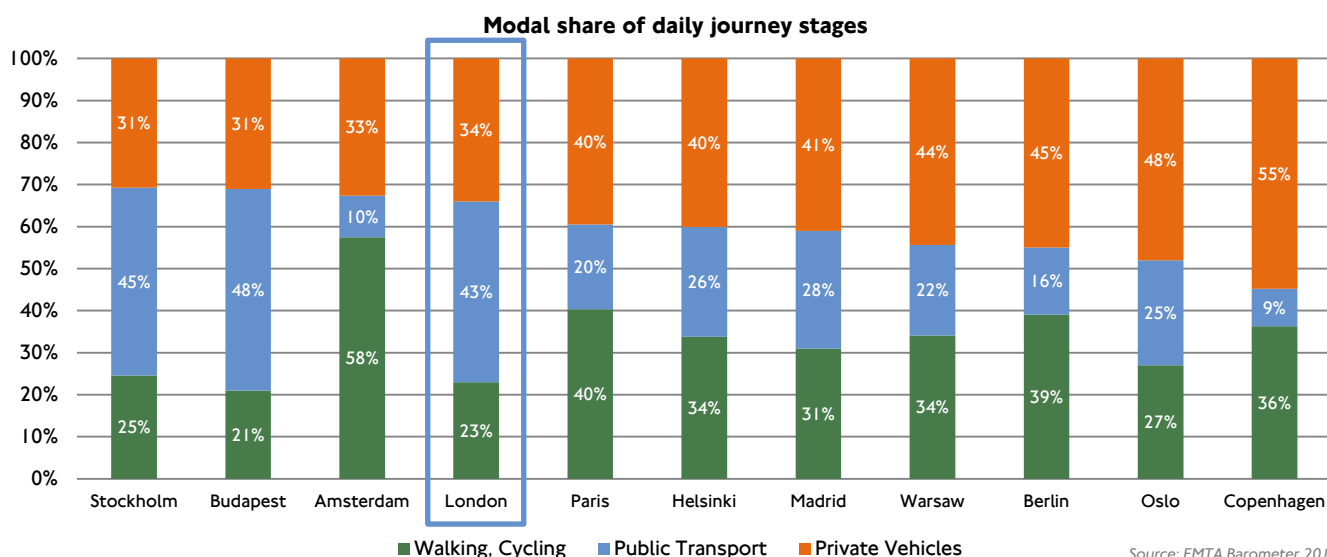
## What Are We Doing To Improve?

TfL's transformation plans will significantly reduce costs through a wholesale review of every element of our operations. This will enable us to reduce costs and thus improve our recovery ratio whilst keeping fares frozen.

# Public Transport, Walking and Cycling

We will ensure that sustainable modes have the capacity to cater for a constantly growing population and the ability to attract that demand through high levels of service.

## Walking And Cycling



### How Are We Performing?

*Two in every three journeys in London are either walked, cycled or completed using public transport. This places London fourth out of eleven European capitals according to the EMTA's Barometer Report. However of these journeys London has a relatively small share of trips made by walking or cycling (23% against an average of 33%), this presents us with a significant opportunity.*

We are committed to encouraging a modal shift towards more active and healthier travel. To accomplish this we will reduce traffic and make walking, cycling and public transport safer and more attractive.

TfL Business Plan commitments:

- More cycling and walking

### What Are We Doing to Improve?

We will make London a byword for cycling by increasing investment to an average £154m per annum for the next five years, and working with the boroughs to create a new network of Cycle Superhighways, Quietways, new safer junctions and Liveable Neighbourhoods. Plans to promote more cycling and walking include:

- Operation Clearway – making it safer and easier for pedestrians to walk along pavements;
- Mini-Hollands – implementing schemes that transform cycling facilities and encourage more people to cycle (schemes include Waltham Forest, Enfield, and Kingston-upon Thames);
- Oxford Street – beginning detailed planning for the transformation of Oxford Street; and
- Rotherhithe crossing – commencing planning for a new pedestrian and cycle crossing between Rotherhithe and Canary Wharf.

We expect cycling to increase by three percent in 2017, and are committed to better in-year reporting of cycling and walking data.

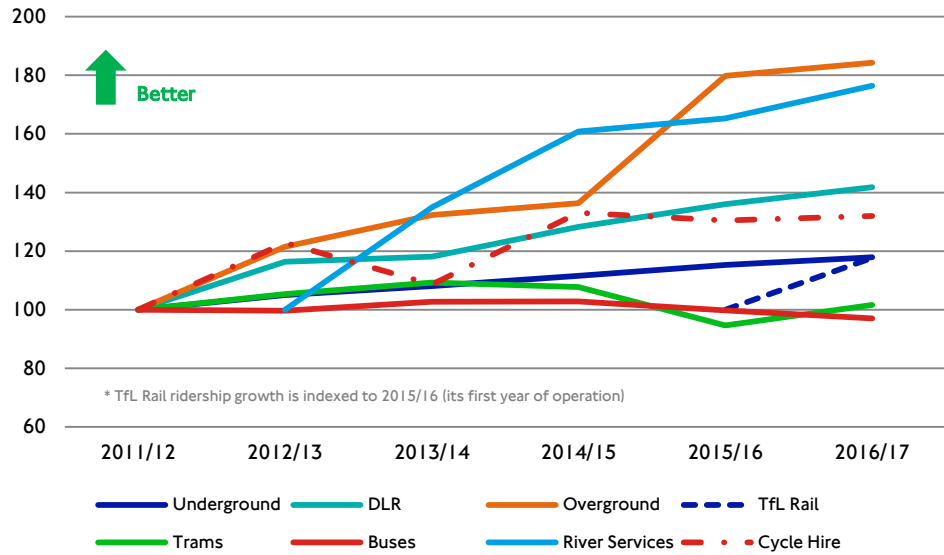
# Public Transport, Walking and Cycling

## Public Transport Demand Trends

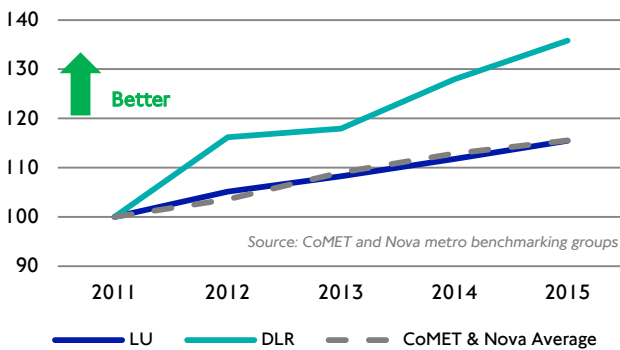
With a growing population, demand for public transport in London continues to rise. Our ridership has grown by 9% since 2011/12. This translates to an extra million passenger journeys per day. However growth hasn't been shared evenly amongst all modes.

Ridership has grown most quickly on Overground, River Services and DLR. Trams have remained largely unchanged, whilst Buses (which represent 56% of trips on our services) have seen a slight reduction.

Growth of ridership by mode since 2011/12  
(Index: 2011/12 = 100) \*



Growth of Ridership by Mode Since 2011  
CoMET & Nova metros (Index: 2011 = 100)

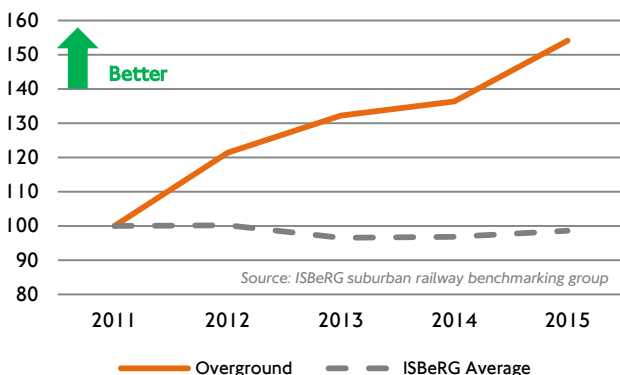


*Ridership growth on the DLR and Overground significantly outstrips international peers. This is due both to increased patronage, and the extension of services across London.*

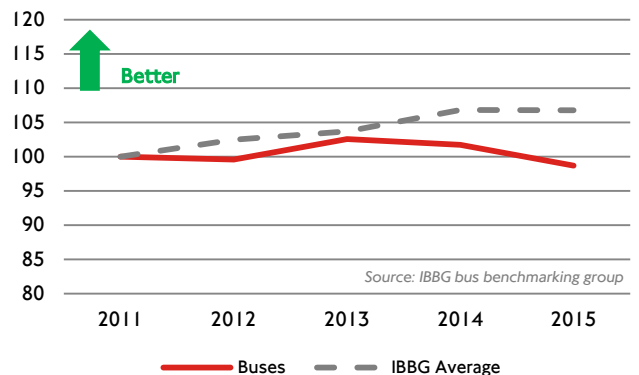
*Underground has kept pace with international comparators, despite the fact that these include new and often swiftly expanding Asian networks.*

*Bus performance has been below the average of peers in IBBG, with ridership decreasing from 2013/14 (see page 13).*

ISBeRG suburban railways (Index: 2011 = 100)



IBBG bus networks (Index: 2011 = 100)



# Public Transport, Walking and Cycling

## Frequency

### How Are We Performing?

High service frequency is important to customers, especially at peak times when congestion can be an issue.

