MÁSTER'S DEGREE IN

RAILWAY SYSTEMS

COMILLAS PONTIFICAL UNIVERSITY

ICAI SCHOOL OF ENGINEERING

COMPATIBILITY ASSESSMENT OF PASSENGER ROLLING STOCK MATERIAL IN GREAT BRITAIN RAIL NETWORK

OFFICIAL MASTER'S DEGREE IN RAILWAY SYSTEM

2016-2017

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Abstract

The Great Britain railway system, distinguished from being one of the oldest in the world, is composed by a plethora of varying types of rolling stock, to a degree incompatible with each other, which cause considerable inefficiencies into the system.

This Master thesis aims to give guidance on the definition of technical specifications for a Standard Rolling Stock Material type (S-RSM) capable of running passenger services for primary and secondary strategic route sections in Great Britain. For this purpose a collection of infrastructure technical data from its manager, Network Rail, is required at first stage for latter analysis and definition of the common railway vehicle parameters.

A route availability (RA) study is also performed in primary and secondary routes so as to locate critical areas in the network that may affect the operation of the railway vehicles at first step compatibility assessment.

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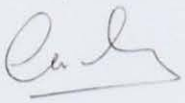

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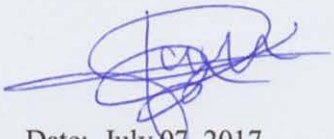

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Acknowledgments

First of all I would like to express my deepest gratitude to the professors and fellows of the Official Master's Degree in Railway Systems, for their excellent guidance and for the provision of an excellent atmosphere. Special thanks go to Emilio Garcia, who was willing to participate as a co-director of the present Master Thesis. I must say that it was a great pleasure to attending his Railway Vehicle Dynamic lessons.

My research would not have been possible without the proposal of Juan Manuel Ramirez. My sincere thanks go to you for your guidance and for introducing me into the British railway network, as I found an intriguing topic to carry on exploring.

Nobody has been more important to me than the members of my family. I would like to thank you for your support in whatever I pursue. Finally, I would like to thank my friends as they were always there cheering me up and stood by me through the good times and bad.

Table of contents

I. OBJECTIVES

The present master thesis aims to develop a better understanding of the technical implications regarding the passenger rolling stock material in Great Britain network rail for both primary and secondary routes. According to the current Master´s Degree in Railway Systems program of ICAI School of Engineering, the objectives are divided and studied into two separate sections:

OBJECTIVES OF THE MASTER THESIS

- Definition of unified Rolling Stock Material main technical specifications for passenger railway vehicles running services in primary and secondary strategic route sections.

OBJECTIVES OF MASTER THESIS EXTENSION

- Summary and evaluation of infrastructure route availability numbers of primary and secondary routes and its classification attending to the vehicle limitations/restrictions to finally identify of the most restrictive locations of the railway network.
- Technical comparison between British Class 800 High-speed vehicles, running services for the Intercity Express Program (IEP) and the Standard Rolling Stock Material (S-RSM) defined at previous section.

II. SCOPE OF WORK

SCOPE OF WORK OF THE MASTER THESIS

- Identification of the primary and secondary strategic route sections of the UK railway network on the basis of Network Specifications provided by Network Rail infrastructure manager.
- Collection of infrastructure technical specifications attending the Route Specifications. This documentation involves the strategic route section, lines of route description, range of speeds for slow and fast lines, infrastructure route availability and gauge, electrification type and signalling method.
- Compilation of information with respect to the operation of the routes. It includes the identification of the Train Operator Company providing services within the primary and secondary lines and the number of trains per hour/day offered. The specified equipment involved is also summarised in tables.
- Provision on technical specifications of rolling stock material arranged by UK Rolling Stock Companies in primary and secondary routes.
- According to the above tasks, analysis of technical specifications for further and definition of a Standard Rolling Stock Material (S-RSM) vehicle.

SCOPE OF WORK OF MASTER THESIS EXTENSION

- According to the Network Specifications, range the route availability values so as to identify the minimum numbers for primary and secondary strategic route sections. Classify each route so as to attach the type of passenger railway vehicle that would accomplish the first step compatibility assessment.
- Gathering information on British Class 800 High-speed vehicles to finally establish a technical comparison with the passenger Standard Rolling Stock Material (S-RSM) defined above.

III. SCHEDULING

The table below summarises the number of hours involved in the execution of the present Master Thesis. Programming is done according to the following principal sections:

- Scope 01: General overview of rail industry in Great Britain
- Scope 02: Primary/Secondary route identification. Route capability overview database
- Scope 03: Compilation of primary/secondary TOC services and British Class railway vehicle types.
- Scope 04: British Class rolling stock material database.
- Scope 05: Gathering information about RSSB standards
- Scope 06: Definition of Standard Rolling Stock Material(S-RSM) technical specifications
- Scope 07: RA assessment of the railway network.
- Scope 08: Technical comparison between British Class 800 and passenger Standard Rolling Stock Material (S-RSM) railway vehicles
- Scope 09: Writing report and preparing presentation
- Scope 10: Supervision and meetings

Scope	Start	Finish	Duration
Master Thesis			
Scope 01	22/11/2016	02/07/2017	23 hours
Scope 02	22/11/2016	27/02/2017	170 hours
Scope 03	04/03/2016	04/05/2016	183 hours
Scope 04	04/05/2016	20/05/2016	106 hours
Scope 05	13/06/2017	02/07/2017	83 hours
Scope 06	13/06/2017	02/07/2017	30 hours
Master Thesis Extension			
Scope 07	26/06/2017	29/06/2017	35 hours
Scope 08	30/06/2017	02/07/2017	8 hours
Scope 09	10/04/2017	02/07/2017	75 hours
Others			
Scope 10	28/02/2017	07/07/2017	8 hours
		Total	**721 hours**

TABLE 1. MASTER THESIS SCHEDULING PLAN

IV. RESEARCH METHODOLOGY AND FINDINGS. MASTER THESIS

Chapter 1. Introduction

1.1. *GENERAL OVERVIEW OF THE RAIL INDUSTRY IN GREAT BRITAIN*

The rail sector in Great Britain has developed since privatisation to actually reach its current structure. It begun in 1994 and had been completed by 1997.

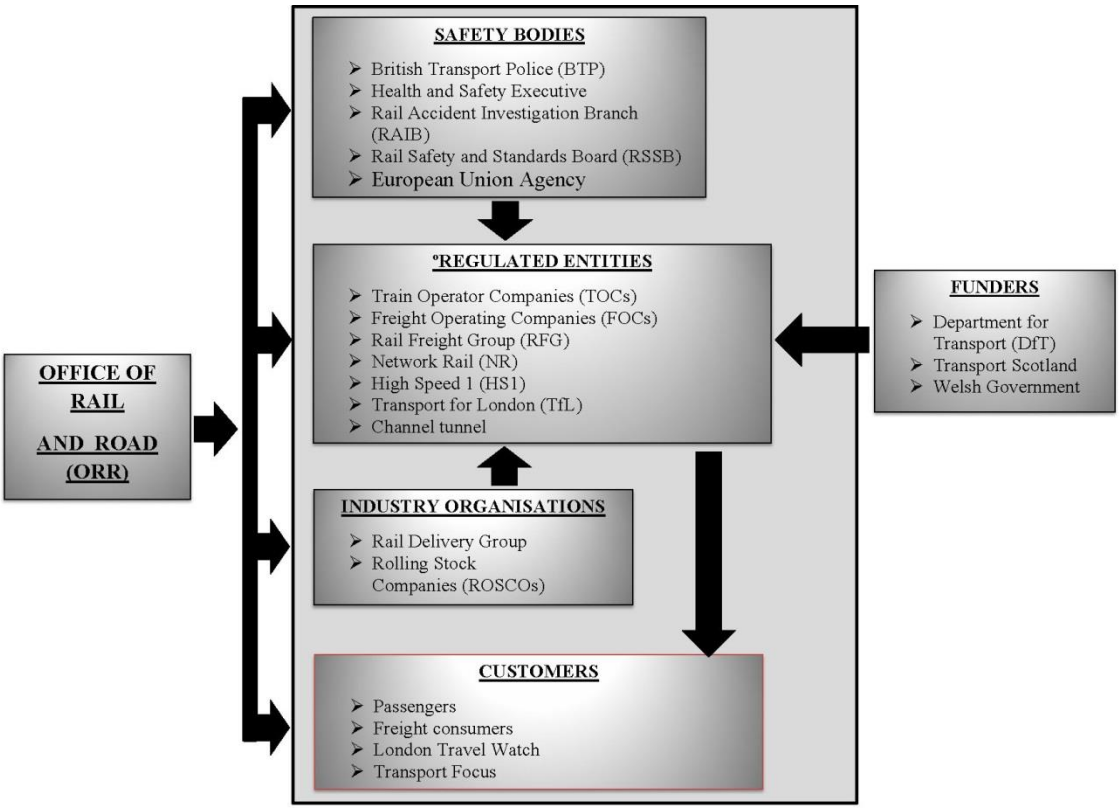

FIGURE 1. UK RAIL INDUSTRY BODIES

The ownership of the infrastructure, stations, and track maintenance belongs to Network Rail. Ownership of passenger trains is property of the rolling stock operating companies (ROSCOs). The stock is leased out to passenger Train Operating Companies (TOCs) awarded contracts through

a system of rail franchising overseen by the Department for Transport (DfT). On the other hand the operation of freight trains belongs to Freight Operating Companies (FOCs).

Figure 1 diagram reflects the actual relationship of the principal the bodies in the railway industry in in Great Britain. A general summary on its main functions is given below:

FUNDERS

- The Department for Transport (DfT) provides strategic direction and funding to the railway network. It is a government department body responsible for the procurement of rail franchises and projects.
- Transport Scotland (TS) is the government department created for carrying out transport functions in Scotland, e.g., those involving network operations and supporting of franchises. The DfT needs to be informed by this body prior to the approval of any new transaction that may have an impact on the Scottish network.
- Welsh Government is the department body with responsibilities for transport in Wales. Contrasting with the TS, the Welsh Government is given more power due to the devolving of franchising functions by the DfT.
- The Passenger Transport Executives (PTE) is responsible for public transport services within large urban areas.

SAFETY BODIES

- British Transport Police (BTP) provides policing services to rail operator, their staff and passengers across the country.
- Health and Safety Executive (HSE) gives advice to the government on health and safety matters.
- Rail Accident Investigation Branch (RAIB) carries out the investigation into rail accidents and incidents without apportioning blame, so as to leaning lessons, improving safety on railways and preventing similar situations.
- Rail Safety and Standards Board (RSSB) helps the mainline railway industry's work to achieve continuous improvement in health and safety performance.

- European Union Agency for Railways which will become from the 2019 the European authority to issue EU safety certificates and vehicle authorisations to railway companies.

REGULATORY BODIES

- Office of Rail and Road (ORR), act as an independent regulator on safety and economic matters for the railway system. If a railway operator wants to access the railway network, they have to apply to ORR for a track access agreement with Network Rail.

  ORR works to ensure that the rail market is competitive and fair for passengers, freight customers, railway operators and taxpayers.

- Autorité de Régulation des Activités Ferroviaires (ARAF) is the French rail regulator of the half Channel Tunnel. The other half regulator is ORR.

- The Intergovernmental Commission (IGC). ORR is not the safety or economic regulator for the Channel Tunnel. Those roles are currently carried out by the bi-national (UK and French) Channel Tunnel Intergovernmental Commission (IGC).

