

# High Speed Railways System and Its Staff Training in the United Kingdom

## Introduction

The railway system in the United Kingdom (UK) is the oldest in the world. The first locomotive-hauled public railway opened in 1825. Whilst the network suffered gradual attrition from about 1900 onwards, and a severe rationalisation in the mid-1960s, the network is again in a position of growth. Presently, there are 2,564 passenger railway stations on the Network Rail network. This does not include the London Underground, nor other systems which are not part of the national network, such as heritage railways.

Most of the railway track is managed by Network Rail, which in 2016 had a network of 15,799 kilometres (9,817 mi) of standard-gauge lines, of which 5,331 kilometres (3,313 mi) were electrified.<sup>1</sup> These lines range from single to quadruple track or more. In addition, some cities have separate rail-based mass transit systems (including the extensive and historic London Underground). There are also several private railways (some of them narrow-gauge), which are primarily short tourist lines. The British railway network is connected with that of continental Europe by an undersea rail link, the Channel Tunnel, opened in 1994.

The UK is a member of the International Union of Railways (UIC). The UK has the 17th largest railway network in the world; despite many lines having closed in the 20th century it remains one of the densest rail networks. It is one of the busiest railways in Europe, with 20% more train services than France, 60% more than Italy, and more than Spain, Switzerland, The Netherlands, Portugal and Norway combined, as well as representing more than 20% of all passenger journeys in Europe.<sup>2</sup>

In 2016, there were 1.718 billion journeys on the National Rail network,<sup>3</sup> making the British network the fifth most used in the world (UK ranks 23rd in world population). Unlike a number of other countries, rail travel in the UK has enjoyed a renaissance in recent years, with passenger numbers reaching their highest ever level. This has coincided with the privatisation of British Rail, but the effect of this is disputed. The growth is partly attributed to a shift away from private motoring due to growing road congestion and increasing petrol prices, but also to the overall increase in travel due to affluence.<sup>4</sup> However, passenger journeys have grown much more quickly than in comparable countries such as France and Germany.<sup>5</sup>

To cope with increasing passenger numbers, there is a large ongoing programme of upgrades to the network, including Thameslink, Crossrail, electrification of lines, in-cab signalling, new inter-city trains and a new high-speed line. For instance, at the end of September 2003, the first part of High Speed 1, a high-speed link to the Channel Tunnel and onward to France and Belgium, was completed, significantly adding to the rail infrastructure of the country. The rest of the link, from north Kent to St Pancras railway station in London, opened in 2007. A major programme of remedial work on the West Coast Main Line started in 1997 and finished in 2009. Furthermore, in the 2010s, many upgrades are under way, such as

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<sup>1</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/568110/rai0101.ods](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/568110/rai0101.ods)

<sup>2</sup> "Nine out of ten trains arrive on time during January" (Press release), Network Rail, 18 February 2010.

<sup>3</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/568110/rai0101.ods](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/568110/rai0101.ods)

<sup>4</sup> "Petrol price hike boosts rail passenger numbers, says ATOC", Rail Peterborough, 10 August 2011, p. 22.

<sup>5</sup> <https://www.raildeliverygroup.com/about-us/publications.html?task=file.download&id=275>

the Thameslink Programme, Crossrail, the Northern Hub and electrification of the Great Western Main Line. Electrification plans for the Midland Main Line and the cross-Pennine line between Manchester and Leeds have been paused with the start of work on these projects postponed to some indefinite date(s) in the 2020s. Planning for High Speed 2 is underway, with a projected completion date of 2026 for Phase 1 (London to Birmingham) and 2033 for Phase 2.

## Privatisation

British Rail operations were privatised during 1994–1997. Since privatisation in the mid-1990s, there have been two types of passenger rail service on the UK rail network: open access operators (i.e. those that bid for ‘slots’ – specific parts of the overall National Rail timetable – to operate their own passenger services) and franchisees (i.e. those who operate a contracted service on a particular part of the rail network under licence from the Government and the regulator). By far the majority of services are run by franchises.<sup>6</sup>

The railways in the UK were privatised under the Railways Act 1993. The passenger railway was restructured so that domestic passenger train services could be offered to the private sector to run on a franchised basis. British Rail (BR) reorganised its passenger services into 29 different train operating units. These units were gradually incorporated as subsidiaries of BR and run as separate ‘shadow’ businesses. They paid access charges for the use of track and infrastructure, and rentals for stations and rolling stock, as do the franchisees that have followed them. Each operated under its own licence (granted by the Rail Regulator), its railway safety case (approved by the Health and Safety Executive) and a track access agreement with Railtrack (approved by the Regulator). A wide range of station and depot access agreements (also approved by the Regulator), property leases and other contracts were also required by each train operating business.<sup>7</sup>