*Our highest peak hour rail frequency is provided by the Victoria line which operates 36 trains per hour. This compares favourably with global best-in-class.*

### What Are We Doing To Improve?

Key to achieving this has been modernisation and the introduction of highly automated signalling systems and trains. The two best performing metros provide frequencies of 42tph. We will continue to share best practice to maximise frequencies across all lines.

## Capacity Provision and Congestion

### How Are We Currently Performing?

Comparing total capacity provided against the number of passengers carried gives a gauge of supply versus demand, as well as congestion. Capacity provision allows London to work and is included in our business case assessments.

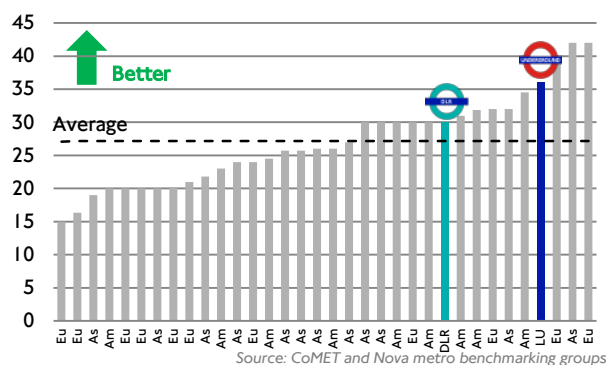
Using this metric Underground and DLR both provide more capacity relative to passenger volumes than the majority of comparators. Overground provides a lower capacity relative to passenger volumes. However it shares infrastructure with other operators which limits frequencies, and has platform constraints limiting train length. It should also be noted that Overground provides a predominantly orbital rather than radial service, and thus capacity is more evenly utilised. Bus capacity relative to passenger volumes is slightly below average.

### What Are We Doing To Improve?

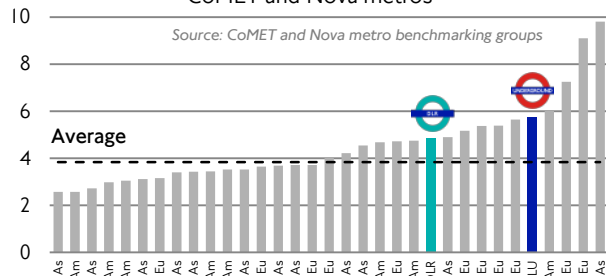
We will improve Overground capacity by introducing longer trains and modernising signalling systems. Underground upgrades, the Elizabeth line and Crossrail 2 will also be crucial in improving rail capacity.

Whilst this metric gives an overview of capacity provision it is not clear which direction represents “better”. Best practice is to provide a level of service that is convenient to customers, but also affordable. We are working with Imperial College to develop peak crowding benchmarking metrics. We hope these will replace capacity km per passenger km in future reports.

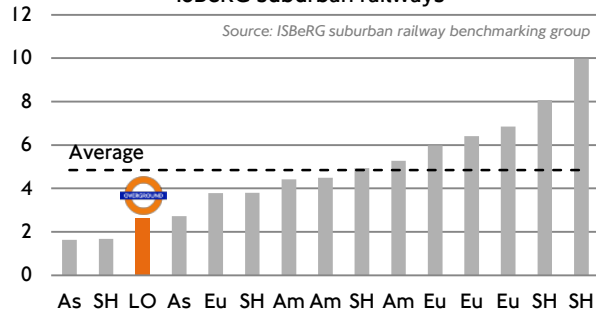
Maximum service frequency (trains per hour)  
CoMET and Nova metros



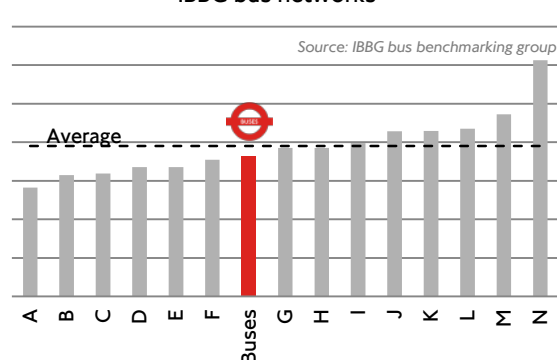
Capacity kms per passenger km (2015)  
CoMET and Nova metros



Capacity kms per passenger km (2015)  
ISBeRG suburban railways



Capacity kms per passenger km (2015)  
IBBG bus networks

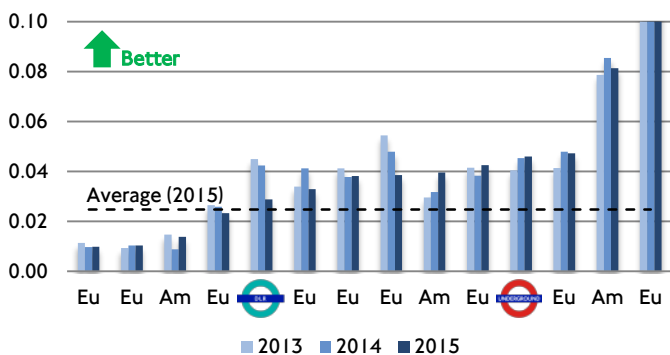


# Public Transport, Walking and Cycling

## Rail Reliability

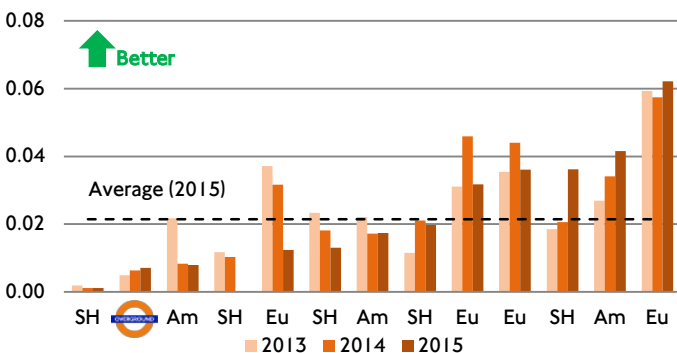
**Reliability: Million car kilometres between incidents causing a delay of five minutes or more**

CoMET & Nova metros (excluding Asian networks)



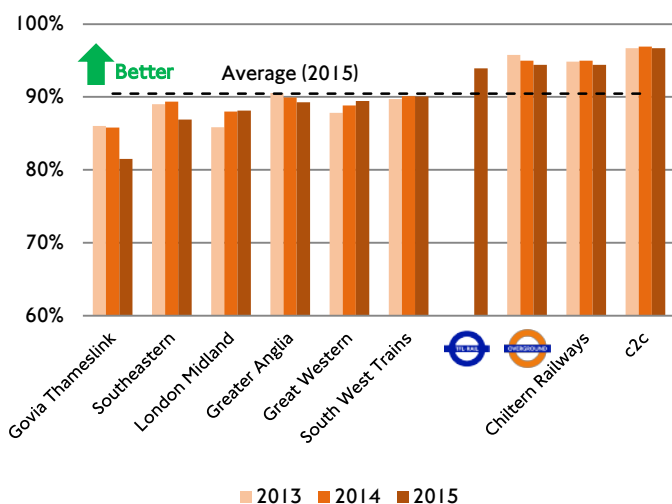
Source: CoMET and Nova metro benchmarking groups

ISBeRG suburban railways (excluding Asian networks)



Source: ISBeRG suburban railway benchmarking group

**Reliability: Public Performance Measure (2015)**  
London and South East train operators



### How Are We Performing?

Reliability is key to both attracting customers and providing world class service.

Within rail, Asian networks lead the way. In addition to differences in operating environment and staffing, Asian railways are newer, with fewer legacy challenges. Therefore, in this section we have benchmarked our rail modes against Western peers only.

Underground reliability is above average and has improved by 137% in the last ten years. The introduction of modern signalling systems and fleets, along with management action, have been crucial in this. Whilst reliability has recently been impacted by operator availability and wheel flats, we have improvement plans in place to ensure the upward trend continues.

DLR's reliability is also above average and improved significantly until 2013/14, but has reduced in the last two years, partly due to failures of the ageing B92 trains.

Overground performs worse than the average ISBeRG railway. This is in part a result of the UK rail model; Overground does not maintain all the infrastructure on which it operates, and shares tracks with multiple operators. Both adversely affect reliability. However, Overground has improved by 18% since 2013/14 and, along with TfL Rail, is one of the highest performing operators in London and the South East when measured against the Public Performance Measure, which indicates the percentage of on-time arrivals at destination. Overground is currently the fourth largest rail operator in London and the South East (by number of trains operated).

### What Are We Doing To Improve?

The 4LM and DTUP programmes will significantly improve reliability on the Underground, as will continued asset condition investment. On DLR initiatives are being implemented to improve the reliability of train systems, and the B92 fleet will be replaced in the mid-2020s. Overground reliability will continue to improve through sustained close working with industry partners.



