steer davies gleave

Understanding the Rolling Stock Costs of TOCs in the UK

Report
January 2015

Office of Rail Regulation

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Executive Summary

The Office of Rail Regulation is looking to improve understanding within the industry, and amongst the public, of the costs associated with train operation and the extent to which operators can manage these costs. To support this approach, Steer Davies Gleave (SDG) has been commissioned to undertake a study of the costs of rolling stock to Train Operating Companies (TOCs) in the UK.

As a result of limited access to TOC data due to commercial sensitivities, SDG has developed an approach that builds on using data available through the ORR and public sources. ORR provided SDG with TOC Management Data for 2012-13 and passenger journey data. In addition, SDG made use of the ORR's GB Rail Industry Financials, which is a publically available document through the ORR's website. This contains financial information from TOCs, Network Rail and governments.

To support the analysis work, SDG developed a rolling stock database containing entries for all mainline rolling stock currently in use in the United Kingdom. This included information on vehicle class, build year, vehicle weight, traction type, owner, and operator. Additional cost data has been sourced from Network Rail's publicly-available CP5 charges. Measures of reliability have been sourced from Modern Railways' publication of Incident data.

For the purpose of this study SDG identified a number of cost elements associated with the operation of rolling stock, these cost elements are: rolling stock leases; maintenance; staff; track access; and energy consumption for traction.

Rolling Stock Leases

Rolling stock leasing costs can be affected by the age of the vehicles, with newer vehicles generally being more expensive than older vehicles. The level of equipment fitted to vehicles will also influence lease costs, with enhancements carrying a premium. Where vehicles have high levels of reliability, this may allow owners to charge a premium for improved availability.

Maintenance

High speed operations are more mechanically demanding and this can mean that greater levels of maintenance are required and will incur additional costs. Also, as many maintenance regimes are based on distance travelled, fleets with high annual mileages will incur higher maintenance costs per year. Maintenance costs will also be affected by the age of vehicles, with older vehicles potentially requiring higher levels of maintenance.

Staff

Train services with on-board facilities such as catering will require additional staff to those services that do not offer this. If TOCs manage stations then they will need to provide the necessary staff for this, which will also affect their costs. Whilst this is not directly related to rolling stock it has an impact on their overall cost base.

Track Access

TOCs incur a range of access charges in order to operate services on Network Rail managed infrastructure. Variable usage charges are linked to vehicle miles travelled, so higher annual mileages will lead to higher annual costs. The type of rolling stock operated also affects costs depending on how much damage it does to the infrastructure.

Energy consumption for traction

Diesel rolling stock is less efficient than electric rolling stock and, therefore, its energy consumption will be higher for a similar service performance which will incur cost. The cost of diesel is also generally higher than the equivalent electricity prices, which also affects cost.

Costs and Controllability

Within the UK, operators bid to run franchise contracts for a given period of time. The approach to rail franchising, government policy and an introduction to each of the current train operating companies are presented to provide context on the UK approach. Franchises also place constraints on TOCs in that they are contracted to provide certain services and may also be required to use certain fleets of rolling stock.

Following SDG's identification of the cost types, the drivers of rolling stock cost have then been determined. For example, the service types, diversity of fleets, distance travelled and average speed, as well as stations operated and fleet reliability. The ability of TOCs to control costs based on their operations and the approaches they take to running and managing their franchise has been explored. SDG also considered the ability of TOCs to influence and control the costs associated with rolling stock.

Controllability tables for each TOC have been developed, drawing together the identified cost elements, the cost drivers, their relationship to rolling stock costs, and the external and internal influences that may affect a TOCs ability to control costs. The ability for TOCs to control costs against each measures is identified as either low, medium or high. Metrics were then provided against each measure to enable the individual TOC to be compared against the average for all TOCs, so that it can be assessed as to whether a TOC's costs would be expected to be higher or lower than the average for all TOCs.

The analysis completed by SDG has demonstrated that it is not straightforward to derive a standard set of costs associated with train operation that can be applied across the industry. This is because costs depend on a number of drivers, each of which can be influenced to different degrees by a range of factors, both internal and external to the TOC.

Within the UK, operators bid to run franchise contracts for a given period of time against a pre-determined specification. This means that TOCs have very limited opportunity to influence or control significant proportions of their rolling stock costs, as many are dictated by either the franchise specification or characteristics of the network being operated.

Another aspect of the franchising process that influences an operator's ability to control costs is the availability of alternative rolling stock at any given time. With most of the national rolling stock fleet on lease at any point in time, there are often a limited number of rolling stock options available to bidders for new franchises.

As there are no two operators within the UK that are required to deliver the exact same franchise commitments, it is very difficult to make a direct comparison between operators. However, where operators run similar types of service, SDG has been able to draw out a number of themes and observations that are linked. These are presented within this report in the Controllability Tables for each TOC.

SDG has produced the TOC Controllability Tables to support ORR in improving understanding within the industry, and amongst the public, of the nature of each TOCs' franchise operation, the factors that influence their costs and the extent to which they can manage these costs.

1 - Introduction

Scope

1.1 - The Office of Rail Regulation (ORR) already comprehensively monitors Network Rail's costs and performance. As part of the move towards a whole industry approach to understanding efficiency, as recommended by Sir Roy McNulty's Rail Value for Money (RVfM) study, ORR is now looking to improve understanding within the industry, and amongst the public, of the costs associated with train operation and the extent to which Operators can manage these costs.

1.2 - Steer Davies Gleave (SDG) has been commissioned by the ORR, as part of their ongoing initiatives to increase transparency and understanding of costs within the industry, to undertake a study of the costs of rolling stock to Train Operating Companies (TOCs) in the UK.

1.3 - The scope of the work was to determine the drivers of rolling stock costs and examine the extent of the constraints (such as those resulting from the franchise specification) on TOCs' ability to control those costs.

Approach

1.4 - In our initial proposal to the ORR for this project, key to SDG's approach to data gathering was our TOC engagement plan. This aimed to achieve a sufficient level of cooperation from TOCs to capture as full a picture as possible of the costs relating to their rolling stock fleets.

1.5 - However, as a result of limited direct access to TOC data due to the commercial sensitivities, SDG has developed an approach that builds on using data available through the ORR and public sources. ORR provided SDG (by email on 13 October 2014) financial management information as well as train and passenger journey data, including the following:

- TOC Management Data for 2012-13 (Actuals);
- Default Consist Data;
- Total Train Kilometre Date;
- Total Train Hours Data; and
- Vehicle Kilometres by Train Service Code 2012-13.

1.6 - In addition to the above, SDG has made use of the ORR's data within the GB Rail Industry Financials, which is a publically available document through the ORR's website. This contains financial data from TOCs, Network Rail and governments.

1.7 - The cost data available to SDG for this stage of the analysis is relatively high-level and has certain limitations, as the lack of transparency within the data available makes it difficult in some cases to identify how costs have been allocated to categories. The high-level categories of cost data available in the GB Rail Industry Financials include the following:

- Staff Costs;
- Fuel Costs – Diesel;
- Fuel Costs – Traction Electricity;
- Rolling Stock Lease Charges;
- Maintenance Costs;
- Network Rail – Fixed Charges;
- Network Rail – Variable Charges; and
- Other Operating Expenditure.

1.8 - The GB Rail Industry Financial data also provided useful information regarding train kilometres, passenger kilometres, passenger journeys, passenger income, and government funding (where applicable as this not relate to every operator).

Rolling Stock Database

1.9 - As part of this project, an SDG-developed rolling stock database was used to conduct the analysis presented in this report. The database contains entries for all mainline rolling stock currently in use in the United Kingdom. It has been populated largely through the use of publicly-available ROSCO fleet portfolios (available online through the ROSCOs' websites) and with some additions from industry rolling stock reference publications. The primary rolling stock data covers:

- Class number;
- Owner;
- Operator; and
- Number of vehicles.

1.10 - A further set of characteristics have been applied in the database to cover:

- Build year;
- Model family (e.g. Siemens Desiro);
- Stock usage (e.g. Intercity);
- Vehicles (cars) per Unit/Set;
- Motor and trailer vehicles per Unit/Set;
- Vehicle weight;
- Vehicle length; and
- Traction type (e.g. Electric-AC).

1.11 - Data relating to costs has been sourced from Network Rail (publicly-available online): CP5 Variable Usage Charge (VUC) and CP5 Generic Electricity Consumption for Traction (EC4T).

1.12 - Measures of reliability have been sourced from Modern Railways' publication of the Miles per Technical Incident data by stock type and operator.

1.13 - In the case of vehicle weights, a "worst-case" scenario has been adopted. That is, the weight of the heaviest vehicle in that class is used for all the class. VTAC/VUC has been averaged across vehicles in a unit (weighted by number of motor/trailer cars).

1.14 - All data used in the Rolling Stock Database Analysis is available in the public domain. Capital and Non-Capital lease costs are commercially confidential and not in the public domain, thus are not included. Diesel consumption rates and costs are also not in the public domain.

1.15 - By bringing together these different datasets, SDG has been able to conduct analysis from a number of angles, including by operator, by owner, by age and by stock type. The inclusion of vehicle numbers at a highly disaggregate level (e.g. c2c Rail operates 184 Porterbrook-owned Class 357 vehicles and 112 Angel Trains-owned Class 357 vehicles) allows precise analysis at the low-level, while the inclusion of vehicle numbers allows for weighted averages to be calculated. The most effective way to present these numerous analyses is through the use of charts, which are produced from the database.

1.16 - There are some limitations to the database which may cause some discrepancy when comparing the database to other sources to which the reader may have access. Limitations include:

- Stock which is not assigned to an operator (e.g. off-lease) is not included;
- Stock owned by freight operating companies is generally not included, as it is not the principal focus of this study, though some data is available on freight-owned stock which is leased to TOCs (e.g. some loco-hauled services);
- Where a given stock type has multiple formations (e.g. can be a 3-car or a 4-car), there may be a discrepancy in total vehicles where only the number of units is reported;
- Where stock is sub-leased by one TOC to another, it may be assigned to the holder of the original lease, rather than the current operator; and
- Where units have been damaged/stored/removed from service, they may still be assigned to a given TOC, depending on how they are reported.

1.17 - As the database is used for high-level comparisons in this report, we believe these limitations and assumptions are acceptable. If the database is to be used for other purposes, it is recommended that a review of the above assumptions is undertaken in order to confirm that they are still appropriate.

GB Rail Financials

1.18 - Cost data has been provided by ORR in the form of the “GB Rail Industry Financials 2012-13”. This gives a breakdown of major cost types and some non-cost data by TOC and also by geographic grouping. The main data used by SDG was the operations/rolling stock cost entries from the Industry Expenditure section and the non-financial information entries.

1.19 - SDG also used the vehicle-km travelled data provided by the ORR. This allowed TOC-by-TOC comparisons of distance travelled (by vehicle and by train) and utilisation of vehicles/trains (passengers/vehicle miles or train miles).

1.20 - Whilst the GB Rail Industry Financial data provided a useful base for this project, the costs are presented at a relatively high-level and without any supporting information to be able to determine exactly how the input costs have been categorised by each operator. For example, some operators may have reported information in a different way to others, such as rolling stock maintenance costs, which could conceivably be categorised under rolling stock costs or staff costs (depending on how the input costs are being treated). This approach means there were limitations to the level of detailed analysis that SDG were able to undertake.

1.21 - In order to provide a more detailed analysis of rolling stock costs and the ability of operators to control these costs, SDG recommend that any further work should strive to include operators directly.

Aim and Structure of this Report

1.22 - The aim of this report is to help improve understanding around the drivers of cost associated with rolling stock and its operation. It also considers whether operators have the ability to control these costs and, where they do, to what extent they are able to influence them.

1.23 - Within the UK, operators bid to run franchise contracts for a given period of time. The approach to rail franchising, government policy and an introduction to each of the current train operating companies are presented in Section 2 Rail Franchising in the UK. This section provides some context on the UK approach. To provide a useful source of reference, each of the operators and their franchises are summarised within Appendix A TOC Characteristics.

1.24 - In approaching this project, SDG initially identified a number of elements that have an impact on rolling stock costs. The elements include rolling stock leases, maintenance obligations, energy consumption, track access and staff numbers. These cost types are discussed in more detail in Section 3 Rolling Stock Costs.

1.25 - Following the identification of cost types, the drivers of rolling stock cost are investigated and considered in more detail. For example, the service types, diversity of fleets, distance travelled and average speed, as well as stations operated and fleet reliability. These aspects are explored in more detail, together with relationship between these drivers and the anticipated costs seen by operators, within Section 4 Cost Drivers. Also within this section, some of SDG's initial data analysis is presented in order to begin to explore some of the themes and relationships between rolling stock, services, contracting arrangements and costs.

1.26 - Building on the initial analysis, SDG has then looked at the ability of TOCs to control these costs based on their operational requirements and the approaches they take to running and managing their franchise. This is covered within Section 5 Controllability of Costs. To further highlight some of the relationships between services, rolling stock and costs, a selection TOC-TOC comparisons are presented.

1.27 - Section 6 Anticipated Impact on TOC Costs includes tables which provide an overview of each TOC's costs in relation to the overall average. For each cost driver, SDG identified a number of key Cost Types that it drives and considered external influences that may limit a TOC's ability to control the cost, as well as ways in which a TOC may have controllability. A comparison between the TOC's cost driver and the average is included in order to give a view on whether SDG expect a TOC to face higher or lower costs

2 - Rail Franchising in the UK

Overview

2.1 - Until the early 1990s UK railways were managed as an integrated business with no distinction between the accounts of infrastructure and operations. British Railways were managed initially by geographical region and subsequently by business sectors broadly equivalent to the current Intercity, London and South East (LSE) and regional businesses, and within them profit centres or service groups.

2.2 - The present structure of the privatised rail industry was put in place by the Railways Act 1993 which separated operation of train services from the management of the national rail network infrastructure, and ownership of the rolling stock. From the original internal profit centres of each business sector 25 new train operating companies (TOCs) were created. Many of the changes took effect from April 1994.

2.3 - The majority of passenger services are provided by the TOCs under a franchise agreement with the Department for Transport (DfT), and formerly through the Office of Passenger Rail Franchising (OPRAF 1994-2000) and by the Strategic Rail Authority (2001-2006). Franchises are let through a competitive tender process, with the DfT specifying minimum service levels.

2.4 - The preferred period of these franchises has varied since privatisation, with most lasting between 5 and 12 years, although Chiltern Railways and Merseyrail (let by Merseyside PTE) have longer terms. Most rolling stock used by the TOCs is leased from rolling stock companies (ROSCOs). In addition, there are a limited number of open access operators (OAOs) providing non-franchised services allowed by the Office of Rail Regulation.

2.5 - The railway infrastructure is owned and operated by Network Rail. Stations are owned by Network Rail who directly manages 19 stations, including 11 London termini. The remaining circa 2,500 stations are leased to the TOCs who provide the majority of the services at each location. The independent Office of National Statistics (ONS) has recently reclassified Network Rail to the public sector, the new classification coming into effect from 1 September 2014.

2.6 - Passenger rolling stock is designed to meet the need of specific market sectors, in terms of layout, capacity and maximum speed. Trains were traditionally ordered for specific routes, taking account of the structure gauge, maximum axle load and nature of power supply available (AC or DC electric or non-electrified). This has created a national fleet with a wide variety of different classes of train.

2.7 - Most types of train have a design life of around 30 years, significantly longer than train operator franchises. In 1993, the preferred solution was to create ROSCOs which could take a whole life view of investment, and offer rolling stock under operating leases. At privatisation, the former British Rail fleet was divided into three with a view to ensuring that there should be potential for competition between ROSCOs.

2.8 - Shortly after privatisation the industry embarked on a major re-equipment programme to replace Mark I slam-door stock (due to safety concerns at the time). Many former loco-hauled services on Cross Country and regional franchises were replaced by new diesel multiple units. Upgrading of West Coast Mainline services also saw the introduction of Pendolino electric trains. In some cases the new investment by ROSCOs was underwritten by the Government through Section 54 Undertakings, which ensure that the trains will continue to be leased for a defined period.

2.9 - Under Section 54, Government sought to encourage private sector investment by providing guarantee payback periods for financiers in order to lower their risk exposure and, therefore, lower the cost of rentals to maintain value for money for the taxpayer. However, the arrangement would only be used as a last resort where it could be proved that the market could not provide the required recovery of the investment by other means.

Government Rail Policy

2.10 - Rail franchises provide the right to run specified services within a specified area or over specified routes, with (in most cases) direct interest in the passenger revenues. The franchise will either receive financial support from, or make a premium payment to, the franchising authority, which for the majority of UK franchises is the Department for Transport.

2.11 - Each franchise is negotiated individually with rights and obligations as specified in a Franchise Agreement. Service specifications can be highly prescriptive in terms of frequencies, journey times and capacity offered, or may simply specify minimum requirements, leaving the operator to determine the best offer for the particular market.

2.12 - There have been attempts to reform the franchising system over the last five years which have affected both the franchise timetable and the duration of franchises offered. Whilst some long term franchises such as Merseyrail (25 years), c2c (15 years) and Chiltern Railways (20 years) have proved reasonably successful in terms of service quality, reliability and financial performance, other examples such as the 15 year franchises operated by Virgin CrossCountry and Virgin West Coast required mid-term renegotiation.

2.13 - Despite this mixed history, in January 2010 the Department for Transport issued a paper setting out the case for moving towards longer franchises and proposed a minimum term of 10 years, with options for even longer franchises based on firm investment proposals. The 2011 McNulty Value for Money Study proposed that average franchise lengths should be extended to at least 15 years to reduce transaction costs and to incentivise franchisees to seek cost savings and product innovation more aggressively.

2.14 - The DfT has noted that there is no single ‘right’ franchise length; circumstances of specific franchises will vary. They considered that there were good arguments for keeping well performing operators in place for reasonable periods of time, allowing operators to plan ahead for the long term, making investment in staff training, improvements to stations and trains where the payback can only be achieved over a longer contract term.

2.15 - However, DfT also noted that longer terms would need to be supported by appropriate incentives for continuous improvement and to ensure franchises continued to provide value for money for taxpayers. Although long term franchises would be considered in return for a commitment to additional investment, franchise bids would still be evaluated in relation to an initial franchise term (set at 10 years).

2.16 - These rules were applied to franchise competitions for West Coast (12 years) and Essex Thameside (15 years), but there were exceptions to the pattern, with Greater Anglia let for just over 2 years (before the recent direct award).

2.17 - In October 2012, the Government announced a further review of the franchising process following a successful challenge to the West Coast franchise bid evaluation and assessment process. The results of the Brown review (published January 2013) saw a substantial revision to the franchising timetable, to allow a focus on 3 to 4 competitions each year. The review also recommended that future franchises should normally have a 7 to 10 year initial term with a pre-contracted continuation, with a 3-5 year extension being subject to meeting agreed franchise criteria.

2.18 - It is also worth noting that DfT policy is shifting towards transferring responsibility for sourcing rolling stock for rail franchises to the TOCs. Recent franchise ITTs have required bidders to identify and propose rolling stock solutions where these are not already covered by Section 54 provisions. As a consequence of this “hands-off” approach, the DfT has made no further updates to the Rolling Stock Plan that it published in 2008.

Train Operating Companies

2.19 - There are currently 23 train operating companies that serve the UK and these are summarised in Table 2.1. Note that four of these operators have not been included by SDG in this analysis as they are not subject to DfT’s rail franchising policy and are regulated separately by ORR, these being Eurostar, First Hull Trains, Grand Central and Heathrow Express.

2.20 - Eurostar is a private joint venture that operates high speed international train services between London/Brussels/Paris, the Alps and Rhone Valley; First Hull Trains is an open access operator providing through trains between London Kings Cross and Hull; Grand Central is an open access operator which provides direct services between London Kings Cross and Sunderland and Bradford; and Heathrow Express operates dedicated services between London Paddington and Heathrow Airport.

Table 2.1 UK Train Operating Companies

Operator	Code	Service Overview
Abellio Greater Anglia	GRA -	Abellio Greater Anglia operates main line trains between London, Colchester, Ipswich and Norwich and local trains across Norfolk, Suffolk and parts of Cambridgeshire.
Arriva Trains Wales	ATW -	Arriva Trains Wales operates a mix of long distance, regional and local services in Wales, including the Valley Lines network of services around Cardiff, and also in the English border counties and to Manchester, Liverpool and Birmingham.
c2c	C2C -	c2c operates an intensive, mainly commuter, service into London Fenchurch Street from south east Essex.
Chiltern Railways	CHI -	Chiltern Railways operates passenger train services throughout the M40 corridor between Birmingham and London. Their passengers are a mix of commuters, business and leisure travellers.
CrossCountry	ACC -	CrossCountry operates a network of long distance services between Scotland and the North East England through to the South West of England and Bournemouth. Services also operate between Birmingham-Leicester-Stansted Airport, and Cardiff-Birmingham-Nottingham.

Operator	Code	Service Overview
East Coast[1]	ECM	East Coast operates long distance train services along the East Coast Main Line, linking London King's Cross, the East Midlands, Yorkshire and Lincolnshire, North East England and Scotland.
East Midlands Trains	EMT	East Midlands Trains operates train services between London, the East Midlands and Yorkshire (Leicester, Nottingham, Derby, Sheffield, and Leeds) and central England services groups linking Nottingham, Derby, Worksop, Lincoln, Cleethorpes, Skegness, Leicester and Cambridge.
First Capital Connect	FCC	First Capital Connect operates train services between London King's Cross and Peterborough, Cambridge and King's Lynn; and services between Moorgate and Herefordshire and Cambridge. Train services also run between Bedford and Brighton; and Luton, St Albans, Sutton and the Wimbledon loop.
First Great Western	FGR	First Great Western operates intercity and local services linking London Paddington, South Wales, the Cotswolds and the West Country, and also operates the London Paddington to Penzance sleeper service.
First ScotRail[2]	FSR	First ScotRail provides 95% of all passenger rail services within Scotland and has services to Carlisle and Newcastle, as well as operating the Caledonian Sleeper service from London Euston to Edinburgh, Glasgow, Fort William, Inverness, and Aberdeen.
First TransPennine Express	TPE	First TransPennine Express operates predominantly long distance services linking major centres of population across both North East and North West England.
London Midland	LOM	London Midland operates express services between London Euston, Milton Keynes and Birmingham New Street (via Northampton).
London Overground	LRL	London Overground operates services between Richmond and Stratford via Willesden Junction, together with the Willesden Junction/Clapham Junction and Gospel Oak/Barking lines.
Merseyrail	MER	Merseyrail provides services between Liverpool and Southport, Ormskirk, Kirby, Hunts Cross, New Brighton, West Kirby, Chester and Ellesmere Port.
Northern	NOR	Northern operates a range of inter-urban, commuter and rural services throughout the North of England.
Southeastern	SEN	Southeastern operates all the services in the south east London suburbs, the whole of Kent and part of Sussex, which are primarily commuter services to/from central London, and also domestic high speed services along HS1.
Southern	SOU	Southern operates predominantly commuter services between London, Surrey and Sussex, as well as services to Gatwick and Brighton, and South Coast services.
South West Trains	SWT	South West Trains operates trains from London Waterloo to Woking, Basingstoke, Southampton, Portsmouth, Exeter, Reading, and Bournemouth.
Virgin Trains West Coast	VWC	Virgin Trains operates services between Glasgow, North West England, North Wales, the West Midlands and London, and also between Birmingham and Glasgow/ Edinburgh.