In sum, the government said privatisation would see an improvement in passenger services and satisfaction (according to the National Rail Passenger survey) has indeed gone up from 76% in 1999 (when the survey started) to 83% in 2013 and the number of passengers not satisfied with their journey dropped from 10% to 6%.<sup>8</sup> Since privatisation, passenger levels have more than doubled, and have surpassed their level in the late 1940s. Train fares cost 2.7% more than under British Rail in real terms on average.<sup>9</sup> However, while the price of anytime and off-peak tickets has increased, the price of Advance tickets has dramatically decreased in real terms: the average Advance ticket in 1995 cost £9.14 (in 2014 prices) compared to £5.17 in 2014.<sup>10</sup>

Rail subsidies have increased from £2.5bn in 1992-93 to £3.3bn in 2015-16 (in current prices), although subsidy per journey has fallen from £3.32 per journey to £1.89 per journey.<sup>11</sup> However,

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<sup>6</sup><http://webcache.googleusercontent.com/search?q=cache:hihRy-ZW5e8J:researchbriefings.files.parliament.uk/documents/SN06521/SN06521.pdf+&cd=2&hl=nl&ct=clnk&gl=uk>

<sup>7</sup> Ibid.

<sup>8</sup> <https://www.raildeliverygroup.com/about-us/publications.html?task=file.download&id=275>

<sup>9</sup> "Have train fares gone up or down since British Rail?", *BBC News*, 22 January 2013.

<sup>10</sup> "The facts about rail fares - Stagecoach Group", *Stage Coach*, 2 October 2016.

<sup>11</sup> "Have train fares gone up or down since British Rail?", *BBC News*, 22 January 2013.

this masks great regional variation, as in 2014-15 funding varied from "£1.41 per passenger journey in England to £6.51 per journey in Scotland and £8.34 per journey in Wales."<sup>12</sup>

It should be noted that the public image of rail travel was severely damaged by a series of significant accidents after privatisation. These included the Hatfield accident, caused by a rail fragmenting due to the development of microscopic cracks. Following this, the rail infrastructure company Railtrack imposed over 1,200 emergency speed restrictions across its network and instigated an extremely costly nationwide track replacement programme. The consequent severe operational disruption to the national network and the company's spiralling costs set in motion a series of events which resulted in the collapse of the company and its replacement with Network Rail, a state-owned,<sup>13</sup> not-for-profit company. According to the European Railway Agency, in 2013 Britain had the safest railways in Europe based on the number of train safety incidents.<sup>14</sup>

Overall, since privatisation in the mid-1990s, there are 32 companies in the UK at the time of writing (February 2021):<sup>15</sup>

### **Abellio ScotRail**

Abellio ScotRail, operating services under the name ScotRail, is the Dutch-owned national train operating company of Scotland.

### **Arriva Trains Wales**

Serving the whole of Wales and the Welsh Marches, Arriva Trains Wales operates services to all major train stations in Wales, including Cardiff Central, Cardiff Queen Street, Newport and Swansea, as well as stations in England such as Birmingham and Manchester.

### **Avanti West Coast**

Avanti West Coast is a train operating company in the United Kingdom owned by FirstGroup (70%) and Trenitalia (30%) that began operating the West Coast Partnership franchise. The franchise covers long-distance passenger services on the West Coast Main Line between London, the West Midlands, North West England, North Wales and Scotland, connecting six of the UK's largest cities: London, Birmingham, Liverpool, Manchester, Glasgow and Edinburgh, which have a combined metropolitan population of over 18 million.

### **C2C Rail Limited**

Connecting London with rail destinations in Essex and Southend-on-Sea, C2C Rail Limited operates services from Fenchurch Street station in London's West End to seaside destinations along the River Thames.

### **Chiltern Railways**

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<sup>12</sup><http://orr.gov.uk/statistics/published-stats/uk-rail-industry-financial-information/uk-rail-industry-financial-information-2015-16>

<sup>13</sup> "Our Legal and Financial Structure: How are we regulated", Network Rail.

<sup>14</sup> Ami Sedghi, "How safe are Europe's railways?", *The Guardian*, 25 July 2013.

<sup>15</sup> <http://www.redspottedhanky.com/trains/train-operators/>

Operating a number of services between the UK's major cities of London and Birmingham, Chiltern Railways carries passengers through historic 'Shakespeare country', making stops at Aylesbury Vale Parkway, High Wycombe, Warwick, Stratford-upon-Avon, Banbury, Leamington Spa and Solihull.