# Public Transport, Walking and Cycling

## Bus Reliability

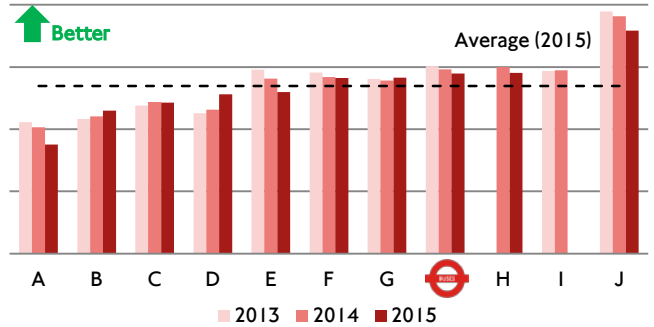
### How Are We Performing?

*Bus reliability is the fourth best in IBBG, but has deteriorated since 2013/14.*

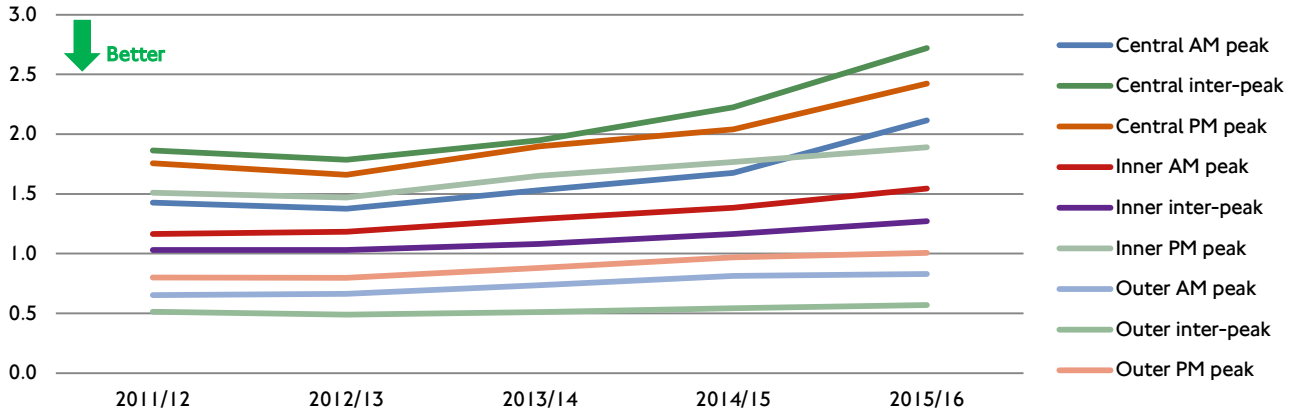
This measure is strongly influenced by road traffic conditions. The prevalence of bus priority lanes and technologies in comparator cities has a major impact on this metric. For instance buses in comparator J run on priority routes for a significant proportion of their networks.

As shown below delays on our roads have been steadily increasing since 2012/13:

Reliability: Punctuality  
IBBG bus networks



Average vehicle delay in London's roads by functional sector (minutes per kilometre)  
Working weekdays, TfL's "network of interest"



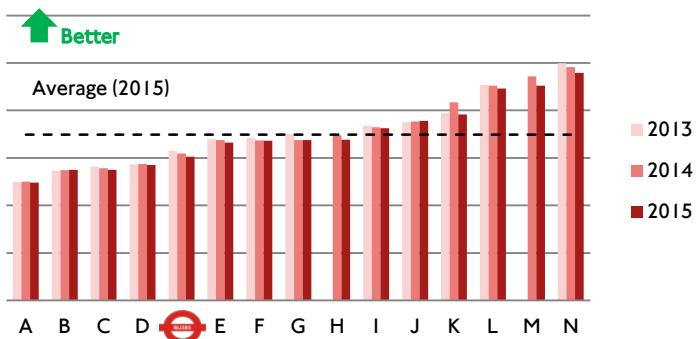
However London has lower road congestion than most world cities, and was ranked 7<sup>th</sup> best out of 30 for congestion in PwC's Cities of Opportunity study.

Our Buses provide a lower average commercial speed than most international comparators. Together with reduced reliability this has negatively affected demand, which has deteriorated since 2013/14.

### What Are We Doing To Improve?

Our Bus Priority Strategy will reverse this trend, introducing continuous bus priority along key corridors and automatic bus detection at traffic signals. Our 'Hello London' campaign will improve customer experience and make travelling on buses more attractive. Bus speeds are a key priority for benchmarking going forward.

Average commercial speed (km/hour)  
IBBG bus networks



Source: IBBG bus benchmarking group

TfL Business Plan commitments:

- More people on the buses (better journeys and reliability)

# Making Transport More Accessible

Our Business Plan includes bigger increases in Step-Free Access (SFA) than ever before, £2.50 for every £1 spent on SFA in the last Business Plan.

## How Are We Performing?

*The Underground network has a lower percentage of step-free stations than most international comparators.*

This is predominantly a legacy issue driven by the age of our network and infrastructure. Ambitious plans are already in place to improve. Ongoing SFA schemes include some of our busiest locations such as Bond Street, Finsbury Park, Tottenham Court Road and Victoria. The Mayor has provided an additional £200m funding to invest in c.30 additional SFA schemes in the next five years. However, whilst this will improve our position we will still be somewhat below the CoMET average.

*The DLR and Trams are both fully step-free. They will be followed by the Elizabeth line, which will also be 100% step-free when it enters full service in 2019.*

Like Underground, our Overground network is below average amongst its peer group. However there are plans to improve, with funding secured for SFA projects at Blackhorse Road, West Hampstead, Brondesbury and Seven Sisters.

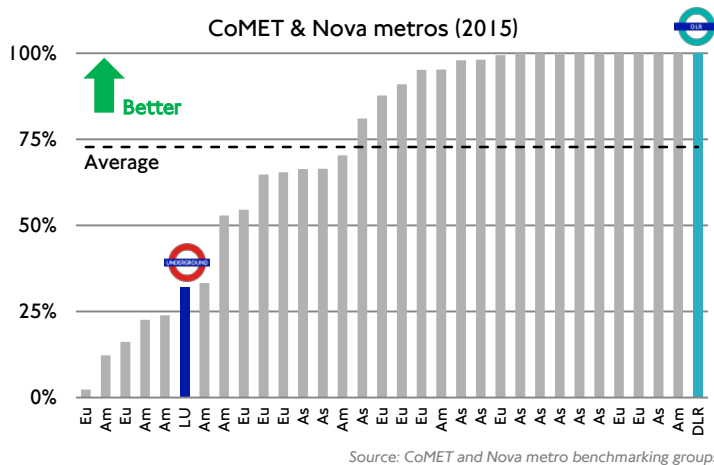
*Of fifteen comparator bus operators we are one of only seven world leaders for whom their entire fleet is comprised of low-floor vehicles (this excludes our heritage Routemasters).*

## What Are We Doing To Improve?

To meet the Mayor's commitment of having 40% of Underground stations step-free by 2021/22 a benchmarking study has been undertaken to examine how industry leaders have delivered similar projects whilst minimising costs. The findings and recommendations from this study will help us drive down the cost of SFA schemes on the Underground and deliver more for less.

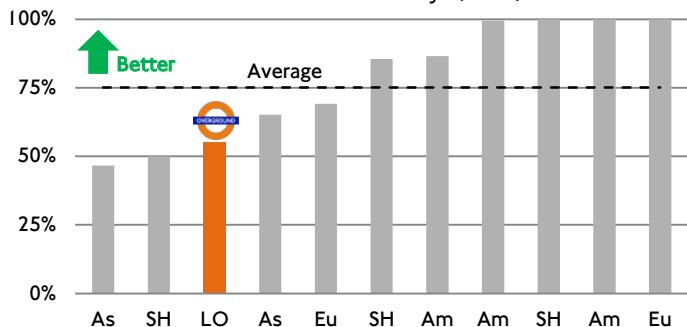
We are on track to hit our targets of making 95% of our bus stops accessible for wheelchair users by the end of 2017/18, and introducing an extra 100 accessible taxi ranks by 2020.

Percentage of stations with step-free access



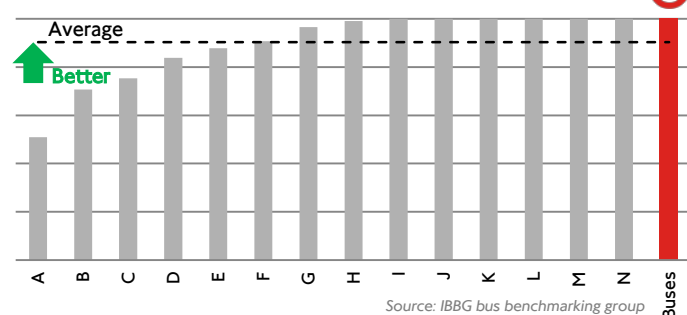
Source: CoMET and Nova metro benchmarking groups

ISBeRG suburban railways (2015)



Source: ISBeRG suburban railway benchmarking group

Percentage of Low-Floor Buses  
IBBG bus networks (2015)



Source: IBBG bus benchmarking group

## Accessible Technology

We are working to make our technology as well as our infrastructure as accessible as possible. Our websites are tested to ensure they meet accessibility standards, including those of the Web Accessibility Initiative. Our online Journey Planner offers a range of travel options for those with accessibility needs.

# Making Transport More Accessible

## Transport Coverage

### How Are We Performing?

London's public transport network enables the city to function and grow.

