



Department
for Transport

Rolling Stock Perspective

Third edition

Moving Britain Ahead



October 2017



Department
for Transport

Rolling Stock Perspective

Third edition

Moving Britain Ahead

The Department for Transport has actively considered the needs of blind and partially sighted people in accessing this document. The text will be made available in full on the Department's website. The text may be freely downloaded and translated by individuals or organisations for conversion into other accessible formats. If you have other needs in this regard please contact the Department.

Department for Transport
Great Minster House
33 Horseferry Road
London SW1P 4DR
Telephone 0300 330 3000
General enquiries <https://forms.dft.gov.uk>
Website www.gov.uk/dft

OGL

© Crown copyright 2017

Copyright in the typographical arrangement rests with the Crown.

You may re-use this information (not including logos or third-party material) free of charge in any format or medium, under the terms of the Open Government Licence v3.0. To view this licence visit <http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3> or write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or e-mail: psi@nationalarchives.gsi.gov.uk.

Where we have identified any third-party copyright information you will need to obtain permission from the copyright holders concerned.

ISBN: 978-1-84864-193-8

Contents

- Ministerial Foreword** **6**
- Rolling Stock Perspective** **8**
- 1. Summary 8
- 2. Rolling Stock and the Industrial Strategy 8
- 3. High-speed trains for HS2 11
- 4. Digital Railway 12
- 5. Our objectives for, and approach to, the rolling stock market 13
 - 5.1. Current and future state of the rolling stock market 14
 - 5.2. Objectives 15
 - 5.3. Approach 16
- 6. Key priorities for future rolling stock specifications 18
 - 6.1. Accessibility – Embedding Inclusive Design 18
 - 6.2. Delivering quality in franchises 20
 - 6.3. Improving train to internet connectivity 17
 - 6.4. Performance 21
 - 6.5. Sustainable development principles 22
 - 6.6. Optimising for whole life value for money 23
- 7. Conclusion 25
- 8. Rolling Stock Aspirations by Service Group 26
 - Metropolitan 26
 - Rural/Regional 27
 - Inter-Urban 27
 - InterCity 27
 - High-speed InterCity 27

9. British Rolling Stock Fleet – Class by Class Overview	33
DMU Rolling Stock (Pre-1996 orders)	34
DMU Rolling Stock (Post-1996 orders)	36
AC EMU Rolling Stock (Pre-1996 orders)	37
AC EMU Rolling Stock (Post-1996 orders)	39
DC EMU Rolling Stock	40
LHCS & HSTs	41
10. Department for Transport – Franchised Operators View	42
Chiltern	43
Cross Country	43
East Anglia	44
East Midlands	44
Essex Thameside	45
Great Western	45
InterCity East Coast	46
InterCity West Coast	46
Northern	47
South Eastern	47
South Western	48
Thameslink, Southern & Great Northern	49
TransPennine Express	50
Wales & Borders	51
West Midlands	51
11. Key Rolling Stock Publications	52

Image Acknowledgements:

1. Page 12: Petards
2. Page 13: Angel Trains Limited
3. Page 18: Stadler
4. Page 18: Stadler
5. Page 19: HS2 Ltd
6. Page 19: HS2 Ltd
7. Page 23: TDI Ltd
8. Page 25: Alstom UK&I

Contribution acknowledgements:

Rail Delivery Group, HS2 Ltd, RSSB and others who contributed to its drafting.

Ministerial Foreword



Passenger numbers have more than doubled since privatisation of the railways 20 years ago and our country's railways need to adapt to cope with this and future demands. This includes investing in upgrades and new services across the country.

In meeting this challenge I am keen that passengers benefit from the rapid technological progress taking place in the rail industry. Recent years have seen the development of new train fuelling technology that is as revolutionary as anything now being deployed in the car industry. For instance, new hybrid diesel-electric (bi-mode) trains, battery powered trains and even hydrogen-powered trains promise to transform the way passengers experience our railways.

This new technology creates new options for service upgrades – including bringing anticipated passenger improvements sooner than expected.

With on-train travel information, passenger counting and even toilet control systems connected to the internet via the train's Wi-Fi system it should be possible to provide advice to passengers on status of the on-board equipment prior to the train arriving at the station. I want to see creative use made of this data so that passengers can make informed decisions about how and when they travel.

This country relies on its railways, for getting people to work, connecting cities and supporting economic growth. That is why I'm committed to delivering the high-speed network and services that will accelerate the growth of industries in all corners of the country.

I am determined that passengers should remain at the heart of all we do. Increasing passenger numbers coupled with increasing pressures on funds creates both challenges and opportunities for innovative new ideas that can relieve some of the stresses we face. Where train operators can use digital systems and processes to improve reliability and reduce costs then I would encourage them to do so. Meanwhile, train designs must incorporate provision for these systems to be fitted in the future.

We have a responsibility to our passengers, neighbours and ourselves to protect the environment in which we live. Our dependency on diesel as a fuel, and the pollution associated with it, challenges us to work towards a cleaner and more sustainable future. In the near term, we are replacing Pacers and some of the network's other older diesels which will help us remove some of the most polluting rail vehicles. I'm looking to those who build, own and operate rolling stock to put forward their ideas for the use of alternative energy sources, including hydrogen and battery technologies, as part of franchise proposals to meet sustainability and environmental targets.

The UK has a proud railway heritage, with many of the skills and practices used around the world developed here first. We are determined to grow the world-class railway skills and expertise this country is known for and not be afraid to promote these openly and with pride around the world.

The railway sector deals we're developing will deliver our part of the Industrial Strategy for Britain. Working with the Department for Business, Energy and Industrial Strategy together we will create the conditions necessary to allow us to build upon our strengths and secure a strong future for those who work in and rely upon the railways.



Paul Maynard MP,
Parliamentary Under Secretary of State for Transport.

Rolling Stock Perspective

1. Summary

This is our third Rolling Stock Perspective in which we set out some of the challenges facing the industry and the work being done to address them. We plan to continue to publish this every year to provide guidance to rolling stock manufacturers, owners and operators on the kind of rolling stock both new and refurbished, that we want to see in future.

In this edition we set out work being done to support the country's industrial strategy, deliver a new high speed fleet for HS2 and embed digital systems and processes into the industry. We also explain the thinking behind the policies that underpin our franchise competitions and our objectives and approach to improving journeys for passengers all over the country.

2. Rolling Stock and the Industrial Strategy

January 2017 saw the publication of the green paper 'Building our Industrial Strategy' which set out ten strategic pillars¹ that underpin the Government's approach to improve the country's living standards and economic growth. In response, the Rail Supply Group and Rail Delivery Group are developing a specific deal for the sector. Working with the industry, they have started to develop a compelling case for the conditions to be created that will increase the supply chain's competitiveness, its capabilities and exports.

¹ <https://www.gov.uk/government/news/pm-unveils-plans-for-a-modern-industrial-strategy-fit-for-global-britain>



Through the franchising process we are placing requirements on the industry to implement this strategy:

- **Investing in science, research and innovation** – The emphasis on delivering quality improvements through franchises provides plenty of opportunities for train operators to stand out by introducing innovative rolling stock designs, technology, maintenance etc.
- **Developing skill** – Minimum requirements for apprenticeships are now a regular feature of franchises and help ensure that the industry has the skilled staff it needs.
- **Improving procurement** – Early dialogue with suppliers and manufacturers is a regular feature of our procurement processes and we plan to further improve our engagement with potential franchise bidders and the supply chain at earlier stages in our competitions.

The UK's railway industry already leads in a number of areas, for example dedicated training academies for railway engineers and technicians as part of centrally funded research and of huge infrastructure projects like East West Rail and HS2. It also has strengths, skills and experience in specific areas:

- Combining Automatic Train Operation with ETCS In-Cab signalling on a high density line (24 trains per hour) for the first time in Europe;
- Widely recognised as providing world class advisory services in rail;
- Innovative powertrain development including hybrid designs & energy storage with exceptionally strong synergies with the UK automotive sector positioning the UK as a Global Centre of Excellence for Automotive Propulsion; and
- A mature supply chain for composite materials matched with strong R&D capabilities in smart materials and 'light-weighting' at a range of universities and suppliers distributed around UK, with key players predominantly located in the Northern Powerhouse and Midlands.

Through a coordinated approach by Government departments (DfT, BEIS) and the private sector we will develop these strengths with sector specific deals that create an environment in which these companies can flourish to make the UK rail industry a world leader in digitisation and sustainable vehicles, enabling a better railway, more exports and increased prosperity.

3. High-speed trains for HS2

The building of the full HS2 'Y' network is central to our plans for the railway. This will see high-speed rolling stock operating in Britain connecting the North and major cities with the capital. On 17th July the Secretary of State for Transport announced² the award of contracts to build the first phase of the route from London to Birmingham.

The process of procuring new trains for HS2 has begun in earnest with the HS2 bill receiving Royal Assent in February, commencement of pre-qualification and the publication of HS2 Ltd's Pre-Qualification Technical Summary identifying the key technical requirements for the trains that will operate on the HS2 and conventional rail network. The structure and requirements for the West Coast Partnership franchise competition are being developed and will include working with HS2 Ltd on the testing and development of high-speed trains for the line.

² <https://www.gov.uk/government/speeches/hs2-update-phase-2a-and-phase-2b>

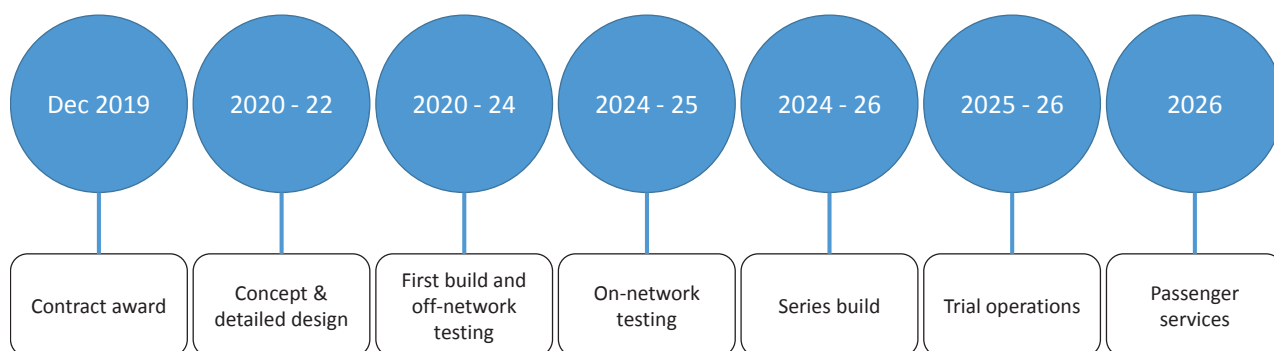


Figure 1: HS2 rolling stock procurement time line.

HS2 Ltd has set itself the following strategic goals for the design of the trains³:

- Safety – in line with regulations and standards, provide a safe and secure environment for all passengers;
- Passenger experience – a design that makes passengers feel safe, comfortable and welcome, is flexible in use and is able to accommodate the needs of a diverse range of users including commuters, families and those with luggage. This also covers staff experience, welfare and provision, which is essential for providing an exceptional passenger experience;
- Performance – delivering a significant reduction in journey times between UK cities;
- Railway capacity – a design that supports the operation of an 18 train per hour per direction railway, with carriages optimised for accessibility and short dwell times;
- Environmental impact and sustainability – a design and maintenance regime that minimises whole-life environmental impact, in particular with respect to carbon, noise emissions and resource efficiency including sustainable sourcing of material;
- Reliability – a design and maintenance regime that delivers exceptional levels of reliability and operational robustness, comparable to high speed services delivered in other countries, ensuring delays are kept to a minimum in order to support the overall delay targets, and trains never have failures that prevent them reaching their destination;
- Whole life, whole system cost – a rolling stock solution that contributes to the HS2 railway business case and maximises value for money.

To achieve these goals the West Coast Partnership franchisee will work collaboratively with train manufacturers, HS2 Ltd and other key stakeholders to develop the operational and passenger facing elements of the trains.

3 HS2 rolling stock – Pre-Qualification Technical Summary.pdf

4. Digital Railway

Digital technologies such as driver advisory systems, in-cab signalling, traffic management and automatic train control will enable the provision of more services for passengers and help secure performance and environmental benefits. It is now becoming much more common for previously separate systems such as CCTV cameras, passenger counting systems, condition monitoring equipment, public address and passenger information to be integrated to form part of the train's system architecture, benefitting from access to a common communications backbone. In particular good progress is being made in deploying digital technologies on Thameslink, Crossrail and other routes.