[1] East Coast will be operated by Virgin Trains East Coast from 1st March 2015

[2] Abellio will operate the ScotRail franchise from 1st April 2015. The Caledonian Sleeper service has been split from ScotRail and will be operated by Serco Caledonian Sleeper from 1st April 2015

3 - Rolling Stock Costs

Introduction

3.1 - As recommended by the Rail Value for Money study, ORR is now developing an improved understanding within the industry, and amongst the public, of the costs associated with rolling stock operation and the extent to which TOCs can manage these costs.

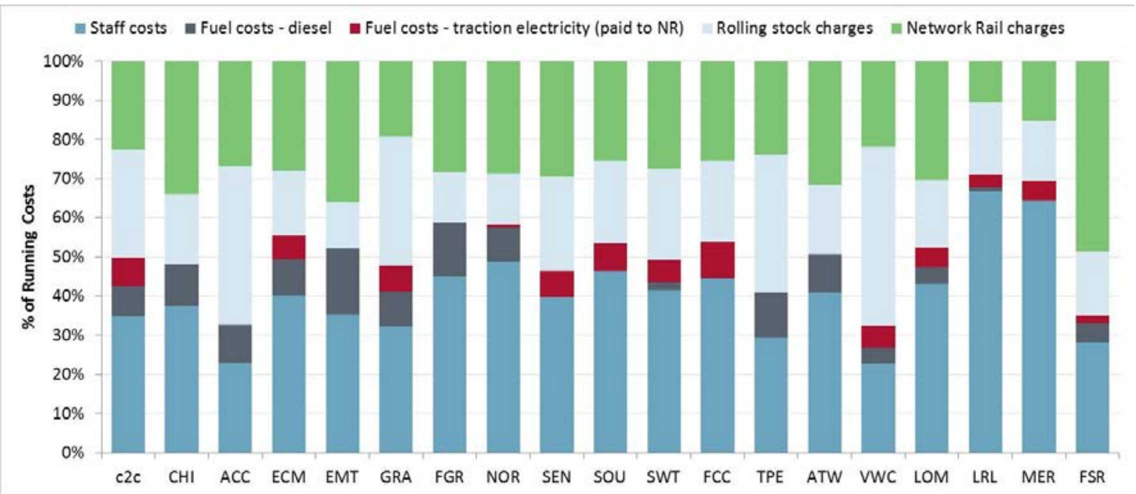
3.2 - For the purpose of this study, SDG has identified the a number of cost elements associated with the operation of rolling stock, these elements are as follows:

- Rolling stock leases;
- Maintenance obligations;
- Staff
- Track access;
- Energy consumption for traction;

Relative Impact of Cost Elements

3.3 - The proportion by which each cost element makes up an Operator's total cost was assessed by SDG, based on the use of the ORR's GB Rail Industry Financials data, and which contains financial data from train operators, Network Rail and governments. The relative impact of each of these cost elements on the total cost seen by operators are shown in Figure 1 below.

Figure 1 Rolling Stock Costs as a Percentage of Total Cost



Leases

Rolling Stock Leases

3.4 - There are two principal lease arrangements for capital investments: finance leasing and operating leasing.

3.5 - A Finance Lease is essentially a "loan" of the cost of the asset, with the acquisition cost spread across the economic life of the asset in monthly payments. The financial commitment by the lessee means that the cost of the asset is included on their balance sheet. This arrangement is best suited to equipment with a relatively short life, such as depot equipment, since financing a new train over a period of 7 years, say, would be very expensive. However, finance lease arrangements have been used by Transport for London for rolling stock used by the London Overground concession.

3.6 - An Operating Lease model applies to the vast majority of National Rail rolling stock, since most franchises at 7 to 12 years are substantially shorter than a train life of typically 30 to 35 years. The basis of operating leasing is that the owner of the asset (the Lessor) allows another party (The Lessee) to use its asset for a specified period, and not more than two-thirds of the life of the asset being leased, receiving rental payments is return. The Lessor, therefore, takes a substantial risk on the future value of the asset – known as Residual Value Risk.

3.7 - Operating leasing is reliant on being able to make a reasonably accurate assessment of residual value, and for this reason is most suitable for assets with a predictable economic life and (ideally) a predictable future value. However, unlike the aircraft market, there are very few secondary market transactions to provide an independent benchmark.

3.8 - Capital lease charges (the "rental" payments) remunerate the Lessor for its investment in the rolling stock and have traditionally been calculated on the basis of what the train was expected to earn over its economic life (i.e. the potential earning power of the assets).

Lease Arrangements

3.9 - Dry leases place all the maintenance responsibility (without exception) on the lessee operator. The lessee takes the risk of procuring the maintenance and variation in cost. This type of lease is favoured for newer stock, where the lessee will then usually sub-contract the maintenance to the train manufacturer through a Train Service Agreement (TSA).

3.10 - For a dry lease without a TSA, ROSCOs typically require a Maintenance Reserve payment to ensure that the cost of maintenance due relating to the use of the asset is fully recovered during the lease period, which helps ensure a fair share of costs between successive lessees and avoids the ROSCO exposure to costs for work due but not performed.

3.11 - Wet leases place all the maintenance responsibility (without exception) on the Lessor, providing a full maintenance package for the rolling stock. The lessee operator pays a Non-Capital rent to the lessor, who takes the risk of procuring the maintenance and variation in cost.

3.12 - Soggy leases include elements of maintenance activity – typically where the ROSCO has responsibility for heavy maintenance and midlife overhauls, including the specification of work and choice of provider. The lessee pays a fixed amount each month, as a Non-Capital rental, in order to smooth their cash flow and avoids the risk of cost over runs. The operator retains responsibility for the day-to-day running maintenance of the trains.

Maintenance

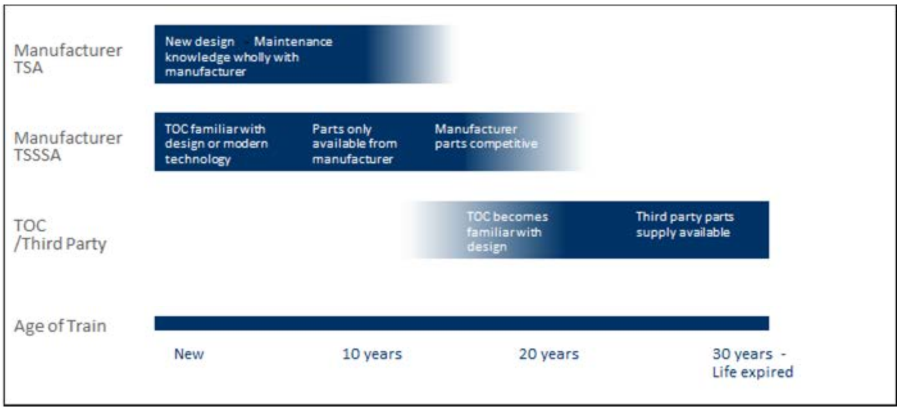
Maintenance Obligations

3.13 - The TOC must put in place a maintenance policy and arrangement in accordance with their Safety Management System (SMS) to ensure that the vehicles continue to remain safe to operate on the rail infrastructure. In the case of older, former British Rail stock, the maintenance schedule is based on historic experience and practices evolved through reliability improvement programmes whilst that for newer trains is based on the OEM requirements to comply with safety and warranty arrangements.

3.14 - The obligations to deliver maintenance are defined in the lease agreement. There are high levels of engagement with passenger operators with regular meetings, ROSCO engineer visits to perform periodic asset condition inspections and audit maintenance documentation to ensure compliance during the period of the lease. Permission is required from the owning ROSCOs for any proposed deviation from the specified regime to protect asset value (this also applies to any equipment proposed to be fitted or removed from the vehicles).

3.15 - The majority of new build rolling stock is initially procured on the basis of a design-build-maintain contract, where the manufacturer provides on-going maintenance under a Train Supply Agreement (TSA). The TSA will cover both light and heavy maintenance activity and can be viewed as providing as a perpetual warranty. This arrangement is suitable where detailed knowledge of the train design and systems is limited to the manufacturer. However, the arrangement is relatively expensive, and as the TOC acquires greater knowledge of the stock, alternative maintenance strategies can be employed.

Figure 2 Train Maintenance Arrangements



3.16 - The procurement agreement will also provide for a Technical Support & Spares Supply Agreement (TSSSA) which provides the TOC with access to a list of critical parts from the manufacturer and updates of train control software, enabling them to assume control of maintenance. As the units increase in age, the reliance on manufacturers is likely to decline, and accredited third party parts are likely to become available.

Staff

Depots

3.17 - The ownership of depots is split between Network Rail, operators and train manufacturers. With the majority of new build rolling stock being procured on the basis of a design-build-maintain contract, where the manufacturer provides on-going maintenance, the manufacturer now often takes responsibility for designing and specifying the depot facilities. In some cases existing depots are taken over and modernised to accommodate the new rolling stock and provide suitable facilities to provide efficient maintenance. However, there are also examples where new manufacturer-specified and procured depots have been contracted.

Cleaning

3.18 - There are a number of different levels of train cleaning ranging from litter picking activities, in some cases done on a service-by-service basis, through end-of-day / overnight cleaning to periodic heavy cleans, where specific items such as carpets and seat coverings would be specially “deep cleaned”.

Stations

3.19 - Whilst not directly related to rolling stock costs, stations do impact on an operators staff costs and these are then reflected in the costs per vehicle kilometre covered later within this work. Network Rail own and manage a number of stations, with the remainder being managed by the train operator.

Energy

3.20 - Rolling stock operating on UK railways is powered either by electric current drawn from fixed infrastructure, feeding traction motors connected to the wheels, or by diesel fuel, for the engine on-board the vehicle(s).

3.21 - There are two types of electric infrastructure which are used on the main UK rail network: 25kV AC supplied by overhead line or 750V DC supplied via third rail. DC third rail electrification is used exclusively in the former BR Southern Region (routes out of London Cannon Street, Charing Cross, Victoria and Waterloo) as well as the Merseyrail network. All other electrification used by heavy rail operators on the National Rail Network is 25kV AC overhead line.

3.22 - Some trains are capable of running on both types of electrification and these are termed “Dual-Voltage” (DV). In regions where no electrification exists or where there is insufficient electric stock, diesel stock is used. With diesel stock, an engine is used either to power the axles directly (Diesel-Mechanical or Diesel-Hydraulic), or to generate electricity to run electric motors (Diesel-Electric). The majority of diesel stock in the UK is Diesel-Mechanical or Diesel-Hydraulic.

Track Access

3.23 - TOCs must pay a range of access charges in order to access and make use of Network Rail managed infrastructure, as discussed below. Whilst ideally Network Rail would accrue all its required income through train operators and other customers, the reporting and affordability issues this arrangement would present do not make it a practical option. Therefore, a proportion of income is provided directly by government through network grants.

3.24 - The variable usage charge (VUC) is designed to recover infrastructure operations and maintenance costs which vary with traffic, excluding those relating to electrification assets (covered by the Electrification Asset Usage Charge, described below) and network congestion (covered by the Capacity Charge). VUC charges are set by vehicle class, reflecting the variation in track wear and tear caused by different vehicles.

3.25 - The electrification asset usage charge (EAUC) is designed to recover the maintenance and renewal costs of electrification assets, such as overhead lines and third rail infrastructure, that vary with traffic. It is only levied on electric vehicle mileage and costs are disaggregated by AC and DC traction to reflect the fact that these two power distribution systems attract different cost profiles. EAUC for passenger vehicles is charged per vehicle mile

3.26 - Traction electricity for electric train operation is supplied by Network Rail with costs off-charged to TOCs via EC4T (electric current for traction) charges. The majority of EC4T is charged on the basis of modelled electricity consumption rates by service code and vehicle class with a wash-up charge reflecting differences between modelled and outturn costs. Only the modelled consumption rates are regulated, with the TOC taking risk on electricity price movements and any wash-up costs or incomes beyond those assumed in its bid.

3.27 - A capacity charge is designed to reflect costs incurred by NR as traffic increases and capacity on the network is used up. The volume of traffic on the network affects NR's ability to manage secondary delays resulting from operational incidents and hence makes it liable for increased Schedule 8 payments to TOCs. The capacity charge is designed to offset this.

3.28 - The long term charge (LTC) mechanism is designed to recover the maintenance, renewal and repair costs incurred by NR for the stations which it owns (which make up the vast majority of stations on the network). For the majority of stations, where a franchised TOC is station facility owner (SFO), this charge is levied on the SFO TOC, whereas for NR managed stations it is split between the TOCs which use the station. LTC is set separately for each station, to reflect a reasonable expected long run efficient maintenance, repair and renewal spend at the level of the group of stations operated by each SFO, or at each managed station.

3.29 - Where the SFO at an NR-owned station is not Network Rail, other operators using the station pay to the SFO a proportion of the station LTC by way of a secondary access charge, with allocation usually based on proportions of vehicle departures at that station. Hence each TOC will pay LTC to NR, plus secondary LTC to other TOCs whose SFO stations it uses, and will also receive income where other TOCs use its SFO stations.

3.30 - The fixed track access charge (FTAC) is set to recover the residual Network Rail net revenue requirement after accounting for direct network grants, variable access charges, stations access income and other single till income (e.g. commercial property income).

4 - Cost Drivers

Service Type

4.1 - Aside from motive power, rolling stock design varies depending on what type of service it is intended to operate. SDG have broadly split the UK rolling stock portfolio into four types, namely Metro, Commuter / Regional, Intercity, and High Speed. The indicative characteristics for each type of rolling stock are shown in Table 4.1 below. -

Table 4.1 Rolling Stock Characteristics by Service Type

Characteristic	Metro	Commuter / Regional	Intercity	High Speed
Journey Time Provision (minutes)	<30 -	<60 -	60+	60+
Maximum Speed (mph)	75 -	75-110 -	110-125	125+
Acceleration	High -	High -	Medium	Medium
Number of Vehicles	2-10 -	2-5 -	4-11	6+
Number of Doors per Vehicle	4-8 -	4 -	2-4	2-4
Door Configuration	End, 1/3, 2/3 -	End or 1/3, 2/3 -	End	End[3]
Seating Configuration	Low Density / - High Standing -	Medium to High - Density -	Medium to Low Density	Medium to Low Density
Toilets	None -	1-2 per train -	1-2 per vehicle	1-2 per vehicle

Metro

4.2 - This type of rolling stock is generally used on short distance routes catering for the movement of large volumes of passengers, such as on some London commuting routes. Example fleets include the Class 314, Class 378 Capitalstars, and Class 455.

4.3 - The traction system and gearing is generally configured for high frequency stopping services, and as such the vehicles will have high acceleration. Maximum speed is less important as trains are not likely to require the ability to operate above 75mph.

4.4 - Metro vehicle interiors will be configured to maximise the movement of large numbers of passengers, having low-density seating and a large areas of standing space around doorways. Minimising station dwell times – the time which trains are stationary at platforms to allow the ingress/egress of passengers – is very important on metro operations in order to support high frequency services. As a result, vehicles will have a high number of wide opening doors. As

[3] The Class 395 Javelin trains that operate domestic high speed services along HS1 have doors in the 1/3 and 2/3 positions

passengers generally only travel short distances, trains do not generally need to have toilets or any form of on-board catering.

Commuter and Regional

4.5 - This grouping includes a wide variety of stock that is generally more suited to longer distance operations than metro-style vehicles. These operations include longer commuter journeys and regional services. The rolling stock can operate at a variety of speeds, but below 110mph. The vehicles are configured with end doors, but there are some examples where 1/3, 2/3 doors are fitted. Commuter and regional stock will have toilets fitted and the ability to provide a catering service (often through use of an on-board catering trolley). Example fleets include Class 158, Class 350, and Class 450.

Intercity

4.6 - These trains are specifically designed for long distance, high speed services. Intercity rolling stock is generally capable of high speed operation (125mph) but this is not a strict condition. They are more likely to contain a catering provision which is in the form of an on-board restaurant/buffet or a shop. Example fleets include the Class 222, Class 390 Pendolino, and Class 444.

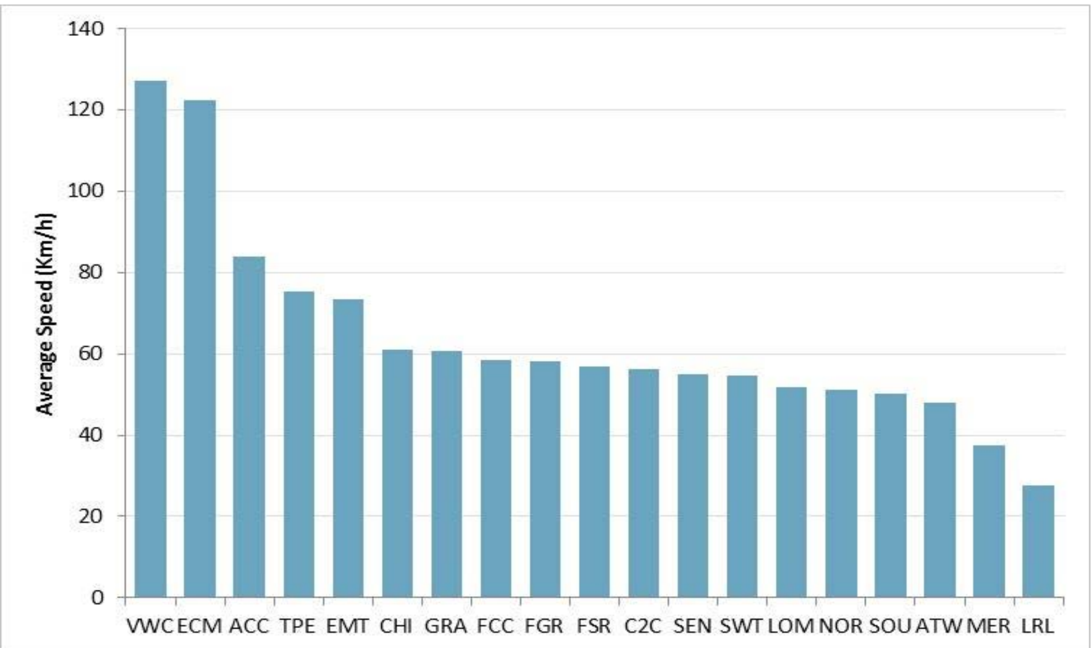
High Speed

4.7 - These trains are capable of >125mph operation. Although several trains on the UK network were designed for such speeds, only one is in domestic passenger operation, the Hitachi-built Class 395 "Javelin" operating on High Speed 1.

Average Speed

4.8 - The services a TOC operates influence the average speed of its trains. Figure 3 shows that VWC and ECM have the highest average speed. This is to be expected given the intercity services they run. MER and LRL run the slowest services on their metro-style routes.

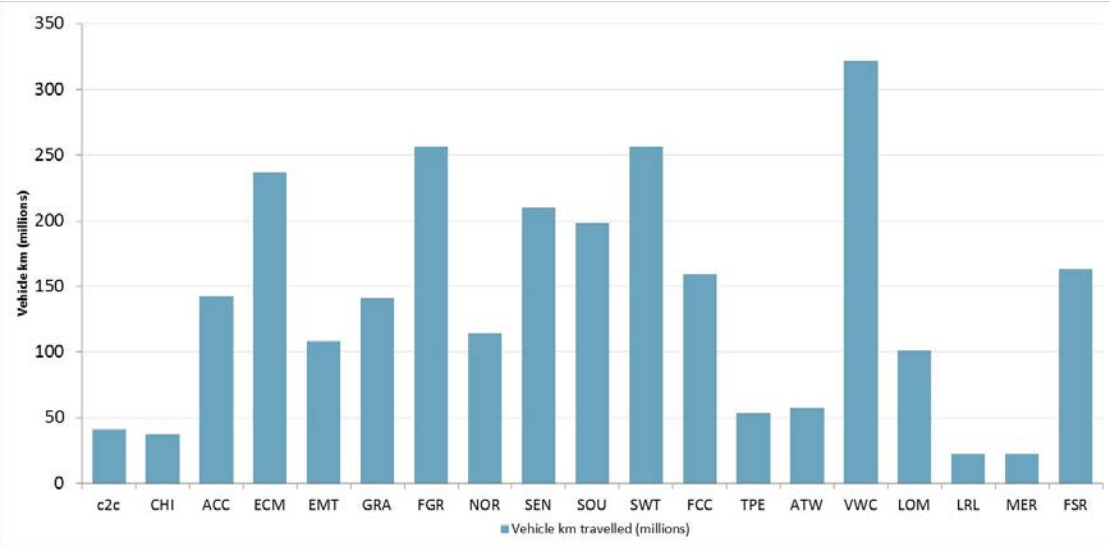
Figure 3: Average Speed by TOC



Vehicle Kilometres

4.9 The absolute distance travelled by rolling stock in a franchise is relevant to its total cost of operation and Figure 4 shows train kilometres by the Operator of each franchise. The franchises with the highest miles are VWC, SWT, FGR and ECM. VWC and ECM both run infrequent long-distance intercity train services, while SWT and FGR run a combination of high-frequency London commuter services and long distance trains to the West Country. Franchises with low vehicle kilometres include c2c, CHI, LRL and MER. All these franchises (with the possible exception of CHI) run small-network commuter/metro services which relatively few vehicles.

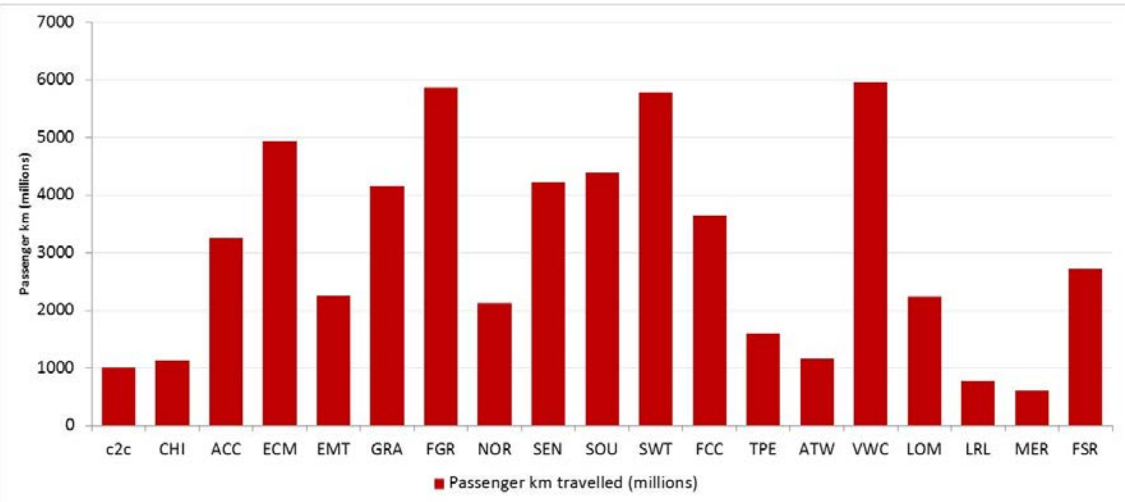
Figure 4 Vehicle Kilometres by Operator



Passenger Kilometres

4.10 - When passenger kilometres are considered, as shown in Figure 5, there is a shift in the trend of results across operators when compared with the train kilometre results. Both NOR and FSR's passenger kilometre results in comparison with other operators are considerably lower. However, FGR and SWT still have amongst the highest results across operators, again reflective of the intensive London Commuter and long distance routes they operate.