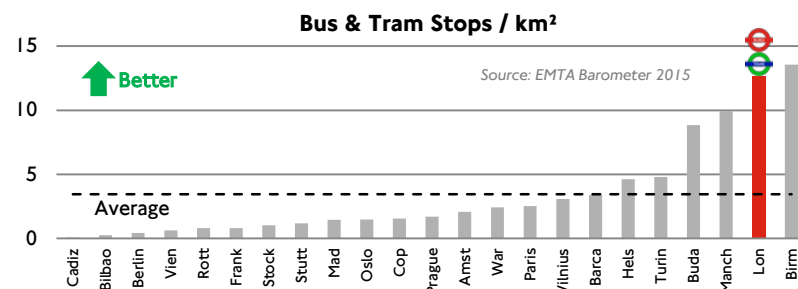
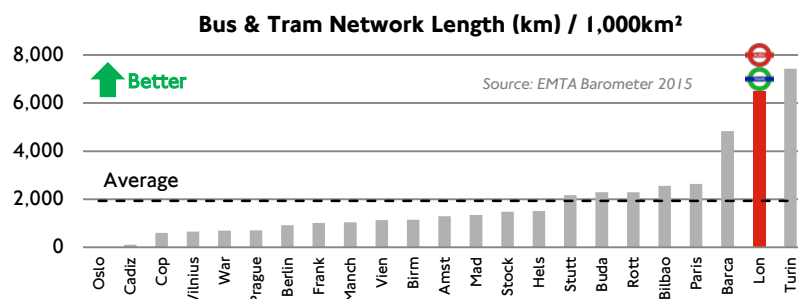
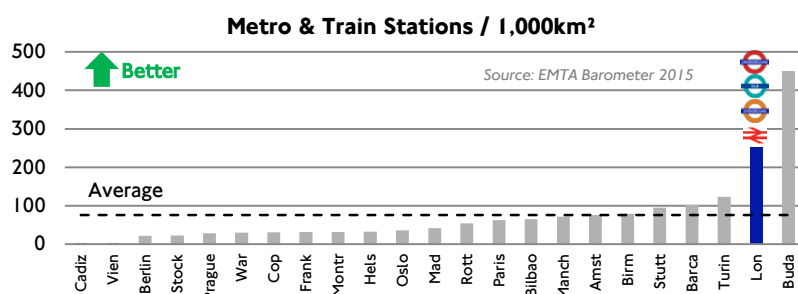
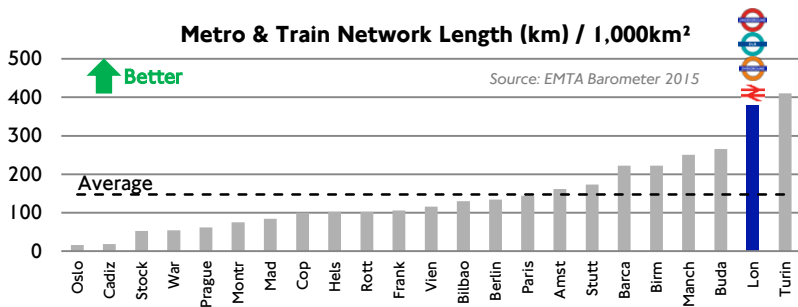
We have benchmarked public transport coverage geographically by examining the kilometrage of rail, bus and tram routes, as well as the number of rail, bus and tram stations and stops, in the city by area. This provides an insight into the density and therefore the ease of access of London's public transport network.

*London has the second highest density of metro, train, bus and tram routes, and the second highest density of metro, train, bus and tram stations, of 23 cities surveyed by the European Metropolitan Transport Authority.*

London's position will improve yet further with the full opening of the Elizabeth line and the extension of the Northern line.

TfL Business Plan commitments:

- More than 40% of tube stations step-free by 2021/22
- 100% step-free Elizabeth line
- Improve bus stop and taxi rank accessibility

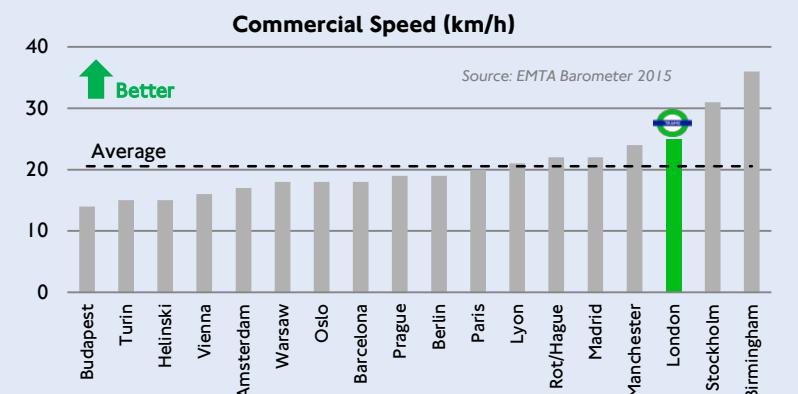


### Tram Commercial Speed

This graph is taken from the EMTA's 2015 Barometer Report and shows average commercial speed.

This incorporates time at stops and traffic levels, and therefore overall time-efficiency of transit.

*Our Tram network performs third best amongst comparator cities.*



# Safer London

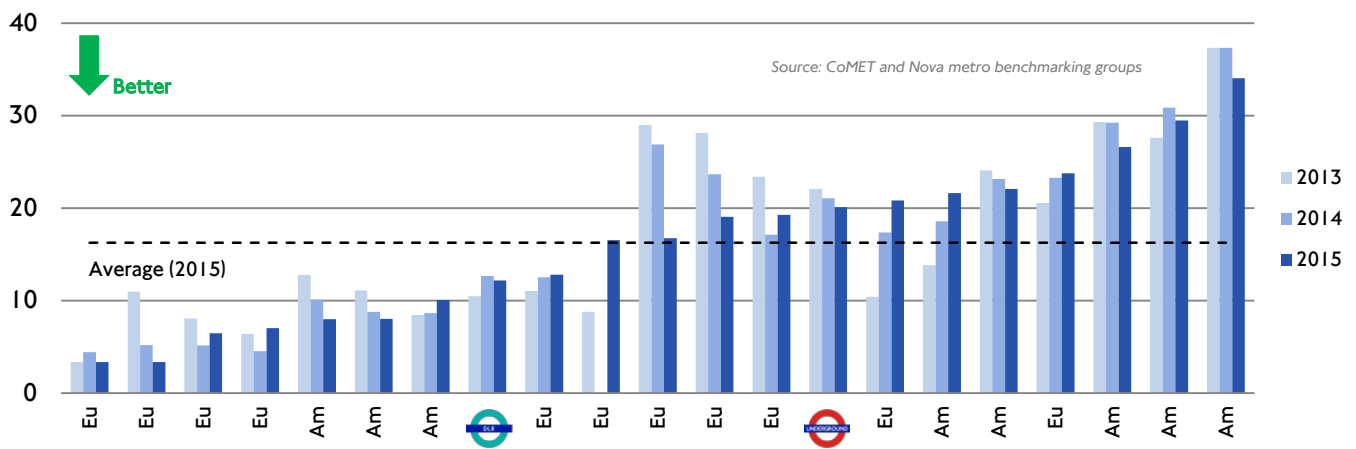
Safety is always our top priority and our goal is to create an environment in which people are safe and feel safe, however they choose to travel.

## Safety On Our Rail Modes

### How Are We Performing?

We have benchmarked railway safety on fatalities per billion journeys. Underground performance is currently slightly worse than average, but improving quickly. DLR performs better than average.

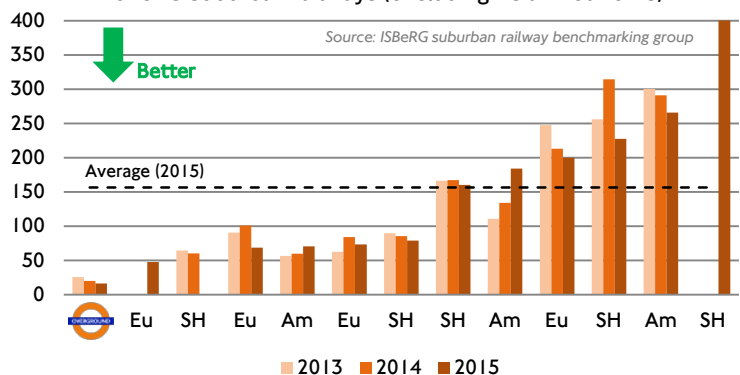
**Fatalities due to accidents, illegal activity or suicides per billion passenger journeys (3-year rolling average)**  
CoMET & Nova metros (excluding Asian networks)



*Overground is the best performer in customer safety, and shows a consistently improving trend.*

Amongst both metros and suburban railways Asian networks tend to have lower fatality rates than their Western peers. In addition to socio-economic differences, Asian networks have generally been built more recently and tend to have a higher proportion of stations with Platform-Edge Doors, which restricts access to the track and reduces platform-train interface incidents. For this reason they have been excluded from this comparison.