REGULATED ENTITIES

- Train operators companies (TOCs) operate passenger train services, in most cases under franchises let by DfT, TS or the Welsh Government.

- Network Rail (NR), is the rail infrastructure owner and operator regulated by ORR.

- High Speed 1 (HS1) has a 30 year concession to operate and manage the railway between St. Pancras and the Channel Tunnel, which is regulated by ORR.

- Transport for London (TfL), London Underground Ltd (LUL), Tramways and Metros, established as integrated bodies responsible for public transport system. And Heritage railways keep living history rail traffic in order to recreate or preserve railway scenes of the past.

- Channel tunnel, which is a rail tunnel linking Folkestone and Kent in the UK, with Coquelles and Pas-de-Calais, near Calais in northern France.

FREIGHT BODIES

- Freight Operating Companies (FOCs) are the companies that operate freight services on Britain's railway.
- Rail Freight Group (RFG) is the representative body for freight rail industry, including big and small companies of the logistic sector. RFG works for the promotion of the rail freight sector, taking awareness on the policy environment as well as supporting their members in the growing of their business.

PASSENGER BODIES AND CUSTOMERS

- Passengers and Freight consumers are both customers
- London Travel Watch is the independent, statutory watchdog group for transport users in and around London. They look into complaints of unhappy users with the services received by the transport providers.
- Transport Focus, independent public body set up by the government to protect the interests of Britain's rail passengers.

INDUSTRY ORGANISATIONS AND RAILWAY COMPANIES WORKING ACROSS THE INDUSTRY

- Rolling stock companies (ROSCOs) procure and own most of the actual passenger trains that run on the rails and lease them to the railway operators, therefore they are responsible for acquiring new trains when needed. When rolling stock is replaced by newer stock on a given route, it is often re-let to other routes operated by different companies. ROSCOs work with train operators to determine the sorts of engines, carriages and trucks required to deliver the desired customer services.
- Rail Delivery Group (RDG) is responsible for coordinating and leading on cross industry initiatives. It brings together, all passenger and freight operators within Network Rail, providing services and support to succeed by delivering better services for their customers.

1.2. *SPECIAL FEATURES OF THE RAIL INDUSTRY IN GREAT BRITAIN*

For a better understanding of the British railway system and its industry, a main list of features can be distinguished and set it apart. They are summarized below:

PUBLIC SUBSIDY

Apparently public subsidy feature is not only unique in Britain rail network but also in the whole rail industry. It is a loss-making industry dependent on government subsidy. And this clearly sets the industry apart from other privatised utilities, as for example water or energy industries.

The reason for public subsidy is that some services, such as many local and regional services are inherently loss-making because of low usage but are kept in service for social reasons.

INTERFACE COMPLEXITY

The railway system in Great Britain, which is the oldest in the world, is constrained by highly complex interfaces, a result of the 170 year legacy of its infrastructure.

Significant network enhancements, such as new rolling stock or lines, cannot be easily installed and operated. New trains must be compatible with the tracks, bridges and tunnels, signalling systems and station platforms, most of which were built at different times with different interfacing requirements.

Interface complexity is particularly acute in areas of high network density, such as Clapham Junction and Birmingham New Street, areas in which the problem of land scarcity arises.

LAND SCARCITY

Land scarcity problem can be particularity applied to the south of England. In contrast to the many other countries such as France and Germany, which are much less densely populated, it is rarely possible to build significant enhancements on green field sites.

A new high speed network in Britain could solve many of the track congestion issues by releasing space on local/regional lines, but whether it is possible to obtain the new land is questionable.

CAPACITY CONSTRAINTS

Another feature to be pointed about the Britain rail industry is the capacity constraint issues. It has been increased since privatisation because of the rise in usage of rail transport and the forecasts predict an increase of capacity in Long Distance and Regional services. This is closely linked to the previous point about land scarcity as network capacity problems are particularly significant in and around large urban areas such as London and Birmingham.

1.3. *NETWORK RAIL (NR)*

Network Rail, as the owner and operator of the railway network in England, Scotland and Wales, manages the track, signalling, bridges, tunnels and stations. UK railway network is divided into eight areas, across the country. Reference (1) displays in a map how cities are linked by the railway mainlines.

FIGURE 2. NETWORK RAIL AREAS

WALES

The Wales route operates the track across Wales and the border counties of England. This route links Cardiff, Newport, Swansea, Wrexham and Shrewsbury and several rural areas.

Main railway lines:

- The South Wales Mainline from Swansea to Paddington via Bridgend, Cardiff, Newport and the Severn Tunnel
- The North Wales Mainline from Holyhead to Crewe.

SCOTLAND

Scotland railway infrastructure connects passengers in Fife, north of Edinburgh, with Edinburgh and the Borders.

Main railway lines:

- The East Coast Mainline
- The West Coast Mainline
- The Highland Mainline from Perth to Inverness
- The Borders Railway from Edinburgh to the Borders
- The West Highland Line from Mallaig and Oban in the Scottish Highlands to Glasgow
- The Edinburgh to Aberdeen from Edinburgh to Aberdeen.

ANGLIA

The Anglia route covers five main corridors through Greater London, Cambridgeshire, Essex, Norfolk and Suffolk.

Main railway lines:

- The Great Eastern Mainline from Liverpool Street to Norwich and branches.
- The Cross-country Corridor via Ely from Ipswich/Norwich to Cambridge/Peterborough.

- The West Anglia Mainline from Liverpool Street to Cambridge, Kings Lynn and branches.
- The Orbital Routes, comprising the North London line from Stratford to Richmond and the Barking to Gospel Oak line.
- The Essex Thameside line from Fenchurch Street to Shoeburyness via Upminster and Tilbury.

WESSEX

The Wessex route covers the major commuter area of south west London as well as from London Waterloo to the south and south-west of England

This route is one of the busiest on the rail network, supports high levels of passenger traffic. The main railway line is:

- The South West Mainline from London Waterloo to Weymouth

SOUTH EAST

The South East route covers the network from London across Kent, parts of Surrey, East and West Sussex. The South East route is the busiest and most congested in the country, connecting the capital and its southern and south eastern suburbs with Kent, Surrey, Sussex and Europe. Busiest stations such as London Victoria, London Bridge, Charing Cross, Cannon Street and St Pancras International are managed in this area.

Main railway lines:

- Brighton Mainline from London Victoria and London Bridge to Brighton
- South Eastern Mainline from Charing Cross to Dover Priory via Tonbridge and Ashford
- Chatham Mainline from London Victoria to Dover Priory and Ramsgate via Chatham
- Hastings Mainline from London Charing Cross to Hastings via Tunbridge Wells
- Network Rail High Speed Ltd. maintains and operates High Speed 1 from St Pancras International to Folkestone.

WESTERN

Western route stretches from London Paddington to Penzance, Bristol Temple Meads, and boundaries with Wales, Worcester and Basingstoke.

The main railway line is:

- The Great Western Mainline from London Paddington to Bristol and into South Wales.

LONDON NORTH WESTERN

This route stretches connects London to Carlisle, including cities of the West Midlands and North West of England.

Main railway lines:

- The West Coast Mainline between London Euston and the Scottish border
- The Chiltern Mainline between London Marylebone and Birmingham Snow Hill.

LONDON NORTH EAST AND EAST MIDLANDS

This route connects the North East, Yorkshire, Lincolnshire, Bedfordshire, parts of Cambridgeshire and the whole of the East Midlands. It runs from Scottish Borders to London St Pancras, connecting cities in the North, North East and East Midlands.

Main railway lines:

- The Midland Mainline from Sheffield to London St Pancras
- The East Coast Mainline from the Scottish border to London King's Cross station

1.4. *TRAIN OPERATOR COMPANIES (TOCS)*

TOCs run passenger services, leasing trains to ROSCOs as well as leasing and managing stations from Network Rail. They are the consumer face of the rail industry, and generally apply for franchises to run specific routes from the Department for Transport. Next table lists the train operating companies involve in Great Britain`s railway passenger services[1].

Train Operator Company (TOC)	
(AW)	Arriva Trains Wales
(CC)	c2c
(CH)	Chiltern Railways
(CS)	Caledonian Sleeper
(EM)	East Midlands Trains
(ES)	Eurostar
(GC)	Grand Central
(GN)	Great Northern
(GR)	Virgin Trains East Coast
(GW)	Great Western Railway
(GX)	Gatwick Express
(HC)	Heathrow Connect
(HT)	Hull Trains
(HX)	Heathrow Express
(IL)	Island Line
(LE)	Greater Anglia
(LM)	London Midland
(LO)	London Overground
(NT)	Northern
(SE)	Southeastern
(SN)	Southern
(SR)	ScotRail
(SW)	South West Trains
(SX)	Stansted Express
(TL)	Thameslink
(TP)	TransPennine Express

[1] Office of Rail and Road (2017), Rolling stock leasing companies, http://www.orr.gov.uk/about-orr/who-we-work-with/industry-organisations/train-operating-companies

(VT)	Virgin Trains West Coast
(XC)	CrossCountry
(XR)	TfL Rail
(ME)	Merseyrail

TABLE 2. LIST OF TRAIN OPERATOR COMPANIES IN UK

1.5. *ROLLING STOCK LEASING COMPANIES (ROSCOS)*

Rolling stock leasing companies (ROSCOs) own most of the coaches, locomotives and freight wagons that run on the rails, which they lease to train operating and freight operating companies, in accordance with the requirements of the services to be operated.

ROSCOs have replaced many of the older trains that were being used at privatisation with modern vehicles. They are often responsible for the heavy maintenance and overhauling of the vehicles they lease to train operators[2].

Next table lists the Rolling Stock Leasing Companies (ROSCOs) involve in Great Britain`s railway passenger services.

Rolling Stock Leasing Companies (ROSCOs)
Angel Trains Ltd
Eversholt Rail Group
Porterbrook Leasing Company Ltd.
Beacon Rail

TABLE 3. LIST OF ROLLING STOCK LEASING COMPANIES (ROSCOS) IN UK

[2] Office of Rail and Road (2017), Rolling stock leasing companies, http://www.orr.gov.uk/about-orr/who-we-work-with/industry-organisations/rolling-stock-companies

Chapter 2. Railway specifications of primary and secondary routes

2.1. *ROUTE TYPE*

According to Network Rail Specifications, railway lines may be identified depending upon the market sector they serve within the area. It can be distinguished the next routes types:

- Primary routes: main lines covering long distances between cities including a wide variety of market sector, such as inter-city, regional or freight sectors.
- Secondary routes: railway line which branches off a more important route, usually a primary route. Secondary routes include more services with stopping regional trains operating over shorter distances than inter-cities, but fewer stops and faster services than commuters.
- Commuter routes: comprised by railway lines that operates between a city centre the suburbs. Trains normally operate following a schedule. The main difference between regional services and commuter services is that the latter is focused on moving people between where they live and where they work on a daily basis, providing high frequencies of travel.
- Rural routes: routes that include shorter branch lines and longer distances. Passenger services may expect high level of comfort and medium frequencies of travel.