### **CrossCountry Trains**

Covering around 1,400 miles and calling at over 100 stations from Aberdeen to Penzance, CrossCountry Trains is the most extensive rail network in the UK.

### **Docklands Light Railway**

The automated Docklands Light Railway is an innovative railway service managed by Transport for London (TfL), which connects many areas of London to the redeveloped Docklands area.

### **East Coast trains now Virgin Trains East Coast**

The new franchise started on March 1st 2015 and is a joint venture between Stagecoach and Virgin Trains.

### **East Midlands Trains**

As well as local trains serving the East Midlands and East England regions, East Midlands Trains also operates fast and frequent trains connecting London to cities such as Liverpool, Nottingham, Corby, Derby, York, Leeds and Sheffield in the north.

### **First Capital Connect**

Connecting 15 stations across London as well as destinations further afield in the south of England, First Capital Connect operates frequent services out of the UK capital along the East Coast Main Line, stopping at Bedford and Brighton, as well as the Great Northern train line, which connects London stations to Cambridge, Peterborough and Kings Lynn.

### **First Great Western Trains**

Operated by FirstGroup Plc, First Great Western has come to be associated with scenic journeys through the beautiful English countryside and trips to seaside resorts in the Cotswolds, Devon and Cornwall.

### **First Hull Trains**

First Hull Trains operates long distance train services between London and Hull along the East Coast Main Line, providing a fast and convenient train service between the major cities of North East and South East England.

### **First ScotRail**

Providing services throughout Scotland and reaching across the Scottish border to Newcastle and Carlisle in the north of England, First ScotRail is a popular choice for express services between Scotland's major cities of Edinburgh, Glasgow, Inverness, Dundee and Aberdeen.

### **First TransPennine Express**

First TransPennine Express draws its name from crossing the Pennines, but services much of the North of England, and includes rail services to Edinburgh and Glasgow in Scotland. Operating under the moniker of First TransPennine Express since 2004, this rail service connects destinations such as Manchester, Leeds, Sheffield and Yorkshire.

### **Gatwick Express**

The Gatwick Express service has been connecting London to Gatwick Airport's Southern Terminal for over 25 years, with regular departures from Victoria Station.

### **Grand Central**

Grand Central is an open-access passenger train operator providing services connecting London to Yorkshire and the North East. Grand Central is part of the Arriva Group.

### **Greater Anglia**

Servicing passengers in the East of England out of London Liverpool Street train station, Greater Anglia operates along the Great Anglia Network.

### **Heathrow Connect**

Heathrow Connect offers travellers a quick and easy way to get between London Paddington Station and Heathrow Airport to the west.

### **Heathrow Express**

Heathrow Express operates a direct and quick rail link between London's Paddington Station and Heathrow Airport.

### **London Midland**

London Midland operates express services between London Euston, Milton Keynes and Birmingham New Street (via Northampton).

### **London North Eastern Railway**

It operates the InterCity East Coast franchise providing long-distance inter-city services on the East Coast Main Line from London King's Cross to Yorkshire, North East England and Scotland.

### **London Overground Rail Operations Ltd**

Just as vital for connecting the UK capital as the iconic London Underground, the London Overground Rail Operations Ltd serves to connect disparate areas of the London region.

### **London Underground**

The London Underground provides travellers with the quickest and easiest form of mass transit in the UK capital city.

### **Merseyrail**

Taking care of travel needs across the Liverpool and Merseyside region, Merseyrail operates electrical train services on both sides of the Mersey River, along the former Northern and Wirral lines.

### **Northern Rail**

Based in the North East and North West of England and the counties of Humberside and Yorkshire, Northern Rail operates local and long distance commuter rail services all across Northern England.

### **South West Trains**

Connecting train stations across the South West, including ferry links to the Isle of Wight, South West Trains operates around 1,700 trains each day, calling at over 200 stations in South West England.

### **Southeastern Trains**

A friend to both the commuter and the long distance train traveller, Southeastern Trains services cover the London, Kent and East Sussex, running around 2000 trains daily.

### **Southern**

Southern operates predominantly commuter services between London, Surrey and Sussex, as well as services to Gatwick and Brighton, and South Coast services.

### **Stansted Express**

Stansted Express provides a quick and easy access route for travellers in London to reach Stansted Airport.

### **Virgin Trains**

Boasting what could be the most distinctive look when it comes to rail transport, Virgin Trains are easily recognised thanks to their red design and familiar brand.