In the 2016 Autumn Statement, as part of the National Productivity Investment Fund, HM Treasury provided an extra £450m for Digital Railway schemes in this Parliament, £84m of which has already been allocated to progressing the first in class cab fitment schemes for in-cab signalling. Train owners and operators are working together to determine other preferred schemes for the remaining funds on the basis of their benefits and the industry's ability to deliver.

However, the future of digital train control has yet to be written. Proposals for the use of in-cab signalling systems using moving block signalling supported by a train management system that can automatically react to any incidents have been around for over 10 years. The industry must look to the work being done with autonomous cars to see what lessons can be learned and applied to the railway, which has a much more controlled environment than an open road.

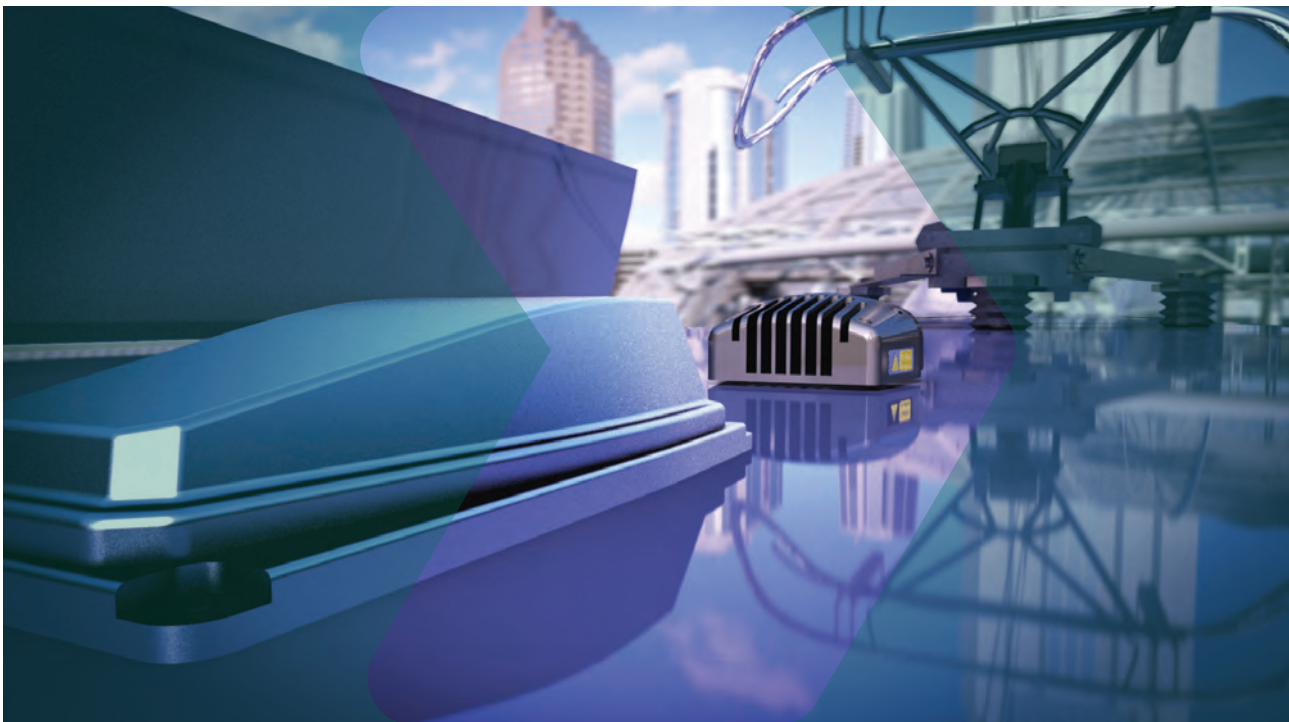


Figure 2: Integrated pantograph monitor and illuminator.

5. Our objectives for, and approach to, the rolling stock market

In the following sections we aim to:

- Provide an assessment of the current state of the rolling stock market (section 5.1);
- Set out the department's overall objectives for (section 5.2) and approach to (section 5.3) the rolling stock market;
- Provide a clear signal to the franchise bidding market, the rolling stock supply chain and the wider public of the priority areas in which the department seeks to secure improvements. It does this in particular through the rolling stock specifications it includes within future franchise competitions. We also showcase examples of best practice that have been developed by the supply chain that are relevant to these priority areas (section 6); and
- To update the information provided in previous editions about the current deployment of the country's rolling stock fleets (section 9).



5.1. Current and future state of the rolling stock market

The growth in the size of the national train fleet, predicted by the Rail Delivery Group in their Long Term Strategy for Passenger Rolling Stock documents, demonstrates that there continues to be strong demand for high quality trains. This view is supported by evidence that shows:

- There is increasing competition in the EMU supply market driven by some high quality train refurbishments, an injection of rolling stock through the Thameslink fleet procurement and new-build orders being placed by successful franchise bidders, resulting in genuine competition and choice in this market;
- There is a growing shortage in the up-to-100mph 'self-powered' train market, though we now have two new suppliers that have successfully broken into this market (CAF and Stadler) and other prospective entrants too;
- There is a predicted shortfall in 125mph self-powered rolling stock – especially 125mph stock with performance characteristics that will meet future journey time aspirations and with the ability to make use of electrified lines where they exist;
- There is a significantly more competitive market for rolling stock finance, with recent new entrants to the market, partly driven by global capital market conditions and historically low interest rates;
- There is a vibrant market for refurbishment driven by modifications required to make trains more accessible and recent transformational rolling stock specifications e.g. on Northern.

These effects present some significant challenges for the rolling stock lessons, particularly where newly-built trains are displaced by other newly-built vehicles procured with very favourable financing rates.

We will continue to seek improvements in the quality of rolling stock for passengers and recent refurbishments have shown how this can be delivered using existing vehicles. To be attractive to the market refurbishments must deliver some of the benefits that newly-built trains can offer such as more customer friendly interiors, greater energy efficiency, digital connectivity and pricing that reflects the competitive rates being offered in the market.

5.2. Objectives

Our core objectives for the rolling stock market are:

- To address passengers' priorities for enhancing the quality of rolling stock across the rail network, including:
 - Ensuring sufficient rolling stock is available across the market with the capacity to meet rising demand for rail travel;
 - Meeting and wherever possible exceeding modern standards for accessibility, minimising the barriers to travel for people with disabilities, passengers travelling with heavy luggage or young children, and people with other specific accessibility requirements.
 - The reliable provision of high-quality, modern on-board facilities – for example in relation to mobile connectivity and the provision of real-time information about their current journey and onward connections – that keep pace with passengers' ever-changing expectations and experiences of how technology is being applied in other areas of their lives;
 - Ensuring modern design with the best possible standards of passenger comfort and cleanliness, providing an on-train environment that makes rail travel a genuinely attractive alternative to the private car and other modes; and
 - Ensuring that the train's interior is suitable for the market it serves and the types of journeys passenger make on them.
- Maintaining healthy, dynamic markets for the supply of new and existing rolling stock fleets and associated finance, in which genuine competition drives continuous improvement in rolling stock quality and innovation;
- Growing a vibrant, successful rolling stock supply chain, with a diverse supply base for rolling stock design, manufacture and assembly, refurbishment, maintenance and component supply, and with domestic suppliers well placed to expand and sell their products, services and expertise abroad;
- Supporting the wider sustainability agenda as set out in the Rail Sustainable Development Principles, including innovation, skills and enhancing the environment;
- Driving a relentless focus on minimising whole-industry, whole-life costs and providing value-for-money for the tax payer.

This document provides further insight into the department's thinking in each of these areas.

5.3. Approach

We are committed to having a healthy and high performing rolling stock market that delivers value for money services for passengers. The following is intended to outline the principles that we expect will continue to inform our approach.

Economic and social objectives

Like other major procurements our approach is to value the contribution that franchisees make to support the UK's rail industry and wider economy. Those manufacturers wanting to tender to build trains for HS2 will be expected to make clear in their proposals how the design, manufacture, maintenance and refurbishment of the rolling stock will add value to the UK economy and how they will contribute to the delivery of the HS2 Programme Strategic Goals and Objectives, including:

- The creation of employment opportunities;
- Investment in workforce education and the development of long-term technical skills; and
- The promotion of capability in designing, manufacturing, maintaining and refurbishing high speed trains and other modern rolling stock.

We would encourage train operators, owners and manufacturers to consider their own approach to procurements and how, using techniques like a balanced scorecard approach⁴, these can be used to support the Industrial Strategy and the wider UK economy.

However, commercial incentives alone may be insufficient to drive the investment that is needed to meet passengers' rising expectations of rolling stock quality and facilities, especially in markets with a relatively low share of revenue earned from discretionary travel. An important part of the rationale for providing attractive, high-quality rail services is based on benefits that accrue to the wider economy and society, over and above the commercial benefits that accrue to participants in the rolling stock market.

In successive competitions since the franchising programme resumed in 2013, the department has sought to drive a transformation in rolling stock quality through the requirements in its invitations to tender and through a reformed bid evaluation process in which substantial weight is given to quality, as well as price, in the overall decision-making process. Section 6.1 discusses in more detail the department's key priorities for enhancing rolling stock quality through future franchise specifications. It also explains more fully the role of "quality scoring" in the franchise bidding process and how it applies to rolling stock. It seeks to respond directly to the concern expressed by some participants in the market that our approach to quality scoring has unduly favoured new trains in preference to achieving equivalent passenger benefits by refurbishing and upgrading existing fleets.

⁴ <https://www.gov.uk/government/news/launch-of-the-procuring-for-growth-balanced-scorecard>

Section 6.1 specifically considers the needs of passengers with disabilities and others with specific accessibility needs. This is an area where regulation as well as franchise-specific obligations have been used to drive progress towards a consistently high standard of provision. This section outlines progress made towards the 2020 accessibility deadline, and reinforces the Government's commitment to securing compliance with this deadline.

Evidence from the National Rail Passenger Survey and other sources clearly demonstrates the importance passengers attach to achieving high standards of reliability and punctuality. Section 6.4 outlines the challenges involved in maintaining performance on a network which needs to accommodate ever-increasing numbers of passengers and services and emphasises the increasing focus we expect to place on bidders' plans to enhance train service performance, including through their rolling stock strategies.

In addition to rolling stock 'quality' as perceived by passengers, the department also attaches considerable importance to the rail industry's contribution to progressing its Sustainable Development Principles. Section 6.5 explains how we are driving forward progress in these areas and how we expect the rolling stock specifications in future franchise competitions to address these issues.

Cost and efficiency

It is not always possible for commercial companies to make a case for investment over the seven to ten year term of a typical franchise. Where opportunities can create benefits over a sustained period of time, the department can specify requirements to allow such benefits to be delivered. Similarly, there are savings to be made through the reduction of costs for infrastructure maintenance that can only be realised through improvements in train design and benefits gained through improved train operations that can only be realised by investing in the infrastructure. By taking a whole system and long-term view the department is able to make the case for such improvements thereby reducing whole-industry costs. See Section 6.6.

Ensuring continuity of services for passengers

There have been many improvements to the franchising process. The introduction of the "passport" scheme for bidders has reduced bid costs, simplified and streamlined the process; the timetabling of franchise competitions has improved since the creation and publication of the first Rail Franchise Schedule in 2013.

During competitions there remain situations that create conflicting demands on the same rolling stock. In such situations we have taken the view that the most practical option is to set the priority given to each franchise in order to de-conflict rolling stock offers made by multiple bidders for multiple franchises and ensure that trains are available to provide services for passengers on all routes.

These actions are a necessary step to ensure the continuity of services and to create clarity and certainty for that market.

6. Key priorities for future rolling stock specifications

6.1. Accessibility – Embedding Inclusive Design

The deadline for ensuring that all rolling stock meets the relevant accessibility requirements is December 31st 2019. The department’s ‘targeted compliance’ policy has always recognised that dispensations or exemptions may be necessary for minor non-compliances identified as vehicles undergo accessibility upgrade work. Train owners and operators know that the requirement to meet accessibility standards has been in place for some years now. We therefore expect them to have already scheduled the necessary upgrade work and requested dispensations and exemptions where necessary. All requests are subject to stakeholder consultation and must demonstrate what measures will be employed to mitigate the impact of the non-compliance on the usability of the vehicles for disabled passengers and persons of reduced mobility.