**Fatalities due to accidents, illegal activity or suicides per billion passenger journeys (3-year rolling average)**  
ISBeRG suburban railways (excluding Asian networks)



### What Are We Doing To Improve?

We are carrying out initiatives across our modes to prevent suicides, including collaborating with the Samaritans, providing training to staff, and undertaking customer awareness campaigns to promote safe behaviours on our networks.

None of these modes had fatalities due to illegal activity in 2015/16, and we continue to work with the British Transport Police to prevent this.

We are working hard to reduce platform-train-interface incidents across our rail modes, and with Imperial College we will be refreshing comparable safety precursor data in the coming year.

# Safer London

## Tram Safety

### How Are We Performing?

9<sup>th</sup> May 2017 was the six month anniversary of the tragic accident at Sandilands, Croydon where a tram derailed, resulting in seven people losing their lives and 51 requiring hospital treatment. Prior to services restarting, and in accordance with advice in the Rail Accident Investigation Branch's (RAIB) interim report the installation of fixed chevron signs at four sites with significant bends was completed in January. Work to install lineside digital signs to complement the fixed chevron signs was completed and the signs brought into service in April. These warn drivers of an approaching speed limit. They are similar to those on the road network. If a tram approaches at above 20kph the radar detects this and a warning will flash '20 zone' giving the driver time to reduce their speed.

We continue to work with the RAIB, and the Office of Rail and Road (ORR) and the BTP who are also conducting investigations. The Mayor wrote to the RAIB to draw their attention to the allegations made in the BBC's Victoria Derbyshire programme to include in their investigation as appropriate. TfL also immediately alerted the RAIB and ORR to the Evening Standard's article around fatigued drivers and a driver appearing to be asleep at the controls of a tram, stopped at lights in the Croydon area. The ORR confirmed it is investigating these allegations independently of the derailment. The Mayor also requested TfL urgently investigate all the claims made in the BBC programme.

### What Are We Doing To Improve?

In addition to supporting the RAIB's, ORR's and the BTP's investigations TfL's independent investigation continues and is expected to report in the Autumn. We continue to explore the development of in-cab systems for monitoring and managing tram speed to provide live tracking and speed warnings. Such systems are rare on trams so we are seeking interest from industry to help support us in their development and introduction. We continue to closely monitor the process for acting upon safety-related complaints and ensuring complaints are passed to the relevant party for review and action. This includes working closely with First Group, to ensure all tram related complaints are reviewed and appropriate action taken.

## Bus Safety

### How Are We Performing?

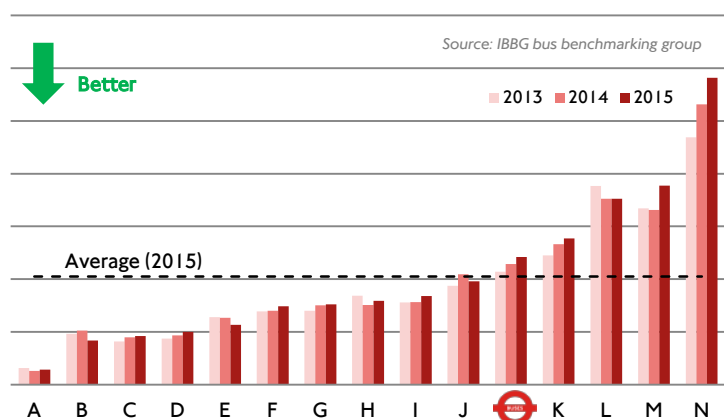
*Bus collisions are slightly above average for the peer group, having unfortunately increased in recent years.*

### What Are We Doing To Improve?

Reducing bus collisions is a priority and we have set ourselves the target of zero fatalities on the bus network. A new Operator Safety Scorecard will come into operation in 2017, and we will be conducting rigorous follow-ups for all major incidents, and providing improved incident support going forward.

New enhanced safety technology will be incorporated into our fleets including Intelligent Speed Assistance and Automatic Emergency Braking with improved safety highway engineering at collision hotspots. We will publish more bus incident data to enhance transparency, and introduce new safety training modules for drivers incorporating the latest ideas from other sectors.

Number of vehicle collisions per million vehicle km  
IBBG bus networks



# Safer London

## Road Safety

Benchmarkable road safety data is less readily available and up-to-date than for our bus and rail modes. To address this we have completed a benchmarking exercise comparing road casualties with other cities. Some high-level comparisons from this piece are included here.

### How Are We Performing?

*London's overall road fatalities per resident were, in 2014, the lowest of the peer group of 13 cities.*

The number of people killed or seriously injured on London's roads fell by 42% in 2015 against the 2005-09 baseline, and is now the lowest on record.

*London also has the lowest number of fatalities per kilometre travelled by car, bicycle or on foot of the three cities surveyed, along with improving year-on-year trends.*

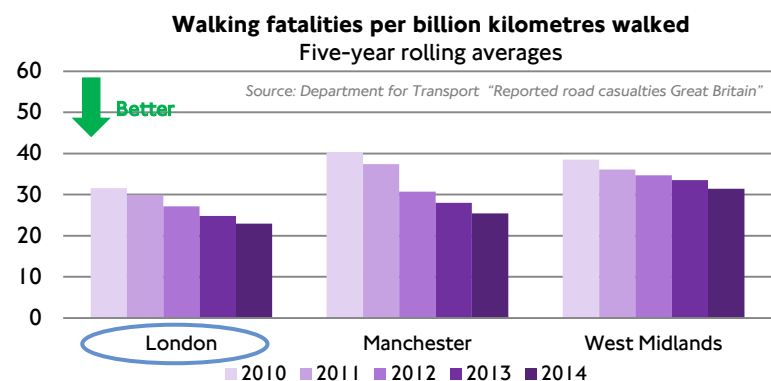
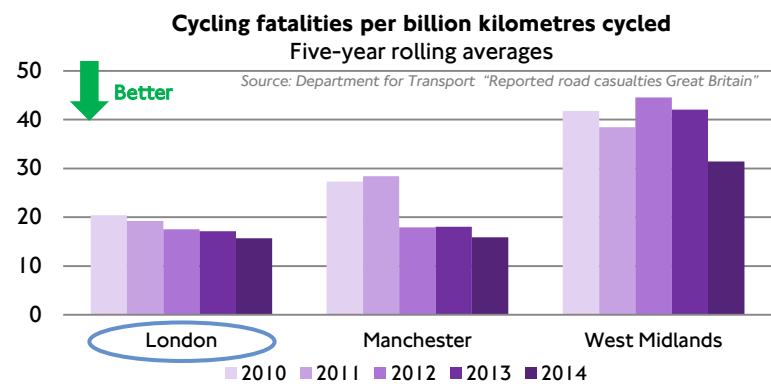
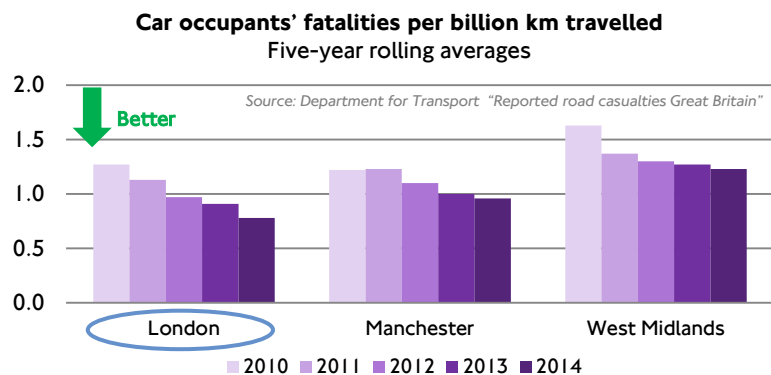
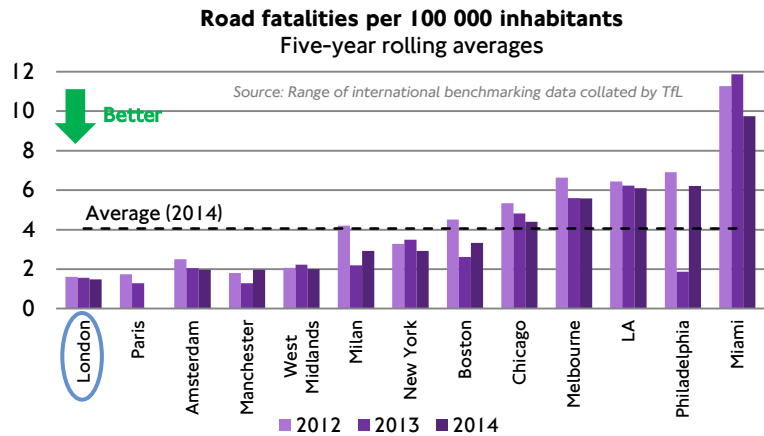
### What Are We Doing To Improve?

We are adopting a "Vision Zero" approach to road safety. This means lowering speed limits and encouraging mode shift from private vehicles. Prioritising the reduction of all road dangers is a core principle of the Healthy Streets portfolio.

We are working to improve the timeliness of road safety data. This will enable us to better benchmark and improve performance, encourage active travel and improve Londoners' health and safety. TfL is a partner in the OECD Safer City Streets network and in the development of the International Road Traffic and Accident Database. The latter will facilitate improved road safety benchmarking.

