Rail infrastructure, assets and environmental 2016-17 Annual Statistical Release

Background

This release contains the following rail statistics for Great Britain in 2016-17:

Rail infrastructure statistics provide details on track length (including electrified track). Sourced from Network Rail and is available from 1985-86.

Number of mainline stations are sourced from Estimates of Station Usage (ORR) and Network Rail and is available from 1985-96

Average age of rolling stock is sourced from the Department for Transport and is published by sector from 2000-01 Q2, and by train operator from 2007-08 Q4.

Environmental statistics are sourced from train and freight operators and provide an estimate of normalised CO_2e emissions from traction energy since 2005-06.

Contents

Infrastructure:

The length of electrified route on the network has increased by 43km, due to completion of some electrification works on the Western route and the Crossrail project

Three new mainline stations opened in 2016-17

- Lea Bridge
- Kirkstall Forge
- Edinburgh Gateway

Average age of rolling stock:

The average age of rolling 21.1 years, a 0.1 year rise over the course of 2016-17. This indicates the average age is being reduced by the introduction on new rolling stock.

Emissions:

Passenger: CO_2e emissions per passenger kilometre have declined by 5.5% since last year, which may be a reflection of an increase in the use of electric powered rolling stock.

Freight: Electricity and diesel consumption in the freight industry has reduced during 2016-17. For 2016-17 the CO_2e emissions per freight tonne kilometre were 33.2g, the second highest on record after a high last year. This is likely due to a shift away from the transportation of bulk coal towards container freight.
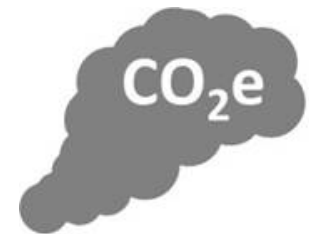
1. Infrastructure on the railways

Route open for traffic

Route open for traffic in 2016-17.	**15,811km**
Track km in 2016-17.	**31,221km**

The total length of route open for traffic in 2016-17 was 12km higher than in the previous year.

On the network there are now an additional 73km of route open for freight traffic only, while the length of route open for combined passenger and freight traffic has reduced by 61km.

These changes are the result of the reclassification of some route sections in Anglia, in addition to a number of other smaller changes across the network.

> Infrastructure on the railways shows data on the number of kilometres of route and track open for passenger and freight traffic, the length of route which is electrified and the number of open passenger stations on the Great Britain rail network.
>
> For a detailed history on how route length has changed, including information on the 'Beeching cuts', please see the accompanying quality report.
>
> **Route kilometres** are the total extent of routes available for trains to operate.
>
> **Track kilometres** takes into account multiple track routes (e.g. for each route kilometre where there is double track, there are two track kilometres).
>
> Sidings and depots are excluded from both measures.

Electrification

The length of electrified route has increased by 43km over the course of 2016-17, and now totals 5,374km (34% of the total route). This is mostly due to completion of electrification work on the Western route between Reading and Didcot and also electrification works as part of the Crossrail project[1].

Over the course of the 2000's the amount of electrified route has been relatively stable, with very little change year-on-year. However, recently there have been larger increases as a result of Crossrail and other projects to electrify track in Scotland, the North West of England, the Great Western Mainline.

In July 2017 the government announced plans to introduce new bi-mode train technology that allows trains to transfer from diesel to electric power; which replaces some of the previously planned electrification work[2].

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[1] Network Rail Annual Return 2017 (Page 14)

[2] https://www.gov.uk/government/speeches/rail-update-bi-mode-train-technology

Number of mainline stations in Great Britain

Number of mainline stations in 2016-17.   **2,560**

Three new stations opened during 2016-17.

Station	Opened	Served by
Lea Bridge	May 2016	Great Anglia services between Bishops Stortford and Stratford (London)
Kirkstall Forge	June 2016	Northern services between Leeds and Ilkley, Bradford Forster Square and Skipton
Edinburgh Gateway	December 2016	ScotRail services between Edinburgh and Perth, Dundee, Glenrothes With Thornton and Inverness

From 2015-16 the number of mainline stations has been sourced from ORR's Estimates of Station Usage. This data set is used as the source from 1997-98 onwards (from when the time series began). Prior to 1997-98 Network Rail's Operational Property Asset System (OPAS) is used as the source. Therefore there is a series break between 1996-97 and 1997-98. Please view the quality report for more information.