Figure 5 Passenger Kilometres by Operator



4.11 - In addition to FGR and SWT, Virgin trains (VWC) and East Coast (ECM) also have high figures for passenger kilometres travelled. This reflects the long distance services that these operators provide, with passenger journey lengths also being relatively high.

4.12 - Although often showing similar characteristics as long-distance operators, VWC has approximately 36% more vehicle miles than ECM (see Figure 4 above). This could be due to ECM's smaller fleet and less intensive level of service, whereas VWC has nine departures from London Euston per off-peak hour compared to ECM's five departures from King's Cross.

Stations Operated

4.13 - Whilst not directly related to rolling stock costs, stations do impact on an operators staff costs and these are then reflected in the costs per vehicle kilometre covered later within this work. Staff required may include those for ticket halls, cleaning, train dispatch and security. Clearly the greater then number of stations then the greater number of staff may be required. In addition, station footfall and crowding will influence staff numbers as very congested stations will likely require additional platform management staff, to ensure safety.

4.14 - As discussed with the track access costs, a long term charge mechanism exists to recover the maintenance, renewal and repair costs incurred by NR for the stations which it owns. For the majority of stations, where a franchised TOC is station facility owner (SFO), this charge is levied on the SFO TOC, whereas for NR managed stations it is split between the TOCs which use the station.

Train & Vehicle Utilisation

4.15 - In order to consider the efficiency of a rolling stock fleet, SDG considered that the train utilisation could be assessed across each operator. This measure looks at the total passenger miles divided by the total train miles, effectively giving an average value of how many passengers are carried for each mile a train travels.

4.16 - As shown in Figure 6 below, ECM has the highest train utilisation, suggesting that on average it has a high number of passengers for each train movement. However, East Coast typically runs very high-capacity trains. For example, a train with a seating capacity of 500 and 100 on board passengers travelling for 10 miles would show a utilisation of:

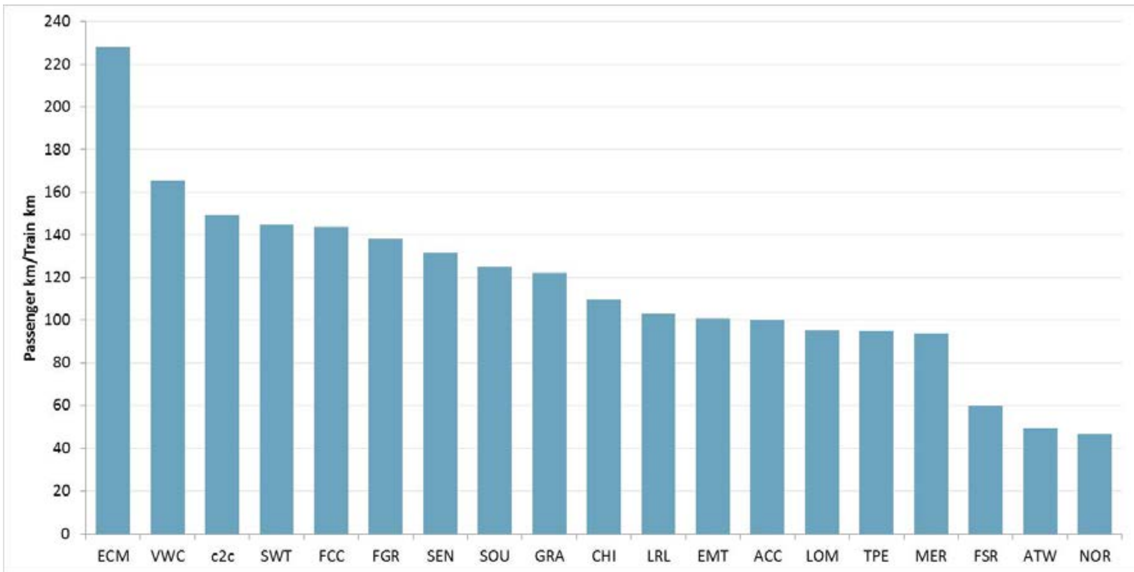
- *Train utilisation = (100 passengers x 10 miles) / 10 train miles = 100; and*
- *Train loading = (100 passengers / 500 seat capacity) = 20%.*

4.17 - In comparison, a smaller train with a seating capacity of only 100 and carrying a total of 75 passengers for 10 miles would have a utilisation of:

- *Train utilisation = (75 passengers x 10 miles) / 10 train miles = 75*;
- *Train loading = (75 passengers / 100 seat capacity) = 75%*.

4.18 - Thus, the above train utilisation measures can favour high capacity trains that actually have a relatively low loading and, therefore, this metric should be treated with caution if used for the purpose of operator-to-operator efficiency comparisons.

Figure 6 Train Utilisation by Operator



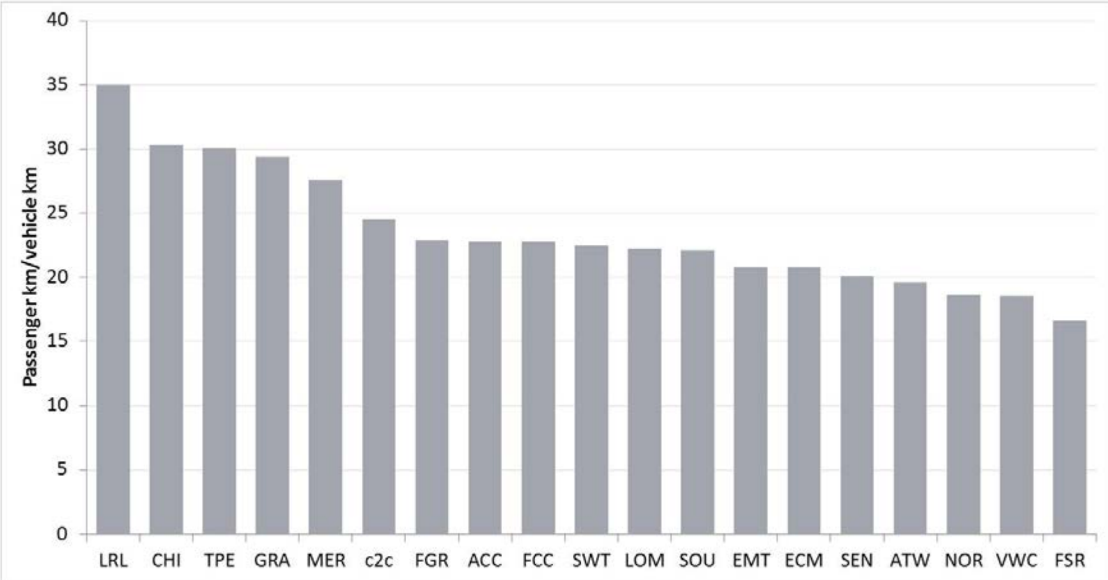
4.19 - Another theme that is drawn out from Figure 6 is the fact that FSR, ATW, and NOR have the lowest train utilisation figures by operator. This reflects the fact that relatively few passengers are travelling in comparison to the total number of trains miles travelled. All three operators run services on regional, commuter, and rural routes. Each of these franchises also receives government support, in the form of a subsidy, as fare-box revenues are not sufficient to cover the costs of their operation.

4.20 - At the other end of the scale, ECM, VWC, C2C, SWT, FCC and FGR are all operators who do not receive any form of government subsidy and instead pay a premium for running the service[4]. Their higher train utilisation figures are representative of the fact that these are more heavily used railways and on routes which are perhaps more aligned to passenger needs (i.e. train services are provided where there is a strong correlation with passenger demand).

4.21 - In addition to train utilisation, SDG has considered as an alternative metric vehicle utilisation, i.e. passenger kilometres travelled per vehicle kilometre travelled. This measure, in SDG's view gives a more accurate picture of how loaded an average service, with the results shown in Figure 7 below. It should be noted that whilst this metric does not completely account for the different numbers of seats per train, overall the relative comparison between operators remains valid.

[4] East Coast is currently being run by Directly Operated Railways, the Government's operator of last resort, however, in February 2015 it will be returned to the private sector under a consortium of Stagecoach and Virgin Holdings.

Figure 7 Vehicle Utilisation by Operator



4.22 - Using vehicle utilisation as the metric for comparison, LRL has the highest utilisation figure due to their use of high-capacity, metro-style rolling stock. Much of this stock is specifically designed to maximise standing room at the expense of seating capacity.

4.23 - There is a noticeable trend of low average vehicle numbers per train and high vehicle utilisation, suggesting the operation of highly-loaded, but short-formation trains is beneficial. As vehicles per train increases, the vehicle utilisation tends to fall, with long distance operators (such as VWC and ECM) showing low vehicle utilisation on its long-formation trains. This is likely a function of the relatively low capacity per carriage on intercity trains, as passengers are given larger seats and greater legroom for comfort commensurate with the time they are likely to spend on the train.

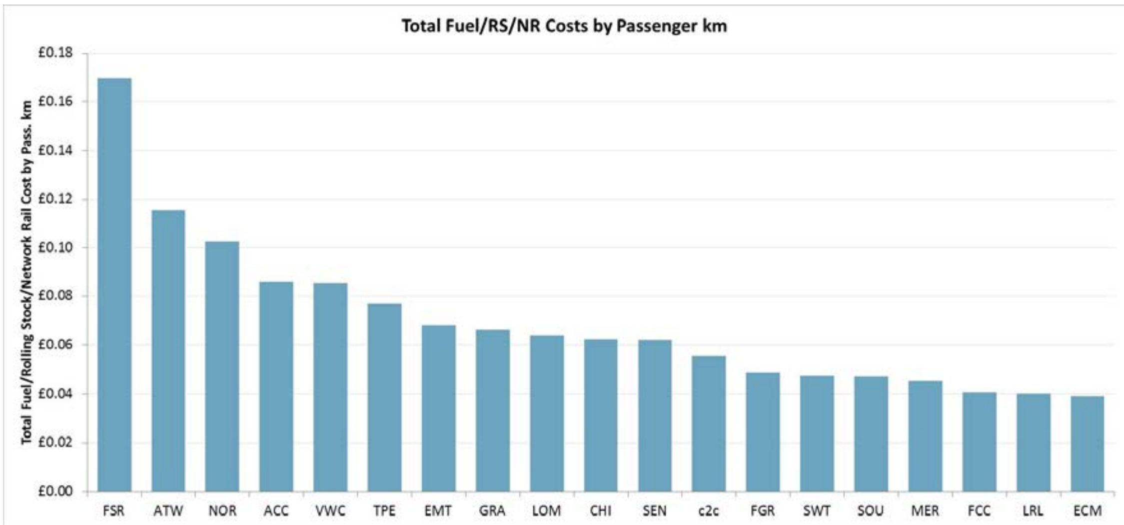
4.24 - Finally, some operators show low utilisation on short formations, namely ATW, NOR, FSR, and to some extent LOM and EMT. This low loading may reflect the rural and community routes that these operators run.

4.25 - At the first review, a low loading per vehicle suggests that additional cost may be incurred to run services without large revenue-earning potential (i.e. few passengers). Operators would therefore reduce the number of vehicles they run or reduce the level of service. The operator would then maximise the number of people per vehicle to reduce costs.

4.26 - The reality is much more complex, as operators are under obligations to run a certain level of service and keep loadings at a reasonable level to prevent passenger discomfort. In addition, operators are also obligated to run specific vehicles, for example, Intercity operators would not be allowed to run metro-style vehicles on their services, which further constrains efforts to normalise vehicle utilisation across operators.

4.27 - As shown in Figure 8, total rolling stock-related costs are much higher per passenger kilometre on services with low loadings on short formation trains. Noticeably, LRL shows very low cost per passenger kilometre as it carries a large number of passengers on its short formation trains. East Coast also shows very low costs per passenger km, despite having reasonably low vehicle utilisation, which may imply that its long formation trains are not unduly costly to run at their current loadings.

Figure 8 Rolling Stock Costs per Passenger Kilometer



4.28 - The number and length of non-passenger movements will also influence rolling stock costs. These include:

- Movements to/from a depot/sidings for maintenance and overnight stabling;
- Movements to/from a depot/sidings for stabling during the day (for example commuter TOCs stable excess stock during the off peak and bring them back into use in the peaks);
- "Bounce-back" movements (when a peak time service runs to or from the attractor terminal empty, so that it can make a second peak trip. Running the train empty saves time in terms of dwells at intermediate stations but sacrifices collecting any contra-peak demand).

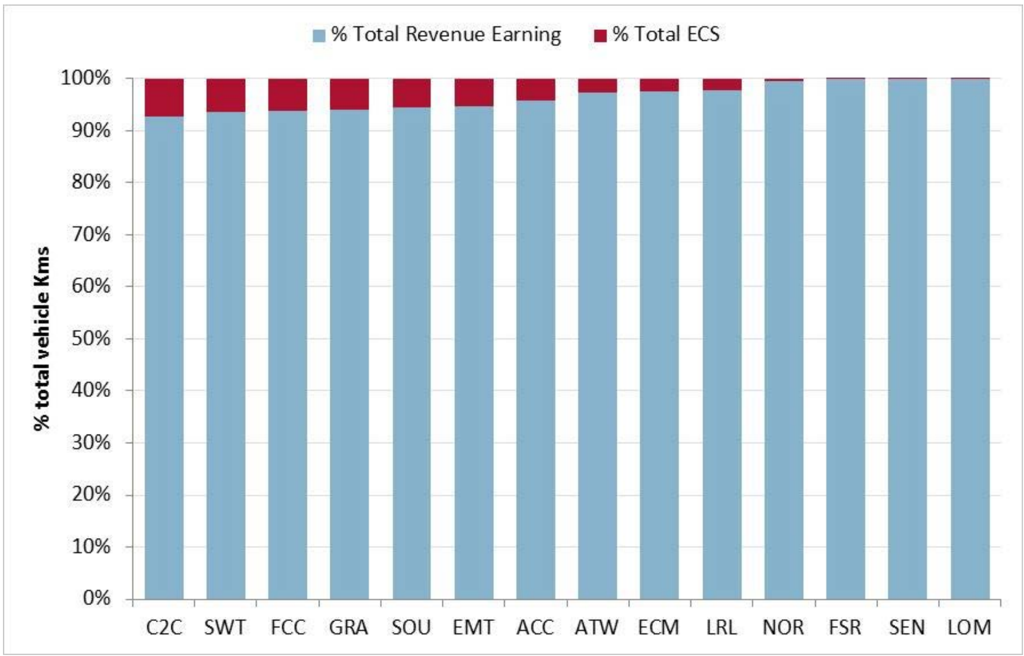
4.29 - A franchise with long distance operations and depots close to terminal stations may be able to reduce the length of Empty Coaching Stock (ECS) movements than an operator which has more dispersed and varied operations, who may have to stable rolling stock further from terminal stations and depots.

4.30 - The placement and capacity of depots have largely been set by history, with the currents TOCs having limited options available as to where to reasonably maintain and stable their rolling stock. However, the introduction of new rolling stock, which is often accompanied with the introduction of a manufacturer specified, purpose-built depot may provide operators with some control over the placement of its maintenance facilities.

4.31 - Figure 9 below shows the 2012/13 total vehicle mileage by operator, split by passenger vehicle miles (revenue-earning) and ECS miles. The five TOCs with the highest percentage of ECS movements are all London Commuter operations, with C2C running the most (7.4%)[5].

[5] Not all TOCs reported ECS mileage separately so they have been excluded from this analysis

Figure 9. Empty Coaching Stock Movements by Operator



4.32 - C2C generally runs some bounce-back moves to stations such as Laindon and Stanford-le-hope which will contribute to a large amount of ECS mileage. In addition, C2C's depot at East Ham is 6m50ch from London Fenchurch Street. As C2C stables stock there during the daytime off-peak, this represents a significant amount of empty mileage for the movement and storage of stock before they are brought back to Fenchurch Street for the evening peak.

4.33 - The operator with the second highest ECS percentage, SWT, operates bounce-back movements as far as Basingstoke and also stables a large amount of stock at Clapham Yard and Wimbledon (3 miles 74 chains and 6 miles 64 chains respectively); these movements would all contribute to its high ECS percentage.

4.34 - Despite being a largely commuter operator, London Midland (LOM) has relatively few ECS movements. It only operates a few bounce-back movements and is able to stable its stock at Camden Carriage Sidings, which is only 1 mile 10 chains from London Euston.

Reliability

4.35 - In order to deliver the requirements of the franchise in terms of train services, operators will need to put a minimum number of trains in service every day. To mitigate the risks of not having enough trains available to run this minimum service requirement, operators will typically lease additional rolling stock. This provides a surplus that can be used to replace trains that have faults or that are required to be taken out of service for routine maintenance.

4.36 - There is no specific formulae for calculating how many surplus units are required to be kept in reserve and the actual number will depend on how many units are in the fleet as a whole (in order to cover units that are taken out of service at regular intervals for planned maintenance)

4.37 - A fleet that has higher levels of reliability means that the operator may be able to lease only the required additional rolling stock to cover routine maintenance. If this is the case, then the operator has the ability to control to an extent the leasing costs for its rolling stock. Conversely, a fleet with poor reliability may mean that the operator needs to lease additional rolling stock to ensure that it can meet the daily service requirements of its franchise.

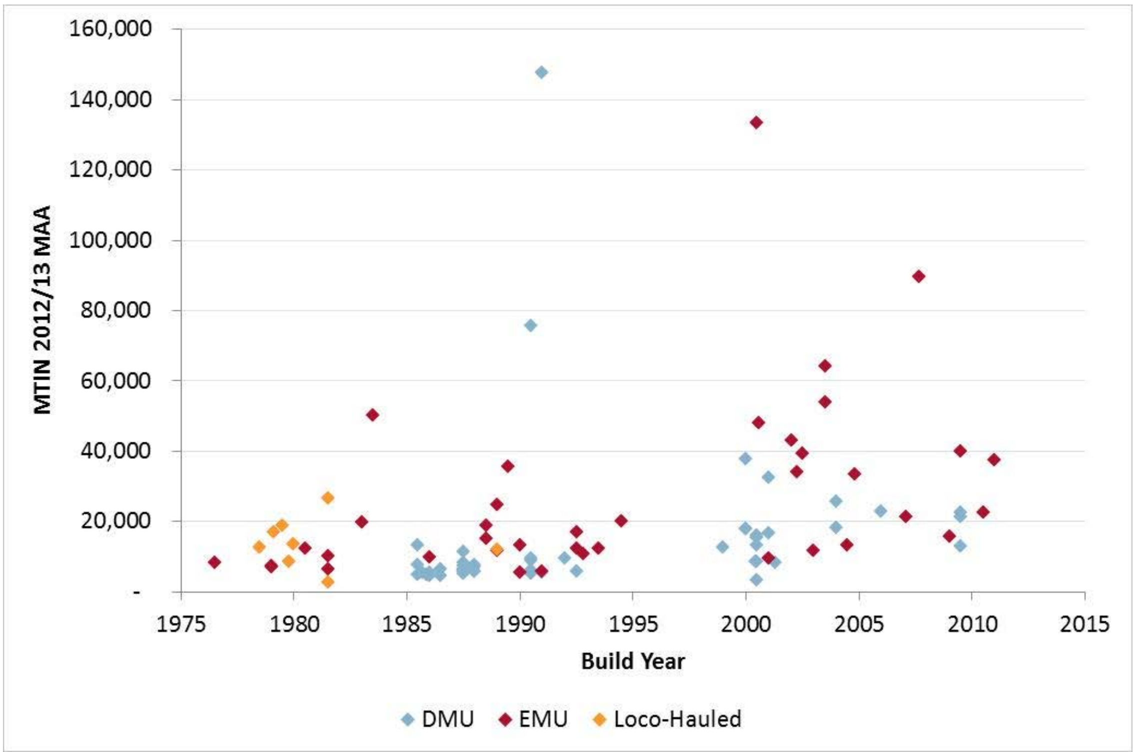
4.38 - As an example, with a fleet of 10 EMUs it would be reasonable to expect that 8-9 units are diagrammed on daily services, keeping 1 or 2 units (10-20% of the total fleet) in reserve at any given time for maintenance or management of faults. With a fleet of 20 EMUs, it may be possible to operate services whilst keeping 2-3 units in reserve (10-15% of the fleet).

4.39 - Fleet reliability depends on many factors and it can often be quite complicated to identify specific issues or factors that influence it, for example technical, operational and cultural issues may all have an influence in varying degrees. Factors such as the service requirements on operators and the penalties for missing services or running short formations may also influence the relative importance and focus that is placed on reliability.

4.40 - The MTIN figures across the UK fleet show a weak trend toward older stock being less reliable than newer stock (see Figure 10). Also from this chart, it can be seen that there is a noticeable gap in rolling stock orders between 1994 and 2000, which represents the start of privatisation and established of the ROSCOs.

4.41 - With the period around privatisation in mind, there is some indication of a split in the trend of reliability between pre- and post-privatisation procurement. Rolling stock introduced during privatisation appears to have a wider variation in terms of reliability figures, while pre-privatisation stock is more closely grouped. This may be due in part to the similar designs of stock pre-privatisation stock and the fact that their reliability has stabilised to what are considered acceptable values (for example the trade-off between managing reliability and costs to acceptable levels). However, the figures suggest that post-privatisation rolling stock is generally more reliable, once entered into service and fully operational.

Figure 10 MTIN Versus Rolling Stock Build Year



4.42 - Throughout the 1980s and 1990s, much of the EMU and DMU builds at the time were based on Mark III carriages and associated designs. More recently, designs have been influenced by each individual manufacturers' platform, for example Alstom's Coradia/Juniper, Bombardier's Electrostar/Turbostar and Siemens' Desiro.

Diversity of fleet

4.43 - In addition to total vehicle numbers, the diversity of a TOC's fleet will affect rolling stock costs in relation to the expected maintenance, staff and leasing costs.

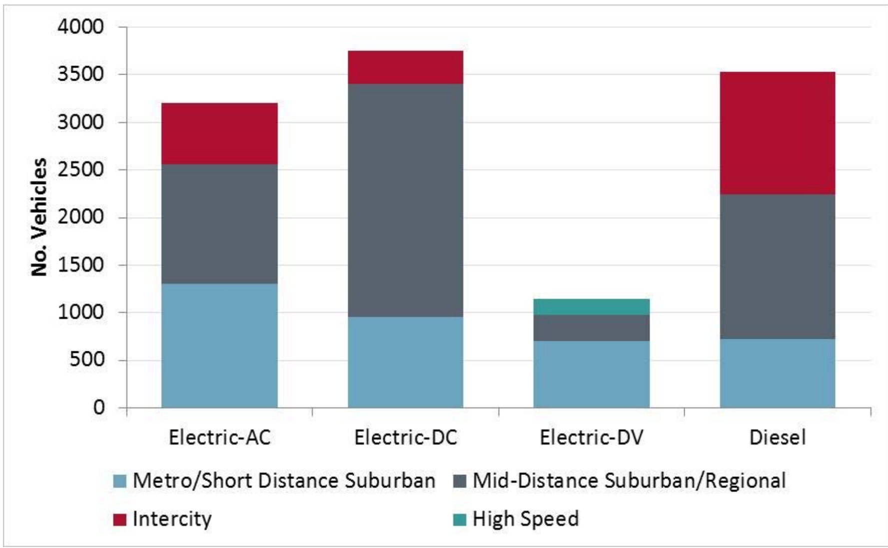
4.44 - Different rolling stock classes may require different maintenance regimes and facilities as well as the need for staff to be trained to operate with different equipment. Technical support would potentially be needed for each stock type as well as spares and equipment specific to each fleet. This added level of complexity and management would be expected to increase TOCs costs of fleet operation.