TfL Business Plan commitments:

- New vision zero target for road safety
- New 20 mph limits

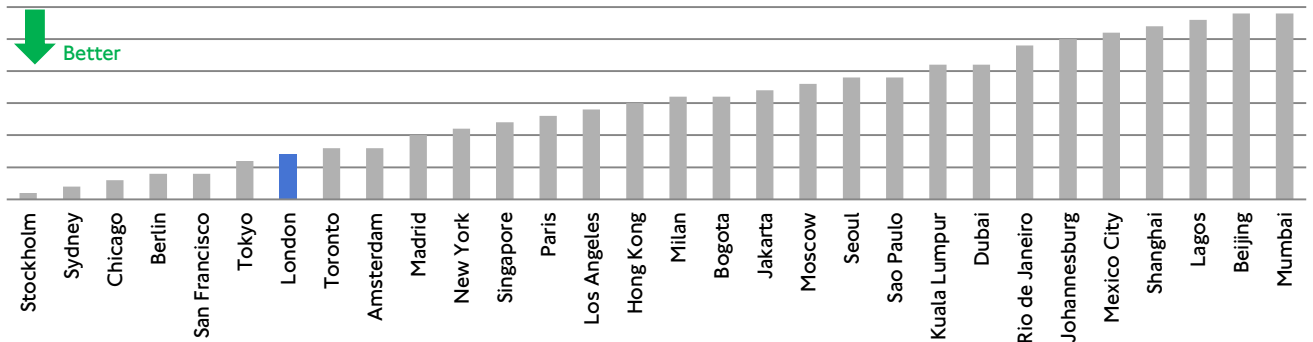


# Cleaning Up Air Quality

## Pollution Levels

### Air Pollution (ranking)

Combination of PM10 concentration levels from the World Health Organisation (WHO) and the Numbeo Pollution Index



Source: Cities of Opportunity 7 (PwC, 2016)

### How Are We Performing?

It is difficult to compare air quality across world cities due to the impact of geography and weather conditions. However this notwithstanding:

**London places seventh amongst 30 world cities for air pollution.**

Whilst we're ahead of all but two European comparators, we acknowledge that our future goals must specifically include reducing harmful nitrogen dioxide levels.

**London currently ranks thirteenth of fifteen comparators for Nitrogen Dioxide levels.**

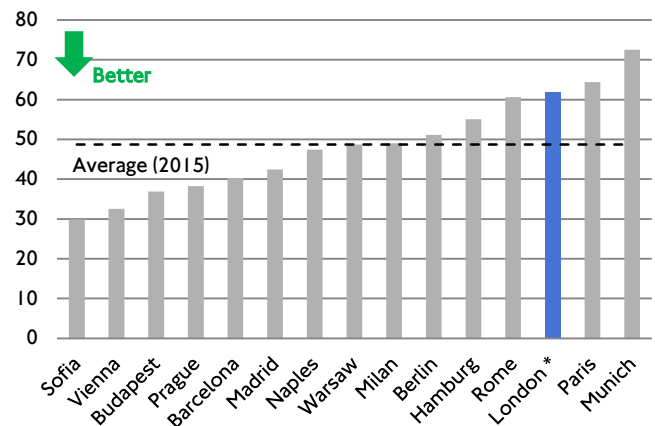
### What Are We Doing To Improve?

Emissions from road transport are the main cause of air pollution. We are working to tackle this by cleaning up our vehicle fleet and reducing dependency on vehicles through measures such as:

- Healthy Streets, a system of policies and strategies to help Londoners use cars less and walk, cycle and use public transport more;
- Introduction of the emissions surcharge;
- Going to statutory consultation on whether the Ultra Low Emissions Zone in central London should be brought forward to 2019, and the area expanded;
- Encouraging the uptake of the new Zero Emission Capable Taxi;
- Supporting boroughs through the Mayor's Air Quality Fund including the delivery of five Low Emission Neighbourhoods; and
- Incentivising the use of public transport through improved affordability, capacity, reliability and safety.

### Air Pollution: NO<sub>2</sub> concentration in urban traffic areas (µg/m<sup>3</sup>)

European cities with over 1 million citizens



Source: European Environment Agency (2015)  
\* London figure updated to 2016

TfL Business Plan commitments:

- Expand the ULEZ
- Introduce the emissions surcharge in 2017
- Purchase only green buses from 2018

# Cleaning Up Air Quality

Improving the efficiency of energy consumption and lowering CO<sub>2</sub> emissions on our modes has a huge positive impact on the carbon footprint of London.

## Carbon Footprint of Public Transport

### How Are We Performing?

*Our bus and rail modes have very low CO<sub>2</sub> emissions and energy consumption levels when compared with international peers.*

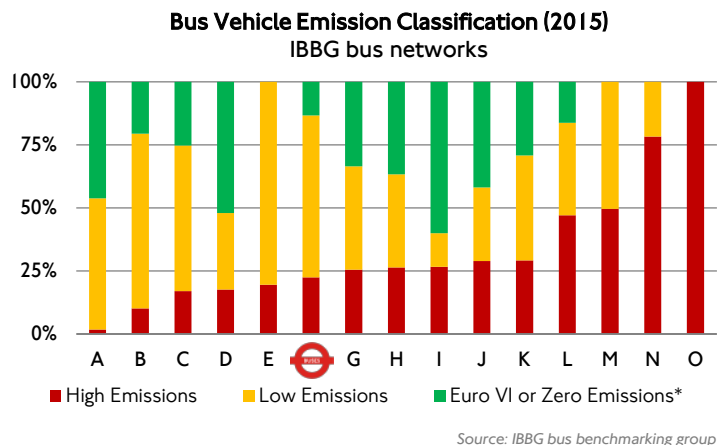
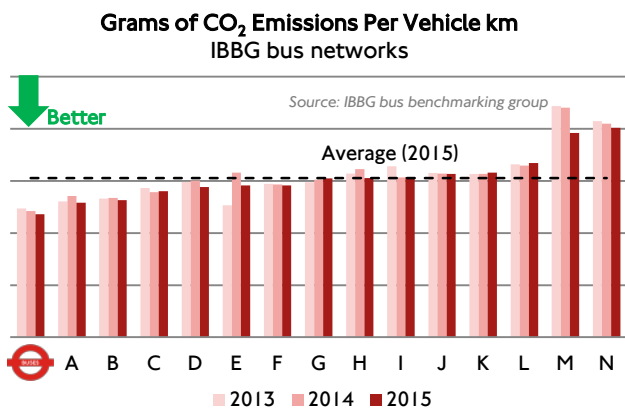
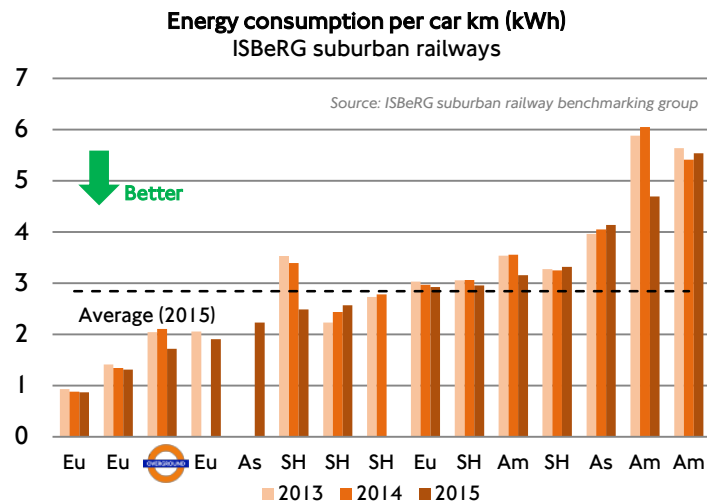
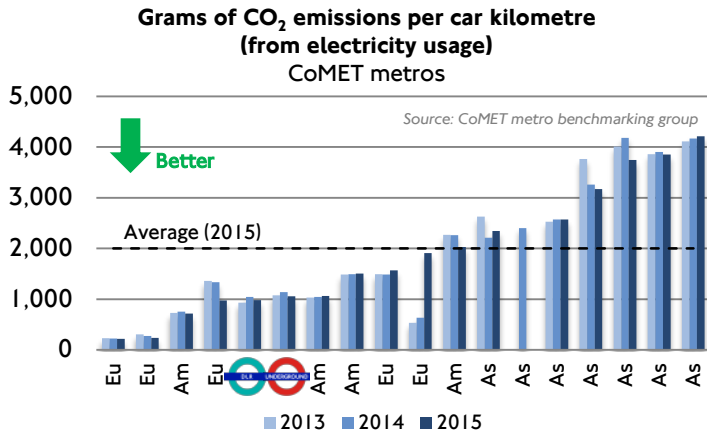
We have achieved low emissions in our rail modes despite increasing services and service speeds through a coordinated programme of traction energy interventions including inverting substations, increasing power regeneration and coasting where practical.

Our bus CO<sub>2</sub> emissions are best-in-class and continue to improve year-on-year. More than three quarters of our fleet is made up of low emission or Euro VI standard / zero emission vehicles. The remainder, those classed as high emissions, have been retrofitted with SCR technology reducing particulate emissions to a level close to Euro VI standards.