■ Infrastructure on the railways (route open, electrifed, and track km) annual data is available on the data portal in: Table 2.52

■ Mainline station annual data is available on the data portal in: Table 2.53

2. Average age of rolling stock

National (franchised)

21.1 years

0.1 year increase since last year

The national rolling stock fleet as of March 2017 is made up of almost 13,400 vehicles; of which around half have been built post-privatisation[3]. The average age of the rolling stock for franchised passenger operators is 21.1 years, a value which has increased by 0.1 years since the end of 2015-16.

As all existing rolling stock will age by one year between one year and the next, any change in average age of less than 1.0 years is an indication of either the introduction of newer rolling stock or the removal of older stock from the fleet. Further details on the rolling stock changes throughout 2016-17 are presented in Annex 3. These suggest that the small increase in the overall average age of rolling stock for franchised operators in 2016-17 is a result of the introduction of new rolling stock by a number of operators.

Average age of rolling stock is shown as at the end of 2016-17. These statistics reflect the rate of introduction of new trains to the national fleet

This includes passenger vehicles leased to franchised train operating companies by rolling stock leasing companies (ROSCOs) and other financiers, but excludes vehicles such as locomotives and Driving Van Trailers.

ROSCOs own most of the coaches, locomotives and freight wagons that run on the rails, which they lease to train operating and freight operating companies.

This data is sourced from the Department for Transport, and does not include the rolling stock operated by non-franchised operators.

Further information on the calculation of the average age of rolling stock is presented on page 9.

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[3] Long Term Passenger Rolling Stock Strategy for the rail industry (fifth edition), March 2017

Average age of rolling stock by sector

London and South East

18.4 years

0.5 year decrease since last year

In the **London and South East** sector the decrease in average age of rolling stock indicates a substantial roll-out of newer rolling stock across the sector. This decrease is a result of new trains introduced by c2c and Govia Thameslink Railway. At 18.4 years, London and South East has the lowest average age of rolling stock across the three sectors.