4.45 - Whilst a common fleet type would be expected to be more efficient for a TOC to operate and manage, thereby reducing costs, if vehicles are sourced from more than one leasing company then differences in vehicle configuration may give rise to differences in maintenance regimes and leasing costs.

Traction Type

4.46 - Approximately 40% of the British rail network (measured in track miles) is currently electrified. Of this two-thirds is equipped with overhead line alternating current electrification (25kV AC), whilst the remainder of the system is predominantly third rail direct current electrification (750V DC) with some small local systems.[6]

Figure 11 UK Fleet Composition by Traction Type



4.47 - The type of service that Rolling Stock operates can influence costs in a number of ways. The frequency of stops that a vehicle makes will influence its energy consumption, as more stops will results in more energy being used to regain speed (this may be offset somewhat by regenerative braking, if installed). High Speed and Intercity vehicles must overcome greater drag than slower speed counterparts. If catering is present on a train, this will result in additional staff costs. Likewise, a more comfortable interior and toilets (such as seen on intercity services) will likely be more difficult to clean than more basic interiors.

[6] Network Rail (2009) *Network RUS Electrification.*[online] Available at:< http://www.networkrail.co.uk/ networkrus_electrification.pdf > [Accessed: 17/11/14]

Diesel Traction

4.48 - Diesel traction provides a versatile type of rolling stock since with self-contained motive power, carrying diesel fuel on board to supply an internal combustion engine that either generates motive power through direct mechanical or hydraulic drive, or drives an alternator generating power for traction motors.

4.49 - As DMUs are not reliant on the infrastructure for a source of power, there are examples where they have been deployed on less intensely operated parts of the national Network, where the capital cost of implementing electrification infrastructure has been considered prohibitive. In this sense, DMUs have advantages in terms of their ability to operate over virtually the entire national infrastructure, including lines which are already electrified.

4.50 - DMUs, however, have their disadvantages as they tend to be heavier than electric rolling stock, making them more costly to operate. The requirement to carry fuel on board can increase the vehicle mass by up to 2,000 kg for a typical DMU.

4.51 - DMUs require more frequent maintenance that EMUs, which typically leads to higher overall maintenance costs than equivalent rolling stock with electric traction. Additionally, they generally tend to have lower levels of reliability, as shown in Table 4.2.

Table 4.2 Miles per Technical Incident (ATOC, 2012)

ATOC Fleet Group	Average Miles per Technical Incident (MTIN Period 12, 2011)	Average MTIN MAA (Period 12, 2011)
New EMU	26,906	23,313
Midlife EMU	11,980	11,078
New DMU	10,272	10,015
Super Sprinter DMU	6,176	5,360
Sprinter DMU	4,559	5,172
Pacer DMU	4,561	3,967
Intercity Trainset	11,978	11,495

4.52 - The relatively high maintenance costs and poor reliability of DMUs are two reasons why electric traction is becoming increasingly more popular with operators (where the Network allows this form of traction within their franchised routes).

Electric Traction

4.53 - DC supply is advantageous with modern power electronic traction control due to the compact size and weight of chopper and inverter drives (elements of the on-train electric traction equipment). For light rail systems using 1.5 kV DC, overhead catenary is normally used, but in the United Kingdom 750 V DC systems operate exclusively on third rail electrification.

4.54 - One of the main drawbacks when using DC traction systems is the fact that electrical energy from power stations, or similar, is universally generated and supplied by electricity companies in the form of alternating current. This will require the railway system to first provide an AC power distribution network, which will then feed into the DC system following conversion. This added level of complexity can increase the capital cost of certain elements of DC systems compared to AC systems.

4.55 - One advantage of AC motors is that they are more compact than DC motors, which makes them easier to package in modern low floor railway vehicles.

Traction Energy Consumption

4.56 - The overall energy consumption of rolling stock depends on a number of factors[7] including:

- Inertia and grade resistance (on the lines operated);
- Air resistance;
- Comfort functions (such as on-board heating and air conditioning); and
- Efficiency losses.

4.57 - Most notably in the case of higher-speed trains, air resistance is proportional to the square of the train speed. This means that as trains travel faster, dependant on the aerodynamic efficiency of the vehicle, the energy required to overcome drag can increase significantly. Thus, trains travelling on high speed routes would be expected to consume more energy than, slower services.

4.58 - The energy lost during the voltage change processes and during the transmission of the energy from the power station to the train is proportional to the energy that reaches the locomotive, and the loss coefficient depends on the train's operating voltage (higher voltage means fewer losses), and also on the electrification characteristics (cross-section of the conductors, distance between substations, etc.).

4.59 - As an example, in Spain the high speed lines are electrified at 25 kV AC and conventional lines at 3 kV DC. The higher voltage means fewer electrical losses during the transformation and transmission processes. It has been shown that the additional amount of electricity that has to be produced, on top of the amount consumed by the pantograph, is 22.6 % for trains operating at 3,000 V DC and 8.8% if the trains operate at 25 kV AC[8].

4.60 - The capital cost of the electrification infrastructure also varies considerably between AC and DC systems. For example, in Sydney Australia the 1.5 kV DC rail system requires a substation every 1.5 km, whereas their 25 kV AC rail system requires a substation every 25 to 35 km.

Traction Distribution

4.61 - Rolling stock in the UK is generally formed into semi-fixed length units with distributed traction (multiple units) or unpowered coaches pulled by a powered locomotive (loco-hauled). There is some ambiguity with regards to high speed trains (Intercity 125s)[9], which are sometimes considered Multiple Units due to their semi-fixed formation. However, for the purposes of the below discussion SDG has treated HSTs as loco-hauled stock. As shown in Figure 12, the majority of vehicles on the UK network are multiple-units. Loco-hauled services are generally found on intercity routes (such as the East Coast Mainline, Great Western

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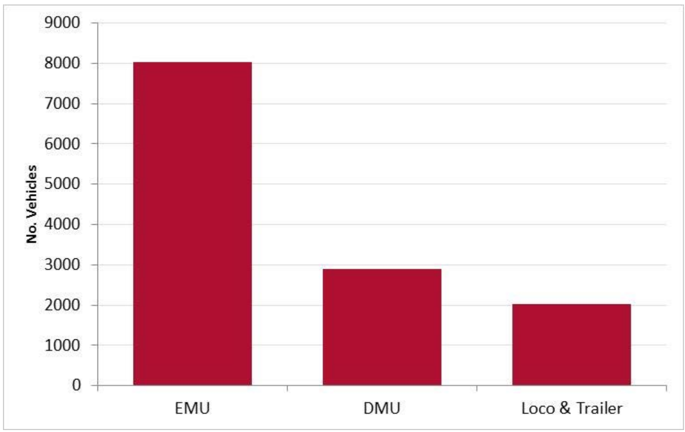
[7] Network Rail (no date) *Comparing Environmental Impact of Conventional and High-Speed Rail*. [pdf] Available at: <http://www.networkrail.co.uk/5878_Comparingenvironmentalimpactofconventionalandhighspeedrail.pdf> [Accessed: 06/11/14]

[8] UIC Report, *High Speed, Energy Consumption and Emissions*, 21 December 2010

[9] HST/IC125: This is a trainset first introduced to the UK in the late 1970s. Each set consists of two Class 43 locomotives operating in a push-pull formation with a semi-fixed rake of Mk.3 coaches (usually 7-9).

Mainline and Midland Mainline), though there are some examples of shorter distance use of loco-hauled services due to stock shortages (e.g. the Fife Circle)[10].

Figure 12 UK Fleet Split by Rolling Stock Type

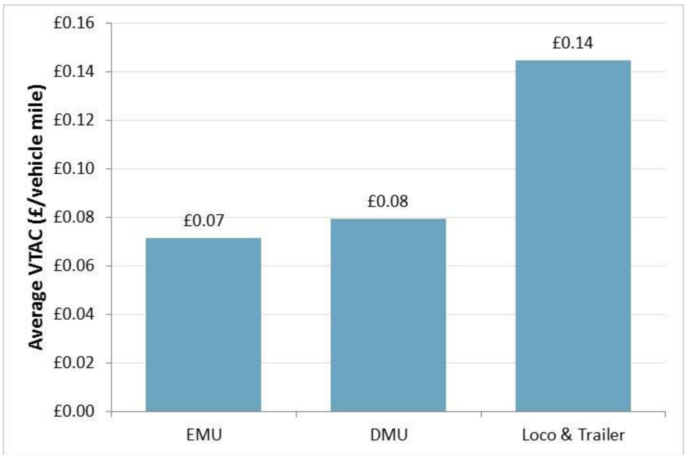


4.62 - Locomotives and their coaches are, on average, older than EMU and DMU counterparts. While new locomotives (e.g. class 67s) are occasionally used on passenger services, there have been no new passenger coaches since Mk.4 coaches were introduced on the East Coast Mainline in the early 1990s.

4.63 - EMUs, however, are being procured with a greater frequency in order to support the electrification of existing lines. Additionally, the IEP stock which should replace the Mk.4s and HSTs on the East Coast will be EMUs. IEPs will also be deployed on the Great Western Mainline (replacing HSTs), while loco-hauled trains have already been replaced by Pendolinos (EMU) and Voyagers (DEMU) on the West Coast Mainline.

4.64 - Use of Network Rail Infrastructure by train and freight operating companies is subject to a Variable Usage Charge (VUC), designed to compensate Network Rail for infrastructure maintenance and renewal costs which vary with use. Figure 13 shows the VUC costs associated with EMU, DMU and loco-hauled services.

Figure 13 Average VTAC per Vehicle Mile by Stock Type



[10] ScotRail (2011) *ScotRail introduces further loco hauled train*. [online] Available at: <http://www.scotrail.co.uk/content/scotrail-introduces-further-loco-hauled-train> [Accessed: 07/11/14]

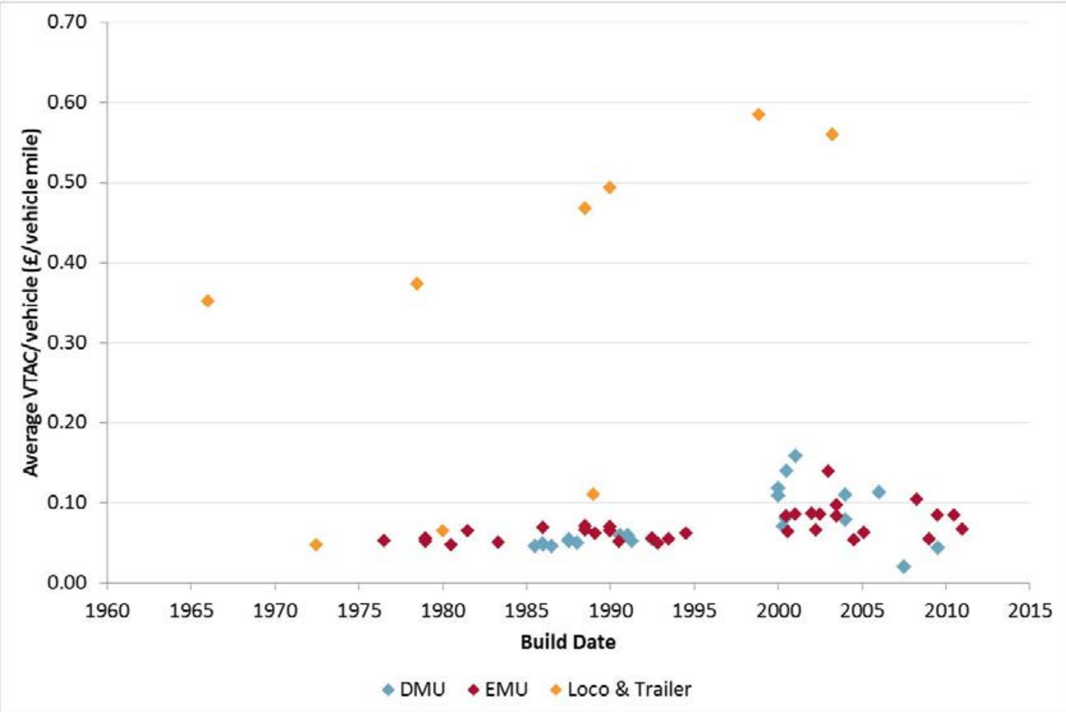
4.65 - In the case of locomotives, where a very large weight is carried over a few axles, the maximum weight applied to the tracks at any point is very high. This is more damaging to the track and therefore the VUC for locomotives are very high.

4.66 - The shift in rolling stock design to distributed traction means that weight is spread more evenly across a unit and its axles, which is less damaging to the track, and therefore, VUC for multiple units tend to be lower. However, there are reasons why this may not always result in a reduction in VUC.

4.67 - As shown in Figure 14, Loco related VUC (represented by the upper cluster of markers) is consistently higher than VUC for multiple units. VUC for EMUs has in some cases been expensive for newer models, suggesting that weight reductions through new technology have been more than offset by increased weight due to additional equipment (e.g. air conditioning and interior enhancements) and enhanced crashworthy structures.

4.68 - VUC for newer DMUs appears to have increased quite markedly post-privatisation, suggesting that greater weight-saving improvements compared with early DMUs has not been possible. This could also be related to the increased power of modern diesel engines, allowing better acceleration and the ability to run more on-board comfort systems (e.g. air conditioning).

Figure 14 VUC Costs by Fleet Type



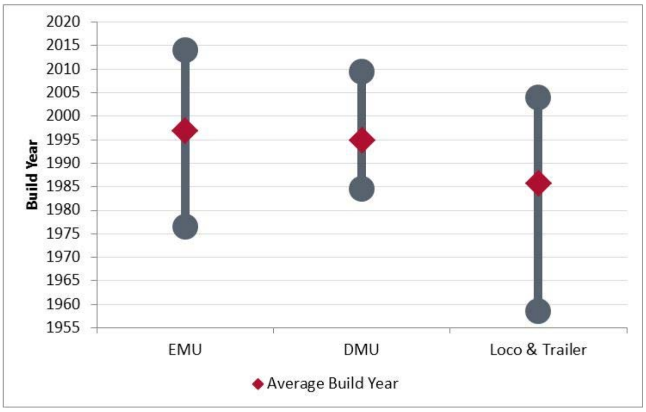
4.69 - It should be noted that in Figure 14 the VUC costs for Loco and Trailer shows a much higher cost for vehicles built in the period between 1998-2010. This is because no new coaches were built in this period, which have a relatively low VUC, so the data presented is for locomotives only, which have a much higher VUC than trailer coaches. This distorts the data presented and suggest that modern fleets are much worse, which is not necessarily the case.

4.70 - VUC charges are set by vehicle class, reflecting the variation in track wear and tear caused by different vehicles. There is work progressing within the industry on vehicles curving classes, a way of categorising vehicles according to the rail surface damage they generate through wear and rolling contact fatigue. Improvements in the curving behaviour of vehicles is important as this can reduce the levels of track maintenance required and therefore influences cost.

Age of Fleet

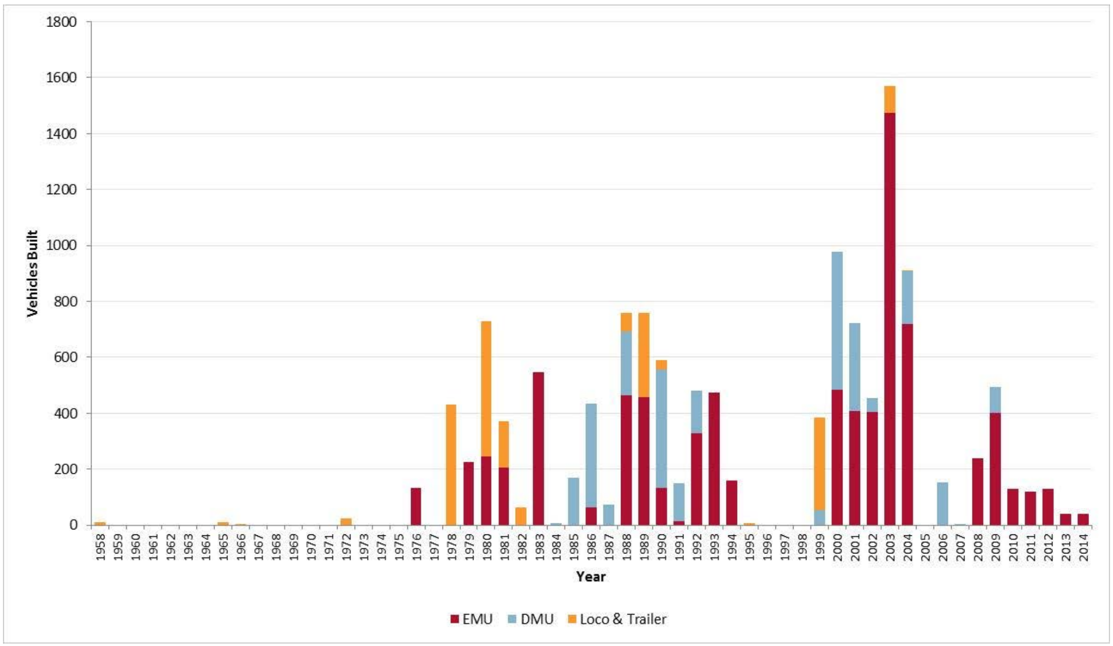
4.71 - The average build year across rolling stock operated in the UK is shown below in Figure 15. This highlights some of the trends already described and demonstrates that rolling stock procurement is moving more towards EMU vehicles.

Figure 15 UK High-Level Fleet Split by Age



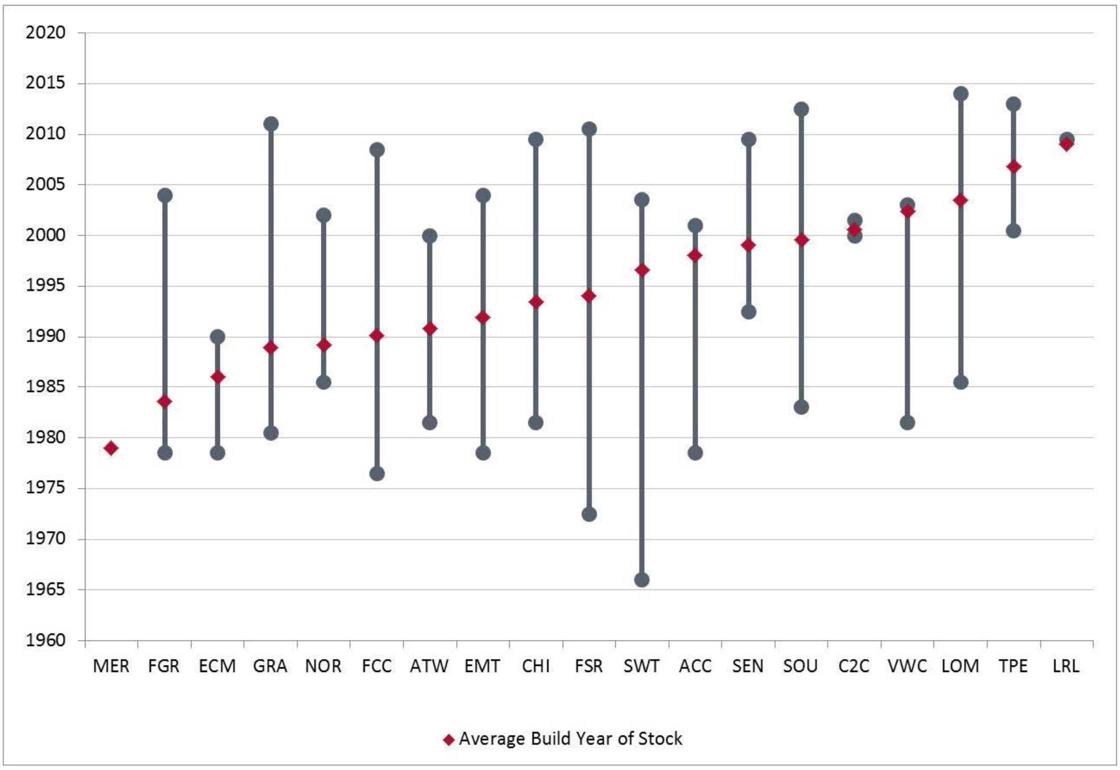
4.72 - This trend is demonstrated in more detail in Figure 16, which shows the large post-privatisation orders of EMUs in former Network South East regions. In line with previous discussions, it is also evident that orders of locomotives and coaches have declined as operators have shifted to procuring multiple units.

Figure 16 Current UK Rolling Stock by Build Year and Type



4.73 - The average build year of stock across TOCs is shown in Figure 17. As can be seen, Merseyrail has, on average, the oldest stock, as it utilises a fleet of 507/508 EMUs. Virgin Trains, First TransPennine Express and London Overground have the newest stock on average, which is in line with relatively recent procurement of all-new stock for these operations.