The present study is focused only on primary and secondary routes and hence the identification of both types of lines must be carried out at a first stage. Network Rail infrastructure manager provides further information in this regard by means of the Network Specifications[3]. The next tables list the primary and secondary lines in Great Britain`s rail network (primary/secondary percentages added as an additional column), obtained from the route map of each area (*See Appendix 01: Great Britain railway maps. Route type*)

[3] Network Rail (2017), Our routes,
https://www.networkrail.co.uk/running-the-railway/our-routes/

WALES

Strategic route section (SRS)	Route type (Primary/Secondary)	% (Primary/Secondary)
SRS L.01	Primary	55%
SRS L.02-03	Primary	
SRS L.04-05	Primary	
SRS L.08-09	Primary	
SRS L.10-12	Primary	
SRS L.13-14	Primary	
SRS L.17	Secondary	45%
SRS L.18	Secondary	
SRS L.19	Secondary	
SRS L.20-22	Secondary	
SRS L.23	Secondary	

TABLE 4. ROUTE TYPE. WALES

SCOTLAND

Strategic route section (SRS)	Route type (Primary/Secondary)	% (Primary/Secondary)
SRS P.01	Primary	15%
SRS P.02	Primary	
SRS Q.01	Primary	
SRS G.11	Primary	
SRS Q.07	Secondary	85%
SRS P.03	Secondary	
SRS P.04	Secondary	
SRS P.05	Secondary	
SRS P.06	Secondary	
SRS P.07	Secondary	
SRS P.08	Secondary	
SRS P.09	Secondary	
SRS P.10	Secondary	
SRS P.11	Secondary	
SRS P.13	Secondary	
SRS N.06	Secondary	
SRS Q.02	Secondary	
SRS Q.03	Secondary	

SRS Q.04	Secondary	
SRS Q.06	Secondary	
SRS Q.08	Secondary	
SRS Q.09	Secondary	
SRS Q.10	Secondary	
SRS Q.11	Secondary	
SRS Q.12	Secondary	
SRS Q.13	Secondary	
SRS G.12	Secondary	

TABLE 5. ROUTE TYPE. SCOTLAND

ANGLIA

Strategic route section (SRS)	Route type (Primary/Secondary)	% (Primary/Secondary)
SRS D.12	Primary	43%
SRS D.10	Primary	
SRS D.11	Primary	
SRS D.20	Secondary	57%
SRS D.06	Secondary	
SRS D.07	Secondary	
SRS D.09	Secondary	

TABLE 6. ROUTE TYPE. ANGLIA

WESSEX

Strategic route section (SRS)	Route type (Primary/Secondary))	% (Primary/Secondary)
SRS C.01	Primary	44%
SRS C.02	Primary	
SRS C.03	Primary	
SRS C.04	Secondary	66%
SRS C.05	Secondary	
SRS C.08	Secondary	
SRS C.09	Secondary	
SRS C.15	Secondary	
SRS C.16	Secondary	

TABLE 7. ROUTE TYPE. WESSEX

SOUTH EAST (KENT AND SUSSEX)

Strategic route section (SRS)	Route type (Primary/Secondary)	% (Primary/Secondary)
SRS A.03	Primary	100%
SRS A.04	Primary	
SRS A.05	Primary	
SRS A.14	Primary	

TABLE 8. ROUTE TYPE. KENT

Strategic route section (SRS)	Route type (P/S)	% (Primary/Secondary)
SRS B.01	Primary	67%
SRS B.02	Primary	
SRS B.15	Secondary	33%

TABLE 9. ROUTE TYPE. SUSSEX

WESTERN

Strategic route section (SRS)	Route type (Primary/Secondary)	% (Primary/Secondary)
SRS J.01	Primary	65%
SRS J.02	Primary	
SRS J.03	Primary	
SRS J.04	Primary	
SRS J.05	Primary	
SRS J.06	Primary	
SRS J.07	Primary	
SRS K.01	Primary	
SRS K.02	Primary	
SRS K.15	Primary	
SRS K.16	Primary	
SRS J.10	Secondary	35%
SRS J.11	Secondary	
SRS K.03	Secondary	
SRS K.04	Secondary	
SRS K.06	Secondary	
SRS K.07	Secondary	

TABLE 10. ROUTE TYPE. WESTERN

LONDON NORTH WESTERN (NORTH AND SOUTH)

Strategic route section (SRS)	Route type (Primary/Secondary)	% (Primary/Secondary)
SRS N.03	Primary	12%
SRS N.05	Primary	
SRS H.22	Primary	
SRS H.25	Primary	
SRS N.04	Secondary	88%
SRS N.06	Secondary	
SRS N.07	Secondary	
SRS N.08	Secondary	
SRS N.09	Secondary	
SRS N.13	Secondary	
SRS H.05	Secondary	
SRS H.10	Secondary	
SRS H.17	Secondary	
SRS H.23	Secondary	
SRS H.24	Secondary	
SRS H.26	Secondary	
SRS H.27	Secondary	
SRS H.28	Secondary	
SRS H.29	Secondary	
SRS H.30	Secondary	
SRS H.31	Secondary	
SRS H.32	Secondary	
SRS H.33	Secondary	
SRS H.35	Secondary	
SRS H.37	Secondary	
SRS H.38	Secondary	
SRS H.39	Secondary	
SRS H.40	Secondary	
SRS H.42	Secondary	
SRS H.45	Secondary	
SRS H.46	Secondary	
SRS O.01	Secondary	

TABLE 11. ROUTE TYPE. LNW NORTH

Strategic route section (SRS)	Route type (Primary/Secondary)	% (Primary/Secondary)
M.12	Primary	46%
M.05	Primary	
M.06-07	Primary	
M.15	Primary	
SRS N.01	Primary	
SRS N.02	Primary	
M.08-09-19-21	Primary-Secondary	31%
M.10-22	Primary-Secondary	
M.11-23	Primary-Secondary	
M.13-18-24	Primary-Secondary	
M.14-25	Secondary	23%
M.20	Secondary	

TABLE 12. ROUTE TYPE. LNW SOUTH

LONDON NORTH EAST & EAST MIDLANDS

Strategic route section (SRS)	Route type (Primary/Secondary)	% (Primary/Secondary)
SRS G.01	Primary	41%
SRS G.05	Primary	
SRS G.06	Primary	
SRS G.07	Primary	
SRS G.08	Primary	
SRS G.09	Primary	
SRS G.10	Primary	
SRS H.01	Primary	
SRS H.12	Primary	
SRS H.13	Primary	
SRS H.14	Primary	
SRS G.13	Secondary	59%
SRS G.16-17	Secondary	
SRS G.18-19	Secondary	
SRS G.20-23	Secondary	
SRS G.21	Secondary	
SRS G.22	Secondary	
SRS H.03	Secondary	
SRS H.05	Secondary	
SRS H.06	Secondary	

SRS H.07	Secondary	
SRS H.08	Secondary	
SRS H.09	Secondary	
SRS H.15	Secondary	
SRS H.16	Secondary	
SRS H.18	Secondary	
SRS H.19	Secondary	

TABLE 13. ROUTE TYPE. LONDON NORTH EAST

Strategic route section (SRS)	Route type (Primary/Secondary)	% (Primary/Secondary)
SRS I.01	Primary	37%
SRS I.02	Primary	
SRS I.03	Primary	
SRS I.04	Secondary	63%
SRS I.05	Secondary	
SRS I.09	Secondary	
SRS I.10	Secondary	
SRS I.11	Secondary	

TABLE 14. ROUTE TYPE. EAST MIDLANDS

2.2. *ROUTE SPECIFICATIONS*

Former section identifies the primary and secondary routes of Great Britain rail network and list them in tables. Once the Strategic Route Sections (SRS) are located, their technical information must be collected. Main data regarding the route capability overview involves:

- Lines of route description (LOR): contains detailed description on the railway lines that comprises the Strategic Route Section.
- Infrastructure Route Availability (RA): defines the axle weight which can be conveyed over any given route. It is mainly determined by the strength of bridges. Route availability values ranges from RA3 to RA10.

Infrastructure Route availability (RA)	Axle load [tonne]
RA3	≤ 16.5
RA5	≤ 19.0
RA6	≤ 20.3
RA8	≤ 22.8
RA9	≤ 24.1
RA10	≤ 25.4

TABLE 15. AXLE LOADING BY ROUTE AVAILABILITY

- Standard gauge: include the W-series of freight gauges. Standard gauge values are used to determine whether are route is compatible with the vehicles. Table below show the list of standard gauges defined by Railway Group Standard.

Standard vehicle gauges	Upper/Lower Sector definition	Application
W6a Lower gauge	Lower sector	Freight vehicles
Lower Sector Vehicle Gauge (LSVG)	Lower sector	Freight vehicles
W6a Upper gauge	Upper sector	Freight vehicles
W7	Upper sector	Freight vehicles
W8	Upper sector	Freight vehicles
W9	Upper sector	Freight vehicles
W9 Plus	Upper sector	Freight vehicles
W10	Upper sector	Freight vehicles
W10a	Upper sector	Freight vehicles
W12	Upper sector	Freight vehicles
PG1	Upper sector	Passenger vehicles
PG2	Upper sector	Passenger vehicles
Locomotives	Upper sector	Locomotives vehicles

TABLE 16. STANDARD VEHICLE GAUGES

- Signalling method: signalling systems used to direct the traffic over the strategic route sections. Notation used in the tables of appendix is explain as follows:

Signalling method	Description
AB	Absolute Block
Colour light	Colour light
Colour light up to 2A-IECC	Colour light up to 2 aspects controlled by Integrated Electronic Control Centre
Colour light up to 3A-IECC	Colour light up to 3 aspects controlled by Integrated Electronic Control Centre
Colour light up to 4A-IECC	Colour light up to 4 aspects controlled by Integrated Electronic Control Centre
Colour light up to 2A-SB	Colour light up to 2 aspects controlled by manual Signal Boxes
Colour light up to 3A-SB	Colour light up to 3 aspects controlled by manual Signal Boxes
ETB	Electric Token Block
ERTMS-L2	European Rail Traffic Management System
NST	No Signaller Token
NSTR	No Signaller Token with Remote Crossing Loops
OTW	One Train Working
Semaphore	Semaphore
Semaphore-SB	Semaphore controlled by manual Signal Boxes
TASS	Tilt Authorisation and Speed Supervision on fast lines
TB	Tokenless Block
TCB	Track Circuit Block

TABLE 17. SIGNALLING METHOD DESCRIPTION

- Maximum speed in fast/slow lines: range the speeds reached by the vehicles during regular operations when rolling in fast/slow lines. Rail vehicles can reach maximum operational speeds of around 125mph to 140mph in primary and secondary routes.

- Electrification: specifies whether the railway line is equipped with overhead line alternating current (25kV AC) or third rail direct current (750V DC) electrification. Routes may also have unelectrified sections.

- Nominal track gauge: European standard nominal 1435mm is applied for the whole network

Network Rail provides further information on infrastructure technical data by means of the Route Specifications documents. *Appendix 02: Route specifications and TOC operations* shows this data in tables labelled as *Lines of route description* and *Route capability overview*.

2.3. *TOC OPERATIONS. SERVICES*

Network Rail Route Specifications supplies all the frequencies of passenger services (trains per hour/trains per day) for strategic each strategic route section. However, it does not detail the TOC in charge of each service. This point is also analysed as part of the present study.