### What Are We Doing To Improve?

We are committed to making our buses even cleaner and will:

- Introduce only hybrid or zero emission double decker buses from 2018;
- Introduce 12 Low Emission Bus Zones;
- Retrofit up to 5,000 buses over the next three years so they are compliant with Euro VI emission standards; and
- Make all 300 single-deck buses zero-emission by 2020.





# Raising Commercial Revenue

By taking a fundamentally different approach, we will generate more non-fares income from our assets to reinvest in transport.

## How Are We Performing?

Underground is currently fifth out of seventeen CoMET metros for non-fare commercial revenue per passenger journey. This reflects the relative wealth of London and the size and scope of our infrastructure in prominent high-value central locations.

The DLR does less well when viewed through this lens. This is due predominantly to weaker advertising revenue as the network serves fewer central locations than most metros. The DLR also has a more limited infrastructure portfolio with fewer opportunities for advertising and retail.

Overground performance is below average. Overground has small stations with space prioritised for passenger flow. It also does not hold responsibility for major termini which generate higher levels of revenue (e.g. Grand Central in New York), or high yield interchange stations which are typically managed by Underground. In addition, comparator suburban railways tend to have a larger portfolio of car parks, which generate significant revenue.

Performance on Buses is improving quickly as we increase advertising at stops and in bus shelters. However, unlike many comparators income from on-vehicle advertising is retained by our bus operators (which reduces contract costs), so this is not a fair comparison.

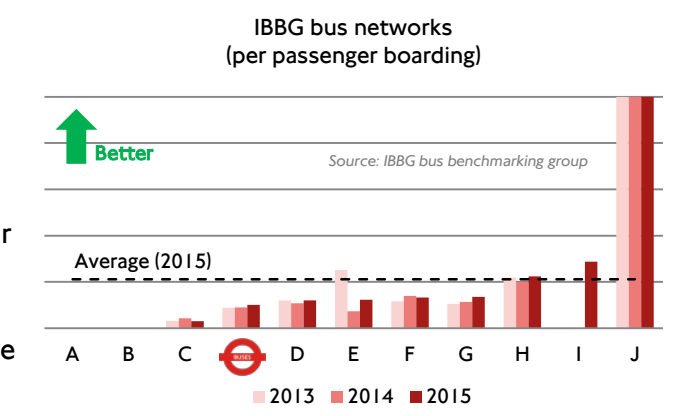
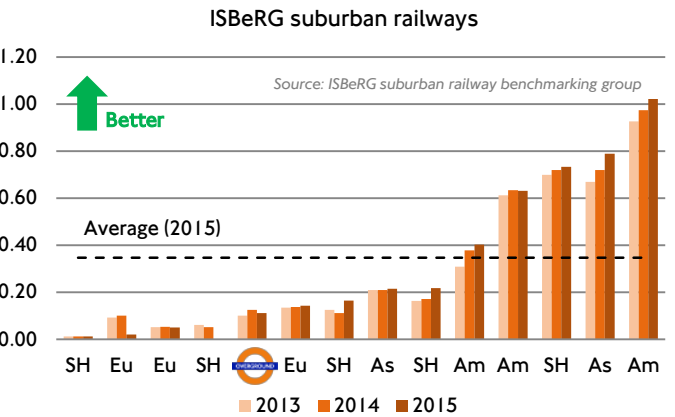
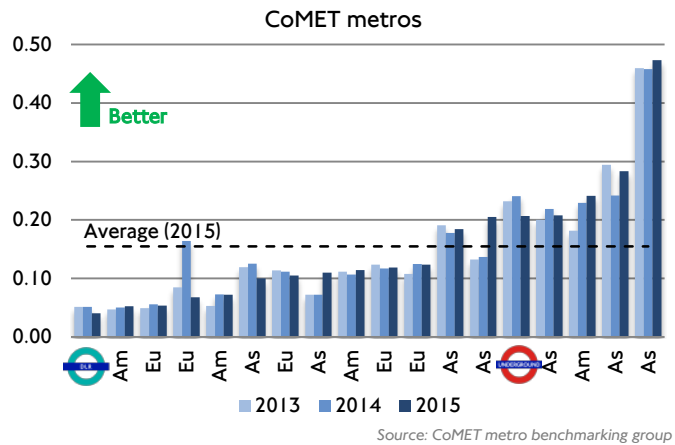
## What Are We Doing to Improve?

We have committed to improving financial sustainability and avoiding fare increases by raising our commercial revenues.

We are investing £82.9m to improve our advertising estate, including introducing more digital infrastructure and enhancing data collection and analysis to allow advertising to be more targeted.

We are making better use of retail spaces at stations and exploiting opportunities in our railway arches as well as leveraging our portfolio of roadside and underpass screens to increase revenue.

Non-fare commercial revenue per passenger journey (US\$ PPP-adjusted, 2015 prices)



TfL Business Plan commitments:

- Improving advertising estate
- Improving retail at stations and in our railway arches

# Harnessing Technology to Improve Journeys

## Connectivity

### How Are We Performing?

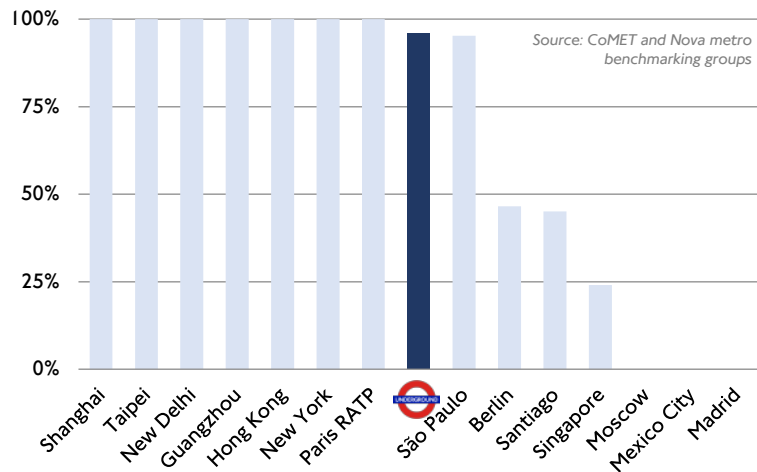
We offer Wi-Fi at over 250 Underground stations and throughout Victoria Coach Station, with 96% coverage in subsurface Underground stations. By 2018 this will have risen to 100% as those stations currently undergoing congestion relief or Elizabeth line works are upgraded.

However we remain behind best-in-class systems such as Moscow who offer Wi-Fi onboard their trains. We are investigating ways of achieving better connectivity across “not-spot” areas such as trains.

### What are we doing to improve?

To ensure London is at the cutting edge of developments a benchmarking workstream is underway to better understand how other cities have financed and procured 4G cellular networks for their underground stations and tunnels.

Percentage of underground stations with Wi-Fi  
CoMET and Nova metros



## Smart Ticketing

### How Are We Performing?

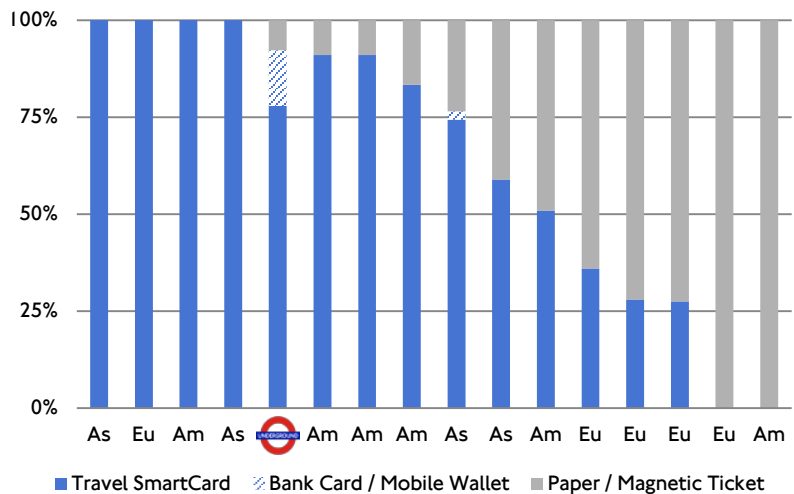
The introduction of Oyster and embracing of both contactless bankcard and mobile payment methods places London at the cutting edge of customer-focused ticketing technology. Smart Ticketing enables us to make our customer’s journeys as seamless as possible, minimising transaction time whilst ensuring they are provided with the best value ticket for travel.

*Of the metros surveyed Underground has the fifth highest use of smart ticketing and was the only participant to utilise both contactless bankcard and mobile payment methods.*

### What are we doing to improve?

A new Oyster app is in development which will offer customers a more convenient way to top up, or check their balance and journey history. These top-ups will be available anywhere on the transport network, including buses, within minutes of purchase.