Regional

24.3 years

0.6 year increase since last year

The increase in average age of rolling stock for the **Regional** sector by 0.6 years suggests there has been some roll-out of newer rolling stock. This reduction in average age is likely to be a result of fleet changes for Scotrail, Northern and TransPennine Express.
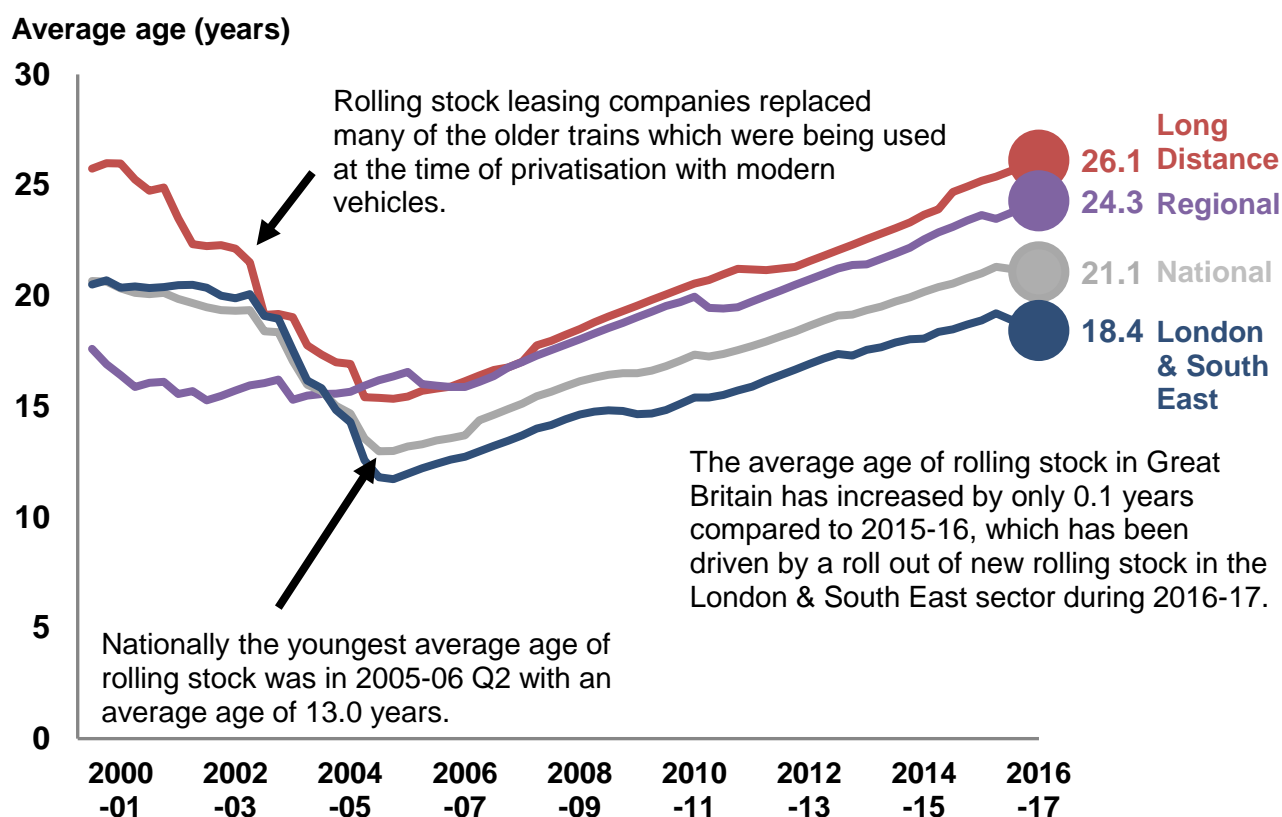
Long distance

26.1 years

0.9 year increase since last year

The oldest rolling stock is found in the **Long Distance** sector, with an average age of 26.1 years. The 0.9 year increase in average age since 2015-16 indicates that there has been little change to the rolling stock in this sector over the past 12 months.

Average age of rolling stock by sector, Great Britain, 2000-01 Q2 to 2016-17 Q4 (Table 2.30)

Average age (years)

Rolling stock leasing companies replaced many of the older trains which were being used at the time of privatisation with modern vehicles.

26.1 Long Distance

24.3 Regional

21.1 National

18.4 London & South East

The average age of rolling stock in Great Britain has increased by only 0.1 years compared to 2015-16, which has been driven by a roll out of new rolling stock in the London & South East sector during 2016-17.

Nationally the youngest average age of rolling stock was in 2005-06 Q2 with an average age of 13.0 years.

Over the last decade there has been a long term trend in the rising average age of rolling stock across all sectors. Between 2005-06 and 2016-17, the average age has risen by 60% (8 years). This was to be expected following the replacement of a number of trains from the British Rail era after privatisation.

The number of new vehicles expected to be delivered over the course of Control Period 5 (2014-2019) and the early years of Control Period 6 (2019-2024) has reached 6,010 with a cost of more than £10 billion. As a consequence the average age of rolling stock is forecast to fall from 21 years of age in 2016-17 to 15 years by March 2021[4]. A selection of future rolling stock orders are explained under each train operating company in Annex 3.

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[4] Long Term Passenger Rolling Stock Strategy for the rail industry (fifth edition), March 2017

Average age of rolling stock by train operating company

For seven operators the average age of rolling stock decreased, or increased by less than a year, during 2016-17

C2C   NORTHERN

GOVIA THAMESLINK RAILWAY   SCOTRAIL

GREAT WESTERN RAILWAY   TRANSPENNINE EXPRESS

GREATER ANGLIA

An increase in average age of less than one year for an operator indicates that either newer rolling stock has been introduced, or older rolling stock phased out.