Figure 17 Rolling Stock Age Profile Across Operators



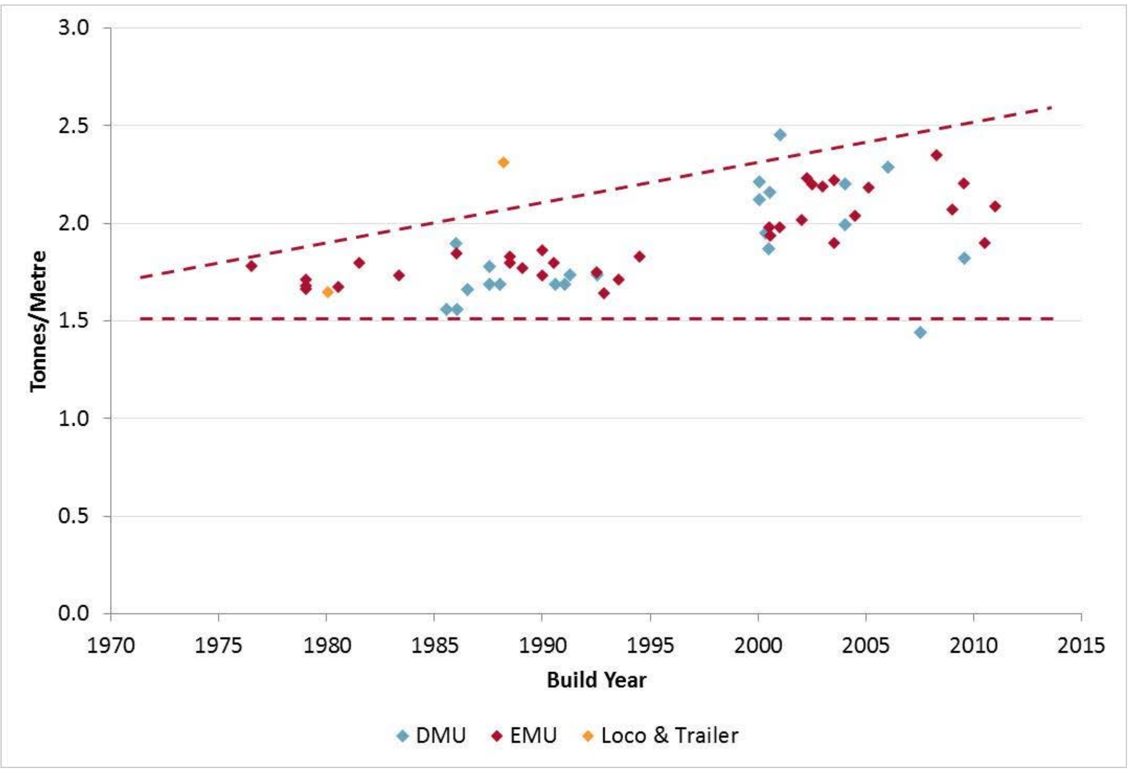
4.74 - It is important to note that numerous refurbishment programmes have been carried out on UK rail fleets. For example, HST fleets have undergone engine replacement which will extend their operational life. This makes comparison of vehicles based on age alone more difficult as refurbished and re-engineered vehicles may be of a comparable quality to newer vehicles.

4.75 - In the case of older vehicles, it is possible that lease costs may be lower as there may be less market demand for older vehicles and the Rolling Stock Leasing Company (ROSCO) may have already recouped its capital investment. Nonetheless, a TOC may be required to operate a particular stock type. In this case, the demand for a particular rolling stock type would be inelastic, implying the ROSCO would gain from raising the price (although ROSCOs are particularly sensitive to this in order to protect themselves against price regulation).

4.76 - In relation to both fleet age and track access charges, Figure 18 shows that the overall trend in average weight per meter of rolling stock has risen since the start of privatisation in 1995, reflecting the changes in rolling stock specifications and level of equipment fitted.

4.77 - Note that in the case of vehicle weights, a “worst-case” scenario has been adopted in that the weight of the heaviest vehicle in that class is used for all the class.

Figure 18 Weight per Metre of Rolling Stock by Build Year



4.78 - The data presented in Figure 18 has been focussed more around the EMU and DMU vehicles, which cover the majority of new-build rolling stock and the trend lines applied clearly show the increase in vehicle weight. This helps support anecdotal views within the industry that rail vehicles are generally getting heavier.

5 - Controllability of Costs

Leases

5.1 - TOCs have relatively little opportunity to influence the capital lease charges for rolling stock since these are set by the ROSCO. The rolling stock industry is characterised by very few suppliers (e.g. ROSCOs) and very few buyers (e.g. TOCs) which means that the ability of TOCs to choose stock from a wide range of options, as well as the ability of ROSCOs to sell to a wide market, are severely limited. This is compounded by further restrictions on loading gauge (size of trains), traction type, vehicle type and availability which dramatically narrow the potential for negotiation on both sides.

5.2 - The vast majority of British Rail-procured rolling stock is on lease at any given time and those that are available are often restricted to certain franchises/routes, so there is little surplus stock sat idle that would provide competition in lease charges. The capital purchase price of post-privatisation new build rolling stock is fairly well understood and leasing charges largely reflect the cost of capital that a ROSCO was able to offer at the time (plus potentially some adjustment for risk contingency).

5.3 - There are a series of factors which, in combination, restrict the choice of rolling stock available for lease at the point franchises are let, including:

- Technical and operational factors which limit interoperability (for example, the ability to switch between routes);
- Costs and risks in switching rolling stock or introducing new rolling stock (for example, train acceptance and staff training); and
- Aspects of the way in which the franchising system operates (for example the provision of Section 54[11] on some fleets).

5.4 - Historically TOCs had relatively little ability or incentive to negotiate with ROSCOs as the same terms would be offered to all bidders as a result of a non-discrimination clause in their Code of Practice. ROSCOs in turn had little incentive to compete with each other because of patterns of ownership and limited availability of spare stock.

5.5 - The Competition Commission investigation into the rolling stock leasing market in 2009 led to the following changes:

- ROSCOs were required to remove non-discrimination requirements from their Codes of Practice to create greater incentives for the TOCs to seek improved terms from the ROSCOs; and

[11] In some cases the new investment by ROSCOs was underwritten by the Government through Section 54 Undertakings which ensure that trains will continue to be leased for a defined period.

- ROSCOs were required to provide TOCs with a set list of information when making a lease rental offer for used rolling stock, to aid transparency and give TOCs the ability to negotiate more effectively.

5.6 - Under the revised ROSCO Code of Practice, short leases are now available for up to three years at a premium not exceeding 10% of the capital rental during the preceding franchise.

5.7 - Another area in which TOCs have a potential opportunity to control leasing costs is with respect to the arrangements for maintenance of the trains. These arrangements can see the ROSCO taking full responsibility under a 'wet lease' or the TOC taking full control under a 'dry lease' or an arrangement split between ROSCO and TOC, a 'soggy lease'.

Maintenance

5.8 - The approach that TOCs take to maintaining their fleets can influence costs. For example, as discussed, wet leases place all the maintenance responsibility on the Lessor who will provide a full maintenance package for the rolling stock.

5.9 - As Lessors do not have capability to provide train maintenance directly, they will need to contract a sub-supplier to do this. Therefore, this approach to maintenance is likely to be more expensive for a TOC due to the additional levels of external management and sub-contacting involved.

5.10 - The TOC pays a Non-Capital rent to the Lessor, who takes the risk of procuring the maintenance and variation in cost. These risks will generally be reflected in costs charged to TOCs, with more risk being offset against greater levels of contingency cost within the Lessors non-Capital rental charge.

5.11 - In contrast to wet leases, the approach on dry leases is to place all the maintenance responsibility on the TOC. The TOC takes the risk of procuring the maintenance and variation in cost. This type of lease is favoured for newer stock, where the lessee will then usually sub-contract the maintenance to the train manufacturer through a Train Service Agreement (TSA).

5.12 - For a dry lease without a TSA, ROSCOs typically require a Maintenance Reserve payment to ensure that the cost of maintenance due relating to the use of the asset is fully recovered during the lease period, which helps ensure a fair share of costs between successive lessees and avoids the ROSCO exposure to costs for work due but not performed.

5.13 - TOCs are becoming more sensitive to the costs of maintenance, as this is developing as an area of competitive advantage in franchise bids. TOCs with dry leases and those contracted to perform the heavy maintenance under soggy leases have become increasingly aware of the potential contract margins earned by third-parties.

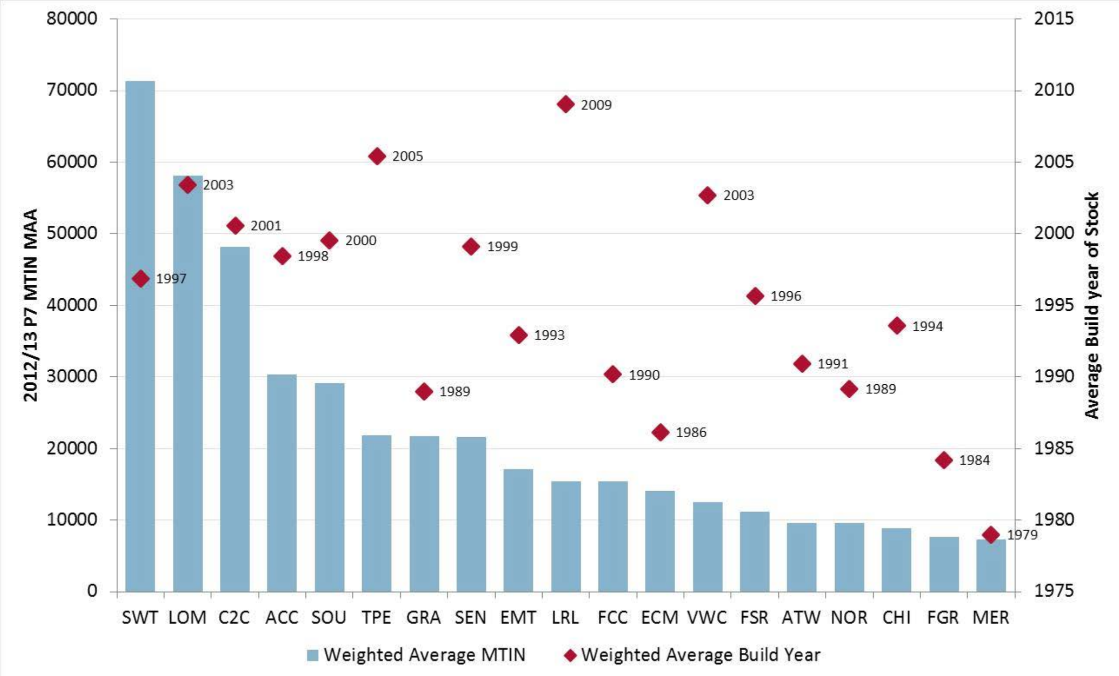
Reliability

5.14 - TOCs are able to influence their maintenance costs to a degree through increasing the reliability of their fleets. Improved reliability suggests reduced costs to deal with breakdowns (though may also warrant expenditure on training and quality control, for example).

5.15 - As the majority of new build rolling stock is procured on the basis of a design-build-maintain contract, where the manufacturer provides on-going maintenance under a Train Supply Agreement (TSA), the manufacturer will have contractual requirements to deliver a defined level of fleet reliability and availability. The way in which stock is procured will therefore influence the TOCs' ongoing controllability of fleet reliability.

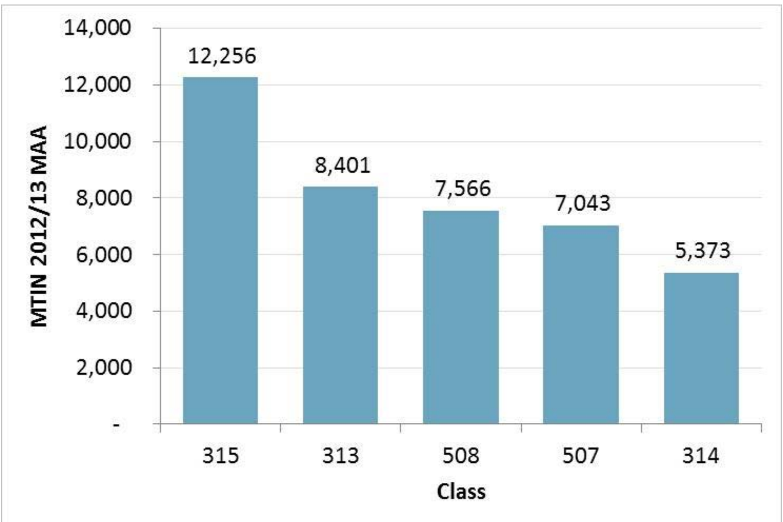
5.16 - TOCs have dramatically different experiences of reliability. To measure fleet reliability, Miles Per Technical Incident (MTIN) is most widely used as the common metric within the industry. The average MTIN figures for each operator are presented in Figure 19, together with the average build year of the fleets they operate.

Figure 19 MTIN and Average Fleet Build Year by Operator



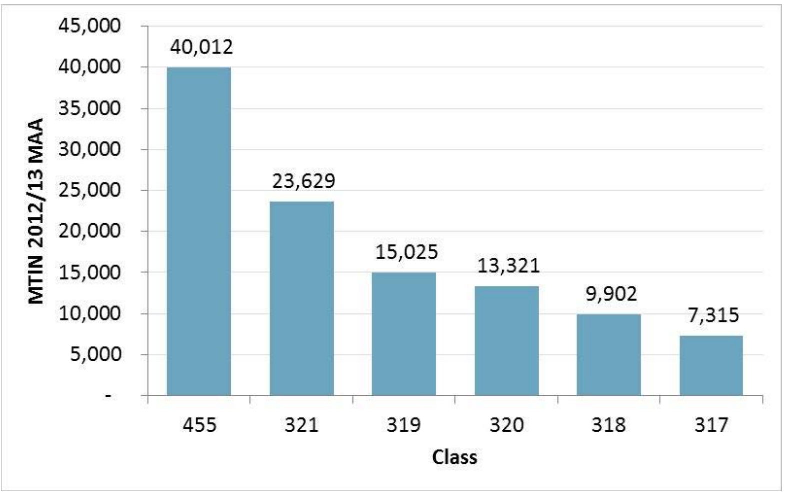
5.17 - There is variation in the reliability of rolling stock between classes as well as within them. For example, Figure 20 shows average MTIN for rolling stock built under the BREL 1972 Design for EMUs. Class 315s are shown to run for over twice the distance as the similar class 314s before developing a fault. These vehicles are mechanically very similar, with the main difference being the different routes they run: 315s run on metro services out of Liverpool Street while 314s run inner suburban services in the Strathclyde PTE area.

Figure 20 Average MTIN for BREL 1972 Designs



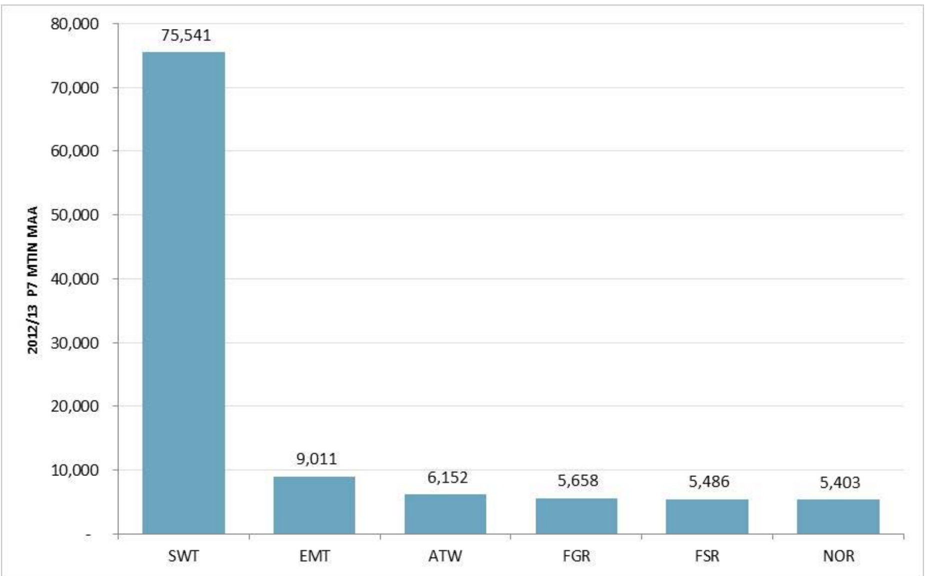
5.18 - A similar theme is demonstrated for BREL's Mark III EMU design, as shown in Figure 21. The Class 455s used by South West Trains on suburban services around southwest London are over five times as reliable as the 317 units that operate Great Northern and West Anglia routes.

Figure 21 Average MTIN for BREL Mark III EMUs



5.19 - Perhaps the best illustration of the variation in reliability across fleets is that of the Class 158s. South West Trains' Class 158s appear to be dramatically more reliable than similar models in use in other parts of the country (see Figure 22). This may be due to South West Trains being able to return much of its rolling stock to a depot at night, the use of separate depots to service specific vehicle classes, and the availability of a highly-skilled workforce. This stark contrast in fleet reliability highlights some of the complexities in comparing fleets and operators.

Figure 22 MTIN for Class 158 DMUs by Operator



5.20 - As much as operators take part in cross-industry forums to discuss fleet reliability and share best practice, the franchising system in the UK ultimately means that these same operators (or more specifically their owning groups) are at the same time directly competing for franchises. Therefore, a particular operator's best practice may also be their unique selling point for a future franchise competition and, as such, they would likely be reluctant to share the details.

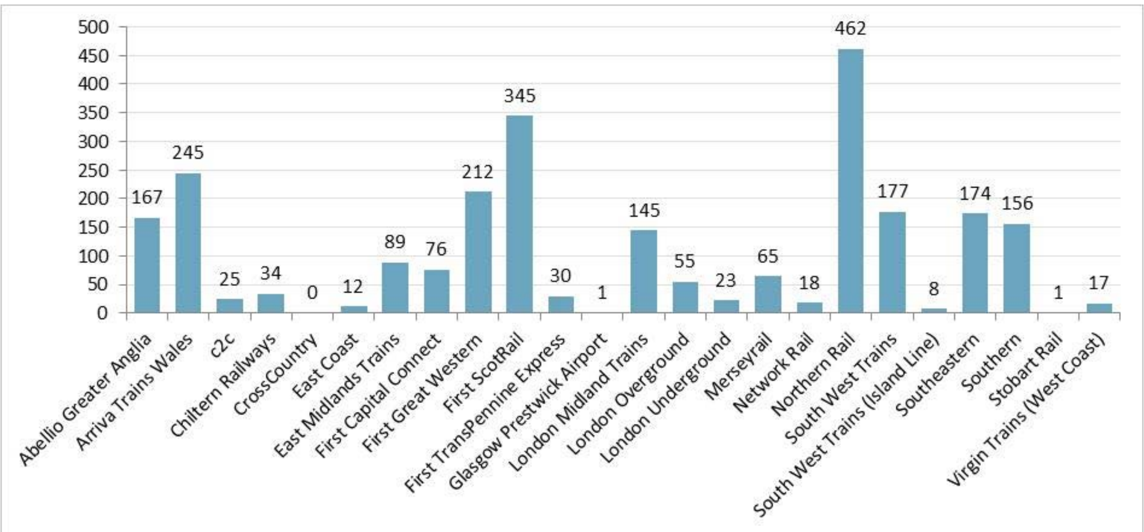
5.21 - Stepping back from specific fleets to look at weighted reliability across all operators, South West Trains stand out again as having the highest average MTIN reliability across their fleets in comparison to all other operators, as shown in Figure 19 above.

Staff

Stations

5.22 - The split of stations across TOCs shows some marked differences in the numbers managed by each Operator, as can be seen in Figure 23 below. Northern Rail manage the largest number of stations of any Operator in the UK, whilst CrossCountry is not responsible for the management of any stations.

Figure 23 Breakdown of Station Facility Owner (SFO)



5.23 - Due to the dataset used, Figure 23 includes some Station Facility Owners that are not directly relevant for this study, for example London Underground, but who are retained in the analysis of SFOs for completeness. Also not included in the above is BAA who own the terminal stations at London Heathrow Airport.

Cleaning

5.24 - Cleaning forms a significant part of an Operators day-to-day activities and this is either carried out in-house by the Operator’s staff or outsourced. The contracting approach gives Operators the ability, to a certain extent, to control their costs, for example, outsourced cleaning can be sought through a competitive tender process and in this case the Operators staff headcount would be reduced (along with other associated costs).

5.25 - The level and quality of cleaning that Operators undertake is linked to their franchise specification, with Operators having more stringent service quality targets than others. These quality targets will have an impact on the Operators cost base, as more stringent targets will likely require a higher level of cleaning to be undertaken, reflected in additional cleaning staff costs.

Depots

5.26 - Depot strategies are likely to influence staff costs and TOCs have some control over how they manage this aspect of their business.

5.27 - When Siemens won the contract to build and maintain the 20 x Class 350 Desiro EMUs, part of the contract required the electrification of the maintenance depot at Ardwick. The depot was extended by approximately 10 m to allow the 4-Car electric multiple units to be accommodated. In addition, one of the shed roads and all of the outside track was electrified. The capital expenditure associated with this work would be expected to be recovered through the TSA costs, which would include an element of depot start-up and mobilisation cost.

Scope and Subcontracting

5.28 - The extent of subcontracting varies, but can include maintenance and cleaning and, in some cases, the provision of drivers. The only core activity which is consistently performed in-house by all train operators is the management of train crew. Therefore, scope to manage costs, and the timescales over which this can be achieved, may depend on whether or not TOCs carry out activities in-house.

Track Access

5.29 - As discussed in Chapter 4, track access cost is driven by the type of rolling stock used. As is the case for rolling stock leases, there is limited excess supply of rolling stock for the UK market so TOCs are unlikely to be able to choose a rolling stock type based on VUC alone. Nonetheless, there are some initiatives TOCs can undertake to reduce track access costs, such as the "Hall Bush" radial arm modification, as discussed below.

Radial Arm Bush Modification

5.30 - A number of rolling stock fleets operating in the UK have had modifications undertaken to their bogies in order to improve ride performance. The Hydraulic Radial Arm Bush Modification, or "Hall Bush" as it is referred to within the industry, is a variable stiffness radial arm bush fitted in order to reduce track wear and therefore variable track access costs.

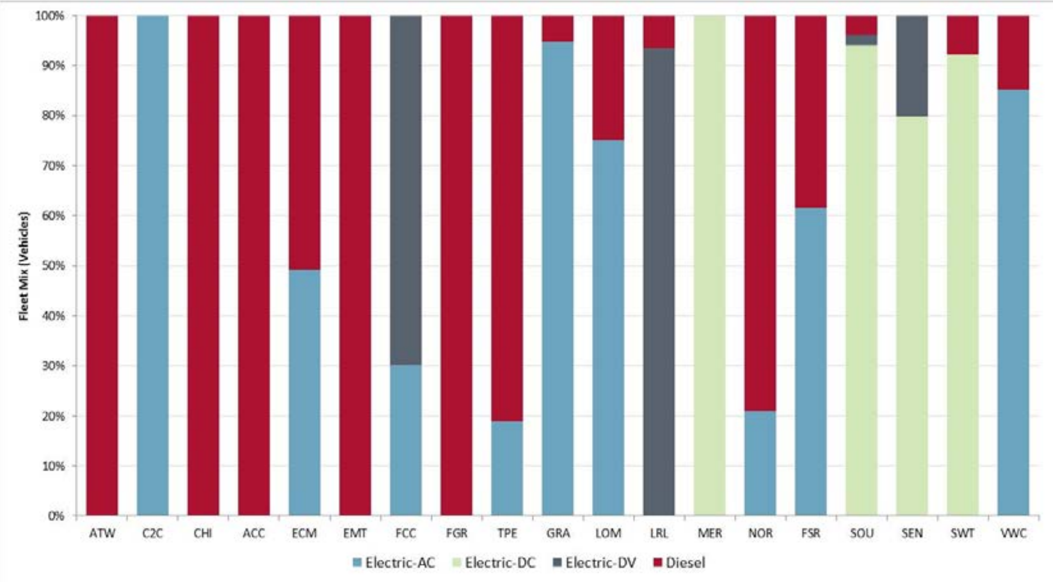
5.31 - The new bush, designed by Freudenberg, works using hydraulic damping (hydraulic fluid) within the bush to vary its stiffness according to unit load and input frequency variations. In simple terms, when the vehicle is operating at high speed (high frequency oscillations), the damping effect is stiff, resulting in less rail impact damage. At low speed, the damping effect is soft, allowing the vehicle to ride more smoothly across the railhead.