The department continues to seek improvements for people with reduced mobility through its franchise competitions. Abellio East Anglia will introduce a new fleet of Stadler Flirt trains in 2020 with devices that fill the gap between the train and the platform edge. This could eliminate the need for portable ramps at many stations. These Stadler trains, already used elsewhere in Europe and due to be used on Merseyrail, have low floors and retractable footsteps that automatically close the gap between the platform and the train as soon as the doors open.



Figure 3: Stadler train with retractable step.

It is essential that all rail services are accessible for all passengers. However, the specific needs of those with physical or mental disabilities or their companions are not always catered for. While much has been done in recent years to improve the accessibility of trains for people with restricted mobility through the procurement of new stock and modifications to the existing fleet the focus has now moved from providing facilities like toilets and passenger information systems to ensuring that they are always available. This is particularly critical for people with reduced mobility or the disabled who depend on visual and audible displays, and wheelchair accessible toilets. We look to train operators and maintainers to ensure that faults with equipment do not happen and, should they occur, are put right quickly.

A recent study on step-free access, undertaken by HS2 Ltd, has highlighted key design features that would enable more passengers to access rail services independently on an equal basis with other passengers. Level access between platforms and trains will significantly improve the accessibility of the railway for all users and if included at the initial design stages of buildings and vehicles could be delivered at minimal extra cost. The report also highlights changes that could be made to passenger facing services to assist those with less obvious disabilities like those described in RSSB's recent Hidden Disabilities report.

“HS2 Ltd is committed to an inclusive design approach that considers everyone’s needs and tries to balance these needs to allow all people to access services and environments independently, safely, conveniently and with dignity. Where a single design solution will not work for everyone, inclusive design offers choice, allowing everyone to access the service in a way that suits their particular needs.” – Thomas Williamson, Head of Rolling Stock Engineering, HS2 Ltd



Figure 4: HS2 Ltd level access boarding trials.

HS2 Ltd’s inclusive design doesn’t just apply to the station environment but the whole end to end journey experience of the system. Train and station operators should seek opportunities, like those highlighted in these reports, to exceed the mandatory requirements.

The HS2 work is very valuable and the department is considering what further steps are needed. We expect all train and station operators to consider the needs of disabled passengers, the elderly and people with reduced mobility not just in normal operation but also degraded conditions and in emergencies. We specifically need those bidding for the contract to build the trains for the HS2 and those bidding for the West Coast Partnership franchise to take this work forward, to deliver an accessible railway for all and it is our expectation that manufacturers will prioritise accessibility in rolling stock.

6.2. Delivering quality in franchises

After consulting with stakeholders and before letting each franchise the department sets requirements for the quality of rail services for passengers. We then look for franchise bidders to propose their plans for meeting and exceeding these. These requirements can include power sockets, modern LED lighting, and travel information systems that give real-time info about onward connections. They also include the less obvious requirements for continual improvements e.g. rising NRPS benchmarks for passenger satisfaction; Wi-Fi and ongoing improvements in mobile connectivity etc. Examples of the features that the department expects each type of train to have are set out in section 8.

We aim to strike a balance between specifying franchise requirements and letting the market propose initiatives that will improve the quality of rail services for passengers. We are particularly interested in innovative and forward thinking proposals that are based on insight into passengers' needs.

“Insight: A penetrating understanding of a need, attitude or behaviour that leads to an opportunity/solves a problem”. (It’s the last part that distinguishes an insight from a finding. The value of an insight comes from the way it will be applied.)

“Innovation: A good idea, driven by an insight – that happens”. (This tends to be the difference between organisations that are product led – i.e. they have a technology or new product and look to find a way to make it relevant, and those that have identified an insight/insights (as above) and use it as a means to developing a relevant solution.)
The latter tend to be more successful.

Paul Leatherdale, Director, Insight Inside.

The provision of quality points, introduced in 2012 following the Brown⁵ review, is now firmly embedded in the franchising process. This review recommended that future franchise competitions be scored on the quality of the services delivered as well as price (subsidy required or revenue projected). It was recommended that quality should count towards the overall evaluation score with the exact percentage being set on a case-by-case basis.

Quality is sought throughout the responses to each of the different areas set out in our Invitations to Tender. Bidders will be given credit where we are confident that they have sound, robust plans for delivering the essential outcomes that we require and where they are committing to do things that materially exceed the minimum requirements we have specified and where their proposals are deliverable and would benefit passengers. To be clear there is no “new-train” bias except where there is exceptional pressure to replace some trains e.g. Pacers. The department is keen to ensure that the requirements are ones that can be delivered through the use of new or existing vehicles refurbished to a high standard.

5 <https://www.gov.uk/government/publications/the-brown-review-of-the-rail-franchising-programme>

6.3. Improving train to internet connectivity

Passengers expect services on trains and in stations to keep pace with the levels of service, facilities and information provided by other transport modes and in other public spaces. Whilst there have been some improvements with Wi-Fi on trains there continue to be some challenges that have yet to be met. One particular challenge is improving mobile connectivity between trains and the infrastructure in rural areas, cuttings and tunnels.

There is a strong business case for improving mobile phone and Wi-Fi connectivity for passengers⁶ which is why the department is making funding available to meet five new key performance indicators (KPIs) for connectivity that are now being introduced through the franchise programme. These five KPIs set the minimum standards for speed of connectivity, service availability (where existing signals are poor or non-existent), minimum data allowances for passengers and a requirement for continuous improvement throughout the franchise.

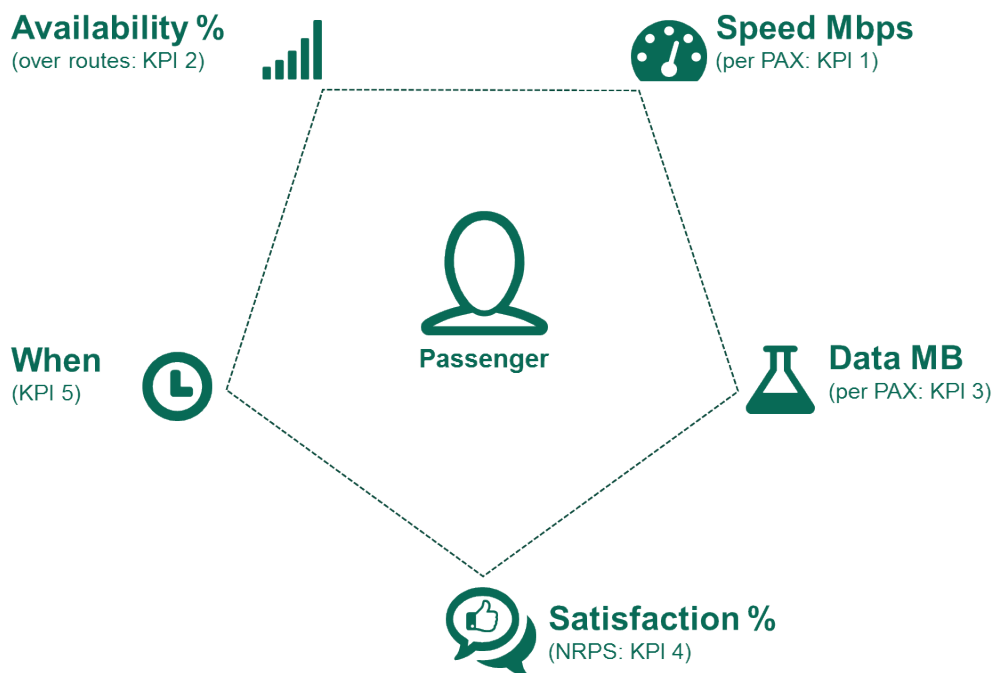


Figure 5: DfT’s Mobile Connectivity KPIs.

Each KPI will be tailored to each franchise with a requirement for passenger satisfaction to be maintained as passengers’ expectations rise. The department then expects franchisees to work with train owners, mobile service providers, specialist companies and Network Rail to install equipment on the trains capable of improving mobile connectivity.

6 <https://www.gov.uk/government/publications/quantifying-the-value-of-internet-access>

Meanwhile, Ofcom is already consulting on the release of radio frequencies needed for 5G mobile services⁷ that promise to deliver connection speeds faster than 1 Gigabit per second. Train manufacturers and Network Rail must prepare for the introduction of 5G mobile services by 2025⁸ if the railway industry is not to fall behind.

6.4. Performance

The spring National Rail Passenger Survey, published by Transport Focus, shows a welcome 3% rise in overall passenger satisfaction on the 2016 figures to 83% in 2017. This coincides with Rail Delivery Group’s measure of train performance (below) clearly showing signs of improvement in train reliability as measured by the mean time between incidents (MTIN).

MTIN and Normalised Impact Mins (MAA)

("701D" Technical Incidents only)

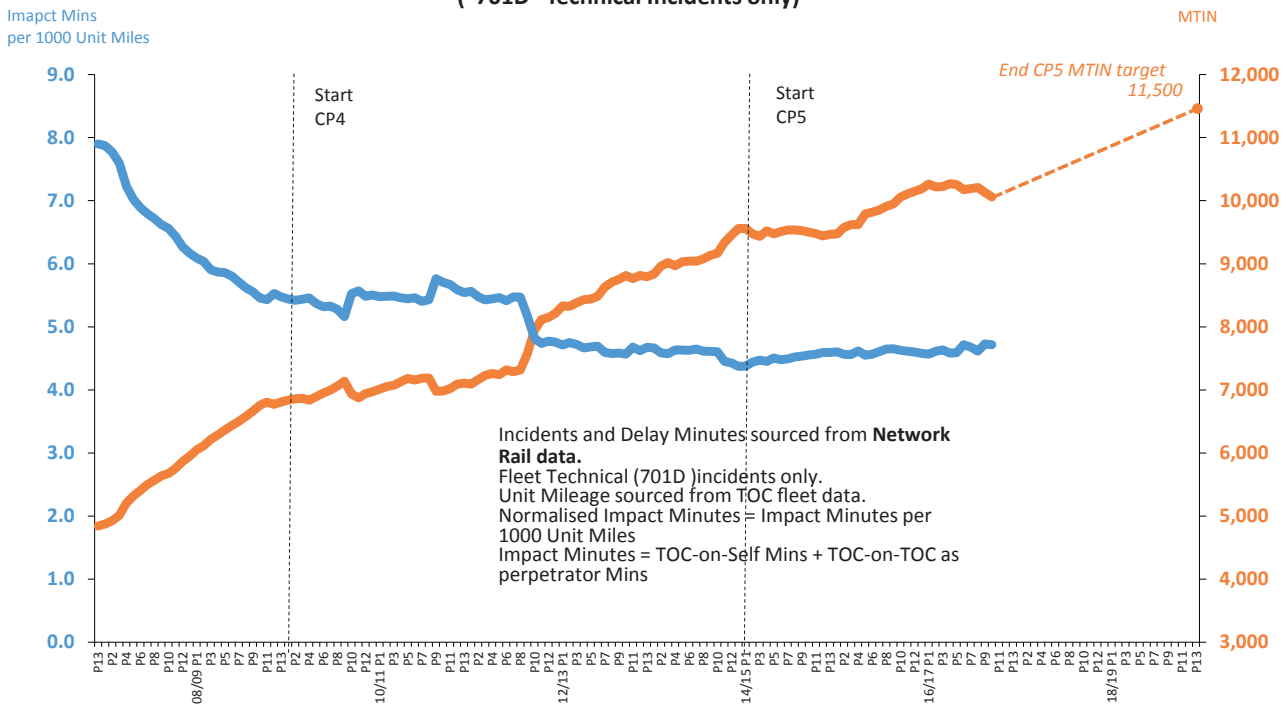


Figure 6: RDG’s Train Performance graph.

Whilst this increase in reliability is welcome the impact of each failure, in terms of delay minutes caused, has plateaued. This is a sign of the huge volume of train services now on the rail network.

Improvements in train reliability and the use of digital systems mentioned in section 4 are becoming ever more critical. These improvements will reduce the number of incidents even further and create additional capacity in the system to allow flexibility in services making them more robust and allowing services to recover from incidents more quickly.