The rolling stock fleet was unchanged for 10 operators

CALEDONIAN SLEEPER   SOUTH WEST TRAINS

CROSS COUNTRY   SOUTHEASTERN

EAST MIDLANDS TRAINS   TFL RAIL

LONDON OVERGROUND   VIRGIN TRAINS EAST COAST

MERSEYRAIL   VIRGIN TRAINS WEST COAST

For each of these operators the average age of rolling stock increased by exactly 1.0 years. This indicates there has been no change to the rolling stock in service over the course of the last year.

The average age of rolling stock increased for three operators

ARRIVA TRAINS WALES   LONDON MIDLAND

CHILTERN RAILWAYS

For each of these operators the average age of rolling stock increased by more than one year. An increase of greater than one year indicates that either some older stock has been put into service, or some younger stock has been removed.

For four operators, c2c, Govia Thameslink Railway, Great Western Railway and TransPennine express, the average age of rolling stock decreased compared to

2015-16. Govia Thameslink Railway had the largest reduction with a decrease in average age of 3.2 years. There were three operators, Greater Anglia, Northern and ScotRail, for which the average age increased by just under one year.

About rolling stock

While new rolling stock may be more efficient and technologically advanced, existing trains can be refurbished during their lifetime to add better facilities (e.g. WiFi capability)[5]. Therefore both newly-built and refurbished rolling stock can offer a more comfortable service for passengers and the age of rolling stock does not necessarily affect passenger satisfaction. The introduction of refurbished rolling stock is not reflected in these statistics.

How average age of rolling stock is calculated

The average age of rolling stock shown is the age as of quarter 4 (January to March) 2016-17. Changes in rolling stock average age are recorded against the same time period the year before. A vehicle drops out of the dataset if it is no longer leased by a franchised train operator.

Rolling stock and accessibility

The Railways (Interoperability) Regulations 2011 and the Rail Vehicle Accessibility (Non-Interoperable Rail Systems) Regulations 2010 require that all passenger rail vehicles meet accessibility standards by 2020. As of March 2017 the Department for Transport estimates that around 75% of heavy rail rolling stock had been built or refurbished to be accessible to disabled passengers[6].

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[5] Long Term Passenger Rolling Stock Strategy for the rail industry (fifth edition), March 2017

[6] https://www.gov.uk/government/publications/list-of-rail-vehicles-built-or-refurbished-to-modern-accessibility-standards, accessed 2 October 2017

Owners of rolling stock

Ownership of rolling stock fleet, March 2017
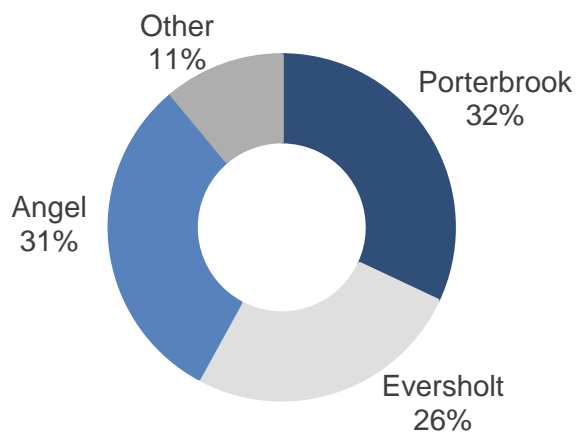
Rolling stock leasing companies (ROSCOs) own the majority of rolling stock in Great Britain, with the three main companies owning 89% of the national fleet. As of March 2017 11% of the fleet was owned by other parties, this is up from 8% in March 2016. The ROSCOs lease rolling stock to train operating companies.

Source: Long Term Passenger Rolling Stock Strategy for the rail industry, March 2017.

- Average age of rolling stock by sector quarterly data are available on the data portal in: Table 2.30

- Average age of rolling stock by train operating company quarterly data are available on the data portal in: Table 2.31

3. Environmental

Passenger train emissions

The level of CO_2e emissions per passenger km in 2016-17 was the lowest since the start of the time series in 2005-06.