According to this, the overall passenger trains services are therefore obtained from the Route Specifications (Ref. 15 up to Ref. 22). Once collected, the TOC carrying out each service is finally acknowledged by checking the Network Rail Train Operator Map[4] together with the electronic National Rail Timetable (eNRT)[5]. Information contained in columns TPH/TPD of *TOC services* tables (Appendix 02) can be explained as follows:

Trains per hour/ Trains per day (TPH)/(TPD)
(T065) & (VT) - (2 Trains) London to Liverpool (Peak) (LDHS) *Meaning:* *"Long Distance High Speed passenger services of 2 trains per hour from London to Liverpool are provided at peak hours by the train operator company Virgin Trains West Coast (VT). Timetable located at eNRT table T065"*
(T040) & (TP) &S (NT) - (6 Trains) Church Fenton to Colton *Meaning:* *"Passenger services of 6 trains per hour from Church Fenton to Colton are provided by the train operator companies TransPennine Express and Northern - (TP) &S (NT)-. Timetable located at eNRT table T040"*

TABLE 18. TPH/TPD TOC SERVICE EXAMPLE

Next tables show a list of the TOCs, per area, providing services for primary and secondary routes of Great Britain`s rail network.

WALES

TOCs operating at primary/secondary routes Wales
(AW) - Arriva Trains Wales
(GW) - Great Western Railway
(VT) - Virgin Train West Coast
(XC) - Cross Country

TABLE 19. TOCS OPERATING ON P/S ROUTES.WALES

[4] Project mapping (2016), Operators map zoom, http://www.projectmapping.co.uk/

[5] Network Rail (2017), Electronic National Rail Timetable, https://www.networkrail.co.uk/running-the-railway/timetabling/electronic-national-rail-timetable-enrt/

SCOTLAND

TOCs operating at primary/secondary routes Scotland
(CS) - Caledonian Sleeper
(GR) - Virgin Trains East Coast
(SR) - ScotRail
(TP) - TransPennine Express
(VT) - Virgin Trains West Coast
(XC) - CrossCountry

TABLE 20. TOCS OPERATING ON P/S ROUTES. SCOTLAND

ANGLIA

TOCs operating at primary/secondary routes Anglia
(EM) - East Midlands Trains
(GN) - Great Northern
(LE) - Greater Anglia
(XC) - CrossCountry
(XR) - TfL Rail

TABLE 21. TOCS OPERATING ON P/S ROUTES. ANGLIA

WESSEX

TOCs operating at primary/secondary routes Wessex
(GW) - Great Western Railway
(SW) - South West Trains
(XC) - CrossCountry

TABLE 22. TOCS OPERATING ON P/S ROUTES. WESSEX

SOUTH EAST (KENT AND SUSSEX)

TOCs operating at primary/secondary routes Kent
(SE) - Southeastern

TABLE 23. TOCS OPERATING ON P/S ROUTES. KENT

TOCs operating at primary/secondary routes Sussex
(GX) - Gatwick express
(SN) - Southern

(TL) - Thameslink

TABLE 24. TOCS OPERATING ON P/S ROUTES. SUSSEX

WESTERN

TOCs operating at primary/secondary routes Western
(GW) - Great Western Railway
(HX) - Heathrow Express
(HC) - Heathrow Connect
(XC) – CrossCountry
SW) - South West Trains

TABLE 25. TOCS OPERATING ON P/S ROUTES. WESTERN

LONDON NORTH WESTERN (NORTH AND SOUTH)

TOCs operating at primary/secondary routes LNW North
(AW) - Arriva Trains Wales
(CS) - Caledonian Sleeper
(EM) - East Midlands Trains
(GC) - Grand Central
(LM) - London Midland
(ME) - Merseyrail
(NT) - Northern
(TP) - TransPennine Express
(VT) - Virgin Trains West Coast
(XC) - CrossCountry

TABLE 26. TOCS OPERATING ON P/S ROUTES. LNW NORTH

TOCs operating at primary/secondary routes LNW South
(AW) - Arriva Trains Wales
(CH) - Chiltern Railways
(CS) - Caledonian Sleeper
(GW) - Great Western Railway
(LM) - London Midland
(SN) - Southern
(VT) - Virgin Trains West Coast
(XC) - CrossCountry

TABLE 27. TOCS OPERATING ON P/S ROUTES. LNW SOUTH

LONDON NORTH EAST & EAST MIDLANDS

TOCs operating at primary/secondary routes LNE
(EM) - East Midlands Trains
(GC) - Grand Central
(GN) - Great Northern
(GR) - Virgin Trains East Coast
(HT) - Hull Trains
(NT) - Northern
(SR) - ScotRail
(TP) - TransPennine Express
(XC) - CrossCountry

TABLE 28. TOCS OPERATING ON P/S ROUTES. LNE

TOCs operating at primary/secondary routes EM
(EM) - East Midlands Trains
(NT) - Northern
(TL) - Thameslink
(XC) - CrossCountry

TABLE 29. TOCS OPERATING ON P/S ROUTES. EM

2.4.*TOC OPERATIONS. SPECIFIED EQUIPMENT*

This section seeks to document the specified equipment used by the TOCs for the provision of passenger services in primary and secondary routes of Great Britain´s rail network.

For this purpose, Track Access Contracts (Passenger Services)[6] pertaining to each company are analysed so as to gather the vehicle class types involving in passenger services (see section of above for prior identification).

The resulting railway vehicles running services per area in primary and secondary routes are displayed in tables below. *Appendix 03: Specified equipment technical information* includes technical specification related to the each vehicle class.

[6] Consolidated agreements (2017), Track Access Contracts (Passenger services), http://www.orr.gov.uk/rail/access-to-the-network/track-access/consolidated-agreements

WALES

TOC Specified equipment - Vehicle class Wales
Class 142
Class 143
Class 150
Class 153
Class 158
Class 170
Class 175
Class 221
Class 43
Class Mk3

TABLE 30. TOC SPECIFIED EQUIPMENT IN P/S ROUTES. WALES

SCOTLAND

TOC Specified equipment - Vehicle class Scotland
Class 156
Class 158
Class 170
Class 185
Class 220
Class 221
Class 314
Class 318
Class 320
Class 334
Class 350
Class 380
Class 390
Class 43
Class 66
Class 68
Class 73
Class 86
Class 87
Class 90

Class 91
Class 92
Class Mk2
Class Mk3
Class Mk4

TABLE 31. SPECIFIED EQUIPMENT IN P/S ROUTES. SCOTLAND

ANGLIA

TOC Specified equipment - Vehicle class Anglia
Class 153
Class 156
Class 158
Class 170
Class 315
Class 317
Class 321
Class 360
Class 365
Class 379
Class 90
Class Mk3

TABLE 32. SPECIFIED EQUIPMENT IN P/S ROUTES. ANGLIA

WESSEX

TOC Specified equipment - Vehicle class Wessex
Class 158
Class 159
Class 166
Class 220
Class 221
Class 444
Class 450
Class 455

TABLE 33. SPECIFIED EQUIPMENT IN P/S ROUTES. WESSEX

SOUTH EAST (KENT AND SUSSEX)

TOC Specified equipment - Vehicle class Kent
Class 375
Class 376
Class 395
Class 465
Class 466

TABLE 34. SPECIFIED EQUIPMENT IN P/S ROUTES. KENT

TOC Specified equipment - Vehicle class Sussex
Class 171
Class 319
Class 377
Class 387
Class 455
Class 700

TABLE 35. SPECIFIED EQUIPMENT IN P/S ROUTES. SUSSEX

WESTERN

TOC Specified equipment - Vehicle class Western
Class 150
Class 153
Class 158
Class 165
Class 166
Class 170
Class 180
Class 220
Class 221
Class 360
Class 387
Class 43
Class 57
Class Mk3

TABLE 36. SPECIFIED EQUIPMENT IN P/S ROUTES. WESTERN

LONDON NORTH WESTERN (NORTH AND SOUTH)

TOC Specified equipment - Vehicle class LNW North
Class 142
Class 144
Class 150
Class 153
Class 156
Class 158
Class 170
Class 175
Class 185
Class 220
Class 221
Class 222
Class 319
Class 323
Class 350
Class 37
Class 390
Class 507
Class 508
Class 67
Class 90
Class 92
Class Mk2
Class Mk3

TABLE 37. SPECIFIED EQUIPMENT IN P/S ROUTES. LNW NORTH

TOC Specified equipment - Vehicle class LNW South
Class 139
Class 150
Class 153
Class 158
Class 165
Class 166
Class 168
Class 170

Class 172
Class 180
Class 220
Class 221
Class 319
Class 323
Class 350
Class 377
Class 390
Class 43
Class 68
Class 90
Class 92
Class Mk3

TABLE 38. SPECIFIED EQUIPMENT IN P/S ROUTES. LNW SOUTH

LONDON NORTH EAST & EAST MIDLANDS

TOC Specified equipment - Vehicle class LNE
Class 142
Class 144
Class 150
Class 153
Class 155
Class 156
Class 158
Class 180
Class 185
Class 220
Class 221
Class 222
Class 313
Class 317
Class 321
Class 322
Class 333
Class 365
Class 387
Class 43

Class 91
Class Mk3
Class Mk4

TABLE 39. SPECIFIED EQUIPMENT IN P/S ROUTES. LNE

TOC Specified equipment - Vehicle class EM
Class 150
Class 153
Class 156
Class 158
Class 170
Class 185
Class 220
Class 221
Class 222
Class 319
Class 377
Class 43
Class 700
Class Mk3

TABLE 40. SPECIFIED EQUIPMENT IN P/S ROUTES. EM

Chapter 3. Passenger Standard Rolling Stock Material (S-RSM) specifications for primary and secondary routes

3.1. *ASSESSMENT OF COMPATIBILITY OF ROLLING STOCK MATERIAL*

Before any new railway vehicle is brought into use, it is essential to assess and to ensure the compatibility between Rolling Stock Material and Infrastructure. The main interfaces involving this matter are detailed as:

- Interfaces defining physical characteristics
- Interfaces defining dynamic characteristics
- Interfaces defining electrical characteristics
- Interfaces defining electromagnetic characteristics
- Interfaces with the signalling subsystem

The purpose of this section is to give guidance on the definition of technical specifications for Standard Rolling Stock Material type (S-RSM) capable of running passenger services in primary and secondary routes in Great Britain rail network.

The interfaces described above are further studied in following sections. However, interfaces related to electromagnetic characteristics are not the aim of the present research as they involve the determination of maximum allowable train emission levels and the characterization of infrastructure susceptibility.

3.2. *DEFINITION OF PHYSICAL CHARACTERISTICS*

GAUGE

As part of the design process of rolling stock material, railway undertakings may use standard vehicles gauges to be aware that dimensions of the vehicle are within the limits so as to maintain adequate clearance between vehicles and adjacent structures and passing clearance between vehicles and other vehicles operating on adjacent tracks.

Ref. (2) and Ref. (3) prescribe the maximum permissible vehicle dimensions by means of standard gauges for upper/lower sector, i.e., areas above and below 1000mm from the plane of rail. Standard gauges are not intended to be exhaustive for all primary and secondary routes, as not all gauges are compatible with all routes, but they fit to the majority of them. Gauge definition here exposed, does not include provision for pantograph and shoe gears.