7 Ofcom Space Spectrum Statement 19 January 2017

8 <https://www.gov.uk/government/publications/connected-future>

6.5. Sustainable development principles

We are committed to a cleaner rail network and reducing the environmental impact of train travel. Train operators, owners and manufacturers must play their part in reducing air pollution in and around stations, depots and sidings not forgetting inside the carriages themselves.

Diesel trains of all types will continue to be required. Many of the diesel multiple units in use today were built around 30 years ago and use engines that do not meet the high standards for emissions expected of newly-built engines. The department is looking to train owners and engine manufacturers to come forward with proposals to address diesel emissions by reducing energy consumption and the production of NO_x, CO₂ and particulates for example by replacing or upgrading existing engines when overhauled and/or the introduction of exhaust treatment systems.



Figure 7: TDI Ltd, WMG and Unipart Rail's Very Light Rail vehicle.

There will be an increase in the number of state of the art bi-mode (diesel with electric) trains operating on the network over the coming years. Bi-modes provide useful options for operators when developing their timetables and mean that we can provide passengers with quicker, more comfortable and reliable trains sooner and reduce disruption. New bi-modes, fitted with modern diesel engines, are less polluting than the trains they will be replacing and as battery technologies improve we would expect to see their diesel engines replaced by electrical energy storage systems capable of providing power to the train between the electrified sections of the network.

The need to reduce carbon emissions will likely result in greater emphasis being put on green initiatives in franchising. Such initiatives include;

- TDI Ltd, WMG and Unipart Rail's, Very Light Rail vehicle which is half the weight of a comparable heavy-rail vehicle⁹
- Bombardier's TRAXX AC Last Mile Electric Locomotive that can transport goods directly into ports, freight terminals or loading warehouses without the additional use of diesel trucks and shunting locomotives or expensive catenary,
- Transport Scotland looking at the use of "independently-powered electric multiple units"¹⁰ that would create less air pollution. Such technology has the additional benefits of reducing or removing the need for expensive electrification, and
- Alstom's development of hydrogen powered fuel cell trains which are a possible alternative to diesel trains. With zero emissions from the train, these and other fuel-cell vehicles could improve the quality of the air particularly in or around stations.

The department wants train owners, operators and Network Rail to take full advantage of these and other initiatives, along with the wealth of knowledge available through RSSB's Rail Carbon Tool¹¹, to identify ways to calculate, assess, analyse, project and ultimately reduce the industry's carbon footprint.

Rolling stock manufacturers and owners should now be developing and identifying new technologies to take advantage of future opportunities. These include the use of bi-mode trains, the use of hydrogen as an energy source, improvements in hybrid technologies and the development of lighter weight designs and materials.

We want to see the industry take the initiative, to be leaders in innovation and take proposals forward. We will continue to support innovation through our franchises and with support made available through Innovate UK.

9 <https://www2.warwick.ac.uk/fac/sci/wmg/research/hvmcatapult/research/rail/vlr>

10 [http://www.transport.gov.scot/system/files/documents/reports/TS – Rail – Rail Infrastructure Strategy Consultation – November 2016.pdf](http://www.transport.gov.scot/system/files/documents/reports/TS%20-%20Rail%20-%20Rail%20Infrastructure%20Strategy%20Consultation%20-%20November%202016.pdf)

11 <https://www.railindustrycarbon.com>



Figure 8: Alstom's zero-emission Coradia iLint train.

6.6. Optimising for whole life value for money

Those companies bidding for franchises or procuring new rolling stock should take advantage of the position the department is in. Where the costs and benefits of innovative ideas fall to different parties, and where funding is available, we are able to consider the whole-industry, whole-life case for such investments. Similarly where there is no direct commercial benefit to investment but there are wider socio-economic benefits (e.g. cleaner environment, less noise, greater passenger satisfaction) and where we are able to quantify these they can be used as key elements of business cases.

7. Conclusion

Customer service should be at the very heart of the railway. We want to see ambitious ideas from franchisees with initiatives that deliver an exceptional experience at each stage in the journey, from making the initial decision to travel through to arriving at the destination. We particularly want franchisees to explore how they can further empower passengers with more up-to-date, personalised travel information, including seat availability and the status of on-board facilities.

Our vision for the future of the railway is one that sees:

- A rolling stock market that works for passengers, franchisees and the department.
- Accessible trains and stations;
- Cleaner air in and around trains and stations;
- British industries leading the world in rail technologies;
- High-speed rail travel integrated with existing services;
- Reliable trains with information on crowding and available facilities provided to customers before they travel;
- Value for money from franchises; and
- The use of alternative fuels, batteries and cleaner sources of energy.

8. Rolling Stock Aspirations by Service Group

The aspirations for rolling stock on the coming pages are necessarily broad and do not take precedence over requirements set out in individual 'Invitations to Tender.' They provide a high level overview, which train operators should work towards. These aspirations are intentionally cast as output based and we expect train operators to take innovative approaches and use their experience to meet or exceed them.

We have divided services into five broad groups. It is important to note that trains can be used flexibly during off-peak periods. Britain has a high-intensity railway, particularly during the morning and evening rush hours, and a train used on a metropolitan service in the morning may be used on inter-urban or rural services outside of the peak. It is also important to note that passengers' perceptions of the type of service they are travelling on vary dependant on the time spent on the train and their reason for traveling.

It is essential for vehicles to have flexible interiors if train operators are to respond to increasing demands from passengers at manageable cost. In the long term this will ensure that rolling stock can be deployed on various routes with differing needs and ultimately allow train operators to prepare quickly and easily for occasions when passenger numbers will exceed capacity e.g. high season holiday or festival traffic. Thought should also be given to providing flexible interiors suitable for large packages, luggage or bicycles.

Metropolitan

The metropolitan service group typically serves high-density traffic flows to meet a high volume of passenger demand during the peak hours, with passengers generally making relatively short journeys on services with frequent stops. Passenger expectations may focus on certain aspects of comfort and there is a recognition that operators must balance the need to transport high volumes of passengers against the expectation of a seat. These trains may also provide services to outer-suburban stations.

Rural/Regional

This service group will generally serve more rural communities at a lower frequency than the other service groups and have lower ridership but it performs a vital service for travellers, the local community and tourists as well as the regional economy.

Inter-Urban

Passenger expectations of the Inter-urban service group are similar to the InterCity group on services that are primarily express with limited stops but may be of a shorter duration. It transports leisure and commuter passengers between towns and cities. These trains may also provide services to outer-suburban stations.

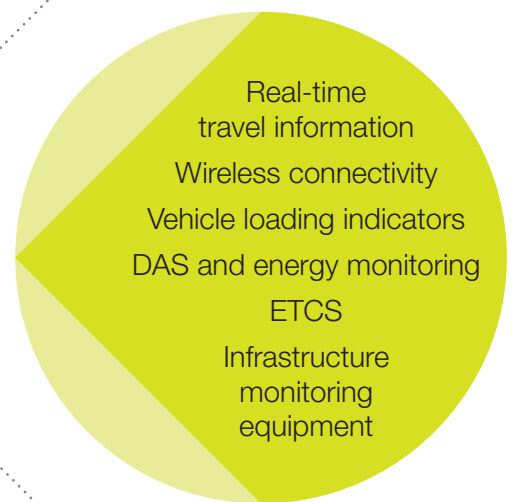
InterCity

The InterCity service group is one of predominantly long distance services where passenger expectations are generally high given the nature of the market, length of journey and the transport modes against which operators compete.

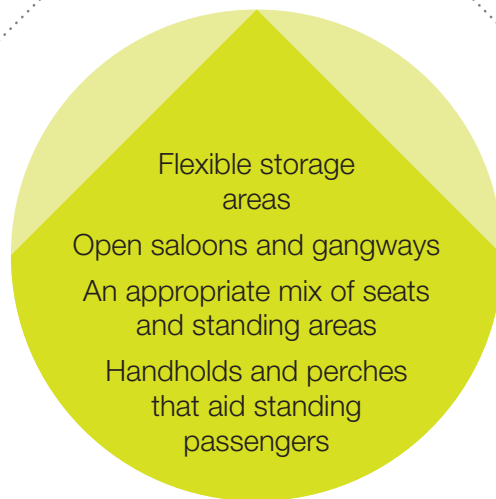
High-Speed InterCity

These vehicles are envisaged as providing ultra-high speed (up to 360kph ~225mph) services between major cities in Britain. Passengers will have high expectations for the facilities on board and for modern state-of-the-art interiors that meet the needs of business, commuting and leisure travellers.

Accessible



Technology



Accommodation



Ambience



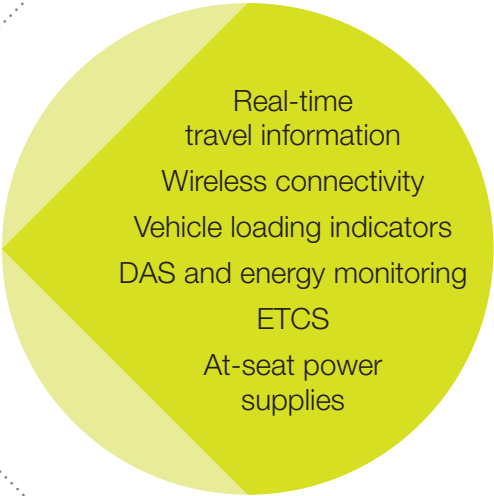
Accessible



Rural/ Regional



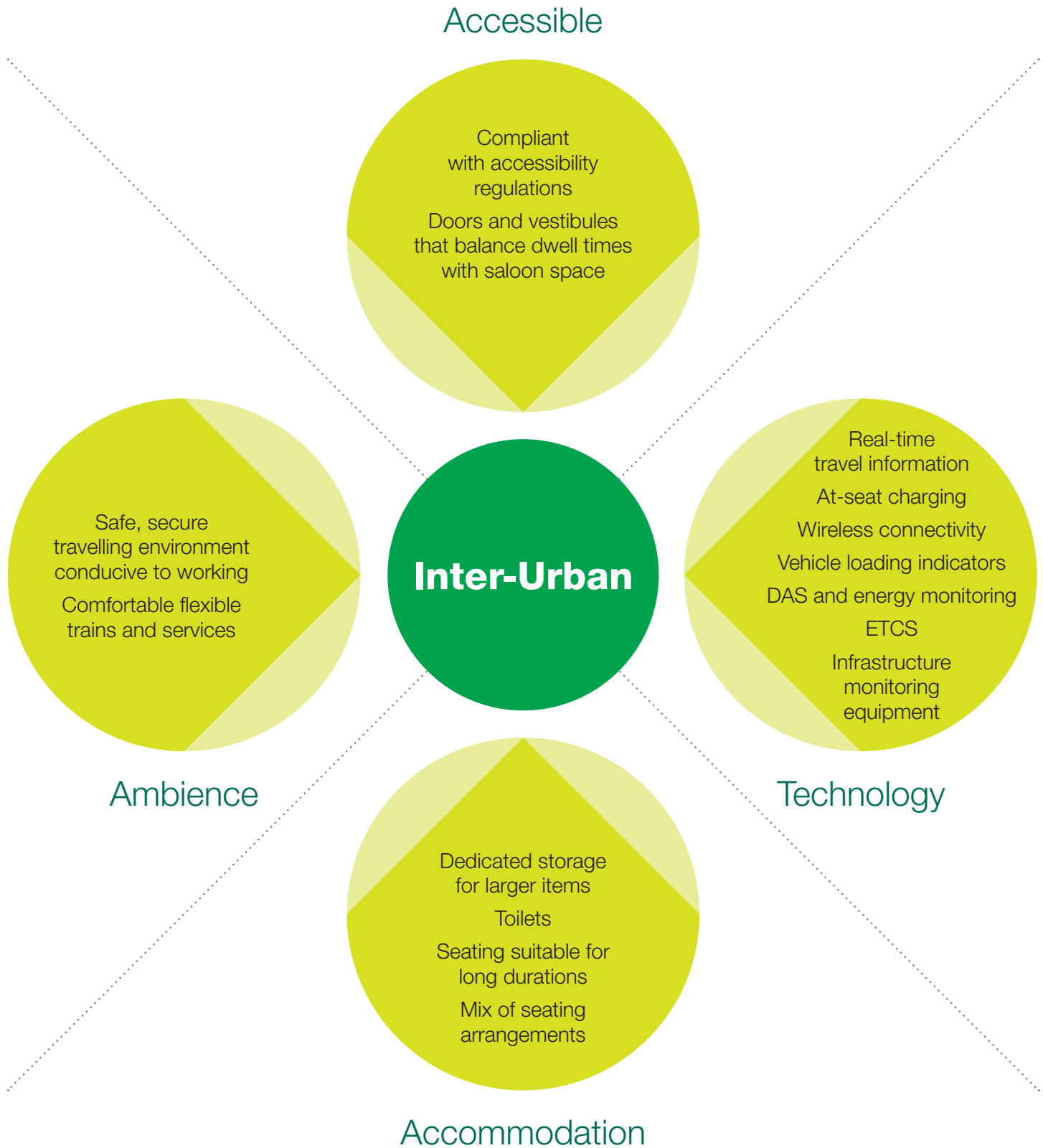
Ambience



Technology



Accommodation





Accessible



High-Speed InterCity

Safe, secure, modern traveling environment conducive to working
Flagship trains and services