Energy

5.32 - The traction mix by operator is in part dictated by the characteristics of their network, for example as there are no electrified lines in Wales, Arriva Trains must operate only diesel rolling stock. As shown in Figure 24, across the franchises there are a number of operators who also run only diesel rolling stock on their networks including:

- Arriva Trains Wales;
- Chiltern Railways;
- Cross Country;
- East Midlands Trains;
- First Great Western.

Figure 24 Traction Mix by Operator

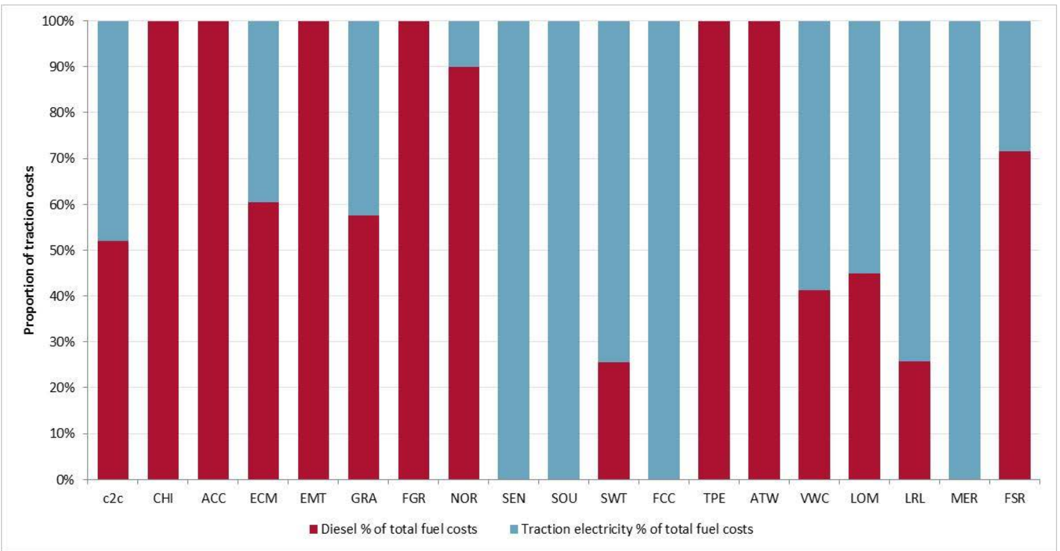


5.33 - As discussed within the section on rolling stock characteristics, SDG anticipated that those operators with only diesel rolling stock would be expected to see higher relative costs of operation, due to the increased weight of diesel stock adversely affecting its track access costs and also the generally lower levels of fleet reliability on diesels.

5.34 - Of those operators with only electric fleets, there are no two that have the same overall fleet portfolio. C2C are the only operator with an all AC traction fleet and Merseyrail are the only Operator with an all DC traction fleet. Although other Operators have only electric fleets, these have a mixed traction type, for example, First Capital Connect have AC and dual-voltage fleets, whilst Southern have a mix of DC and dual-voltage fleets.

5.35 - When looking at the traction mix across an operator's fleet and the costs incurred for diesel fuel and electricity for traction, the dominance of the higher costs for diesel is clearly evident, as shown in Figure 25. Whilst VWC's fleet portfolio includes only around 15% diesel rolling stock, its cost for diesel fuel makes up around 40% of its total costs for traction (i.e. the sum of all costs diesel and electricity).

Figure 25 Influence of EC4T and Diesel Costs on Total Traction Costs



5.36 - However, whilst the differences between diesel and electricity costs are clearly evident, other aspects of the data analysis considered in this report shows that there are other areas to consider in making a direct correlation between the influence of traction type and costs per vehicle kilometre. For example, whilst ATW and FGR both operate entirely diesel powered fleets, they have quite different rolling stock and fuel costs per vehicle mile. This suggest that, as would be expected, the type of rolling stock used and the routes over which it operates also need to be taken into account.

5.37 - Whether Operators use rolling stock that is electric or diesel powered, they are able to control costs to an extent by the way in which they manage driving techniques; this means that drivers are educated to drive efficiently over a given route by only applying power when required and by maximising the time at which trains coast (i.e. coasting at a running speed without the application of power or the brake). This approach to driving has been shown to reduce the energy consumption of the train over a given route.

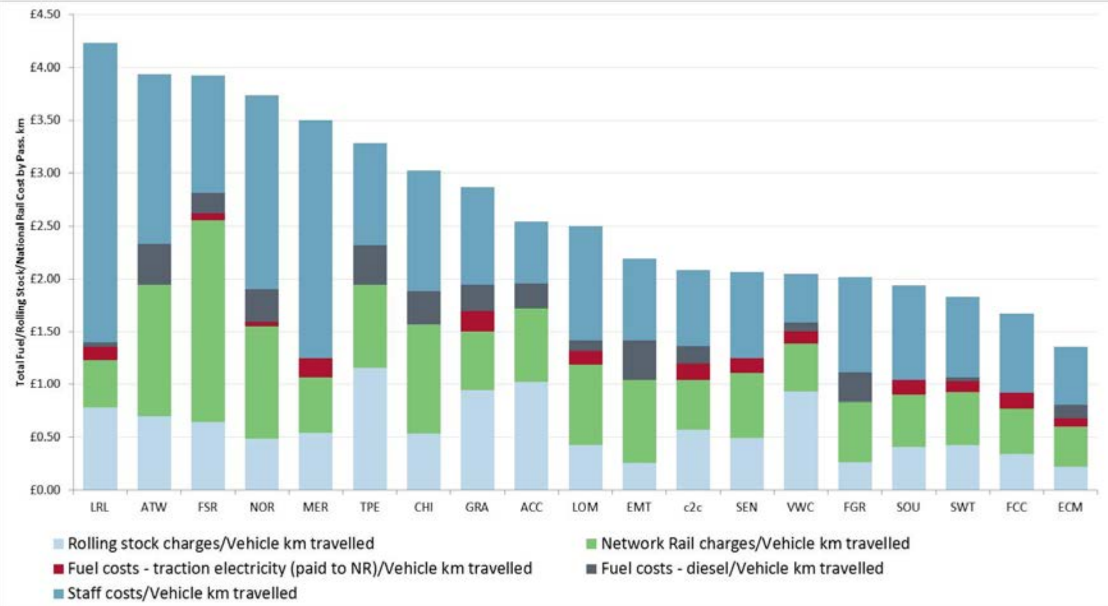
5.38 - Operators of diesel rolling stock are generally able to set up their own supply contracts for diesel fuel, in much the same way as the supply of household utilities are arranged. In order to manage and control costs, Operators could elect to “hedge” the price they pay for diesel fuel by entering into a long-term supply contract at a fixed price.

Selected TOC-TOC Comparisons of Costs and Approach

Cost by vehicle kilometre travelled

5.39 - The total cost of rolling stock operation, based on the data within the GB Rail Financials, includes rolling stock charges, network rail charges, diesel fuel costs, electricity for traction costs, and staff costs. These costs have been normalised by SDG against vehicle kilometres, the results of which are shown in Figure 26. Operators have then been sorted from the highest to lowest total cost per vehicle kilometre (sub-divided by the cost categories within the GB Rail Financial data).

Figure 26 Operator Costs by Vehicle Kilometre



5.40 As discussed previously, SDG anticipated that those operators with only diesel rolling stock would be expected to see higher costs of operation, this includes Arriva Trains Wales (ATW), First Great Western (FGR), Chiltern Railways (CHI), Cross Country (ACC), and East Midlands Trains (EMT). However, from the data provided there is no clear evidence that this relationship holds true. Whilst Arriva Trains Wales has the second overall cost per vehicle mile, First Great Western is at the other end of the scale with one of the lowest costs per vehicle kilometre travelled.

5.41 - From Figure 26 it can be seen that the total cost per vehicle kilometre for both LOROL (LRL) and Merseyrail (MER) is dominated by staff costs, reflecting the points discussed previously about Transport for London having a requirement that LOROL stations are manned from the first to last train. SDG also understand that Merseyrail generally place staff on all stations across their network, but that this is reflective of their general approach to train management as opposed to being mandated through the terms of the franchise.

5.42 - The costs per vehicle kilometre above also demonstrate the high relative cost that First ScotRail (FSR) incur for Network Rail charges, contributing to nearly 50% of their total cost base for rolling stock operation. This reflects in part the size of their network but may also be related to how track access costs are dealt with in Scotland, which is discussed again later in this report.

5.43 - EMT, FGR and ECM all operate some locomotives, Mark III and Mark IV carriages. This rolling stock would be expected to have relatively low leasing costs, as the vehicles are older, and it can be seen that correspondingly each operators' cost associated with rolling stock charges is relatively low.

Comparison of Services, Rolling Stock and Costs

5.44 - There are no two operators within the UK that are required to deliver the exact same franchise commitments, therefore, it is very difficult to make a direct comparison between operators based on the services they run. However, where operators run similar types of service, for example commuter and InterCity services (as defined by SDG in Table 4.1), SDG has been able to draw out a number of themes and observations that are linked to the characteristics discussed previously within this report.

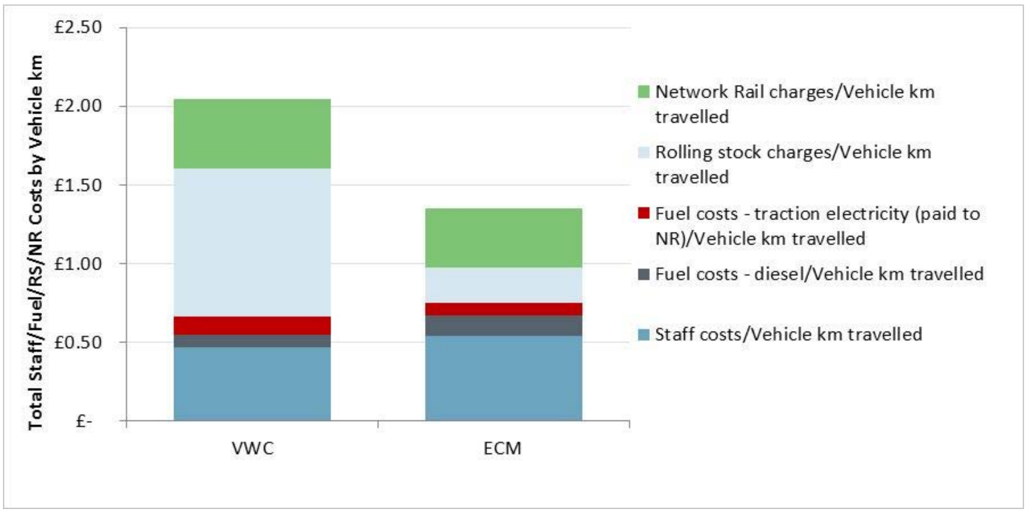
InterCity Operators

5.45 - East Coast (ECM) operate InterCity services from London King's Cross to Aberdeen, Inverness, Edinburgh, Glasgow, Hull, Leeds, Bradford, Skipton, Harrogate and Lincoln. ECM's rolling stock fleet consists of electric Class 91 locomotives with Mk4 carriages and diesel HSTs (Class 43 locomotives and Mk3 carriages). This rolling stock was introduced under British Rail and is amongst the oldest currently in operation on the UK network.

5.46 - Virgin Trains (VWC) also operate Intercity services, but over a different part of the network, from London Euston to Birmingham, Holyhead, Manchester, Liverpool, Glasgow, and Edinburgh. VWC's fleet consists of electric Class 390 "Pendolinos" and diesel Class 221s. The Pendolino sets were procured post-privatisation and for the enhanced West Coast Main Line, they have a maximum operating speed of 140 mph and tilt-technology fitted. Between 2010 and 2013, a number of Pendolino sets were extended from 9-car to 11-car operation in order to provide additional capacity.

5.47 - The costs per vehicle kilometre travelled for ECM and VWC are shown in Figure 27 below. The majority of the individual cost elements are very similar between the two operators, covering Network Rail charges, fuel costs and staff costs. The one area of significant difference between the operators is for the rolling stock charges.

Figure 27 Costs per Vehicle Kilometre for Intercity Operators



5.48 - The average build year of the rolling stock operated by East Coast is 1986, whereas the average build year for Virgin Trains' rolling stock is 2002. This will have a direct influence on the capital leasing costs for the rolling stock, as the majority of the HST's capital investment will already have been recovered whereas the Class 390s have around another 20 years of life over which the capital expenditure for their procurement needs to be recovered.

5.49 - Therefore, operators may have the ability to control their cost base through the selection of rolling stock, with older fleets generally being less costly to lease. However, this is dependent on suitable rolling stock being available for operation on the franchise. As nearly all of the rolling stock owned by ROSCOs is on lease at any given point in time, at the time of bidding for a franchise there are often only a limited number of options that a prospective operator has in terms of the fleets that they would be able to lease. This clearly places constraints on their ability to control costs, aside from any contract negotiations that may take place at the time lease terms are being agreed.

5.50 - There are also differences in the way that East Coast and Virgin Trains approach the maintenance on their fleets, with the latter operator having engaged Alstom Transportation under a TSA to maintain their Class 390 fleet (Alstom Transportation are the original manufacturer of the trains). This may also increase the rolling stock costs that Virgin Trains see, as they are outsourcing the fleet maintenance rather than taking it in-house and using their own staff.

Regional, Commuter and Rural Operators

5.51 - Arriva Trains Wales (ATW), First ScotRail (FSR) and Northern Rail (NOR) operate broadly similar regional, commuter, and rural services across relatively large geographic areas.

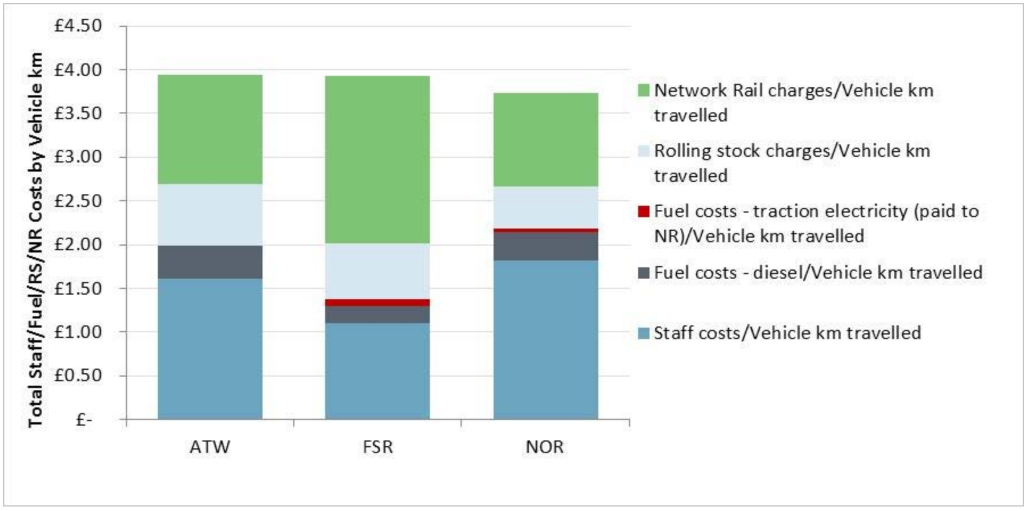
5.52 - ATW's routes cover Wales (including North, Mid, and South Wales, Valley Lines, and the Welsh Marshes and Border region) and routes to Shrewsbury, Manchester, Crewe, Chester, Birmingham, Bidston, and Cheltenham Spa. No electric rolling stock is used and their diesel fleet contains locomotives with Mk 2 and Mk 3 carriages, as well as Class 121, 142, 143, 150/2, 153, 158, 175/0, and 175/1 multiple units..

5.53 - All routes in Scotland are operated by FSR and they also run services to Carlisle and Newcastle, and Caledonian Sleeper to London Euston. They operate a mixed fleet of electric (Classes 314, 318, 320, 334, 380/0, and 380/1) and diesel (Classes 156, 158, 170/3, and 170/4) multiple units.

5.54 - Regional services in Yorkshire, Lancashire, Cumbria, Greater Manchester, Merseyside, and the North East and operated by NOR. They operate a similarly mixed fleet of electric (Classes 321/9, 322, 323, and 333) and diesel (Classes 142, 144, 150/1, 150/2, 153, 155, 156, 158/0, and 158/9) rolling stock.

5.55 - The costs per vehicle kilometre travelled for ATW, FSR and NOR are shown in Figure 28 below. It is worth noting that all three operators have very mixed fleets of rolling stock, whether this is electric, diesel or a mix of both.

Figure 28 Costs per Vehicle Kilometre for Regional, Commuter, and Rural Operators



5.56 - The first point to note with respect to costs per vehicle kilometre operated, is that the regional, commuter and rural services are significantly more expensive than the Intercity operations. The three operators in Figure 28 have an average cost per vehicle kilometre of around £4.00, whereas the costs for Intercity operations was half this for Virgin Trains (at around £2.00) and lower still for East Coast (at around £1.40).

5.57 - Across all three operators, the costs associated with rolling stock charges are broadly similar, which is likely to be related to the fact that the average build year of their fleets are also similar: NOR is 1989, ATW is 1991, and FSR is 1994. Furthermore, there are similarities in the types of rolling stock they operate and how these are maintained.

5.58 - Network Rail charges, associated with track access, have a significant impact on FSR's overall cost per vehicle kilometre, accounting for almost 50% of their total cost. This could reflect the fact that the Fixed Charge element of track access in Scotland is paid in full by the current franchisee, in this case FSR.

5.59 - The track access costs that an operator sees are principally related to their franchise requirements, which will set out the routes they are required to operate and the minimum levels of service to be provided. Noting that operators may propose to run routes and services in addition to the minimum franchise levels. With this in mind, operators have relatively limited opportunity to control track access costs.

5.60 - As previously shown in Figure 23, NOR, FSR and ATW are the top three operators in terms of the number of stations they are each responsible for (at 462, 345 and 245 respectively). This will have a direct impact on their staff costs, as we see in Figure 28 above, where it relates to around 50% of NOR's cost per vehicle kilometre operated. ATW's staff costs are also very significant, representing around 40% of their total cost base.

Metro Operators

5.61 - London Overground (LRL) and Merseyrail (MER) are, for the purpose of this project, considered metro operators based on the fact that they run commuter services stopping at a high number of stations but with relatively short average passenger journeys.

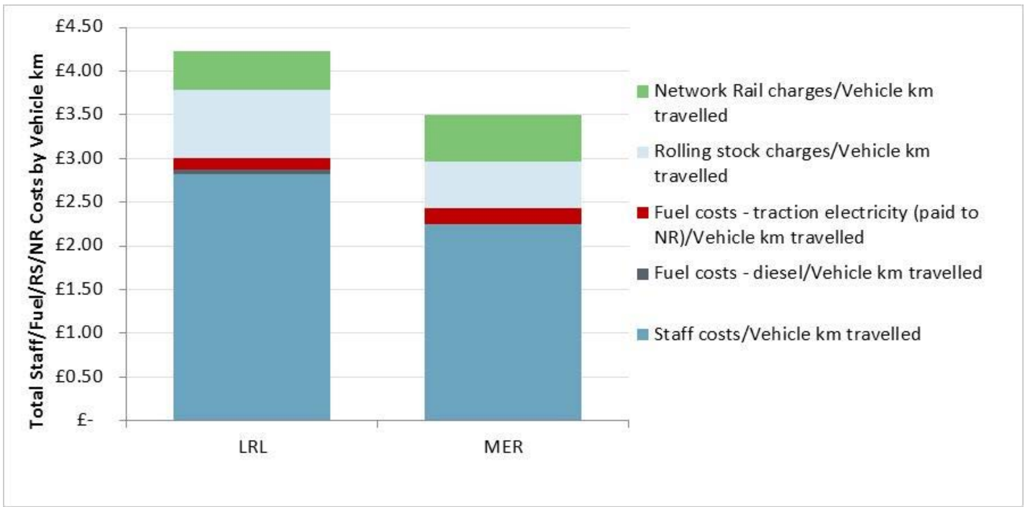
5.62 - LRL serves the East London Line, Gospel Oak to Barking Line, North London Line, Watford DC Line, West London Line, and South London Line. Their rolling stock consists of both electric (Classes 378/1 and 378/2) and diesel stock (Class 09/0 locomotive and Class 172/0).

5.63 - Merseyrail operate Class 507 and 508 rolling stock on 750 V DC third-rail electrified routes around Liverpool and the wider Merseyside region. They do not operate any diesel rolling stock. MER's network covers a 6.5 mile section that runs underground through the original Mersey railway tunnel, which brings limitations to the rolling stock that can operate this section due to the small clearances and tight curve radii.

5.64 - In terms of the average age of rolling stock operated, Merseyrail's fleets are the oldest on the UK Network with an average build year of 1979. By contrast, London Overground has the most recent average build year of 2009 for their rolling stock fleet. As discussed on the InterCity operators, this would be expected to have a direct influence on the capital leasing costs for their rolling stock, with the more recently introduced LRL fleets being more expensive than MER's 35 year old trains (as the majority of their original capital investment should already have been recovered).

5.65 - Looking at the costs per vehicle kilometre for LRL and MER, as shown in Figure 29, surprisingly the rolling stock charges associated with each operator are very similar. This is in stark contrast to the difference in rolling stock charges seen for the InterCity operators, which also operate fleets with very different average age profiles.

Figure 29 Costs per Vehicle Kilometre for Metro Operators



5.66 - London Overground's Class 378 Capitalstar rolling stock is owned by a consortium of National Australia Bank's nabCapital division and Sumitomo Mitsui Banking Corporation, who in turn lease the rolling stock to Transport for London. Merseyrail's Class 507 and 508 fleets are owned by Angel Trains, one of the UK's three ROSCOs established when British Rail was privatised. The differences in rolling stock ownership and their financing approach may explain some of the differences in rolling stock charges, but without having more detailed information on what is included within this category it is difficult to make any assertions on what is directly affecting the costs.

5.67 - Staff costs for LRL and MER are higher per vehicle kilometre travelled than both InterCity and regional/commuter operators. LRL and MER are responsible for only 55 and 65 stations respectively (see Figure 23), much lower than the number of stations NOR, FSR and ATW manage. However, SDG understand that LRL and MER may staff all of their stations from operation of the first to the last train each day; this would certainly increase the number of staff required and their associated cost. Further insight from LRL and MER as to how they manage their operations would be necessary to validate this observation.

6 - Anticipated Impact on TOC Costs -

Structure of the Controllability Tables

6.1 - SDG has identified a number of elements that have an impact on rolling stock costs. The elements include rolling stock leases, maintenance obligations, energy consumption, track access and staff numbers.

6.2 - Following the identification of cost types, the drivers of rolling stock cost have been determined, for example: the service types; diversity of the fleet; the distance travelled and average speed; number of stations operated; and fleet reliability. There is also a relationship between these drivers and the anticipated costs seen by operators, as discussed within Section 4 Cost Drivers.

6.3 - The ability of TOCs to control rolling stock costs varies based on their operational requirements and the approaches they take to running and managing their franchise. This was demonstrated by the TOC comparisons presented, which highlight the relationships between services, rolling stock and costs.

6.4 - The following controllability tables draw together the identified cost elements, cost drivers, their relationship to rolling stock costs, and the external and internal influences that may affect a TOCs ability to control costs.