The following types of gauges are to be used when defining passenger railway vehicles:

Passenger Gauge (PG1) & Lower Sector Vehicle Gauge (LSVG): Multiple Units and Coaches 20.38m long bodyshell, 14.173m bogie centres, 2.6m axle spacing and dynamic characteristics typical of a 100mph vehicle with soft suspensions characteristics. The vehicle cross section shall be reduced to accommodate any increase in lateral or vertical overthrow associated with alternative vehicle dimensions based on a minimum curve radius of 120m and 160m for Lower Sector Vehicle Gauge *(Figure 3).*

- Passenger Gauge (PG2) & Lower Sector Vehicle Gauge (LSVG): Multiple Units and Coaches 23.072m long bodyshell, 16m bogie centres, 2.6m axle spacing and dynamic characteristics typical of a 100mph vehicle with soft suspensions characteristics. . The vehicle cross section shall be reduced to accommodate any increase in lateral or vertical overthrow associated with alternative vehicle dimensions based on a minimum curve radius of 120m and 160m for Lower Sector Vehicle Gauge *(Figure 4).*

- Locomotive Gauge: Locomotives 19.13m long bodyshell, 14.85m bogie centres, 4.18m axle spacing (Co'Co') and dynamic characteristics typical of an 80mph vehicle. This information has been generated from Class 58 locomotive. The vehicle cross section represents the maximum overthrow contour on a 200m curve *(Figure 5).*

Passenger Gauges PG1 and PG2 are determined on the basis of static gauges and dynamic movements must also be considered by relevant software. Dynamic movements are nevertheless included in Locomotive Gauge.

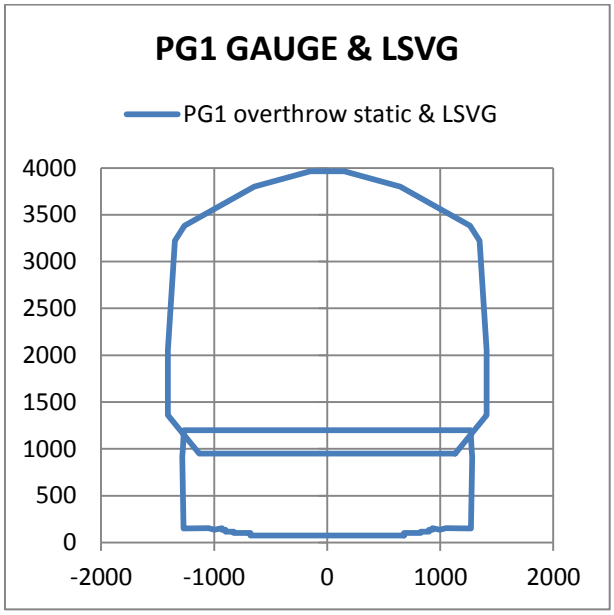

FIGURE 3. STATIC GAUGE PG1 AND LSVG

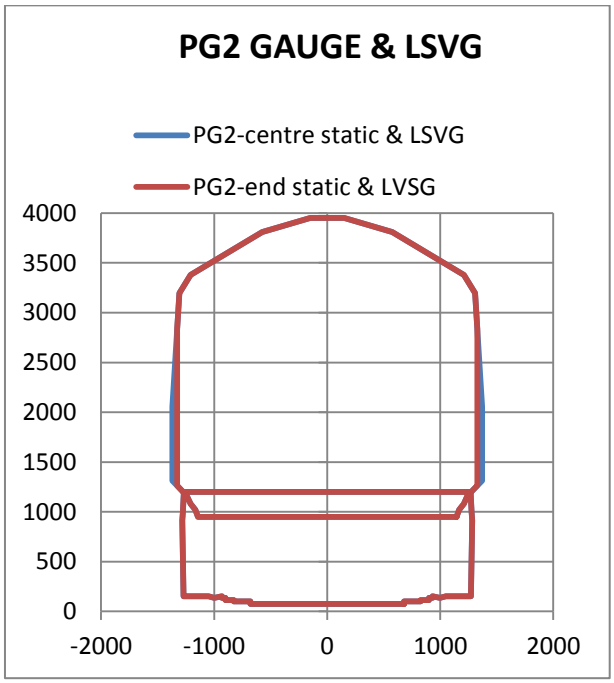

FIGURE 4 CENTRE/END STATIC GAUGE PG2 AND LSVG

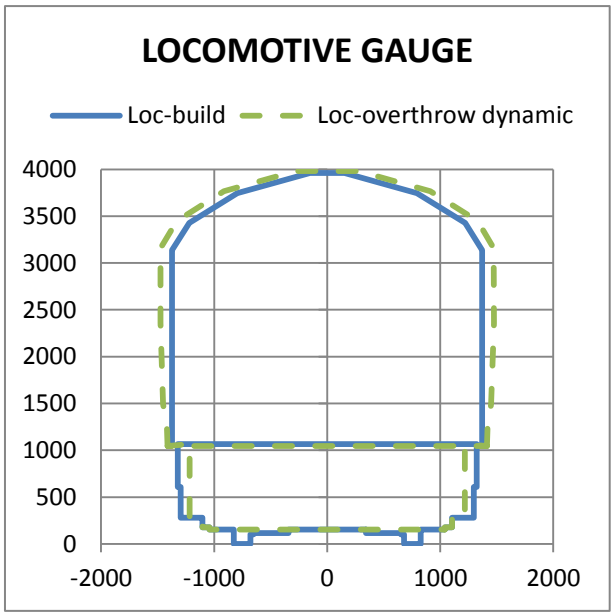

FIGURE 5. BUILT/DYNAMIC LOCOMOTIVE GAUGE

ROUTE AVAILABILITY (RA)

A general overview on the RA number is given in *V. Chapter 1 Route availability (RA) assessment of primary and secondary routes*. Results of this section show the critical areas in primary and secondary routes of Great Britain railway system (locations ASS 1).

Appendix 04: RA assessment results also summarised in the tables RA maximum and minimum values extracted from the for each strategic route section and labelled into categories such as locations ASS 1, ASS 2 and ASS 3, which introduce restrictions/limitations for railway vehicles to operate at first step compatibility RA assessment

3.3. *DEFINITION OF DYNAMIC CHARACTERISTICS*

PERMISSIBLE TRACK FORCES

Trains that operate on British railways tracks shall be design so that they do not generate excessive forces between wheels and rails when operating under normal conditions. Ref. (4) details the maximum permissible track forces for railway vehicles to be exerted on the track.

Track force	Max. permissible value
Vertical static	Static wheel load shall not exceed the lower value of the following: $Q = 0.130\ D$ or $Q = 125\ kN$ Q = Maximum static wheel load [kN] D = Wheel thread diameter [mm] (Minimum D value shall not be less than 250mm)
Vertical dynamic	Vehicle shall be able to negotiate a vertical ramp discontinuity in rail top profile at its maximum design operating speed without exceeding the following for per wheel: $P2 = 322\ kN$
Lateral	Railway vehicles, under normal track operating conditions, shall not subject the track to lateral forces greater than: $Y = {}^{W}/_{3} + 10$ Y = Lateral force transmitted to track per axle [kN] W = Static axle load [kN] When travelling on a curve at maximum normal operating speed and at maximum cant deficiency, the vehicles shall not exceed: $Y = 71\ kN$
Longitudinal	Vehicles and trains shall not transmit longitudinal tractive and breaking forces to the track greater than: $Traction = 10\ {}^{kN}/_{m}\ up\ to\ 100m$ $Traction = 500\ \text{kN}\ over\ 100m$ $Braking = 8\ {}^{kN}/_{m}\ up\ to\ 100m$ $Braking = 800\ \text{kN}\ over\ 100m$ Considering RL standard loading type (passenger vehicles) per loading length as most severe condition. Ref. (5)

TABLE 41. MAX. PERMISSIBLE TRACK FORCES FOR PASSENGER RSM

SPEED

Based on the provision of information given in *Appendix 02 Route specifications and TOC operations*, Table 42 resumes Maximum/Mean speed values for primary and secondary routes attending to each Network Rail area. It can be noted that 3 main locations arise as a result of the maximum speed at which trains are to be operating the primary routes.

- Location SP1: Maximum operating speeds of 125 mph in Scotland, LNW North, Western, London North East, East Midlands and LNW South
- Location SP2: Maximum operating speeds of 100 mph in South East Kent, Wessex and Anglia
- Location SP3: Maximum operating speeds of 90 mph in South East Sussex and Wales

Network Rail areas (% Primary - % Secondary)		Primary Max. Speed [mph]	Primary Mean Speed [mph]	Secondary Max. Speed [mph]	Secondary Mean Speed [mph]
SP1	Scotland (15% - 85%)	125	107	125	80
	LNW North (12% - 88%)	125	110	125	77
	Western (65% - 35%)	125	111	100	75
	London North East (41% - 59%)	125	105	90	72
	East Midlands (37% - 63%)	125	125	90	75
	LNW South (46% - 23%)	125	113	70	63
SP2	South East Kent (100% - 0%)	100	88	-	-
	Wessex (44% - 66%)	100	97	90	76
	Anglia (43% - 57%)	100	97	75	75
SP3	South East Sussex (67% - 33%)	90	80	85	85
	Wales (55% - 45%)	90	84	75	60

TABLE 42.MAXIMUM AND MEAN SPEED VALUES FOR P/S ROUTES

3.4. *DEFINITION OF ELECTRICAL CHARACTERISTICS*

Table 43 makes a review of the electrification system type for primary and secondary routes based on data found in *Appendix 02 Route specifications and TOC operations*. Percentages of electrified, partly electrified and totally unelectrified lines are provided attending to each Network Rail area. The information reveals again the existence of 3 main locations:

- Location EL1: AC 25kV Over Head Line (OHL) in Scotland, Anglia, LNW South, Western, East Midlands, London North East and LNW North. It should be noted that both London North East DC1500V system and LNW North DC750V system are parts of routes partly electrified.
- Location EL2: DC 750V Third Rail in South East Kent, Wessex and South East Sussex.
- Location EL3: Totally unelectrified system in Wales.

	Network Rail areas (% Primary - % Secondary)	Electrified routes [%]	Partly electrified routes [%]	Unelectrified routes [%]	Electrification System
EL1	Scotland (15% - 85%)	44%	4%	52%	AC 25kV OHL
	Anglia (43% - 57%)	43%	14%	43%	AC 25kV OHL
	LNW South (46% - 23%)	31%	23%	46%	AC 25kV OHL
	Western (65% - 35%)	94%	-	6%	AC 25kV OHL
	East Midlands (37% - 63%)	25%	-	75%	AC 25kV OHL
	London North East (41% - 59%)	33%	3%	64%	AC 25kV OHL DC 1500V OHL
	LNW North (12% - 88%)	47%	6%	47%	AC 25kV OHL DC 750V TR
EL2	Wales (55% - 45%)	-	-	100%	-
EL3	Wessex (44% - 66%)	56%	22%	22%	DC 750V TR
	South East Kent (100% - 0%)	100%	-	-	DC 750V TR
	South East Sussex (67% - 33%)	100%	-	-	DC 750V TR
	TOTAL	**46%**	**6%**	**48%**	

TABLE 43. OVERVIEW ON ELECTRIFICATION SYSTEM TYPE IN P/S ROUTES

3.5. *DEFINITON OF THE ON BOARD TRAIN PROTECTION SYSTEM*

The Automatic Warning System (AWS) has been implemented as the national warning system on almost all passenger lines of British railway network since 1950. It provides the driver with an audible and visual indication before reach the distant signal and indicates whether it is clear or at caution. If the driver fails to respond to the warning indication by pressing the AWS acknowledgement button, an emergency brake application will be initiated.

The Great Western Main Line (GW-ATP) train protection system is the legacy British Rail Automatic Train Protection system installed on the Great Western Main Line. The system utilises 1980 technology. GW-ATP system provides continuous supervision of driver using "distance to go" calculations and prevents the train from approaching signal faster than braking performance permits

The Train Protection and Warning System (TPWS) began in 2000 to meet the requirements of the Railway Safety Regulations (RSB). The purpose of TPWS is to stop the train by automatically initiating a braking if the vehicle passes a signal at danger without authority, approaches a signal at danger too fast, approaches a reduction in permissible speed too fast or approaches at buffer stops too fast (intermittent supervision). TPWS is not designed to prevent Signal Passed At Danger (SPAD) but to mitigate against the consequences of a SPAD.