Ambience

Real-time travel information
Intelligent seat reservations guiding passengers
Active occupancy detection
Wireless connectivity
At-seat power supplies
Infrastructure monitoring equipment

Technology

Dedicated storage for larger items
Toilets
Seating suitable for medium to long durations
Mix of seating arrangements

Accommodation

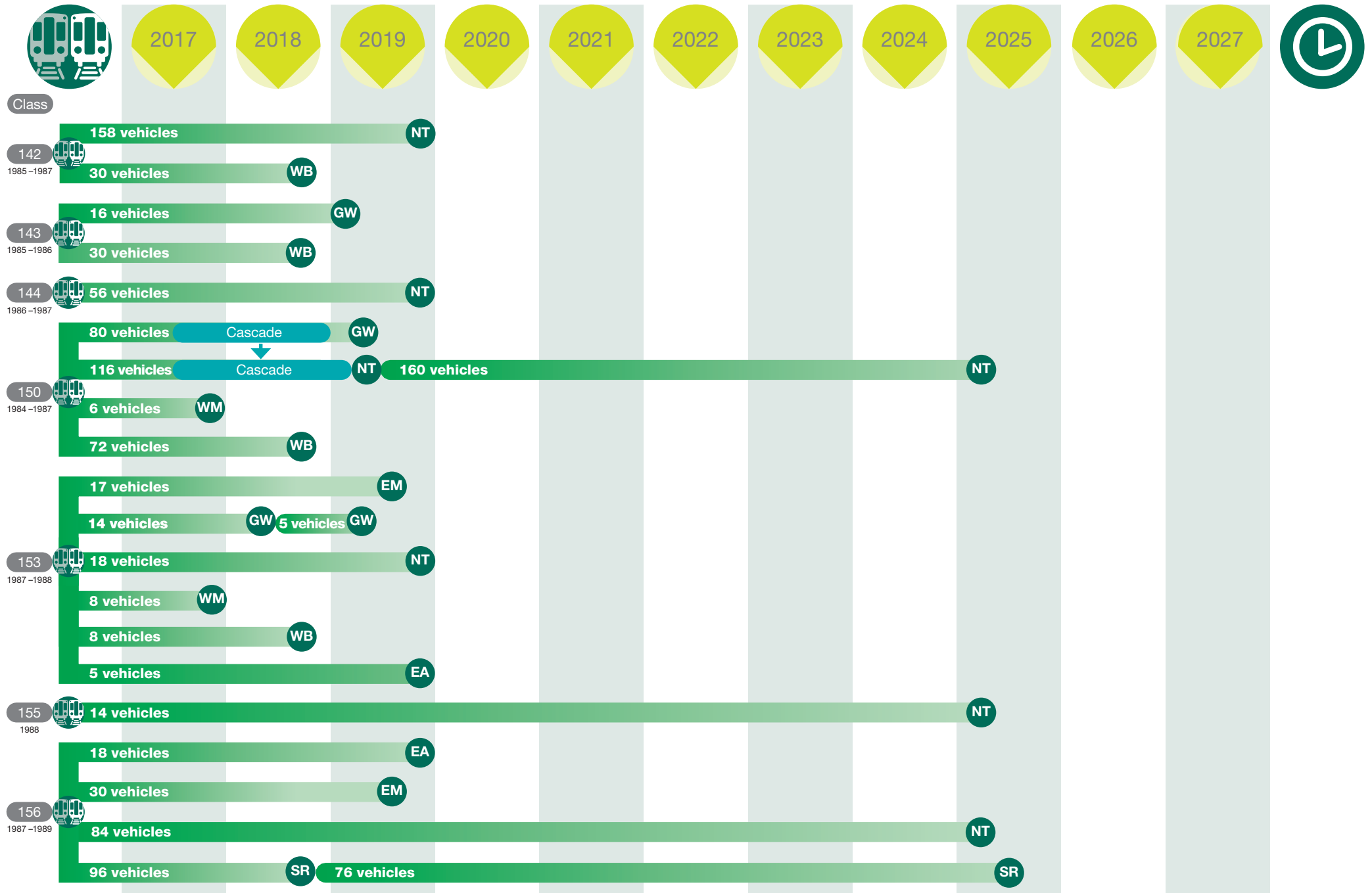
9. British Rolling Stock Fleet – Class by Class Overview

The following charts provide an overview of rolling stock in Britain, showing on which franchises or concessions they are currently operated, the date they are leased to as well as an indication of the year in which they were built. It is important to note that the quality of the vehicle is important, not its age. Good, high quality refurbishment can deliver a passenger experience comparable with new rolling stock.

The information contained within this section is indicative and has been prepared using Franchise Agreements and other material as available to the Secretary of State at the date of this document. As such neither the Secretary of State nor his officials, appointed agents or advisers makes any representation or warranty (express or implied) as to the accuracy or completeness of the information. It does not include Open Access Operators. Sub-leasing arrangements have been simplified in some instances. The department's Rolling Stock Team welcome any ideas for future publications, comments or corrections and can be contacted at:

RollingStockPerspective@dft.gsi.gov.uk

DMU Rolling Stock (Pre-1996 Orders)

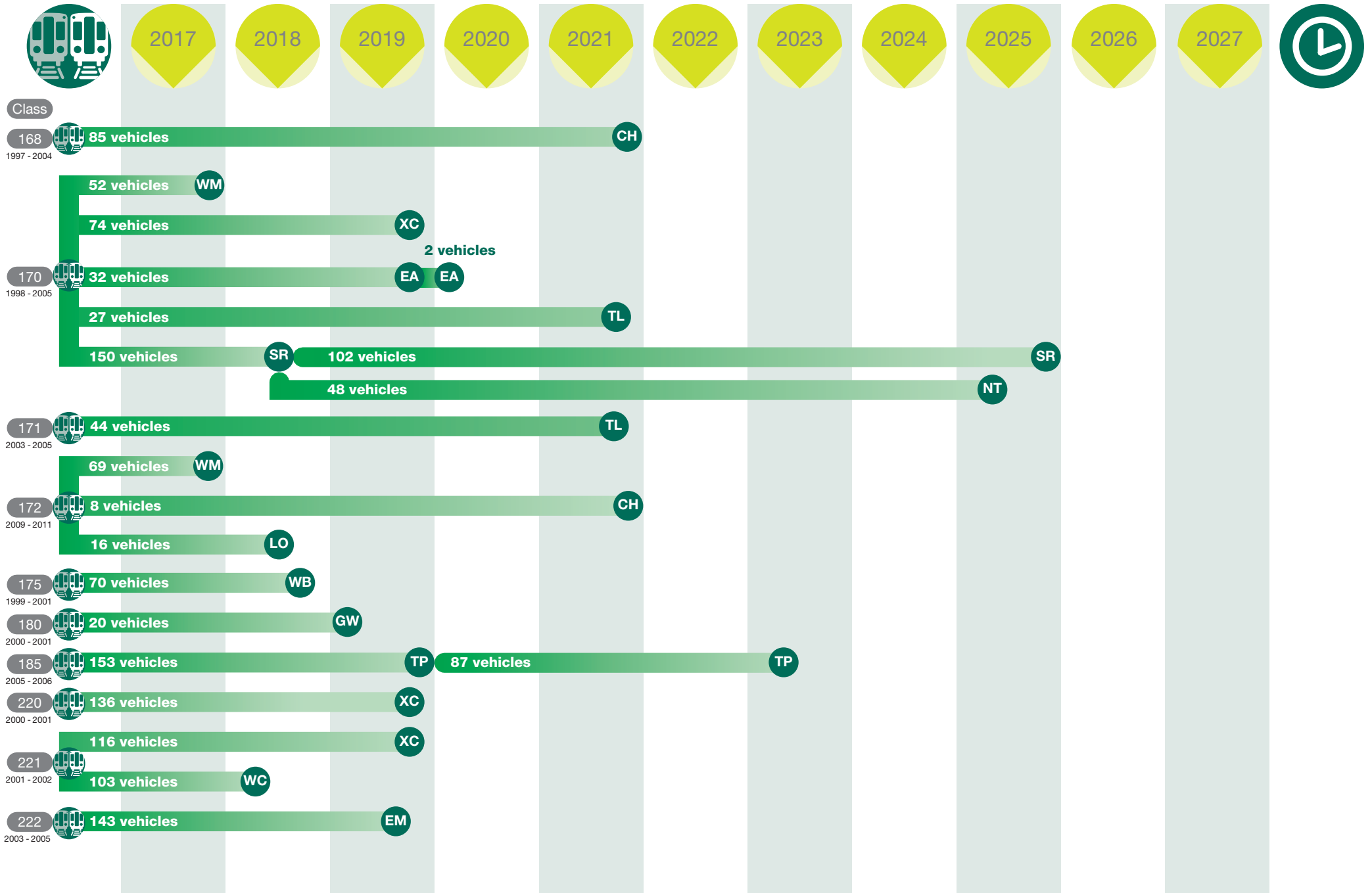


Key EA East Anglia EM East Midlands GW Great Western NT Northern SR ScotRail WB Wales and Borders WM West Midlands Current Lease 19XX Indicative build dates

DMU Rolling Stock (Pre-1996 Orders)



DMU Rolling Stock (Post-1996 orders)



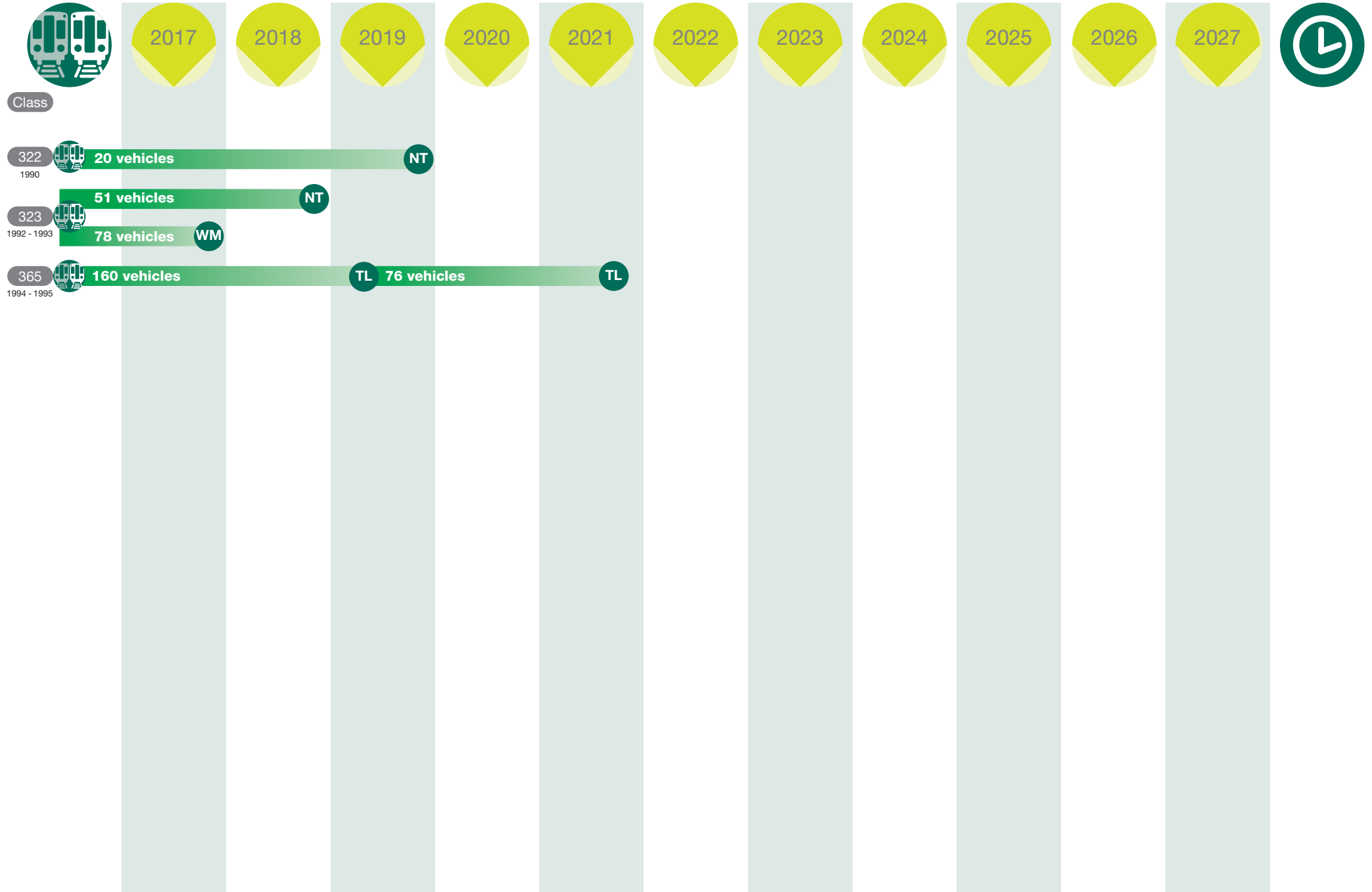
Key CH Chiltern EM East Midlands LO LOROL TL TSGN WB Wales and Borders WM West Midlands
 EA East Anglia GW Great Western SR ScotRail TP TransPennine Express WC West Coast XC Cross Country
 Current Lease 19XX Indicative build dates