In 2016-17 passenger services consumed:

3,524 million kWh of electricity

Increase of 2.1% compared to 2015-16

501 million litres of diesel

Increase of 0.2% compared to 2015-16

Which resulted in:

2,961 KTonnes CO_2e emissions

Decrease of 3.7% compared to 2015-16

43.8 g CO_2e per passenger km

Decrease of 5.5% compared to 2015-16

Although the volume of CO_2e emissions decreased between 2015-16 and 2016-17, the normalised emissions per passenger km saw a greater reduction due to an increase in passenger kilometers by 2.0% over the same time period. The decrease in emissions could be attributed to a gradual transition to more electric rolling stock being in use on the railway. In March 2017 electric vehicles comprised 71% of the fleet in Great Britain, compared to 68% in 2013[7].

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[7] Long Term passenger rolling stock strategy for the rail industry, February 2013

Freight train emissions

Despite a 1.7% reduction compared to the previous year, the level of CO_2e emissions per freight tonne km in 2016-17 was the second highest on record since the start of the time series in 2005-06.

In 2016-17 freight services consumed:

58 million kWh of electricity

Decrease of 15.2% compared to 2015-16

204 million litres of diesel

Decrease of 5.0% compared to 2015-16

Which resulted in:

629 KTonnes CO_2e emissions

Decrease of 4.2% compared to 2015-16

33.2 g CO_2e per tonne km

Decrease of 1.7% compared to 2015-16

The reduction in diesel and electricity consumption by freight services may be a reflection of a reduction in freight being transported across the network; freight moved in tonne km reduced by 2.9% compared to 2015-16.

Since 2014-15 the amount of coal transported by rail freight has fallen by 78% whereas domestic intermodal transport has increased by 5%, accounting for 39% of freight moved in 2016-17. Intermodal containers are typically used for lower-density goods, and may not always be filled to capacity, which may explain the relatively high level of emission per freight tonne km seen in 2016-17.

About emissions

Environmental statistics are an environmental indicator showing normalised CO_2e (carbon dioxide equivalent) emissions from traction energy for passenger and freight trains.

Passenger data has been normalised to show the average CO_2e emission per passenger kilometre. Freight data has been normalised to show the average CO_2e emission per net tonne kilometre of freight moved.

Traction energy refers to rolling stock on the Great Britain rail network and the energy used to power passenger and freight train movements. Non-traction emissions are excluded.

How emissions are calculated:

CO_2e emissions are calculated from actual and estimated data for energy consumption. Train operators provide ORR with their total traction electricity (kWh) and diesel usage (litres) consumption.

Actual energy consumption data is converted into CO_2e using standard conversion factors from the Department for Environment, Food and Rural Affairs (DEFRA). The conversion factors allow activity data (e.g. litres of fuel used, kWh consumed) to be converted into kilograms of carbon dioxide equivalent (CO_2e) which is a universal unit of measurement that allows the global warming potential of different greenhouse gases (GHGs) to be compared. For more technical information see the quality report.

Estimated emissions:

For 2016-17 the following were estimated due to passenger train or freight operators not providing data:

- Emissions from three passenger train operators; 97% of passenger kilometres are covered by actual emissions data.

- Emissions from five freight operators; 97% of freight tonne kilometres are covered by the four freight companies who provided emissions data

Fifth Carbon Budget

The government has a legally binding Fifth Carbon Budget which aims to reduce emissions by 57% in 2032 compared to 1990 levels, and an 80% reduction by 2050. Moving freight from road to rail is part of the solution and has the potential to help reduce emissions[8]. As part of this a study showed that shifting from HGV road freight to rail could reduce greenhouse gas emissions by nearly a fifth (19%)[9].

■ Estimates of normalised passenger and freight CO_2e emissions annual data is available on the data portal in: Table 2.100.

■ Estimates of passenger and freight energy consumption and CO_2e emissions annual data is available on the data portal in: Table 2.101.