The European Rail Traffic Management System (ERTMS) basically comprises both the European Train Control System (ETCS) and the Global System for Mobile communications - Railways (GSM-R). ETCS is an automatic train protection system (ATP) that tries to replace and unify the existing national ATP-systems and it involves continuous supervision of the train. GSM-R, a radio system for provides voice and data communication between the track and the train, is based on standard GSM using frequencies specifically reserved for rail application with certain specific and advanced functions. The development of ERTMS has been heavily introduced in Great Britain industry strategic business plan for the period 2014-2019. The first application of ERTMS in service in Great Britain is the Cambrian Line in Wales.

The Tilt Authorisation and Speed Supervision (TASS) is a system installed on tilting trains that controls the operation of the tilt system and the speed of the train on routes where enhanced permissible speeds are applied on TASS fitted lines.

3.6. *SUMMARY OF TECHNICAL SPECIFICATIONS FOR PASSENGER STANDARD ROLLING STOCK MATERIAL (S-RSM)*

These notes are intending to give guidance on the definition of technical specifications for Standard Rolling Stock Material type (S-RSM) capable of running passenger services in primary and secondary routes in Great Britain rail network. The analysis of physical, dynamic, electrical and train protection system characteristics outlines the following conclusions:

The definition of the passenger Standard Rolling Stock Material (S-RSM) will include both railway vehicles, Multiple Units or Locomotives &Coaches. Gauging compatibly will include PG1, PG2 and Locomotive gauge types. (Based on *Appendix 3. Specified equipment technical information*, all rolling stock material operating in primary and secondary routes are not composed by articulated trainsets)

- As Figure 7 and Table 44 show, 46% of the railway network is electrified whereas 54% of it is partly or totally unlectrified in primary and secondary routes. Moreover the maximum operating speed in AC 25kV OHL are of around 125mph, in contrast to DC 750V routes that allows maximum speeds of around 100mph. Considering all, a first approach shall include S-RSM self-powered vehicles with traction equipment capable to withstand AC 25kV OHL/ DC 750V TR systems. Note that the electrification system DC 1500V OHL is neglected in the analysis as it only comprises 3 miles from the rail network.

	Network Rail areas (% Primary - % Secondary)	Electrified routes [%]	Partly or unelectrified routes [%]	Electrification System	Primary Max. Speed [mph]
EL1	Scotland (15% - 85%)	44%	56%	AC 25kV OHL	125
	Anglia (43% - 57%)	43%	57%	AC 25kV OHL	100
	LNW South (46% - 23%)	31%	69%	AC 25kV OHL	125
	Western (65% - 35%)	94%	6%	AC 25kV OHL	125
	East Midlands (37% - 63%)	25%	75%	AC 25kV OHL	125
	London North East (41% - 59%)	33%	67%	AC 25kV OHL DC 1500V OHL	125
	LNW North (12% - 88%)	47%	53%	AC 25kV OHL DC 750V TR	125
EL2	Wales (55% - 45%)	-	100%	-	90

EL3	Wessex (44% - 66%)	56%	44%	DC 750V TR	100
	South East Kent (100% - 0%)	100%	-	DC 750V TR	100
	South East Sussex (67% - 33%)	100%	-	DC 750V TR	90
	TOTAL	**46%**	**54%**		

TABLE 44. OVERVIEW IN ELECTRIFICATION SYSTEM AND MAXIMUM PRIMARY OPERATION SPEED IN P/S ROUTES

- Infrastructure route availability analysis can be summarised and divided by Network Rail areas. Results show that in almost 85% of the routes RA values ranged between 5 and 8 and only 3% of the routes are considered as critical locations. The S-RSM design will be determined by these locations and hence it shall accomplish RA3 numbers to carry out services in the network without any limitation/restriction.

Network Rail areas	Number of SRS	3 ≤ RA ≤ 4 16,5 t ≤ RA ≤ 17,7 t	5 ≤ RA ≤ 8 17,7 t < RA ≤ 22,8 t	9 ≤ RA ≤ 10 22,8t < RA ≤ 25,4 t
Western	17	-	100%	-
LNW South	13	-	100%	-
Wales	11	-	100%	-
East Midlands	8	-	100%	-
Anglia	7	-	100%	-
South East Kent	4	-	100%	-
South East Sussex	3	-	100%	-
LNW North	33	-	97%	3%
Wessex	9	11%	89%	-
London North East	27	-	78%	22%
Scotland	27	8%	48%	44%
TOTAL	**159**	**3%**	**85%**	**12%**

TABLE 45. RA INFRASTRUCTURE ANALYSIS FOR P/S ROUTES 01

However it is a practice for railway vehicles not accomplishing with the route availability assessment at first stage compatibility the application of limitations/restrictions in certain areas during operation.

In order to minimise the effect involving limitation/restrictions practices and enhance the design of the S-RSM vehicle type by providing higher RA number, a deeper analysis on infrastructure RA values is resumed in table 46. The results indicate that S-RSM vehicles with RA values up to 5 (19tons per axle) only affect the inclusion of limitation/restriction in 3 strategic routes section of total primary and secondary routes.

Infrastructure RA number	Number of SRS	Percentage %	Axle tonnes
RA3	2	1,3%	Up to 16,5
RA4	1	0,6%	Up to 17,7
RA5	10	6,3%	Up to 19,0
RA6	7	4,4%	Up to 20,3
RA7	12	7,5%	Up to 21,5
RA8	107	67,3%	Up to 22,8
RA9	7	4,4%	Up to 24,1
RA10	13	8,2%	Up to 25,4
TOTAL	**159**	**100%**	

TABLE 46. INFRASTRUCTURE ANALYSIS FOR P/S ROUTE

- *Appendix 03: Specified equipment technical information* also includes technical specification related to the each Automatic Train Protection systems related to each vehicle class. For the majority of them AWS and TPWS on board train protection systems are installed. Only GW-ATP and ERTMS systems are presented in rolling stock material running services in areas such as Western (SRS J.01, SRS J.02, SRS J.03, SRS J.04) and Wales(SRS L.08/09). TASS systems are only available in tilting trains. The definition of the S-RSM on board protection systems will include all of them excluding TASS systems where relevant.

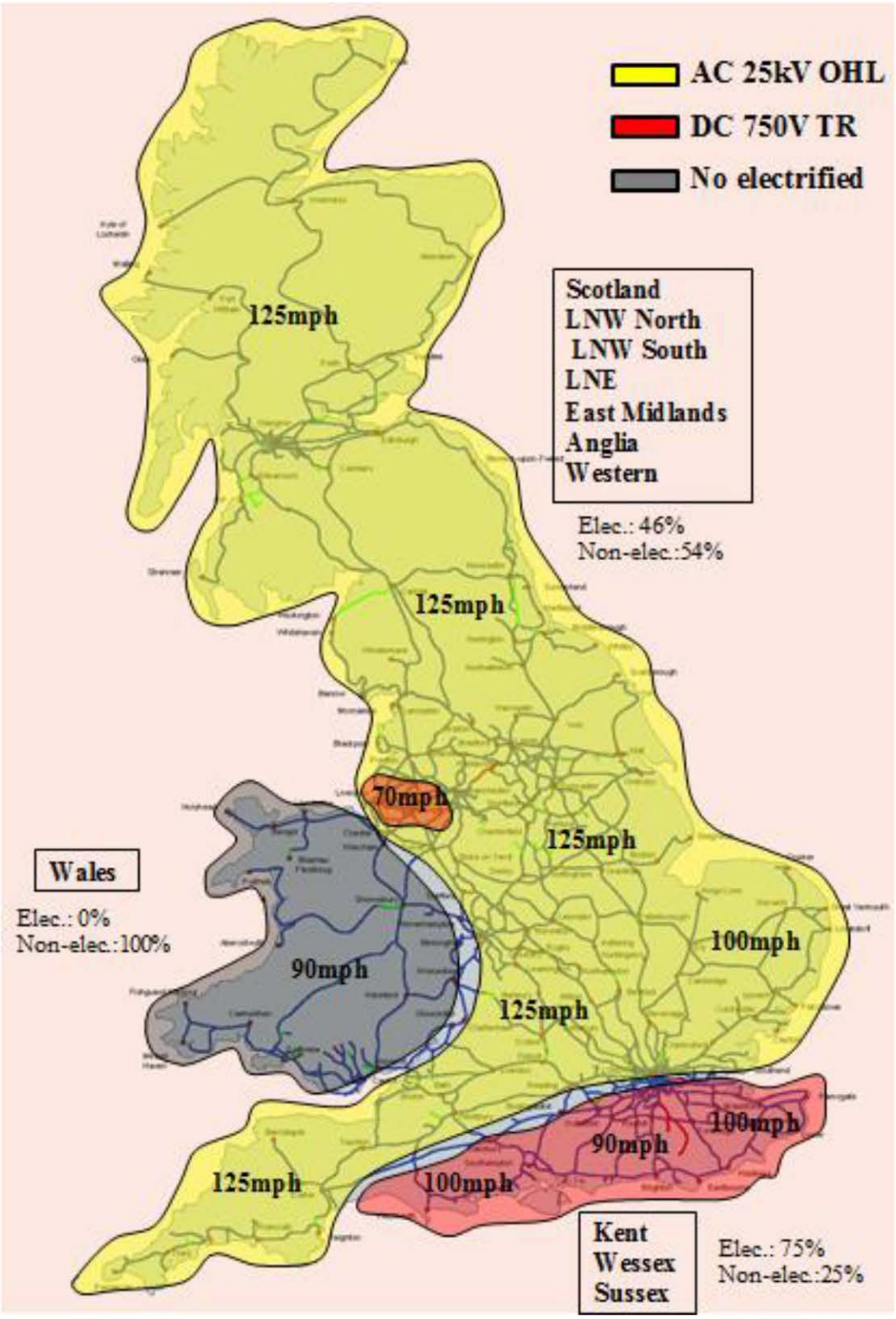

FIGURE 6. OVERVIEW IN ELECTRIFICATION SYSTEMS AND MAXIMUM PRIMARY OPERATION SPEEDS IN P/S ROUTES

Table 47 classifies the passenger Standard Rolling Stock Material (S-RSM) types for primary and secondary routes, and defines the main technical specifications. It includes:

- S-RSM 01: Running services at all Network rail areas. Vehicle design allows for maximum speed operation of 125 mph and route availability RA3. Passenger services are provided for both electrified (AC 25kV OHL & DC 750V) and unelectrified lines, hence self-powered traction system condition is met. The performance of S-RSM 01 shall only be at self-powered mode in Wales Network Rail areas. S-RSM 01 type shall include AWS, TPWS, GW-ATP and ERTMS systems, as well as TASS system in those vehicles subjected to tilting conditions during operations.

- S-RSM 01.L: The operation area, similar to those of S-RSM 01 railway vehicles, excludes locations limited up to RA4 route availability values (see *Appendix 05. Detailed information about critical locations ASS 1).* It allows increasing the vehicle RA number up to 5 (up to 19 axle tons).