AC EMU Rolling Stock (Pre-1996 Orders)



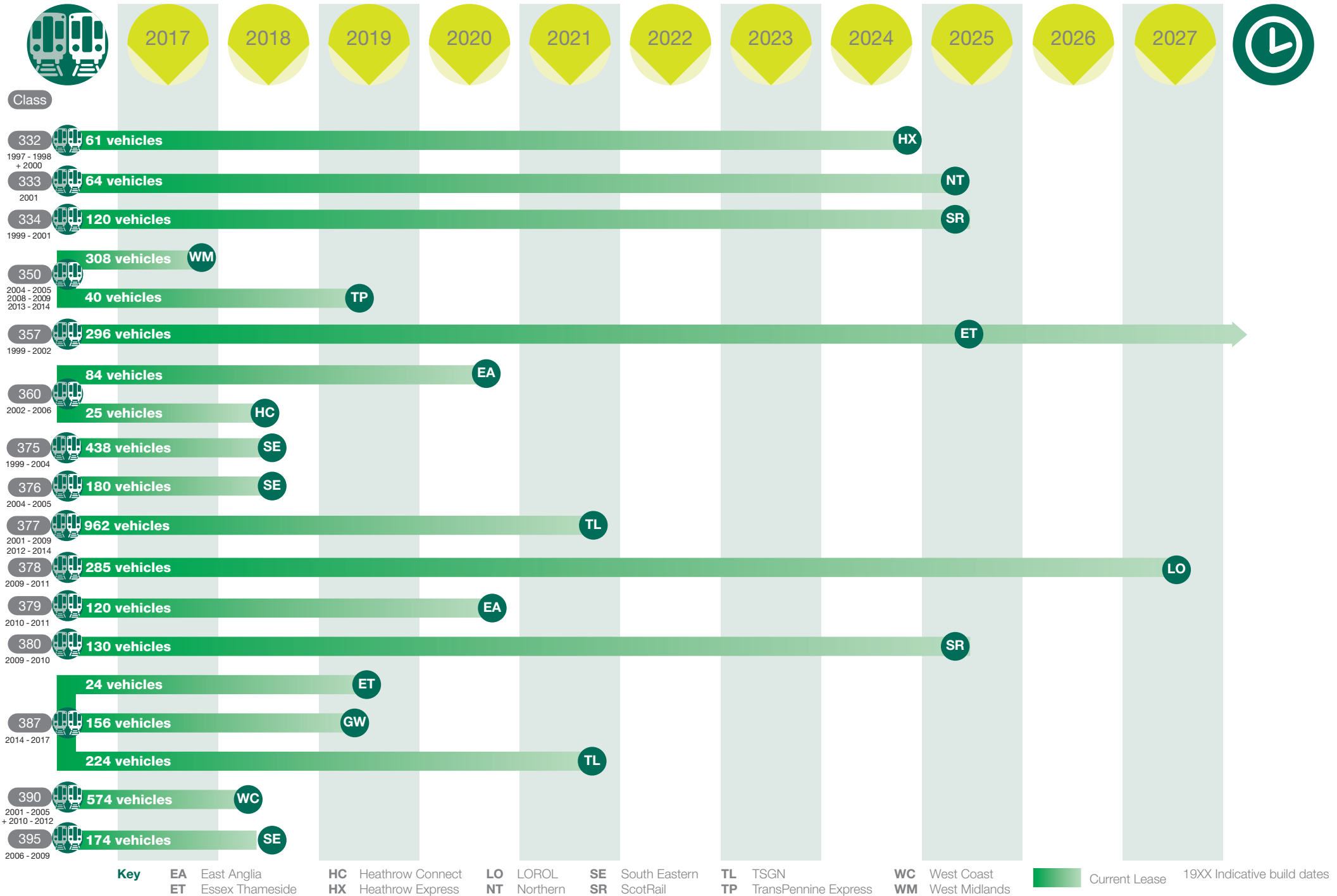
AC EMU Rolling Stock (Pre-1996 Orders)

38

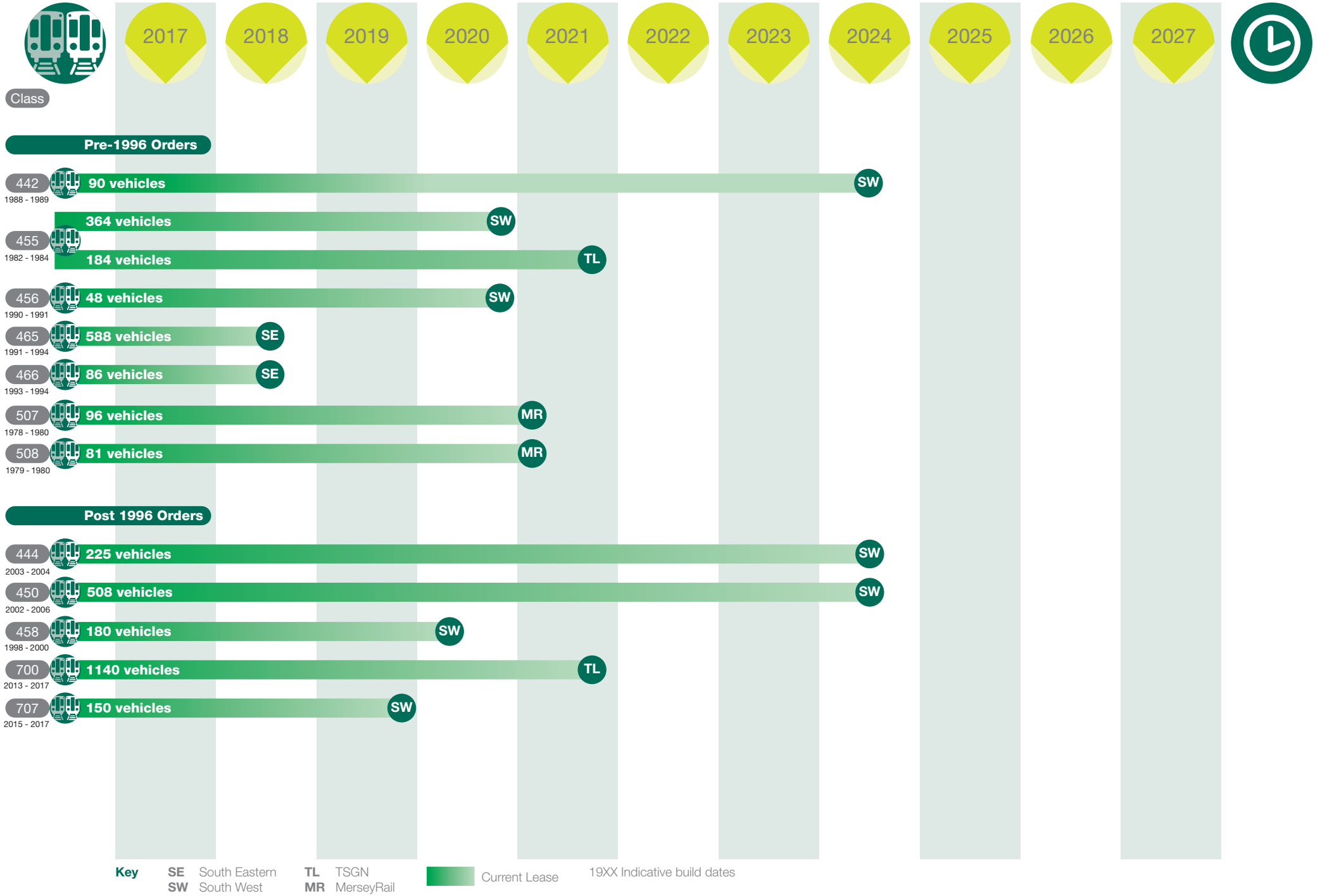


Key WM West Midlands NT Northern
 GW Great Western TL TSGN
 Current Lease 19XX Indicative build dates

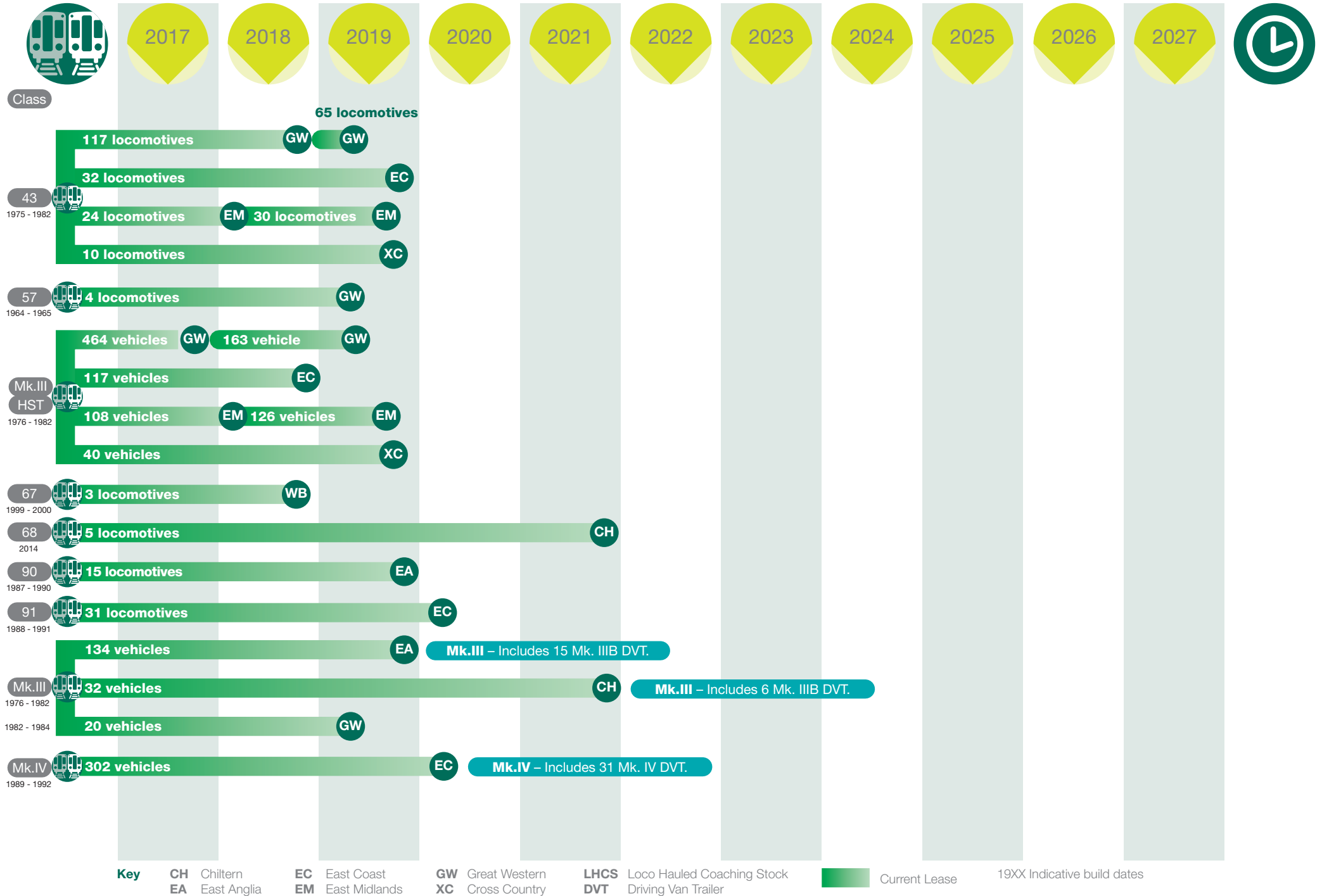
AC EMU Rolling Stock (Post-1996 orders)