6.5 - The ability for TOCs to control costs against each measures is identified as either low, medium or high.

6.6 - Metrics are then provided against each measure which enable the individual TOC to be compared against the overall average for all TOCs; this leads to an indication being provided as to whether the TOCs rolling stock costs would be expected to be higher or lower (when compared against the overall average for all TOCs).

How to read the Controllability Tables

6.7 - An extract from the controllability table for Arriva Trains Wales is shown below in Table 6.1. The first column of the table provides the reader with a cross reference to section within this report that the specific cost driver is explained. The remaining columns of the table and an explanation of how these show be read is covered below.

Table 6.1: Sample Controllability Table

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC Average		
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise Specification	Timetable	Low	Average Speed	63.64 km/h	48.11 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓

6.8 - Taking the identified “cost driver” above, in this case average speed, this influences a number of the defined “cost types” in the following column:

- Energy;
- Maintenance; and
- Track Access.

6.9 - The influence that the cost driver (average speed) has on the above cost types is explained within the column “relationship to cost”. For example, in relation to energy, a higher average speed requires higher levels of energy and, therefore, energy costs would be expected to be higher. For maintenance, higher average speeds are more mechanically demanding and so rolling stock would require additional maintenance, reflected in higher costs.

6.10 - The column on “external influences” details the external factors that affect the TOCs ability to control and manage costs. The column om “internal controllability” details those things that a TOC may be able to change in order to control and manage costs. The level of expected controllability that a TOC has in relation to the specified cost driver is then identified in the “TOC Controllability” column.

6.11 - Metrics are then provided for each cost driver showing the TOC average (i.e. the average value for all TOCs) and the value for the specific TOC being considered. In this case, the average speed for ATW is lower than the TOC average. Therefore, this lower average speed would be expected to drive ATW’s rolling stock costs as follows: energy costs would be lower; maintenance costs would be lower; and track access costs would be lower. This is shown in the last column “Expected Impact on Costs”, where the arrows show whether costs are expected to be higher or lower.

Controllability Tables for each TOC

The following controllability tables cover the current 19 franchised train operating companies that serve the UK.

Arriva Trains Wales

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	ATW	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	48.11 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	57.18 million km	↓
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↓
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↓
		Energy	More energy required to travel further							↓
		Track Access	Track access calculated by vehicle miles							↓
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	245	↑
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	20.2 avg pax/veh	↓
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	9,590	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	11	↑
			Parts may not be transferrable between stock types							↑
		Staff	Additional training required for work on different classes							↑
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0 : 1	↑
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↑
		Energy	Diesel more expensive than electricity							↑
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	0.95 : 0.05	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	1991	↓
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↑
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↑
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↓

c2c

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	c2c	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	56.38 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	41.13 million km	↓
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↓
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↓
		Energy	More energy required to travel further							↓
		Track Access	Track access calculated by vehicle miles							↓
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	25	↓
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	24.5 avg pax/veh	↑
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	48,175	↓
		Maintenance	Breakdowns costly to fix							↓
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	2	↓
			Parts may not be transferrable between stock types							↓
		Staff	Additional training required for work on different classes							↓
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	1 : 0	↓
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↓
		Energy	Diesel more expensive than electricity							↓
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	1 : 0	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	2001	↑
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↓
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↓
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↑

Chiltern Railways

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	CHI	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	60.91 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	37.34 million km	↓
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↓
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↓
		Energy	More energy required to travel further							↓
		Track Access	Track access calculated by vehicle miles							↓
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	32	↓
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	30.3 avg pax/veh	↑
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	8,931	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	9	↓
			Parts may not be transferrable between stock types							↓
		Staff	Additional training required for work on different classes							↓
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0 : 1	↑
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↑
		Energy	Diesel more expensive than electricity							↑
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	0.81 : 0.19	↓
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↑
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↑
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	1993	↓
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↑
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↑
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↓

CrossCountry

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	ACC	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	84.03 km/h	↑
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↑
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↑
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	142.73 million km	↑
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↑
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↑
		Energy	More energy required to travel further							↑
		Track Access	Track access calculated by vehicle miles							↑
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	0	↓
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	22.8 avg pax/veh	↓
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	30,330	↓
		Maintenance	Breakdowns costly to fix							↓
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	9	↓
			Parts may not be transferrable between stock types							↓
		Staff	Additional training required for work on different classes							↓
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0 : 1	↑
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↑
		Energy	Diesel more expensive than electricity							↑
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	0.89 : 0.11	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	1998	↑
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↓
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↓
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↑

East Coast

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	ECM	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	122.31 km/h	↑
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↑
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↑
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	237.30 million km	↑
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↑
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↑
		Energy	More energy required to travel further							↑
		Track Access	Track access calculated by vehicle miles							↑
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	12	↓
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	20.8 avg pax/veh	↓
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	14,108	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	8	↓
			Parts may not be transferrable between stock types							↓
		Staff	Additional training required for work on different classes							↓
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0.49 : 0.51	↑
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↑
		Energy	Diesel more expensive than electricity							↑
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	0 : 1	↓
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↑
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↑
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	1986	↓
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↑
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↑
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↓

East Midlands Trains

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	EMT	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	73.33 km/h	↑
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↑
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↑
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	108.31 million km	↓
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↓
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↓
		Energy	More energy required to travel further							↓
		Track Access	Track access calculated by vehicle miles							↓
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	89	↓
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	20.8 avg pax/veh	↓
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	17,107	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	12	↑
			Parts may not be transferrable between stock types							↑
		Staff	Additional training required for work on different classes							↑
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0 : 1	↑
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↑
		Energy	Diesel more expensive than electricity							↑
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	0.69 : 0.31	↓
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↑
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↑
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	1992	↓
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↑
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↑
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↓

First Capital Connect

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	FCC	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	58.40 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	159.79 million km	↑
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↑
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↑
		Energy	More energy required to travel further							↑
		Track Access	Track access calculated by vehicle miles							↑
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	75	↓
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	22.8 avg pax/veh	↓
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	15,417	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	7	↓
			Parts may not be transferrable between stock types							↓
		Staff	Additional training required for work on different classes							↓
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	1 : 0	↓
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↓
		Energy	Diesel more expensive than electricity							↓
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	1 : 0	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	1990	↓
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↑
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↑
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↓

First Great Western

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	FGR	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	58.07 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	256.30 million km	↑
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↑
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↑
		Energy	More energy required to travel further							↑
		Track Access	Track access calculated by vehicle miles							↑
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	206	↑
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	22.9 avg pax/veh	↓
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	7,703	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	22	↑
			Parts may not be transferrable between stock types							↑
		Staff	Additional training required for work on different classes							↑
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0 : 1	↑
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↑
		Energy	Diesel more expensive than electricity							↑
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	0.35 : 0.65	↓
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↑
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↑
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	1984	↓
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↑
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↑
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↓

First ScotRail

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	FSR	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	56.79 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	163.50 million km	↑
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↑
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↑
		Energy	More energy required to travel further							↑
		Track Access	Track access calculated by vehicle miles							↑
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	347	↑
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	16.6 avg pax/veh	↓
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	11,147	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	18	↑
			Parts may not be transferrable between stock types							↑
		Staff	Additional training required for work on different classes							↑
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0.62 : 0.38	↓
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↓
		Energy	Diesel more expensive than electricity							↓
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	0.89 : 0.11	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	1994	↓
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↑
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↑
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↓

TransPennine Express

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	TPE	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	75.29 km/h	↑
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↑
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↑
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	53.29 million km	↓
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↓
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↓
		Energy	More energy required to travel further							↓
		Track Access	Track access calculated by vehicle miles							↓
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	30	↓
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	30.1 avg pax/veh	↑
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	21,817	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	3	↓
			Parts may not be transferrable between stock types							↓
		Staff	Additional training required for work on different classes							↓
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0.19 : 0.81	↑
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↑
		Energy	Diesel more expensive than electricity							↑
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	1 : 0	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	2007	↑
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↓
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↓
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↑

Greater Anglia

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	GRA	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	60.63 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	141.06 million km	↑
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↑
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↑
		Energy	More energy required to travel further							↑
		Track Access	Track access calculated by vehicle miles							↑
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	167	↑
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	29.4 avg pax/veh	↑
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	21,681	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	14	↑
			Parts may not be transferrable between stock types							↑
		Staff	Additional training required for work on different classes							↑
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0.95 : 0.05	↓
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↓
		Energy	Diesel more expensive than electricity							↓
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	0.87 : 0.13	=
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							=
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							=
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	1989	↓
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↑
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↑
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↓

London Midland

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	LOM	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	51.78 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	100.84 million km	↓
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↓
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↓
		Energy	More energy required to travel further							↓
		Track Access	Track access calculated by vehicle miles							↓
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	148	↑
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	22.2 avg pax/veh	↓
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	58,089	↓
		Maintenance	Breakdowns costly to fix							↓
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	13	↑
			Parts may not be transferrable between stock types							↑
		Staff	Additional training required for work on different classes							↑
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0.75 : 0.25	↓
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↓
		Energy	Diesel more expensive than electricity							↓
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	1 : 0	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	2003	↑
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↓
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↓
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↑

London Overground

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	LRL	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	27.76 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	22.30 million km	↓
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↓
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↓
		Energy	More energy required to travel further							↓
		Track Access	Track access calculated by vehicle miles							↓
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	57	↓
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	35.0 avg pax/veh	↑
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	15,473	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	2	↓
			Parts may not be transferrable between stock types							↓
		Staff	Additional training required for work on different classes							↓
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0.93 : 0.07	↓
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↓
		Energy	Diesel more expensive than electricity							↓
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	1 : 0	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	2009	↑
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↓
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↓
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↑

MerseyRail

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	MER	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	37.39 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	22.19 million km	↓
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↓
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↓
		Energy	More energy required to travel further							↓
		Track Access	Track access calculated by vehicle miles							↓
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	66	↓
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	27.6 avg pax/veh	↑
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	7,282	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	2	↓
			Parts may not be transferrable between stock types							↓
		Staff	Additional training required for work on different classes							↓
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	1 : 0	↓
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↓
		Energy	Diesel more expensive than electricity							↓
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	1 : 0	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	1979	↓
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↑
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↑
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↓

Northern Rail

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	NOR	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	51.00 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	114.17 million km	↓
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↓
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↓
		Energy	More energy required to travel further							↓
		Track Access	Track access calculated by vehicle miles							↓
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	463	↑
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	18.6 avg pax/veh	↓
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	9,571	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	16	↑
			Parts may not be transferrable between stock types							↑
		Staff	Additional training required for work on different classes							↑
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0.21 : 0.79	↑
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↑
		Energy	Diesel more expensive than electricity							↑
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	1 : 0	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	1989	↓
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↑
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↑
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↓

South West Trains

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	SWT	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	54.71 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	256.74 million km	↑
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↑
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↑
		Energy	More energy required to travel further							↑
		Track Access	Track access calculated by vehicle miles							↑
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	186	↑
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	22.5 avg pax/veh	↓
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	71,356	↓
		Maintenance	Breakdowns costly to fix							↓
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	9	↓
			Parts may not be transferrable between stock types							↓
		Staff	Additional training required for work on different classes							↓
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0.92 : 0.08	↓
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↓
		Energy	Diesel more expensive than electricity							↓
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	1 : 0	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	1997	↑
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↓
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↓
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↑

Southeastern

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	SEN	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	55.00 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	210.06 million km	↑
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↑
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↑
		Energy	More energy required to travel further							↑
		Track Access	Track access calculated by vehicle miles							↑
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	173	↑
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	20.1 avg pax/veh	↓
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	21,619	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	11	↑
			Parts may not be transferrable between stock types							↑
		Staff	Additional training required for work on different classes							↑
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	1 : 0	↓
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↓
		Energy	Diesel more expensive than electricity							↓
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	1 : 0	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	1999	↑
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↓
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↓
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↑

Southern

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	SOU	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	50.06 km/h	↓
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↓
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↓
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	198.30 million km	↑
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↑
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↑
		Energy	More energy required to travel further							↑
		Track Access	Track access calculated by vehicle miles							↑
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	156	↑
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	22.1 avg pax/veh	↓
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	29,172	↓
		Maintenance	Breakdowns costly to fix							↓
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	9	↓
			Parts may not be transferrable between stock types							↓
		Staff	Additional training required for work on different classes							↓
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0.96 : 0.04	↓
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↓
		Energy	Diesel more expensive than electricity							↓
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	1 : 0	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	2000	↑
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↓
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↓
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↑

Virgin West Coast

Report Section	Cost Driver	Cost Type	Relationship to Cost	External Influences	Internal Controllability	TOC Controllability	Measure	TOC average	VWC	Expected Impact on Costs
Detailed Breakdown										
4.8	Average Speed	Energy	Higher speeds require exponentially higher energy due to air resistance	Franchise specification	Timetable	Low	Average Speed	63.64 km/h	127.25 km/h	↑
		Maintenance	Higher speeds are more mechanically demanding, therefore increase maintenance costs							↑
		Track Access	Higher speeds cause more damage to the track, therefore incur higher track access charges							↑
4.9	Vehicle km	Lease	Longer distance travelled will entail more rolling stock required	Franchise specification; Location of Depots	Timetable; Rolling Stock Strategy; Depot Strategy	Medium	Timetabled Vehicle km	139.19 million km	322.03 million km	↑
		Maintenance	Longer distance will result in more wear and tear on rolling stock							↑
		Staff	More staff required for long distances travelled, especially if staff diagrams are not balanced on a daily basis							↑
		Energy	More energy required to travel further							↑
		Track Access	Track access calculated by vehicle miles							↑
4.13	Stations Operated	Staff	Additional staff needed to operate stations	Franchise Specification	Subcontracting Strategy	Medium	Stations Operated	131	17	↓
4.15	Vehicle Utilisation (Crowding)	Staff	Higher passenger numbers likely to require more staff to manage crowding, check tickets and provide services	Existing level of demand	Marketing; Pricing; Passenger Management	Medium	Passenger km/ Vehicle km	23.6 avg pax/veh	18.5 avg pax/veh	↓
4.35	Reliability	Leases	Less reliable trains will imply more spare vehicles are needed in case of breakdown	Available Rolling Stock	Maintenance Practices; Depot Strategy	Medium	Miles per Technical Incident	22,691	12,566	↑
		Maintenance	Breakdowns costly to fix							↑
4.43	Diversity of Fleet	Maintenance	Diverse fleet may require different depot facilities	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Relationships with Suppliers; Training	Low	Number of different fleets	9.6	5	↓
			Parts may not be transferrable between stock types							↓
		Staff	Additional training required for work on different classes							↓
4.46	Traction Type	Lease	Diesel units (especially new builds) likely to be more expensive than electric trains due to scarcity	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Energy cost hedging	Low	Traction Type (Electric : Diesel)	0.57 : 0.43	0.85 : 0.15	↓
		Maintenance	Diesel-mechanical units have higher maintenance costs than diesel-electric and electric							↓
		Energy	Diesel more expensive than electricity							↓
4.61	Traction Distribution	Maintenance	Maintenance of locomotives (non-distributed) only affects one vehicle and trailers also mechanically simple	Franchise specification; Available Rolling Stock	Rolling Stock Procurement	Low	Distribution mix (MU : Loco/Trailer)	0.87 : 0.13	0.99 : 0.01	↑
			Newer trains with distributed power likely to be modular design which reduces maintenance downtime / costs							↓
		Track Access	Locomotives & trailers incur higher VUC charges than multiple-units							↓
4.71	Age of Fleet	Lease	Older vehicles are expected to be cheaper than newer vehicles due to much of the initial capital payment having already been paid off.	Franchise specification; Available Rolling Stock	Rolling Stock Procurement; Refurbishment Decisions; Maintenance Practices	Low	Age of fleet	1995	2002	↑
		Maintenance	Older vehicles are expected to be less reliable, requiring greater levels of maintenance and repair which will have a cost.							↓
		Staff	Certain classes of older vehicles may require manual door operation and other labour-intensive operations (e.g. Mk3)							↓
		Track Access	Newer trains tend to be heavier due to safety equipment and comfort features, therefore higher Track Access							↑

7 - Observations

7.1 - The ORR is looking to improve understanding within the industry, and amongst the public, of the costs associated with train operation and the extent to which operators can manage these costs. The work completed by SDG has demonstrated that it is not straightforward to derive a standard set of costs associated with train operation that can be applied across the industry. This is because costs depend on a number of drivers, each of which can be influenced to different degrees by a range of factors.

7.2 - There are currently 23 train operating companies that serve the UK and their characteristics have been reviewed in terms of their franchise timeline, the routes they operate, the types of service they run, and the rolling stock fleets they utilise. SDG's analysis shows that there is a high level of variation between the total costs associated with rolling stock for each of these operators, but that some themes can be observed between how drivers affect costs.

7.3 - An operator requires sufficient rolling stock to meet its minimum service requirements as well as having some surplus stock to allow routine maintenance to be undertaken and faults rectified. Rolling stock fleets that have a higher level of reliability mean that operators may be able to reduce the number of trains they need to lease, which would then reduce the leasing charges they incur. However, for rolling stock with high levels of reliability the ROSCO may be able to charge a premium for this, reflected in higher leasing charges per vehicle. This demonstrates some of the complexities, inter-relationships and challenges that operators face in managing and controlling costs.

7.4 - As much as operators take part in cross-industry forums to discuss fleet reliability and share best practice, the franchising system in the UK ultimately means that these same operators are at the same time directly competing for franchises. Therefore, a particular operator's best practice may also be their unique selling point for a future franchise competition and, as such, they would likely be reluctant to share the details. In this respect, the way in which franchising works within the UK could influence an operators costs, if they are not party to improvements made in other areas of the industry.

7.5 - Another aspect of the franchising process that influences an operator's ability to control costs is the availability of alternative rolling stock at any given time. As currently nearly all of the national rolling stock fleet is on lease, at the time of bidding for a new franchise there are often a limited number of rolling stock options available. This places a constraint on an operators ability to control cost through, say, switching to an alternative with lower leasing costs or that has proven to be more reliable, in turn reducing maintenance costs.

7.6 - The approach that operators take to maintaining their fleets may also influence their overall costs. The Class 390 rolling stock operated by Virgin Trains is maintained by Alstom under a train service agreement and its costs associated with rolling stock are significantly higher than its nearest comparator service provider East Coast. As there are stark differences in the age profile of the rolling stock between both operators, the effect this has on their respective leasing charges also needs to be considered, but there is anecdotal evidence to suggest that TSA agreements incur additional cost. As discussed within this report, having a more detailed breakdown of how maintenance costs have been categorised would enable further analysis to be undertaken.

7.7 An analysis of traction energy costs has shown the dominance of diesel fuel charges on an operators overall cost base. For example, whilst Virgin Trains fleet portfolio includes only 15% diesel rolling stock, the cost of diesel accounts for 40% of its total energy costs. In a number of cases operators have no choice but to run diesel stock, as areas of their network may not be electrified. There are no electrified lines in Wales, which means that Arriva Trains can only operate diesel rolling stock. This and the nature of their routes mean that they also have the highest cost of diesel per vehicle kilometre travelled.

steer davies gleave

Appendices

A - TOC Characteristics

Franchise Agreements

A.1 - As discussed in the previous section, the majority of passenger services are provided by the Train Operating Companies under a franchise agreement with the Department for Transport. There are currently 23 train operating companies that serve the UK and their characteristics are presented in this section (noting that Open Access Operators have been excluded).

A.2 - The following aspects of each train operating company are covered:

- Franchise timeline
- Route:
- Types of Service
- Fleets
- Depots
- Any other information

A.3 - The information within this section has been source from the website of each operator and the Rail Guide, a railway industry publication by Colin J Marsden.

Abellio Greater Anglia

Franchise timeline	1997 - Privatised as Anglia Railways, First Great Eastern, and West Anglia Great Northern 2001 - Greater Anglia franchise awarded to National Express as "one" starts Feb 2012 - Abellio greater Anglia franchise July 2014 - Abellio given Direct Award franchise to October 2016 -
Route	London Liverpool Street to Enfield, Chingford, Hertford East, Stansted Airport, - Cambridge, Peterborough, King's Lynn, Norwich, Sheringham, Great Yarmouth, - Lowestoft, Upminster, Southend, Southminster, Braintree, Sudbury, Colchester, - Clacton-on-Sea, Walton-on-the-Naze, Harwich, andFelixtowe, and intermediate routes. -
Types of services	Intercity, inter-urban, commuter, rural -
Fleets	*Electric: Class 90 locomotives and Mk3 carriages and DVT, Classes 315, 317/5-8, 321/3-4, 360/1, and 379* *Diesel: Classes 153, 156, and 170/2*
Depots	Norwich Crown Point – Class 90s and Mk3s and DVTs, DMUs, and EMT Class 158 DMU light maintenance Clacton-on-Sea – maintenance depot delivers a diverse workload. AGA operate three maintenance teams to meet their daily requirements along with delivering a number of special projects, for example the upgrade programme of the ex-London Midland trains that are now operated by Greater Anglia. Ilford – train stabling and light maintenance depot for electric multiple units. On-site staff from Siemens manage the Class 360s while Bombardier manage the Class 379.

Any other information	Class 360s have a reliability of 39,797 MTIN MAA (P7 2012-13) Class 90 locomotive-hauled Norwich to London Liverpool Street services returned 22,507 MTIN MAA (P7 2012-13), which is amongst one of the best performance figures for intercity rolling stock (by comparison the newer Class 390 Pendolinos achieved 10,750 MTIN MAA for the same period.