### **Virgin Trains East Coast**

Virgin Trains East Coast operates long distance train services along the East Coast Main Line, linking London King's Cross, the East Midlands, Yorkshire and Humberside, North East England and Scotland.

### **Wrexham & Shropshire**

Trains originate at Wrexham General railway station and run to London Marylebone in the capital city, connecting at 11 total intermediate stations in the West Midlands, including Ruabon,

Chirk, Gobowen, Shrewsbury, Wellington, Telford Central, Cosford, Wolverhampton, Tame Bridge Parkway, Leamington Spa and Banbury.

It should be noted that railways in the UK are in the private sector, but they are subject to control by central government, and to economic and safety regulation by arms of government.

In 2006, using powers in the Railways Act 2005, the Department for Transport (DfT) took over most of the functions of the now wound up Strategic Rail Authority. The DfT now itself runs competitions for the award of passenger rail franchises, and, once awarded, monitors and enforces the contracts with the private sector franchisees. Franchises specify the passenger rail services which are to be run and the quality and other conditions (for example, the cleanliness of trains, station facilities and opening hours, the punctuality and reliability of trains) which the operators have to meet. Some franchises receive a subsidy from the DfT for doing so, and some are cash-positive, which means the franchisee pays the DfT for the contract. Some franchises start life as subsidised and, over their life, move to being cash-positive.

The other regulatory authority for the privatised railway is the Office of Rail and Road (previously the Office of Rail Regulation), which, following the Railways Act 2005, is the combined economic and safety regulator. It replaced the Rail Regulator on 5 July 2004. The Rail Safety and Standards Board still exists, however; established in 2003 on the recommendations of a public inquiry, it leads the industry's progress in health and safety matters.

The principal modern railway statutes are:

- Railways Act 1993
- Competition Act 1998 (insofar as it confers competition powers on the Office of Rail and Road)
- Transport Act 2000
- Railways and Transport Safety Act 2003
- Railways Act 2005

### **High-speed rail in the United Kingdom**

It is provided on four upgraded railway lines running at top speeds of 125 mph (200 km/h) and one purpose-built high-speed line reaching 186 mph (300 km/h).

Trains currently travel at 125 mph (200 km/h) on the East Coast Main Line, Great Western main line, Midland Main Line, parts of the Cross Country Route, and the West Coast Main Line. On the latter line, only tilting trains can reach this maximum speed due to the difficult track geometry.<sup>16</sup>

The 67-mile long HS1 line connects London to the Channel Tunnel, with international Eurostar services running from London St Pancras station to cities in France, Belgium, and the Netherlands at 186 mph (300 km/h). That line is also used by high-speed commuter services from Kent to the capital, operating at top speeds of 140 mph (225 km/h).

Since 2019 construction has been ongoing on a major new purpose-built high-speed rail line, High Speed 2 (HS2) which will link London with major cities in the North and the

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<sup>16</sup> <https://highspeed1.co.uk/about-us>

Midlands at 224 mph (360 km/h) and reduce journey times to Scotland. Phase 1 of the project to Birmingham is due to open in 2026, with the line set to go as far as Manchester and Leeds by 2033.<sup>17</sup>

Government-backed plans to provide east-west high-speed services between cities in the North of England are also in their early stages of development, as part of the Northern Powerhouse Rail project.<sup>18</sup>

There has been no single national rail operator in the UK since British Rail was privatised in the 1990s. High-speed services are provided by CrossCountry, East Midlands, Eurostar, Grand Central, First Great Western, First Hull Trains, London North Eastern Railway, Southeastern, Avanti West Coast, Abellio ScotRail and First TransPennine Express.<sup>19</sup>

### **Future of the high-speed trains in the UK**

The InterCity 125 is still in widespread use. First Great Western planned to supplement (but not replace) its InterCity 125s with 14 Class 180 *Adelante* trains, which can travel at the same speed. Because every carriage has an underfloor engine, they can accelerate approximately twice as quickly, which reduces journey times and allows for more frequent services. However, in-car noise levels are higher than in the InterCity 125 because of the underfloor engines, which, combined with less-comfortable seats and harsh interior lighting, has made them unpopular with passengers. They also proved to be unreliable, leading to a significant overhaul programme in 2004 to fix the major problems. These issues ultimately led to the units being withdrawn from First Great Western services and transferred to open access operators Grand Central and Hull Trains.