- S-RSM 02: Running services at all Network rail areas. Vehicle design allows for maximum speed operation of 125 mph and route availability RA3. Passenger services are provided for both electrified (AC 25kV OHL) and unelectrified lines hence self-powered traction system condition is met. The performance of S-RSM 02 shall only be at self-powered mode in Wales, Wessex, Kent, Sussex, Network Rail areas, as well as SRS O.01 of London North Western. S-RSM 02 type shall include AWS, TPWS, GW-ATP and ERTMS systems, as well as TASS system in those vehicles subjected to tilting conditions during operations.

- S-RSM 02L: The operation area, similar to those of S-RSM 02 railway vehicles, excludes locations limited up to RA4 route availability values (see *Appendix 05. Detailed information about critical locations ASS 1).* It allows increasing the vehicle RA number up to 5 (up to 19 axle tons).

- S-RSM 03: Running services at Wales, Wessex, Kent, Sussex and Anglia Network rail areas as well as SRS O.01 of London North Western. Vehicle design allows for maximum speed operation of 100 mph and route availability RA4. Passenger services are provided for both electrified (DC 750V TR) and unelectrified lines hence self-powered traction system condition is met. The performance of S-RSM 03 shall only be at self-powered mode in Wales and Anglia Network Rail areas. S-RSM 03 type shall include AWS, TPWS and ERTMS

systems, as well as TASS system in those vehicles subjected to tilting conditions during operations.

- S-RSM 03L: The operation area, similar to those of S-RSM 03 railway vehicles, excludes locations limited up to RA4 route availability values (see *Appendix 05. Detailed information about critical locations ASS 1).* It allows increasing the vehicle RA number up to 5 (up to 19 axle tons).

S-RSM type	RSM type	Standard gauge	Length [m]	Width [m]	Max. Speed [mph]	Vehicle RA	Axle load [tons]	Traction power requirements	On board safety systems
S-RSM 1	DEMU	PG1	20	2.82	125	≤RA3	16.5	AC 25kV OHL DC 750V TR Self-powered	AWS TPWS GW-ATP ERTMS TASS
		PG2	23	2.74					
	Electric & Diesel Locomotives	Loc.	19	2.74					
	Coaches	PG1	20	2.82					
		PG2	23	2.74					
S-RSM 1L	DEMU	PG1	20	2.82	125	≤RA5	19.0	AC 25kV OHL DC 750V TR Self-powered	AWS TPWS GW-ATP ERTMS TASS
		PG2	23	2.74					
	Electric & Diesel Locomotives	Loc.	19	2.74					
	Coaches	PG1	20	2.82					
		PG2	23	2.74					
S-RSM 2	DEMU	PG1	20	2.82	125	≤RA3	16.5	AC 25kV OHL Self-powered	AWS TPWS GW-ATP ERTMS TASS
		PG2	23	2.74					
	Electric & Diesel Locomotives	Loc.	19	2.74					
	Coaches	PG1	20	2.82					
		PG2	23	2.74					
S-RSM 2L	DEMU	PG1	20	2.82	125	≤RA5	19.0	AC 25kV OHL Self-powered	AWS TPWS GW-ATP ERTMS TASS
		PG2	23	2.74					
	Electric & Diesel Locomotives	Loc.	19	2.74					
	Coaches	PG1	20	2.82					
		PG2	23	2.74					

S-RSM 3	DEMU	PG1	20	2.82	100	≤RA4	17.7	DC 750V TR Self-powered	AWS TPWS ERTMS TASS
		PG2	23	2.74					
	Electric & Diesel Locomotives	Loc.	19	2.74					
	Coaches	PG1	20	2.82					
		PG2	23	2.74					
S-RSM 3L	DEMU	PG1	20	2.82	100	≤RA5	19.0	DC 750V TR Self-powered	AWS TPWS ERTMS TASS
		PG2	23	2.74					
	Electric & Diesel Locomotives	Loc.	19	2.74					
	Coaches	PG1	20	2.82					
		PG2	23	2.74					

TABLE 47. STANDARD ROLLING STOCK MATERIAL TYPES (S-RSM) FOR P/S ROUTES

V. RESEARCH METHODOLOGY AND FINDINGS. MASTER THESIS EXTENSION

Chapter 1. Route availability (RA) assessment of primary and secondary routes

1.1. *INTRODUCTION TO RA SYSTEM*

Before any new or changed infrastructure or rolling stock is brought into use, it is essential to ensure its compatibility. As part of this assessment the Route Availability (RA) system evaluates the weight of rail vehicles with respect the capacity of the infrastructure in which those are to be running.

In the RA system, a vehicle's weight is expressed as a RA number, based on the vehicle's axle load and its axle distances.

Similarly, the load capable to carry the structures of a route is expressed as a RA number, based on the application of a generic vehicle load model and taking into account the dynamic effects of such loading. A route is then assigned a RA number, based on the lowest RA number that generally comes from bridges as most restrictive parts of the routes.

If the highest RA number of any rail vehicle in the train is less than or equal to the RA number of the route at the proposed speed of operation, then the weight of the train is compatible with the capacity of that route. However, if this condition is not satisfied, a detail assessment may be performed to evaluate whether the train could still operate in the route by means of speed restriction or limitation on its weight.

1.2. *ASSESSMENT APPROACH*

The tracks and structures over which passenger and freight trains pass are designed according to the speed, weight and traffic volume likely to be in use. For this reason, Network Rail currently gives the allowed axle loadings (route availability values) as follows:

Infrastructure Route availability (RA)	Axle load [tonne]
RA3	≤ 16.5
RA5	≤ 19.0
RA6	≤ 20.3
RA8	≤ 22.8
RA9	≤ 24.1
RA10	≤ 25.4

TABLE 48. NETWORK RAIL RA VALUES

This section aims to identify the parts of the infrastructure where primary and secondary routes exhibit lower route availability values. As results involve passenger rail services, RA values for locomotives, Multiple Units (MU) and coaches are analysed more in detail. Based on *Appendix 03: Specified equipment technical information*, a summary of the route availability numbers, per type of RSM, is submitted in table below:

RSM type	Route availability (RA) number
Coaches	RA1
Multiple units (MU)	RA 1 to R3
Locomotives	RA 5 to RA8

TABLE 49. RAIL VEHICLE RA NUMBER FOR P/S ROUTES

Therefore, the locations to be analysed for primary and secondary routes of UK rail network are divided according to the scheme below:

RA assessment	Route availability (RA) range	Axle load [tonne]	RSM type allowed
Loc. ASS 1	3 ≤ RA ≤ 4	16.5 < Axle load ≤ 17.7	Multiple Units
Loc. ASS 2	5 ≤ RA ≤ 8	17.7 < Axle load ≤ 22.8	Multiple Units
			Locomotives & Coaches
Loc. ASS 3	9 ≤ RA ≤ 10	22.8 < Axle load ≤ 25.4	All passenger railway vehicles

TABLE 50. RA ASSESSMENT CRITERIA

It could be explained as follows:

- Location ASS 1: Parts of the network rail in which generally Multiple Units are permitted to operate at first step compatibility assessment Ref. (6). These locations are distinguished such as critical due to the fact that RSM composed by Locomotives & Coaches are not allowed to running these lines. However, as it reveals *Appendix 4*, RA2 numbers are found at London

North East area. In this case, Class vehicles with RA3 numbers enclosed are restricted to operate at first stage compatibility as well.

- Location ASS 2: Locomotives & Coaches compositions and Multiple Units are usually allowed to run these lines at first stage compatibility assessment. It must be noted locomotives with higher RA numbers may not accomplished the first stage compatibility assessment in which required to operate.

- Location ASS 3: Multiple Units and Locomotives & Coaches compositions are compatible at first stage and hence free to run the routes.

It must be remarked that incompatibility conditions may arise between vehicles and structure RA numbers. In such cases and wherever possible, the infrastructure manager shall undertake a second stage assessment to set the out speed restrictions or weight limitations to be applied to the railway vehicles for running this specific location.

1.3. *RESULTS*

For present research purposes, critical areas according to RA number are identified in primary and secondary routes such as ASS 1 locations (see *Table 47. RA assessment criteria*).

Route capability overview tables of *Appendix 02: Route specification and TOC operations* show the route availability values of each strategic route section (SRS). According to this data, maximum and minimum values can be summarised in tables to extract the points of Great Britain rail network where ASS 1 locations are presented (see *Appendix 04: RA assessment results).* Locations ASS 1 are resumed in Table 49 and Figure 7, where further detailed information is given in *Appendix 05: Detailed information about critical locations ASS 1*.

Network rail area	Strategic route section (SRS)	Route type (P/S)	Min. Infrastructure RA
Scotland	SRS P.13	Secondary	RA3
Scotland	SRS Q.09	Secondary	RA3
Wessex	SRS C.01	Primary	RA4

TABLE 51. SUMMARY OF LOCATIONS ASS 1 FOR P/S ROUTES

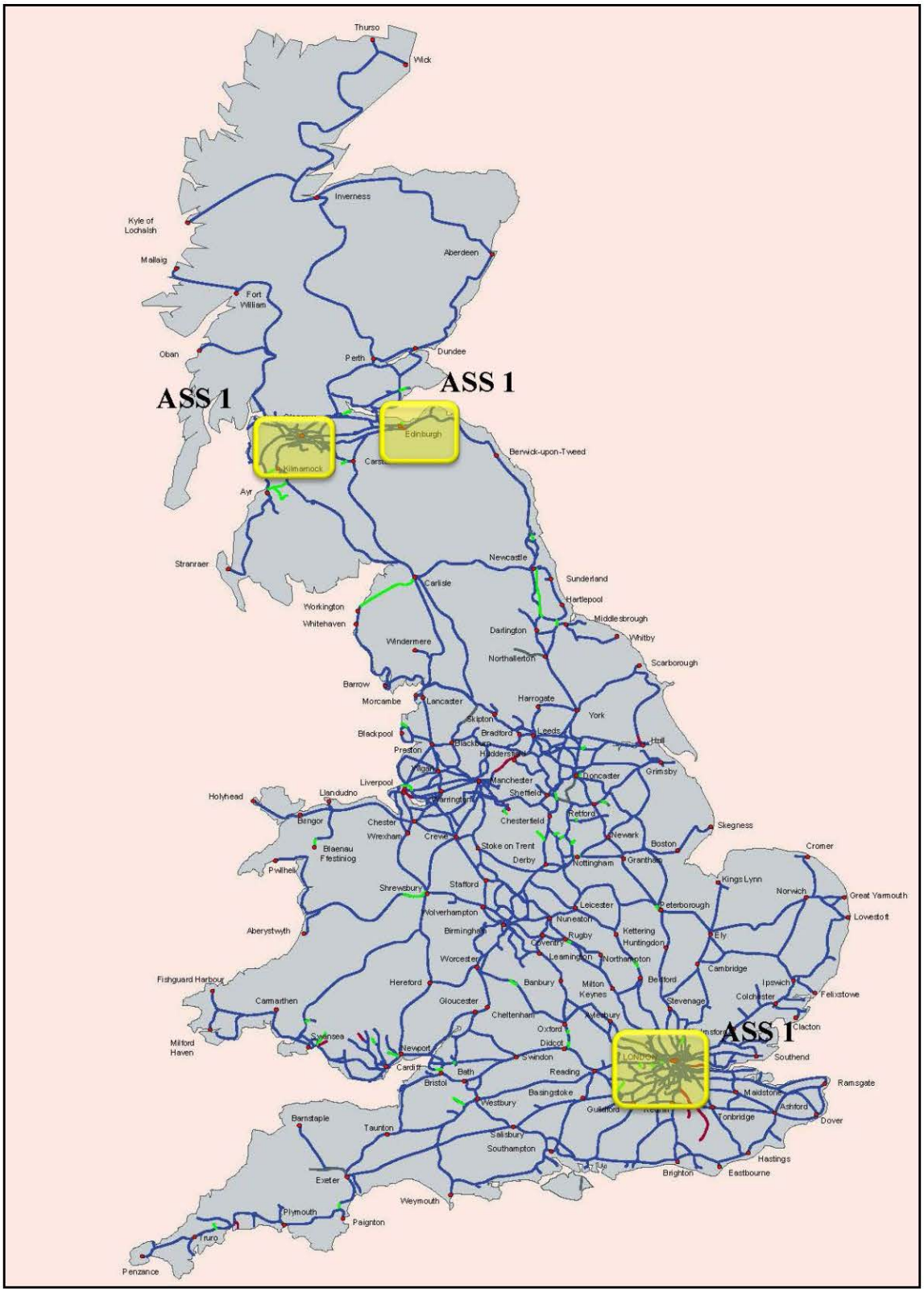

FIGURE 7. SUMMARY OF LOCATIONS ASS 1 FOR P/S ROUTES

Chapter 2. Technical comparison between British Class 800 and passenger Standard Rolling Stock Material (S-RSM)

2.1. *UK INTERCITY EXPRESS PROGRAM(IEP)*

Hitachi developed the Class 800 rolling stock for the Intercity Express Programme (IEP) to run between London and other major cities in the UK. The IEP project is intended to replace all of the rolling stock on the UK's East Coast Main Line (ECML) and Great Western Main Line (GWML) that have been in service for more than 30 years.