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[8] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/552492/rail-freight-strategy.pdf
[9] http://www.arup.com/railfreightmarket

Annex 1 – List of pre-created reports available on the ORR Data Portal

All data tables can be accessed on the data portal free of charge. The ORR data portal provides on screen data reports, as well as the facility to download data in Excel format and print the report. We can provide data in csv format on request.

Infrastructure on the railways

- Infrastructure on the railways (1985-86 to 2016-17) – Table 2.52
- Mainline station in Great Britain (1985-86 to 2016-17) – Table 2.53

Average age of rolling stock data

- Average age of rolling stock by sector (2000-01 Q2 to 2016-17 Q4) – Table 2.30
- Average age of rolling stock by train operating company (2007-08 Q4 to 2016-17 Q4) – Table 2.31

Environmental data

- Estimates of normalised passenger and freight CO_2e emissions (2005-06 to 2016-17) – Table 2.100.
- Estimates of passenger and freight energy consumption and CO_2e emissions (2005-06 to 2016-17) – Table 2.101.

Revisions: There have been revisions to the previously published time series. Further details on revisions to the data can be found in the Revisions Log

Annex 2 – Statistical Releases

This publication is part of the statistical releases which cover the majority of reports that were previously released through the Data Portal. The statistical releases consist of four annual and four quarterly themed releases:

Annual:

- Rail Finance & Rail Fares Index;
- Key Safety Statistics;
- Rail Infrastructure, Assets and Environmental;
- Regional Rail Usage.

Quarterly:

- Passenger and Freight Rail Performance;
- Freight Rail Usage;
- Passenger Rail Usage;
- Passenger Rail Service Complaints.

A full list of publication dates for the next twelve months can be found in the release schedule on the ORR website.

National Statistics

The United Kingdom Statistics Authority designated these statistics as National Statistics, in accordance with the Statistics and Registration Service Act 2007 and signifying compliance with the Code of Practice for Official Statistics. National Statistics status means that official statistics meet the highest standards of trustworthiness, quality and public value.

All official statistics should comply with all aspects of the Code of Practice for Official Statistics. They are awarded National Statistics status following an assessment by the Authority's regulatory arm. The Authority considers whether the statistics meet the highest standards of Code compliance, including the value they add to public decisions and debate.

It is ORR's responsibility to maintain compliance with the standards expected of National Statistics. If we become concerned about whether these statistics are still meeting the appropriate standards, we will discuss any concerns with the Authority promptly. National Statistics status can be removed at any point when the highest standards are not maintained, and reinstated when standards are restored.

For more details please contact the Statistics Head of Profession Abby Sbeade on 020 7282 2022 or contact rail.stats@orr.gsi.gov.uk.

The Department for Transport (DfT) also publishes a range of rail statistics which can be found at DfT Rail Statistics.

Annex 3 – Average age of rolling stock: further detail by train operator

This annex supplements the rolling stock chapter, and provides some further detail about key rolling stock changes and future rolling stock orders. Further information on rolling stock changes and future developments can be found in the [Rolling Stock Perspective, third edition](#) and the [Long Term Passenger Rolling Stock Strategy](#).

	Average age of rolling stock	Compared to 2015-16	
Arriva Trains Wales	**27.0 years**	⇧ **1.6**	**From 2018 ATW will be introducing five new class 319 bi-mode trains into service[10]**
c2c	**14.9 years**	⇩ **0.2**	**c2c has introduced six new class 387 units, which were rolled out from November 2016 onwards[11]**
Caledonian Sleeper	**42.4 years**	⇧ **1.0**	
Chiltern Railways	**23.2 years**	⇧ **3.4**	**The introduction of class 168/3 units, transferred from TPE, was completed during 2016-17**
CrossCountry	**18.6 years**	⇧ **1.0**	
East Midlands Trains	**25.3 years**	⇧ **1.0**	
Govia Thameslink Railway	**15.7 years**	⇩ **3.2**	**Four class 171 units, previously in service in Scotland, were introduced to the GTR route in June 2016[12]. In addition GTR has ordered a new fleet of class 700s trains, the first of which entered service in June 2016[13]**