In 2004, First Great Western announced a major overhaul upgrade for its Class 43 locomotives (InterCity 125 power cars), including a new MTU engine. Two power cars with the new engine were successfully trialled. In 2005, it undertook a trial refurbishment of a pair of InterCity 125 coaches to bring them up to modern standards. Another coach has been refurbished with experimental aircraft-style seat-back screens. As part of its franchise commitments First Great Western announced that it will refurbish the entire fleet and re-engine all power cars with the MTU engine.

In January 2006 the first batch of power cars were taken to Brush Traction to have MTU engines installed. This work has now been completed.

Twenty-six of First Great Western's InterCity 125 fleet have been refurbished into a high-density layout of mostly airline seats for services in the M4 corridor to Bristol and Cardiff. To improve acceleration on this route, where most stations are 20–25 minutes apart, the buffet cars will be removed. The remainder will be refurbished with new seating (leather in First Class) and at-seat power-points, and retain the buffet for the long-distance services to Swansea and the West Country.

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<sup>17</sup> Gwyn Topham, "All stations to regeneration? Work on HS2 begins in earnest", *The Guardian*, 19 January 2019, <https://www.theguardian.com/business/2019/jan/19/hs2-all-stations-regeneration-work-begins-earnest-london-euston>

<sup>18</sup> <https://transportforthenorth.com/northern-powerhouse-rail/>

<sup>19</sup> [https://en.wikipedia.org/wiki/High-speed\\_rail\\_in\\_the\\_United\\_Kingdom](https://en.wikipedia.org/wiki/High-speed_rail_in_the_United_Kingdom)



Midland Mainline supplemented its fleet with Class 222 Meridian units (similar to Virgin CrossCountry's Class 220 and 221 Voyager trains), replacing the slower Class 170 Turbostar units. The franchise has since been reorganised and transferred to East Midlands Trains.

London North Eastern Railway operate InterCity 125 sets between London King's Cross and the North of Scotland. The previous franchise holder, GNER gave the coaches an extensive interior refurbishment upon its taking over of the sets in 1996. GNER also began to have their InterCity 125 sets a further refit to bring them to the same *Mallard* standard as their recently refurbished InterCity 225 fleet, a programme that has been continued by National Express.

The Great Western power cars have had major modifications to their cooling system to prevent overheating on hot days. GNER's solution to the overheating problem was to haul sets under the wires using Class 91 electric Locomotives.<sup>20</sup>

### **To train the high-speed train professions**

The National College for Advanced Transport & Infrastructure (NCATI) has been established to provide the higher-level skills needed to transform the UK rail and transport infrastructure network.

The College is dedicated to providing the higher-level training required to create HS2, Northern Powerhouse Rail and other rail projects, as well as supporting the skills demand from employers who are facing skills challenges such as digitalisation of the railway and an ageing workforce

Through a combination of classroom teaching, real work experience and short courses, the College provides technical and professional courses, using the very latest industry technology, to a diverse range of learners that are starting a career in the industry, are looking to switch careers, or are part of the existing workforce.

This programme covers the following mandatory modules:

#### **Year One (Level 4)**

- Health, Safety and Security on the Railway and Social, Economic and Environmental Considerations
- High Speed Rail in Context
- Introduction to Railway Engineering
- Introduction to Technical Management and Systems Thinking
- Introduction to the Management and Operation of the Railway
- Introduction to the Railway system

#### **Year Two (Level 5)**

- Civil Engineering and Track

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<sup>20</sup> [https://en.wikipedia.org/wiki/High-speed\\_rail\\_in\\_the\\_United\\_Kingdom](https://en.wikipedia.org/wiki/High-speed_rail_in_the_United_Kingdom)

- Operations and Management
- Project Management in the Context of High Speed Rail
- Rolling Stock and Power
- Systems Engineering and Command, Control and Communications
- Systems Thinking Tools and Understanding the Environments of Railway Projects (work placement)

The College also offers a non-apprenticeship route with a course in high-speed railway – a 12-month multi-disciplinary course with three-month placement – that will lead to a level 4 qualification.<sup>21</sup>

### **Conclusion**

In the future, a network of UK high-speed lines could radically change travel patterns for work, education and leisure, and help regenerate towns and cities in the Midlands and North. Such a network could help shrink Britain into a country that is easy to travel around, without the need to opt for air travel or hopping in a car.<sup>22</sup> In this respect, the high-speed train professionals should be trained accordingly and sufficiently. Therefore, the NCATI has been established to take an important part in terms of training the high-speed train professionals.

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<sup>21</sup> <https://www.nchr.ac.uk/>

<sup>22</sup> <https://www.wired.co.uk/article/hitachi-rail-trains>