Percentage of Passenger Journeys by Ticket Type



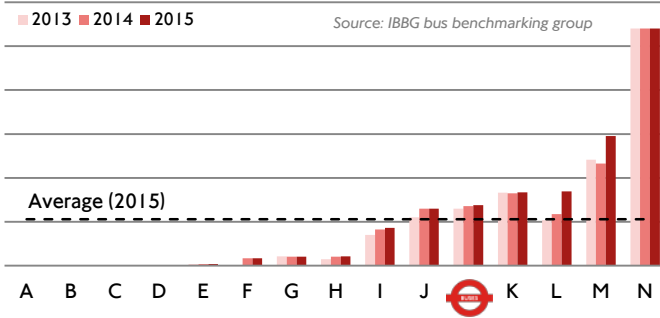
TfL Business Plan commitments:

- Top-ups available anywhere on the network, and a new ticketing app
- 600 apps using TfL Open Data

# Harnessing Technology to Improve Journeys

## Customer Information

Percentage of bus stops with dynamic information  
IBBG bus networks



With real-time information the norm at the majority of our rail stations, we have embraced technology to improve the quality of customer information on buses. Over 14% of stops have dynamic information (these stops account for over 35% of boarders). IBBG describe TfL's provision as lying in the "sweet-spot", as operators that provide higher levels of coverage have reported diminishing returns and inefficient maintenance costs. Furthermore all of our buses now have iBus, and are equipped with automatic vehicle location enabling customers to obtain updates through mobile technology throughout the network.

## Future Technology & Stimulating Innovation

We are committed to utilising technology to get the most from our infrastructure and to provide our customers with the most accurate and accessible travel information. We are working with industry to stimulate innovation and ensure we stay at the forefront of technological developments. Initiatives to harness technology to improve our customers' journeys include:

- The Surface Intelligent Transport System, which will replace many of the critical systems we use to manage London's road network. It will equip us with new technology fed by real-time data to make our operational decision-making quicker, leading to less disruption and congestion;
- A partnership with Google on Waze technology, which will see them use our open data, while we use their crowd-sourced data on road conditions to manage traffic incidents and road closures;
- Using Bluetooth Low Energy beacons, we are developing a system that lets visually impaired people navigate independently on the Underground network. Following a study at Pimlico Station, and a larger scale trial at Euston (in collaboration with the Royal Society for Blind Children) we are currently developing a scalable product;
- Combining Building Information Modelling with virtual and augmented reality has enabled greater efficiency and accuracy in reviewing options pre-tender. The result has been a 'left-shift' in the project lifecycle, with key requirements better understood, and greater engagement and savings throughout design, delivery and handover;
- Taking an active role in monitoring the development of connected and autonomous vehicles. We will take part in any trials of new vehicle technology in London with a safety-first approach, and ensure policies are in place which encourage the emergence of this technology in a way that is consistent with the Mayor's Transport Strategy. In 2016 we conducted a study alongside IBBG on automatic vehicle location applications and accuracy. A wealth of experience was gathered which will inform future decision making; and
- We plan to work with Catapult Future Cities on their Innovation Index. The workstream aims to provide insights into urban mobility and innovation, and to deliver a guide to fostering innovation in mobility services and systems.

# Key Findings

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As noted in the introduction benchmarking comparisons are never perfect, however they help to set our performance and progress in context, and prompt questions as to how we can improve further.

The below provides a summary of the key findings from this report. This includes areas where we perform well, and in some cases are best-in-class. But it also includes others in which we know we have to do better. This has been recognised by the Mayor and is targeted in our Business Plan.

## Affordable Transport

1. Underground and DLR fares are amongst the most expensive in the world. The Mayor has recognised this and taken action. Affordability will improve for all customers as fares are frozen for the whole Mayoral term. Average bus fares have already decreased with the introduction of the Hopper fare;
2. Our Tram fares are domestically best-in-class, and 38% below the average of UK tram and light rail networks;
3. We perform very strongly across all modes for financial sustainability - that is the extent to which we are able to fund operations and maintenance expenditure, including the cost of financing, through our own income. Both Underground and DLR are able to cover their operating costs through income. Few international comparator organisations have as little dependence on operating subsidies as TfL.

## Public Transport, Walking and Cycling

4. Two in every three journeys in London are either walked, cycled or completed using public transport. This places London fourth out of eleven European capitals surveyed. However, of these journeys, London has a relatively small share of trips made by walking or cycling (23% against an average of 33%). We are committed to encouraging a modal shift towards more active and healthier travel. To accomplish this we will reduce traffic and make walking, cycling and public transport safer and more attractive;
5. Ridership growth on the DLR and Overground has significantly outstripped that of international peers. Underground has kept pace with international comparators, despite the fact that these include new and often swiftly expanding networks in Asia and elsewhere. Bus performance has been below the average of peers in IBBG, with ridership decreasing from 2013/14;
6. Our highest peak hour rail frequency is provided by the Victoria line which operates 36 trains per hour. This compares favourably with global best-in-class;
7. Bus reliability is the fourth best in IBBG, but has deteriorated since 2013/14. Our buses also provide a lower average commercial speed than most international comparators. We recognise these are issues. Our Bus Priority Strategy will look to address this by introducing continuous bus priority in key corridors and automatic bus detection at traffic signals.

## Making Transport More Accessible

8. Despite recent improvements the Underground network has a lower percentage of step-free access stations than the majority of international comparators. This has been recognised by the Mayor, and plans are in place to invest £200m in c.30 step free access schemes over the next five years;

## Key Findings

9. The DLR and Trams are both fully step-free. They will be joined by the Elizabeth line when it enters full service in 2019;
10. Our entire bus fleet is comprised of low-floor vehicles. We are on track to hit our targets of making 95% of our bus stops accessible for wheelchair users by the end of 2017/18, and introducing an extra 100 accessible taxi ranks by 2020;
11. London has the second highest density of metro, train, bus and tram routes, and the second highest density of metro, train, bus and tram stations, of 23 cities surveyed by the EMTA.

### Safer London

12. Overground is the second safest suburban rail network in ISBeRG, and shows a consistently improving trend. DLR performance is also better than average. Underground performs slightly worse than average for its peer group, but has a clear improving trend;
13. Bus collisions are slightly worse than average for the peer group, having unfortunately increased in recent years. Reducing collisions is a priority and we have set ourselves the target of zero fatalities on the bus network. A new Operator Safety Scorecard will come into operation in 2017, and new enhanced safety technology will be incorporated into our fleets including Intelligent Speed Assistance and Automatic Emergency Braking;
14. London's road fatalities per resident were, in 2015, the lowest amongst 13 comparator cities. London also has a lower number of fatalities per kilometre travelled by car, bicycle or on foot than Manchester or the West Midlands, along with improving year-on-year trends.

### Cleaning Up Air Quality

15. London places seventh best amongst 30 world cities for air pollution. However we perform poorly for nitrogen dioxide concentration in built up areas. The Mayor is leading a drive to clean up London's air;
16. Our bus and rail modes have extremely low CO2 emissions and energy consumption levels when compared with international peers. Low CO2 emissions and low energy consumption does not necessarily contribute to air quality, but it does have a large positive impact on the carbon footprint of London..

### Raising Commercial Revenue

17. The scale of our commercial revenue is not world-leading. The Mayor has recognised that we can improve and ambitious plans are in place. We are investing over £80m to improve our advertising estate and will make better use of retail spaces at stations and exploit opportunities in our railway arches.

### Harnessing Technology to Improve Journeys

18. Of the metros surveyed Underground has the fifth highest use of smart ticketing, and was the only participant to utilise both contactless bankcard and mobile payment methods.

# Benchmarking Priorities

The process of identifying and prioritising benchmarking workstreams for inclusion in the 2017/18 workplan is currently underway. The workplan will be aligned to the Business Plan, but will incorporate a degree of flexibility in order to respond to changing business needs over time.

Although not yet confirmed the workplan is likely to include:



## Affordable Transport

- Our Underground OPEX and CAPEX unit rate report was delivered to IIPAG in May, comparing costs across lines and assets with world-leading metros.



## Public Transport, Walking and Cycling

- We are focused on developing benchmarking in less mature areas such as Walking, Cycling and Roads. Alongside Singapore's Land Transport Authority we are looking to establish a new international roads benchmarking group;
- We will investigate conducting a benchmarking study into bus speeds; this will compliment our Bus Priority Strategy and Healthy Streets initiatives.



## Making Transport More Accessible

- A benchmarking study was recently completed examining how industry leaders have delivered step-free access projects whilst minimising costs. The findings and recommendations will help us deliver more for less with the funding available;
- In 2017 CoMET will be undertaking a Station Design and Passenger Flow study, the outputs from which will inform our future plans.



## Safer London

- DLR and Underground are working with CoMET, and Overground with ISBeRG, in the production of safety precursor indicator benchmarking. Overground will also take part in a benchmarking exercise examining how best to manage employee fatigue to increase railway safety;
- Bus and Road safety is a priority, benchmarking will play a key role in supporting this by improving comparator information.



## Cleaning Up Air Quality

- We will develop our ability to provide in year usage data for zero emissions modes such as walking and cycling. This aligns with our new scorecard and will enable us to better benchmark and improve performance, driving usage and improving Londoners health.



## Raising Commercial Revenue

- A benchmarking study is underway to better understand how cities have financed and procured 4G cellular networks for their underground stations and tunnels. This study will provide recommendations and insight to inform the commercial arrangements and service management model.



## Harnessing Technology to Improve Journeys

- Overground is undertaking a Digital Railway study with ISBeRG focusing on utilising technology to maximise customer amenities on trains and at stations;
- We will work with Catapult Future Cities on their Urban Mobility Innovation Index. The workstream will provide insights into transport innovations worldwide and recommendations for fostering innovations for urban transport systems.