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[10] https://www.globalrailnews.com/2017/07/17/arriva-trains-wales-invests-in-bi-mode-class-319s/

[11] http://www.railtechnologymagazine.com/Rail-News/c2c-reveals-2017-timetable-as-new-class-387-enters-service

[12] https://www.pressreader.com/uk/rail-uk/20160423/281900182392416

[13] http://www.railtechnologymagazine.com/Rail-News/gtr-unveils-new-class-700-passenger-train

Great Western Railway	**32.0 years**	⇩ 1.4	**Great Western Railway introduced new class 387 Electrostar units in September 2016**[14] **Starting in 2017, Hitachi Rail is expected to deliver 57 trains to Great Western Railway as part of the Intercity Express Programme (IEP)**[15]**. In addition to these GWR is procuring an additional 29 class 387 electric units and seven bi-mode units. which are due to come into service from 2018 onwards**[16]
Greater Anglia	**27.6 years**	⇧ 0.9	**Over the course of the new East Anglia franchise Greater Anglia is planning to replace its entire fleet of trains with new units built by Bombardier and Stadler**[17]
London Midland	**13.1 years**	⇧ 1.4	
London Overground	**14.7 years**	⇧ 1.0	
Merseyrail	**38.3 years**	⇧ 1.0	**The current fleet of trains are due to be replaced by new units built be Stadler from 2020**[18]
Northern	**28.2 years**	⇧ 0.98	**When the new Northern franchise commenced in April 2016 a small number of services were transferred from TPE to Northern, alongside the rolling stock used for those services**[19]
ScotRail	**20.8 years**	⇧ 0.9	**ScotRail has order 70 new class 385 trains, the first of which began testing in January 2017**[20]

[14] http://www.railtechnologymagazine.com/Rail-News/first-electrostars-enter-service-on-great-western-railway

[15] https://www.eversholtrail.co.uk/news/eversholt-rail-to-finance-new-trains-for-first-great-western

[16] https://www.eversholtrail.co.uk/news/great-western-railway-increases-hitachi-intercity-fleet-size-with-new-multi-million-pound-order

[17] https://www.greateranglia.co.uk/form/transforming-your-railway-with-new-trains

[18] http://www.railtechnologymagazine.com/Rail-News/liverpool-leaders-give-green-light-to-new-merseyrail-fleet

[19] http://orr.gov.uk/__data/assets/pdf_file/0008/22796/passenger-freight-performance-2016-17-q1.pdf

[20] http://www.railtechnologymagazine.com/Rail-News/scotrail-begins-night-testing-class-385-trains

South West Trains	**20.9 years**	⇧ **1.0**	**The average age of rolling stock is expected to almost half by December 2020 as a result of the introduction of a number of new and refurbished trains under the new South Western franchise[21]**
Southeastern	**17.4 years**	⇧ **1.0**	
TfL Rail	**37.3 years**	⇧ **1.0**	
TransPennine Express	**9.2 years**	⇩ **0.3**	**The last of TPE's class 170 trains transferred to Chiltern in July 2016[22]. In addition a small number of services and associated rolling stock were transferred to Northern at the start of the new franchise in April 2016.** **TPE have ordered 19 bi-mode units from Hitachi Rail, which are to be introduced from December 2019[23]**
Virgin Trains East Coast	**31.3 years**	⇧ **1.0**	**A new fleet of class 800 Azuma trains will be introduced by Virgin Trains East Coast in 2018[24]**
Virgin Trains West Coast	**12.4 years**	⇧ **1.0**	

[21] http://www.railtechnologymagazine.com/Rail-News/first-mtr-joint-venture-awarded-south-western-franchise-

[22] https://www.tpexpress.co.uk/media-centre/news/2016/july/farewell-tour-for-transpennine-express-trains-raises-16000-for-charity

[23] http://www.railwaygazette.com/news/traction-rolling-stock/single-view/view/hitachi-awarded-transpennine-express-multiple-unit-contract.html

[24] https://www.virgintrainseastcoast.com/news/new-announcement/