DC EMU Rolling Stock



LHCS & HST



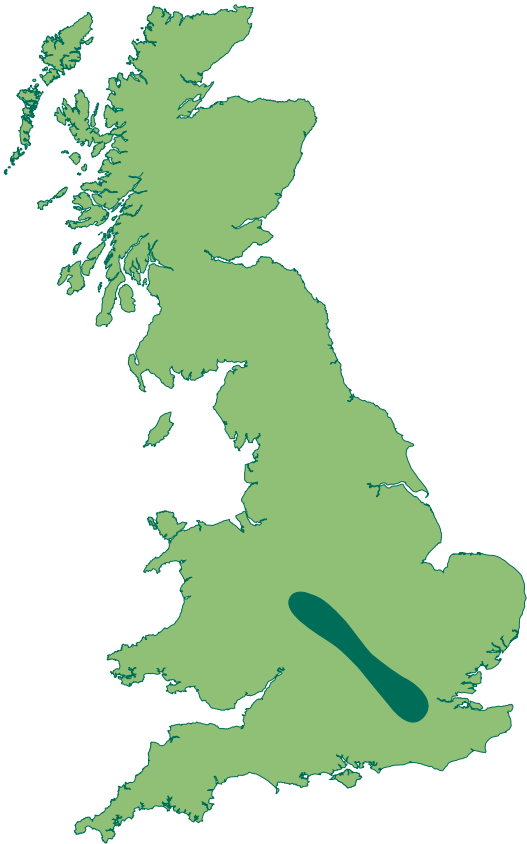
10. Department for Transport – Franchised Operators

The following charts provide an overview of rolling stock that is currently on each of the franchises let by the department with an indication of the make-up of their fleets and the years in which they were built.

The information contained within this section is indicative and has been prepared using Franchise Agreements and other material as available to the Secretary of State at the date of this document. As such neither the Secretary of State nor his officials, appointed agents or advisers makes any representation or warranty (express or implied) as to the accuracy or completeness of the information. It does not include Open Access Operators. Sub-leasing arrangements have been simplified in some instances. The department's Rolling Stock Team welcome any ideas for future publications, comments or corrections and can be contacted at:

RollingStockPerspective@dft.gsi.gov.uk

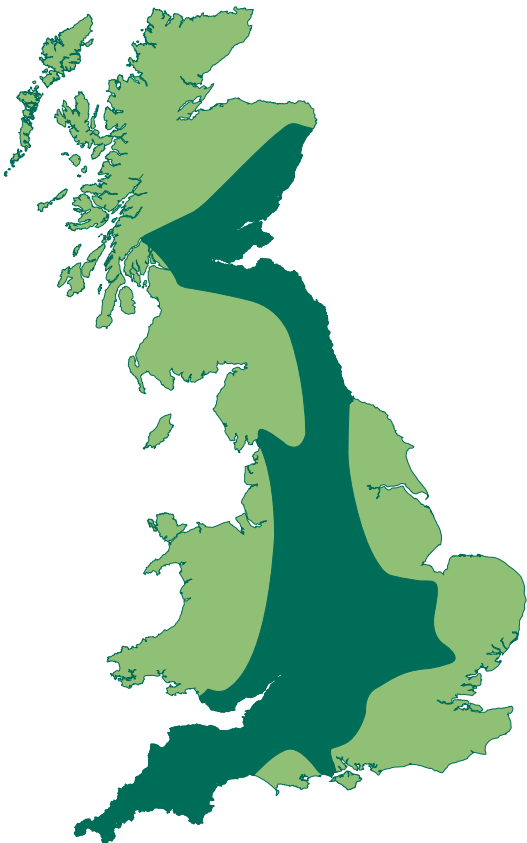
Chiltern



Diesel Fleet

<i>Class</i>	<i>Quantity</i>	<i>Built</i>
Class 68	6 Locomotives	2014
Mk. III (inc. DVT)	32 Vehicles	1975–1988
Class 165	89 Vehicles	1990–1992
Class 168	85 Vehicles	1997–2004
Class 172/1	8 Vehicles	2009–2010

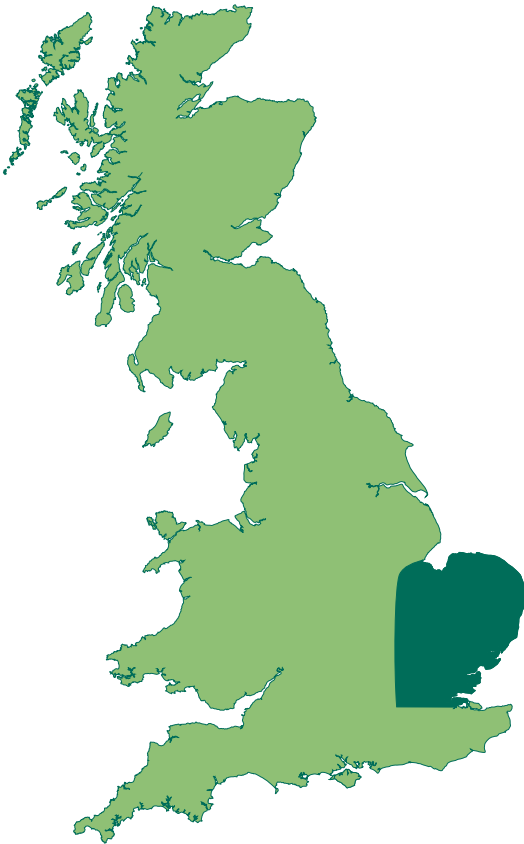
Cross Country



Diesel Fleet

<i>Class</i>	<i>Quantity</i>	<i>Built</i>
Class 43	10 Locomotives	1976–1982
Mk. III	40 Vehicles	1974–1988
Class 170	74 Vehicles	1999–2000
Class 220	136 Vehicles	2000–2001
Class 221	116 Vehicles	2000–2001

East Anglia



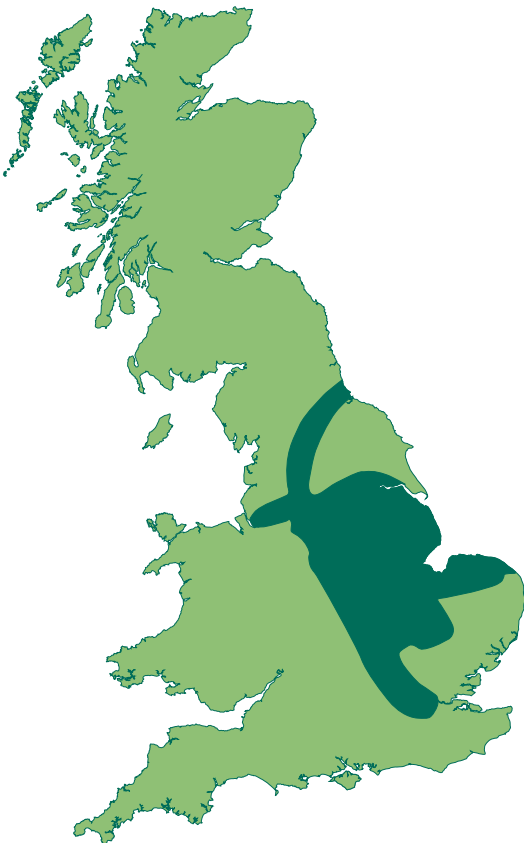
Diesel
Fleet

Class	Quantity	Built
Class 153	5 Vehicles	1985–1987
Class 156	18 Vehicles	1986–1987
Class 170	32 Vehicles	2002

Electric
Fleet

Class	Quantity	Built
Class 90	15 Locomotives	1987–1990
Mk. III (inc. DVT)	134 Vehicles	1975–1988
Class 317	232 Vehicles	1980–1986
Class 321	444 Vehicles	1988–1990
Class 360	84 Vehicles	2002–2003
Class 379	120 Vehicles	2010–2011

East Midlands



Diesel
Fleet

Class	Quantity	Built
Class 43	24 Locomotives	1976–1982
Mk. III	108 Vehicles	1975–1988
Class 153	17 Vehicles	1987–1988
Class 156	30 Vehicles	1987–1989
Class 158	52 Vehicles	1989–1992
Class 222	143 Vehicles	2003–2005

Essex Thameside



Electric
Fleet

Class	Quantity	Built
Class 357	296 Vehicles	1999–2002
Class 387	24 Vehicles	2014–2016

Great Western

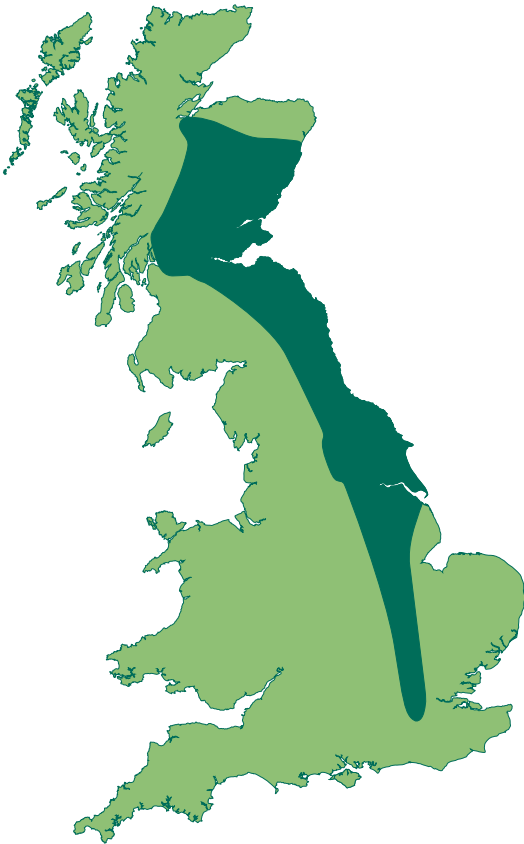


Diesel
Fleet

Class	Quantity	Built
Class 43	117 Locomotives	1975–1982
Mk. III	464 Vehicles	1976–1982
Class 57	4 Locomotives	1964–1965*
Mk. III Sleeper	20 Vehicles	1982–1984
Class 143	16 Vehicles	1985–1986
Class 150	80 Vehicles	1984–1987
Class 153	14 Vehicles	1987–1988
Class 158	43 Vehicles	1989–1992
Class 165	88 Vehicles	1992
Class 166	63 Vehicles	1992–1993
Class 180	20 Vehicles	2000–2001
Class 387	24 Vehicles	2014–2016

* Built as class 47 locomotives, rebuilt as Class 57 in 2004.