Arriva Trains Wales

Franchise timeline	Privatised as Wales & West and Valley Lines franchises, both run by National Express 2003 – New Wales & Borders franchise awarded to Arriva Trains Wales starts combining both earlier franchises along with First North Western services from Manchester to Welsh destinations, and Conwy Valley Line, and Central Trains Cambrian Coast services. 2005 – franchise responsibility devolved to Welsh Assembly 2018 – franchise renewal date
Route	All routes in Wales including North, Mid, and South Wales, Valley Lines, and the Welsh Marshes and Border region. Also routes to Shrewsbury, Manchester, Crewe, Chester, Birmingham, Bidston, and Cheltenham Spa.
Types of services	Inter-urban, regional, commuter, and rural
Fleets	*Electric:* none *Diesel:* Class 67 locomotives and Mk 2 and Mk 3 carriages with Mk 3 DVT, Classes 121, - 142, 143, 150/2, 153, 158, 175/0, and 175/1. -
Depots	Cardiff Canton, Chester, Holyhead, Machynlleth, and Shrewsbury. -
Any other information	There are currently no electrified railway lines in Wales. - The Cambrian Coast line is fitted with ETCS Level 2, which was completed as the test - scheme of ERTMS in the UK. Class 158s have been fitted with equipment for working - this route, replacing the earlier RETB. - The large and dispersed network operated by ATW means that many units are stabled - away from depots at night and it is also challenging to recover failed units back to a - depot for repair work to be undertaken. This can make train planning more difficult as - units may be widely dispersed and operating a range of different services; for example - many services running between Manchester and Cardiff are often then run through-diagrams into Wales, preventing them being serviced and maintained at Canton Depot, - Cardiff. -

c2c

Franchise timeline	1996 – 15 year franchise awarded to LTS Rail 2000 – National Express takes over LTS Rail 2003 – rebranded c2c May 2013 – 16 month franchise extension awarded November 2014 – new 15 year franchise awarded to National Express Trains trading as c2c
Route	London Liverpool Street and Fenchurch Street to Tilbury and Shoeburyness
Types of services	Inter-urban and commuter
Fleets	*Electric:* Classes 357/0 and 357/2 *Diesel:* None
Depots	East Ham and Shoeburyness

Any other information	In the peaks, most units operate a single round trip and off-peak service availability - requirements for c2c are very low, with around only 18 units required. This means that - trains always return to a depot at night, there is no out-stabling, and train servicing and - maintenance is relatively easy to manage. - C2c's network is arguably quite simple, running due east from London Fenchurch - Street and along the northern Thames Gateway area of southern Essex. - The Class 357 EMUs are configured to meet high peak demand passenger numbers - with 3+2 seating. -

Chiltern Railways

Franchise timeline	1996 – franchise awarded to M40 trains 2008 – Franchise sold to Deutsche Bahn, coming under control of Arriva Trains UK 2021 – New franchise due
Route	London Marylebone and Paddington to Aylesbury via Amersham and Aylesbury via Monks Risborough, Oxford, Stratford-upon-Avon, Birmingham Snow Hill, and Kidderminster.
Types of services	Inter-urban
Fleets	*Electric:* None - *Diesel:* Class 67 locomotives with Mk3 carriages and Mk3 DVT, Class 01.5 locomotive, - Classes 121, 165/0, 168/0-2, 172/1, and 960 service units (1x ex Class 121 and 1x ex - Class 117) -
Depots	Aylesbury and Wembley -
Any other information	Trains running to Aylesbury via Amersham do so for part of the route over London Underground infrastructure and must be fitted with trip-cocks. Eco-flex bogie fitted Class 172/1s cannot be easily fitted with trip-cocks so can only work this route in multiple with a Class 165 or 168 leading. The network is relatively self-contained and most trains return to a depot after service operation, with little stranded overnight and not able to receive maintenance attention, if required.

CrossCountry

Franchise timeline	1997 – Franchise awarded to Virgin CrossCountry starts 2007 – Franchise awarded to Arriva Trains UK trading as CrossCountry starts combining existing Cross Country network with Birmingham to Stansted Airport and Cardiff to Nottingham services originally operated by Central Trains, and some Manchester – - Scotland services originally operated by Virgin West Coast. - April 2016 – original new franchise start date - December 2019 – new franchise start date -
Route	Penzance / Paignton – Manchester / Edinburgh / Aberdeen, Bournemouth – - Manchester / Edinburgh / Aberdeen, Birmingham – Stansted Airport, Nottingham - Cardiff -
Types of services	Intercity -
Fleets	*Electric:* None - *Diesel:* HSTs (Class 43 and Mk3 carriages), Classes 170/1, 170/3, 170/5, 170/6, 220, 221 -
Depots	Central Rivers, Tyseley, and Craigentinny -

Any other information	Class 221 tilt equipment has been isolated as route has no sections which allow high-speed running which requires tilt. - CrossCountry does not manage any stations. - The Class 220 fleet is maintained in its entirety by the manufacturer, Bombardier - Transportation, at its Central Rivers depot. -

East Coast

Franchise timeline	1996 – GNER awarded franchise 2002 – 2 year franchise extension awarded to GNER 2005 – GNER awarded 7 year franchise 2006 – Following parent company Sea Containers encountering financial difficulties, DfT strips GNER of the franchise 2007 – National Express awarded franchise starts 2009 – National Express defaults and hands franchise back to DfT 2009 – Directly Operated Railways (DOR) takes over control of franchise 2014 – Virgin Trains East Coast (Stagecoach 90% / Virgin 10%) awarded franchise starting in March 2015
Route	London King's Cross to Aberdeen, Inverness, Edinburgh, Glasgow, Hull, Leeds, Bradford, Skipton, Harrogate and Lincoln.
Types of services	Intercity
Fleets	*Electric:* Class 91 locomotives and Mk4 carriages and Mk4 DVT *Diesel:* HSTs (Class 43 locomotives and Mk3 carriages)
Depots	Bounds Green, Craigentinny (and operating into Polmadie, Heaton, and Neville Hill)
Any other information	Operates fixed formation InterCity services. Also own 11 Mk3 and Mk4 barrier vehicles. New franchise will additionally provide services to Huddersfield, Sunderland, Dewsbury, Middlesbrough, and Thornaby. In 2019, Hitachi Super Express Trains (SET) procured by the DfT under the Intercity Express Programme (IEP) will enter service.

East Midlands Trains

Franchise timeline	1996 – Midland Mainline (National Express) awarded franchise starts 2007 – New franchise awarded to Stagecoach branded as East Midlands Trains starts combining Midland Mainline with the East Midlands services operated by Central - trains - April 2015 – Original new franchise start date - October 2017 – New franchise start date -
Route	London St Pancras to Sheffield / York / Leeds / Nottingham, Norwich / Skegness / - Cleethorpes to Nottingham / Crewe / Liverpool / Matlock. -
Types of services	Intercity, inter-urban, commuter, and rural -
Fleets	*Electric:* None - *Diesel:* Class 08 locomotives, HSTs (Class 43 locomotives and Mk3 carriages), Classes - 153, 156, 158, 222/0, and 222/1. -
Depots	Etches Park, Nottingham, Neville Hill -

Any other information	Also own 5 Mk3 barrier vehicles. - Class 43 engines were replaced with the Paxman VP185 rather than the MTU engine - fitted to all other Class 43s. - Other than the lines to Liverpool and Manchester, no East Midlands Trains routes are - electrified north of Bedford and all trains operated are diesel-powered. - As a result of a major programme of infrastructure works to upgrade some sections of - the line to 125 mph operation, faster services now run from Nottingham and Sheffield - to London St Pancras (using HSTs and Class 222 DEMUs. -

First Great Western

Franchise timeline	1996 – Franchise awarded to Great Western Holdings starts 1998 – First Group buys out its partners to take over the franchise 2006 – Franchise awarded to First Great Western starts combining the Great Western franchise, the Great Western Link franchise, and Wessex Trains franchise 2013 – Direct award franchise awarded 2019 – New franchise start date
Route	London Paddington to Penzance, Paignton, Bristol, Cardiff, and Swansea, Thames Valley lines, Bristol to Weymouth, Portsmouth, and Brighton, and local lines in the West Country.
Types of services	Intercity, inter-urban, commuter, rural -
Fleets	*Electric:* None - *Diesel:* Class 08 locomotives, HSTs (Class 43 locomotives and Mk3 carriages), Class 57/6 - locomotives and Mk3 sleeper carriages, Classes 143, 150/0, 150/1, 120/2, 153, 158/0, - 165/1, 166, and 180. -
Depots	Laira, Old Oak Common, Exeter, Landore, St Philip's Marsh, Penzance, and Reading. -
Any other information	Also own 4 Mk3 carriage barrier vehicles. - In 2017, Hitachi Super Express Trains (SET) procured by the DfT under the Intercity - Express Programme (IEP) will enter service. - FGW operates the London Paddington – Penzance sleeper service. -

First ScotRail

Franchise timeline	1997 – Franchise awarded to National Express branded as ScotRail starts 2004 – Franchise awarded to First ScotRail starts 2005 – Franchise powers devolved to transport Scotland 2008 – First ScotRail awarded three year franchise extension April 2015 – Abellio ScotRail franchise start date (April 2015 – Caledonian Sleeper franchise start date as separate franchise)
Route	All routes in Scotland, and services to Carlisle and Newcastle, and Caledonian Sleeper to London Euston.
Types of services	Intercity, inter-urban, commuter, rural
Fleets	*Electric* Classes 314, 318, 320, 334, 380/0, and 380/1. *Diesel* Classes 156, 158, 170/3, and 170/4. -
Depots	Corkerhill, Glasgow Shields Road, Haymarket, and Inverness. -

Any other information	First ScotRail run the sleeper service with Mk2 and Mk3 carriages and locomotives hired from DB Schenker. The ScotRail franchise has recently been awarded to Abellio, who take over the new franchise on 1st April 2015. Similarly, the Caledonian Sleeper franchise, which has been separated from the main ScotRail franchise, has been awarded to Serco, and will start on the same date. As part of the new franchises, Abellio will introduce new Hitachi built AT200 EMUs and refurbished HSTs (released from Great Western following introduction of the IEP), and Serco will introduce new sleeper carriages.

First TransPennine Express

Franchise timeline	1997 – Franchise awarded to Northern Spirit starts 1998 – Long distance services rebranded TransPennine Express 2001 – Northern Spirit rebranded Arriva Trains Northern following buy-out 2004 – Franchise awarded to First TransPennine Express starts 2011 – Franchise extension awarded 2013 – Further franchise extension awarded 2016 – New franchise start date
Route	Newcastle, Middlesbrough, Scarborough, Hull, and Cleethorpes to Manchester and Liverpool, Manchester to Barrow-in-Furness, Windermere, Carlisle, Edinburgh, and Glasgow.
Types of services	Intercity
Fleets	*Electric* Class 350/3 *Diesel* Classes 170/3 and 185 -
Depots	Ardwick, York, and Crofton -
Any other information	Rail North, an organisation made up of the PTEs and Councils through which First - TransPennine Express and Northern operate are in discussion with DfT to assume more - control of the franchises and would like to procure rolling stock as part of that control - change. - Siemens are responsible for maintaining the Class 185 DMU and Class 350 EMU fleets. - Bombardier Transportation maintains the Class 170 Turbostar fleet. - The Class 185 fleet was designed with hill climbing in mind, necessary for the routes it - operates, and it was also a specification requirement that the units be capable of 100 - mph operation. The high installed power reduces their overall fuel efficiency and an - “Eco-mode” has been introduced, to improve fuel efficiency on sections that do not - require the full power of the train to be available. -

London Midland

Franchise timeline	1997 – Franchises awarded to Central Trains and Silverlink start 2007 – Franchise awarded to London Midland (Govia) starts combining Central Trains West Midlands services with Silverlink County services. 2013 – Franchise extension awarded 2017 – New franchise due to start
Route	London Euston to Liverpool Lime Street, and West Midlands routes
Types of services	Inter-urban, commuter, rural

Fleets	*Electric* Classes 321/4, 323, 350/1, 350/2, and 350/4. *Diesel* Class 08 locomotives, Classes 139, 150/1, 153, 170/5, 170/6, 172/2, and 172/3
Depots	Northampton, Soho, Tyseley, and Stourbridge
Any other information	Oyster cards are valid between London and Watford Junction.

London Overground

Franchise timeline	2007 – Concession awarded to MTR Laing Rail branded as LOROL starts 2008 – Laing Rail procured by Deutsche Bahn and LOROL becomes part of Arriva Trains - UK - 2014 – Concession extended until November 2016 - 2015 – London Overground will take over current Greater Anglia services from London - Liverpool Street to Chingford, Cheshunt, and Enfield Town, and Romford to Upminster. - November 2016 – New concession due to start -
Route	East London Line, Gospel Oak to Barking Line, North London Line, Watford DC Line, - West London Line, and South London Line. -
Types of services	Commuter -
Fleets	*Electric:* Classes 378/1 and 378/2 - *Diesel:* Class 09/0 locomotive, Class 172/0 -
Depots	Willesden and New Cross Gate -
Any other information	The Class 378 Capitalstars have a metro-style interior layout, with longitudinal seating - and large open areas to maximise space for standing passengers. The one-third and - two-third doors, as well as the open inter-vehicle gangways, assist passenger - movement into, out of, and through vehicles. -

Merseyrail

Franchise timeline	1997 – Franchise awarded to MTL branded as Merseyrail Electrics starts 2000 – MTL purchased by Arriva Trains UK 2001 – Franchise rebranded Arriva Trains Merseyside 2003 – Franchise awarded to a consortium of Serco and Abellio trading as Merseyrail starts 2028 – New franchise due
Route	750 DC third rail electrified routes around Liverpool and the wider Merseyside region
Types of services	Commuter
Fleets	*Electric:* Classes 507 and 508 *Diesel:* None
Depots	Birkenhead North
Any other information	Merseytravel, the PTE for the Liverpool region awards the Merseyrail franchises. It is currently working towards procuring a new fleet of trains to replace all the existing stock. The network covers the Wirral and Northern Lines within Merseyside, running on approximately 75 route miles of track. Of these, 6.5 miles run underground through the original Mersey railway tunnel. This brings limitations to the rolling stock that can operate this section due to the small clearances and tight curve radii within the underground section.

Northern Rail

Franchise timeline	1997 – Franchises awarded to Northern Spirit and North West Trains start - 1998 – North West Trains rebranded First North Western following buy-out - 2001 – Northern Spirit rebranded Arriva Trains Northern following buy-out - 2004 – Franchise awarded to Serco-Ned Railways trading as Northern Rail starts, - combining the Arriva Trains Northern and First North Western services (with the - exception of TransPennine Express which became a separate franchise) - 2010 – First franchise extension awarded - 2016 – New franchise due to start -
Route	Regional services in Yorkshire, Lancashire, Cumbria, Greater Manchester, Merseyside, - and the North East. -
Types of services	Regional, commuter, and rural -
Fleets	*Electric:* Classes 321/9, 322, 323, and 333. - *Diesel:* Classes 142, 144, 150/1, 150/2, 153, 155, 156, 158/0, and 158/9 -
Depots	Newton heath, Heaton, Longsight, Neville Hill, and Allerton -
Any other information	Northern are starting to receive Class 319s released by Thameslink to be used on the - newly electrified lines in the North West. - Rail North, an organisation made up of the PTEs and Councils through which Northern - and TransPennine Express operate are in discussion with DfT to assume more control - of the franchises and would like to procure rolling stock as part of that control change. -

Southeastern

Franchise timeline	1996 – Franchide awarded to Connex South Eastern starts 2003 – Connex stripped of franchise (7 years' early) due to poor financial management - and franchise transferred to SRA run South Eastern Trains - 2006 – Integrated Kent franchise combining South Eastern and domestic services on - HS1 starts having been awarded to Govia branded as Southeastern. - 2011 – First franchise extension awarded - 2018 – New franchise due to start -
Route	HS1, Ashford Line, Chatham Line, Hastings Line, Maidstone East Line, Medway Valley - Line, Sheerness Line, Bexleyheath Line, Bromley South Line, Hayes Line, Sevenoaks - Line, Sidcup Line, Greenwich Line, Bromley North Branch, -
Types of services	High speed, regional, and commuter -
Fleets	*Electric:* Classes 375/1, 375/6, 375/7, 375/8, 375/9, 376, 395, 465/0, 465/1, 465/2, - 465/9, and 466. - *Diesel:* None -
Depots	Ashford, Slade Green, and Ramsgate -
Any other information	In March 2007, Hitachi Rail Europe secured a contract to replace the traction - equipment on the HSBC-owned Class 465 fleet. At the time, the fleet was suffering - from poor reliability, which has now been improved. The re-traction has also made a - difference operationally, as before Southeastern operated the units in multiple, where - the improved reliability means they can now operate in single formation too. -

South West Trains

Franchise timeline	1996 – Franchises awarded to Stagecoach branded as South West Trains and Island Line 2004 – South West Trains new three year franchise starts 2007 – South West Trains new franchise starts combing the existing South western franchise with the Island Line on the Isle of Wight. 2013 – Franchise extension awarded 2019 – New franchise due to start
Route	London Waterloo to Weymouth, Exeter, Portsmouth, and suburban services in Berkshire, Hampshire, and Surrey. All services on the Isle of Wight.
Types of services	Regional and commuter
Fleets	*Electric:* Classes 444, 450/0, 450/5, 455/7-9, 456, 458/0, 458/5, and 483 *Diesel:* Classes 158, 159/0, and 159/1
Depots	Wimbledon Park, Bournemouth, Clapham Junction, Salisbury, Northam, and Ryde St John's Road
Any other information	The Class 159 fleet, which is relatively small, returns to Salisbury depot every night and thus can receive maintenance attention daily, if required. There is also anecdotal evidence that Salisbury depot has access to good, ex-army staff. Siemens maintain the Desiro fleets under a Train Services Agreement (TSA).

First Capital Connect

Franchise timeline	1996 – South Central franchise awarded to Connex South Central starts 1997 – Thameslink franchise awarded to Govia branded as Thameslink starts 1997 – West Anglia Great Northern franchise awarded to Prism Rail starts 2000 – West Anglia Great Northern franchise bought out by National Express 2000 – Connex's poor performance results in new South Central franchise process initiated early - 2001 – Govia awarded South Central franchise starting in 2003 but buys Connex out of - remaining term and takes over in 2001 under the brand Southern. - 2004 – West Anglia section of the West Anglia Great Northern franchise transferred to - Greater Anglia franchise. Great Northern section continues under the brand WAGN. - 2006 – Thameslink Great Northern franchise starts when the Thameslink franchise - combined with the Great Northern section of the West Anglia Great Northern franchise - which was awarded to First Group branded as First Capital Connect. -
Route	Bedford to Brighton, and Luton to Wimbledon and Sutton - Southern – London Victoria and London Bridge to Brighton, Uckfield, East Grinstead, - and the Coastway route. Services to Surrey and Sussex. Brighton to Ashford - International - London King's Cross to King's Lynn, Cambridge, and Peterborough, London Moorgate - to Weleyn Garden City, Hertford North, and Letchworth Garden City. -
Types of services	Inter-urban, regional, and commuter -
Fleets	*Electric:* Thameslink – Classes 319/0, 319/2-4, and 377/5; Southern – Classes 313/2, - 377/1-4, 377/6, 442, 455/8, and 456; Great Northern – Classes 313, 317/1, 321, and - 365 - *Diesel* Thameslink – None; Southern – Class 09/0 and 73/2 locomotives, Classes 171/7 - and 171/8; Great Northern - Class 03 locomotive -

Depots	Thameslink – Bedford Cauldwell Walk, Brighton Southern – Brighton, Selhurst Great Northern – Hornsey
Any other information	New Class 700 EMUs will start to enter service in 2016, built for the Thameslink services, maintained at new depots at Hornsey and Three Bridges.

Virgin Trains West Coast

Franchise timeline	1997 – Intercity West Coast 15 year franchise, awarded to Virgin trains, starts 2011 – Franchise extension awarded August 2012 – First Group announced winner of new franchise competition October 2012 – New franchise cancelled after flaws discovered in DfT evaluation procedure December 2012 – Management contract franchise awarded to Virgin Trains 2014 – Franchise extension awarded 2017 – New franchise due to start
Route	London Euston to Birmingham, Holyhead, Manchester, Liverpool, Glasgow, and Edinburgh
Types of services	Intercity
Fleets	*Electric:* Class 390 *Diesel:* Class 221
Depots	Longsight, Edge Hill, Oxley, Wembley, and Central Rivers
Any other information	The Pendolino sets procured for the enhanced West Coast Main Line have a maximum operating speed of 140 mph but, due to the reduced scope of electrification upgrade work on the WCML, are restricted to 125 mph operation Between 2010 and 2013, a number of Pendolino sets were extended from 9-car to 11-car operation in order to provide more Standard Class capacity. The order was placed by the Department for Transport for a total of 106 carriages comprising four complete 11-car sets and 31 sets being extended to 11-car operation.

B - Regulated Standards and Obligations -

B.1 - The development of standards is an on-going process and new and revised requirements emerge on a regular basis. The European Commission is actively pursuing the concept of interoperability across the railway industry through a series of directives intended to ensure common technical standards are applied across Europe, to help remove technical and financial barriers to the supply of equipment and the running of trains between Member States. Although the British rail network is largely isolated from the rest of Europe, and has a different (smaller) loading gauge, the measures are still required to be implemented in national law.

B.2 - Changes in regulatory standards could affect the cost of new trains and potentially affect existing stock in a number of possible ways, for example:

- Limitations on the deployment or use of stock (e.g. operating restrictions);
- Cost of making necessary modifications to achieve compliance; and
- Potential to shorten the expected life of the stock if it is not practical or economic to modify (and no derogation is obtained).

B.3 - The capital costs for carrying out this work will be reflected in the capital lease charges that TOCs pay for rolling stock; with vehicles that are compliant to the standards likely to be more expensive than those that are not compliant.

Persons of Reduced Mobility

B.4 - The Rail Vehicle Accessibility Regulations (RVAR) were created following the provisions of the Disability Discrimination Act 1995 (DDA) and applied to heavy rail services and equipment. These regulations are now superseded by the Persons of Reduced Mobility Technical Specifications for Interoperability (PRM TSI) which came into force on 4 December 2009.

B.5 - Existing vehicles must be modified to comply with the accessibility requirements of PRM-TSI by 31 December 2019, a target date set by the Government. Much of the more modern fleet is already compliant but work remains to be completed on some older units. Most can still be modified to enable recovery of costs via capital rentals over their remaining economic life.

European Rail Traffic Management System

B.6 - The European Rail Traffic Management System (ERTMS) is a common mandatory standard for command-control, signalling subsystem and railway operations. It comprises trackside and train-borne systems, utilising in-cab signalling (for Levels 2 & 3) and automatic train protection to control the speed of the train to the requirements of the track; a European Train Control System (ETCS).

B.7 - ERTMS is currently a requirement for high-speed lines and whenever the Infrastructure Manager comprehensively renews a section of main line railway it will be required to equip it so that it is ERTMS compliant.

B.8 - The introduction of the European Rail Traffic Management System (ERTMS) in the UK took place in 2011 on Arriva Trains Wales' Cambrian Line as part of a scheme termed the Early Deployment Scheme (EDS) to establish what problems would require to be overcome. This line is now signalled using ETCS Level 2.

B.9 - The first installation of ERTMS as part of the National Implementation Plan will take place on the Great Western Main Line as part of the large-scale re-signalling of the line, coinciding with the arrival of new trains and electrification in Network Rail's Control Period 5 (2014-2019).

Diesel Engine Emissions

B.10 - Until 2006 the rail industry was not subject to any compulsory emissions legislation. However, the situation changed with the adoption of European emission standards for non-road engines (i.e. including rail vehicles and locomotives) [Directive 2004/26/EC]. Stage IIIA standards have been phased-in from 2006 to 2013, applying to rolling stock rated at over 560kW from 2009. Stage IIIB limits applied from 2012. Stage IV is not expected to apply until 2020 and Stage V legislation is currently being drafted. (Stage III/IV limits are also harmonised with the US Tier 3/4 standards).

B.11 - In November 2011 the EU passed Directive 2011/88/EU which amends Directive 97/68/EC to provide for some flexibility in adapting Stage IIIB for rolling stock with particular emphasis on circumstances in the UK market. This provided for a limited number of new locomotives to be manufactured for up to 3 years after the Stage IIIB requirements came into force (i.e. by 31 December 2014).

B.12 - It is important to note that Stage III/IV legislation applies only to new vehicles and equipment. The Directive does not apply to existing overhauled engines which, in theory, can continue to be repaired indefinitely, provided that individual replacement components continue to be available. This may, however, have an impact on the costs associated with the continued operation of older rolling stock.

Control Sheet -

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Understanding the Rolling Stock Costs of TOCs in the UK

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