InterCity East Coast



Diesel
Fleet

Class	Quantity	Built
Class 43	32 Locomotives	1975–1982
Mk. III	117 Vehicles	1976–1982

Electric
Fleet

Class	Quantity	Built
Class 91	31 Locomotives	1988–1991
Mk. IV (inc. DVT)	302 Vehicles	1989–1992

InterCity West Coast



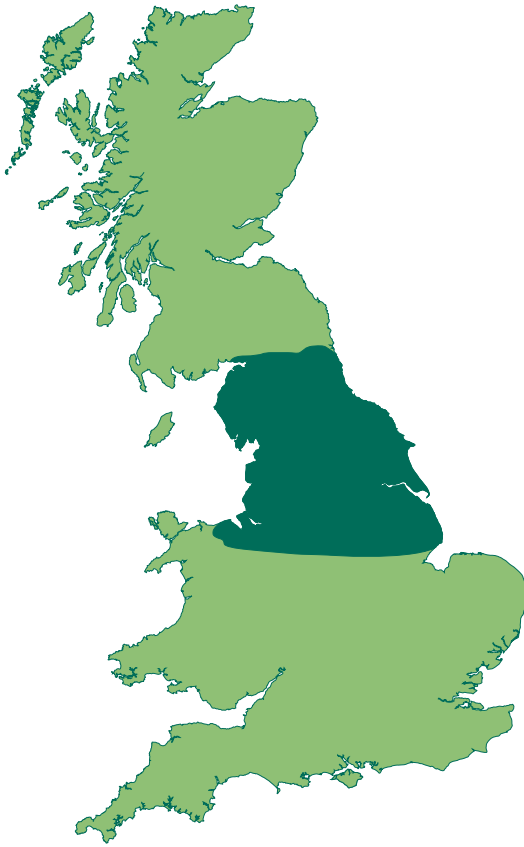
Diesel
Fleet

Class	Quantity	Built
Class 221	103 Vehicles	2001–2002

Electric
Fleet

Class	Quantity	Built
Class 390	574 Vehicles	2001–2012

Northern



Diesel Fleet

Class	Quantity	Built
Class 142	158 Vehicles	1985–1987
Class 144	56 Vehicles	1986–1987
Class 150	116 Vehicles	1985–1987
Class 153	18 Vehicles	1987–1988
Class 155	14 Vehicles	1988
Class 156	94 Vehicles	1987–1988
Class 158	98 Vehicles	1989–1992

Electric Fleet

Class	Quantity	Built
Class 319	128 Vehicles	1990
Class 321	12 Vehicles	1988–1991
Class 322	20 Vehicles	1990
Class 323	51 Vehicles	1992–1993
Class 333	64 Vehicles	2000 & 2006

South Eastern



DC/DV Electric Fleet

Class	Quantity	Built
Class 375	438 Vehicles	1999–2005
Class 376	180 Vehicles	2004–2005
Class 395	174 Vehicles	2006–2009
Class 465	588 Vehicles	1991–1994
Class 466	86 Vehicles	1993–1994

South Western



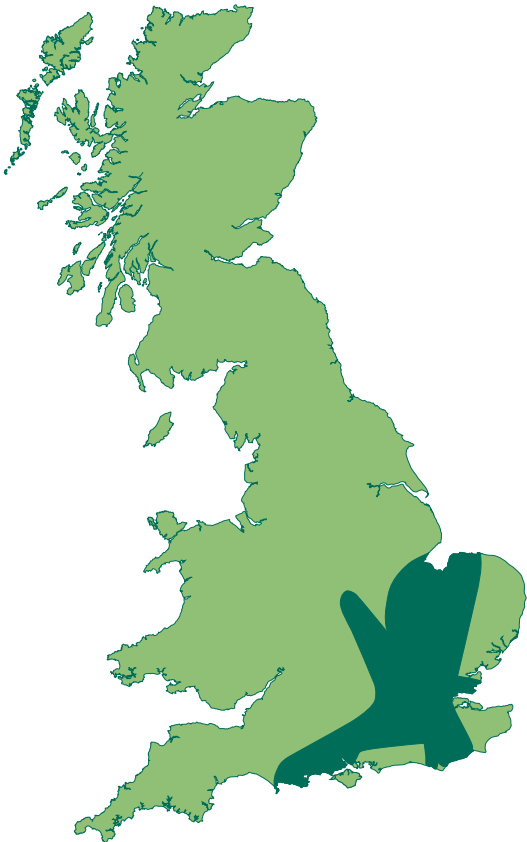
Diesel Fleet

<i>Class</i>	<i>Quantity</i>	<i>Built</i>
Class 158	22 Vehicles	1989–1992
Class 159	90 Vehicles	1989–1992

DC Electric Fleet

<i>Class</i>	<i>Quantity</i>	<i>Built</i>
Class 444	225 Vehicles	2003–2004
Class 450	508 Vehicles	2002–2006
Class 455	364 Vehicles	1984–1985
Class 456	48 Vehicles	1990–1991
Class 458/5	180 Vehicles	1998–2000
Class 483	12 Vehicles	1938
Class 707	150 Vehicles	2015–2017

Thameslink, Southern & Great Northern



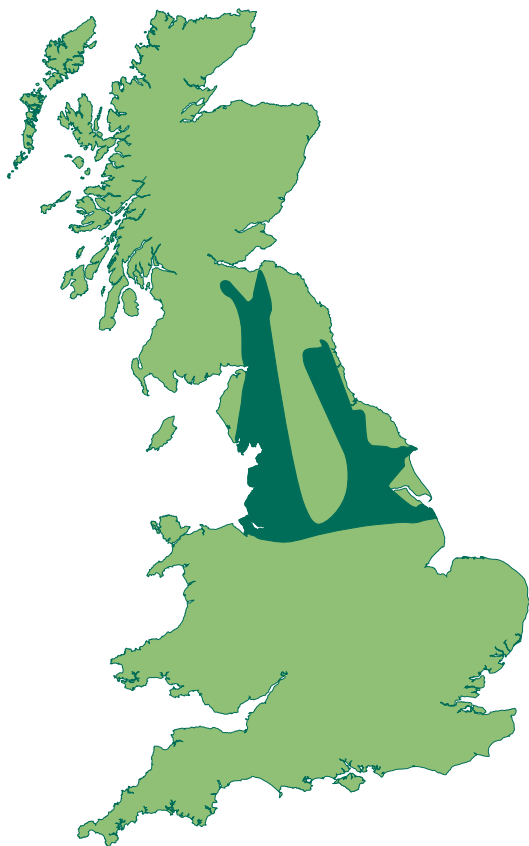
Diesel Fleet

Class	Quantity	Built
Class 171	44 Vehicles*	2003–2005

Electric Fleet

Class	Quantity	Built
Class 313	189 Vehicles	1976–1977
Class 317	48 Vehicles	1981–1982
Class 319	212 Vehicles*	1987–1988
Class 321	52 Vehicles	1989–1990
Class 365	160 Vehicles	1994–1995
Class 377	962 Vehicles	2001–2014
Class 387	224 Vehicles	2014–on
Class 455	184 Vehicles	1982–1984
Class 700	1140 Vehicles	2013–2017

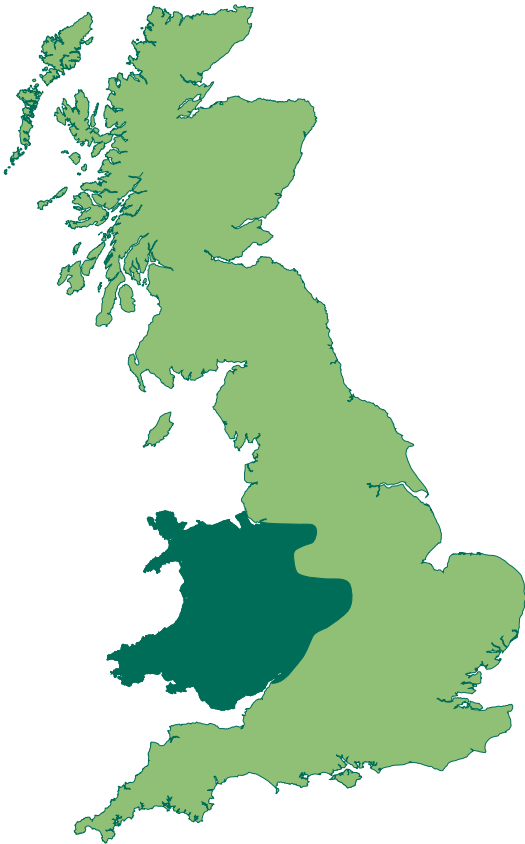
TransPennine Express



Diesel Fleet	<i>Class</i>	<i>Quantity</i>	<i>Built</i>
	Class 185	153 Vehicles	2005–2006

Electric Fleet	<i>Class</i>	<i>Quantity</i>	<i>Built</i>
	Class 350	40 Vehicles	2013–2014

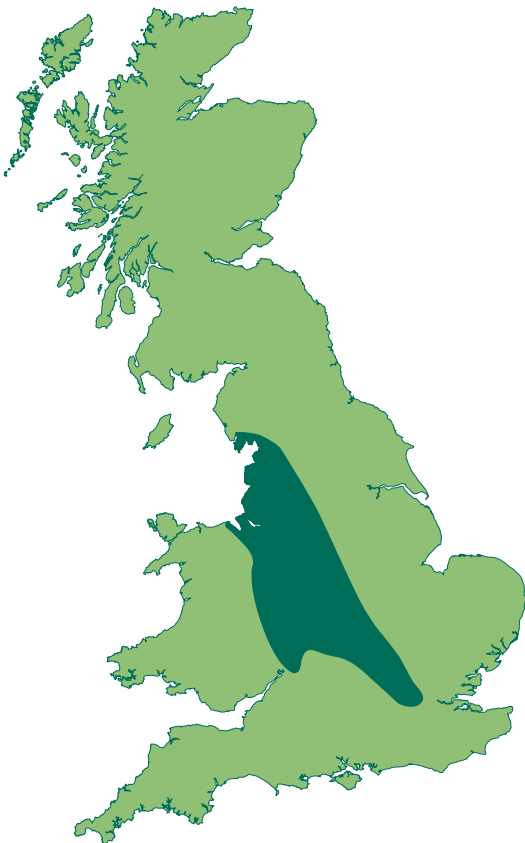
Wales & Borders



Diesel Fleet

Class	Quantity	Built
Class 67	3 Locomotives	1999–2000
Mk. II (inc. DVT)	15 Vehicles	1975–1987
Class 142	30 Vehicles	1985–1987
Class 143	30 Vehicles	1985–1987
Class 150	72 Vehicles	1986–1988
Class 153	8 Vehicles	1987–1988
Class 158	48 Vehicles	1989–1992
Class 175	70 Vehicles	1999–2001

West Midlands



Diesel Fleet

Class	Quantity	Built
Class 150	6 Vehicles	1984–1987
Class 153	8 Vehicles	1987–1988
Class 170	52 Vehicles	1999–2000
Class 172	69 Vehicles	2011

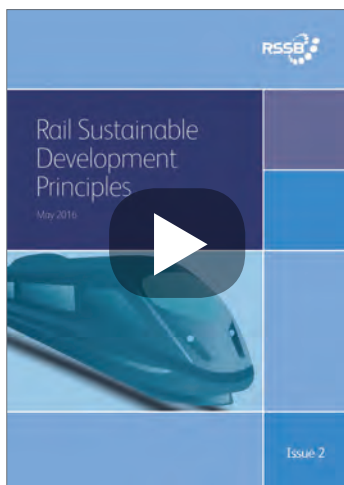
Electric Fleet

Class	Quantity	Built
Class 319	28 Vehicles	1988–1991
Class 323	78 Vehicles	1992–1993
Class 350	308 Vehicles	2004–2005

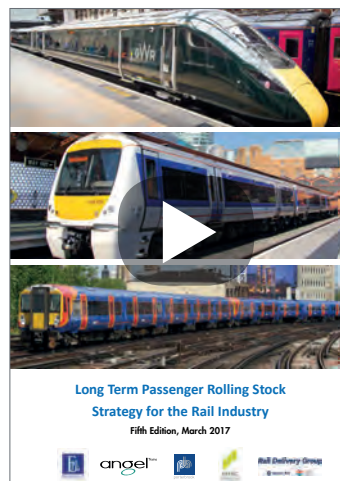
11. Key Rolling Stock Publications

There are a number of key publications for rolling stock which we have listed here for reference.

[Rail Sustainable Development Principles](#)



[Industry Rolling Stock Strategy Steering Group](#)



[The Rail Technical Strategy](#)



[Building our Industrial Strategy](#)



The Key Train Requirements



Rail Sector Skills Delivery Plan



Rail Technical Strategy Capability Delivery Plan



Fast Track to the Future



ISBN 978-1-84864-193-8



9 781848 641938