British class 800 trains are managed by Great Western Railway and Virgin Trains East Coast TOCs. The rolling stock material complies with the European standards, including the Technical Specifications for Interoperability (TSI), and Railway Group Standard (RGS) UK railway standards. Hitachi trains provide with flexibility to run on a number of different lines with different infrastructure (including non-electrified sections as well as aging platforms and bridges). They are also capable to adapt for future plans on electrification and variable passenger demand. Trains have a unit configuration of up to 12 cars, including the ability to add or remove standardized intermediate cars and the generator units (GUs).

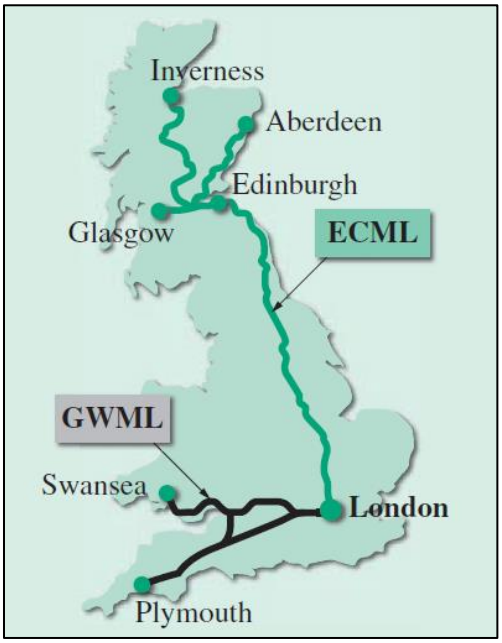

FIGURE 8. INTERCITY EXPRESS PROGRAM (GWML & ECML)

2.2. *ROLLING STOCK MATERIAL COMPARISON*

Table below shows the main specifications of the British Class 800 rolling stock material stock of the Intercity Express Programme (IEP)

TABLE 52. BRITISH CLASS 800

Comparing to rolling stock material type S-RSM, British class 800 vehicles allows for longer bodyshell, up to 6m compares to gauge PG1 gauges of standard vehicles, resulting in narrow sections of the upper sector gauge that may affect interior comfort.

Another difference to be remark is the value of route availability number. Lower axle loads in Class 800 design may permit reducing RA values of the vehicle and hence no disadvantages against critical infrastructure RA values may arise.

Although traction system requirements does not take into consideration the operation in DC 750V TR, similar performance in maximum speed operation (125mph) and on board protection systems are reached for Class 800, S-RSM 01 and S-RSM 02 vehicles.

S-RSM type	RSM type	Standard gauge	Length [m]	Width [m]	Max. Speed [mph]	Vehicle RA	Axle load [tons]	Traction power requirements	On board safety systems
S-RSM 1	DEMU	PG1	20	2.82	125	≤RA3	Up to16.5	AC 25kV OHL DC 750V TR Self-powered	AWS TPWS GW-ATP ERTMS TASS
		PG2	23	2.74					
	Electric & Diesel Locomotives	Loc.	19	2.74					
	Coaches	PG1	20	2.82					
		PG2	23	2.74					
S-RSM 2	DEMU	PG1	20	2.82	125	≤RA3	Up to16.5	AC 25kV OHL Self-powered	AWS TPWS GW-ATP ERTMS TASS
		PG2	23	2.74					
	Electric & Diesel Locomotives	Loc.	19	2.74					
	Coaches	PG1	20	2.82					
		PG2	23	2.74					
S-RSM 3	DEMU	PG1	20	2.82	100	≤RA4	Up to 17.7	DC 750V TR Self-powered	AWS TPWS ERTMS TASS
		PG2	23	2.74					
	Electric & Diesel Locomotives	Loc.	19	2.74					
	Coaches	PG1	20	2.82					
		PG2	23	2.74					
Class 800	DEMU	N/A	26	2.7	125	Around RA2	15	AC 25kV OHL Self-powered	AWS TPWS GW-ATP ERTMS

TABLE 53. COMPARISON S-RSM AND BRITISH CLASS 800

VI. CONCLUSIONS

MASTER THESIS

The historical development of the British railway system results in different tracks, loading gauges, platforms heights and lengths, signalling systems and type of electrifications, which leads into a wide range of rolling stock vehicles incompatible one each other. This fact is a source of inefficiencies into the system.

The present Master Thesis purpose is to guide on the definition of common technical specifications for Rolling Stock Material so as to reach a standard vehicle type (S-RSM) capable of running passenger services in primary and secondary routes of Great Britain rail network.

The analysis of infrastructure technical data from Network Rail Route Specifications together with the assessment on compatibility between Rolling Stock Material and Infrastructure characteristics outline the following S-RSM types:

- S-RSM 01: Running services at all Network rail areas. Vehicle design allows for maximum speed operation of 125 mph and route availability RA3. Passenger services are provided for both electrified (AC 25kV OHL & DC 750V) and unelectrified lines, hence self-powered traction system condition is met. The performance of S-RSM 01 shall only be at self-powered mode in Wales Network Rail areas. S-RSM 01 type shall include AWS, TPWS, GW-ATP and ERTMS systems, as well as TASS system in those vehicles subjected to tilting conditions during operations. A particularization of this standard railway vehicle can be defined as a S-RSM 01.L, that allows increasing the axle load from 16.6 tons up to 19 tons (higher RA number, up to 5) by including only limitations/restrictions of operation in routes of Scotland (SRS P.13 and SRS Q.09) and Wessex (SRS C.01)

- S-RSM 02: Running services at all Network rail areas. Vehicle design allows for maximum speed operation of 125 mph and route availability RA3. Passenger services are provided for both electrified (AC 25kV OHL) and unelectrified lines hence self-powered traction system condition is met. The performance of S-RSM 02 shall only be at self-powered mode in Wales, Wessex, Kent, Sussex, Network Rail areas, as well as SRS O.01 of London North Western. S-RSM 02 type shall include AWS, TPWS, GW-ATP and ERTMS systems, as well as TASS system in those vehicles subjected to tilting conditions during operations. A particularization

of this standard railway vehicle can be defined as a S-RSM 02.L, that allows increasing the axle load from 16.6 tons up to 19 tons (higher RA number, up to 5) by including only limitations/restrictions of operation in routes of Scotland (SRS P.13 and SRS Q.09) and Wessex (SRS C.01)

- S-RSM 03: Running services at Wales, Wessex, Kent, Sussex and Anglia Network rail areas as well as SRS O.01 of London North Western. Vehicle design allows for maximum speed operation of 100 mph and route availability RA4. Passenger services are provided for both electrified (DC 750V TR) and unelectrified lines hence self-powered traction system condition is met. The performance of S-RSM 03 shall only be at self-powered mode in Wales and Anglia Network Rail areas. S-RSM 03 type shall include AWS, TPWS and ERTMS systems, as well as TASS system in those vehicles subjected to tilting conditions during operations. A particularization of this standard railway vehicle can be defined as a S-RSM 03.L, that allows increasing the axle load from 17.7 tons up to 19 tons (higher RA number, up to 5) by including only limitations/restrictions of operation in Wessex route SRS C.01

MASTER THESIS EXTENSION

As part of the Master Thesis Extension, route availability (RA) assessment is also performed for primary and secondary routes. Results can be summarised as follows:

- Infrastructure route availability (RA) values ranging from 9 and up to 10 depict 12% of the primary and secondary routes. They allow axle loads of railway vehicles from more than 22.8tons up to 25.4tons included.

- Infrastructure route availability (RA) values ranging from 5 and up to 8 represent 85% of the primary and secondary routes. They allow axle loads of railway vehicles from more than 17.7tons up to 22.8tons included.

- Infrastructure route availability (RA) values ranging from 3 and up to 4 are only 3% of the primary and secondary routes. They allow axle loads of railway vehicles from more than 16.5tons up to 17.7tons included. The strategic route sections pertaining to these locations are considered as critical (named as location ASS1), as they do not allow Locomotive & Coach compositions (only Multiple Units) to be operated at first stage compatibility assessment but at second stage, meaning that any the train could still operate in the route by means of speed restriction or limitation on its weight. SRS P.13, SRS Q.09 of Scotland, and SRS C.01 of Wessex compiled the ASS1 locations of primary and secondary routes.

VII. CONTRIBUTIONS

MASTER THESIS

Historically the rail sector in Great Britain was developed in various stages and as a result there are variations across the network in electrification, gauge and platform lengths that contributes to the introduction of the many different rolling stock types in operation today.

This Master Thesis aims to give guidance on the definition of a Standard Rolling Stock Material (S-RSM) operating passenger services in primary and secondary routes of Great Britain. Rolling stock fleets which are operating widely on the network allow much more flexibility than those with a narrow coverage. Such operational flexibility could be efficient for Train Operating Companies (TOCs) and the Rolling Stock Companies (ROSCOs). The TOCs benefit by having a vehicle fleet less diverse and more interoperable, easier to manage allowing them to respond to changes in the demand. The ROSCOs benefit by having vehicles which are more easily cascadable which reduces their commercial risk. Cascading vehicles which are operationally flexible become profitable, as their compatibility with the network does not suppose a constraining factor.

MASTER THESIS EXTENSION

Over the next 4 to 5 years, a significant proportion of the passenger rolling stock currently operating in Great Britain rail network will require replacement or life extension, and Talgo, the Spanish train manufacturer, is trying to satisfy the rolling stock demand. However some barriers, such as the route availability, prevent the introduction of articulated trains in this country.

The definition of a Standard Rolling Stock Material together with the performance of a Route Availability assessment in primary and secondary routes, will benefit Talgo by guiding in the definition of a route availability value for its trains so as to accomplishing the compatibility with infrastructure.

VIII. APPENDICES

Appendix 1. Great Britain railway maps. Route type

AP. 1.1. WALES - REF. (7)

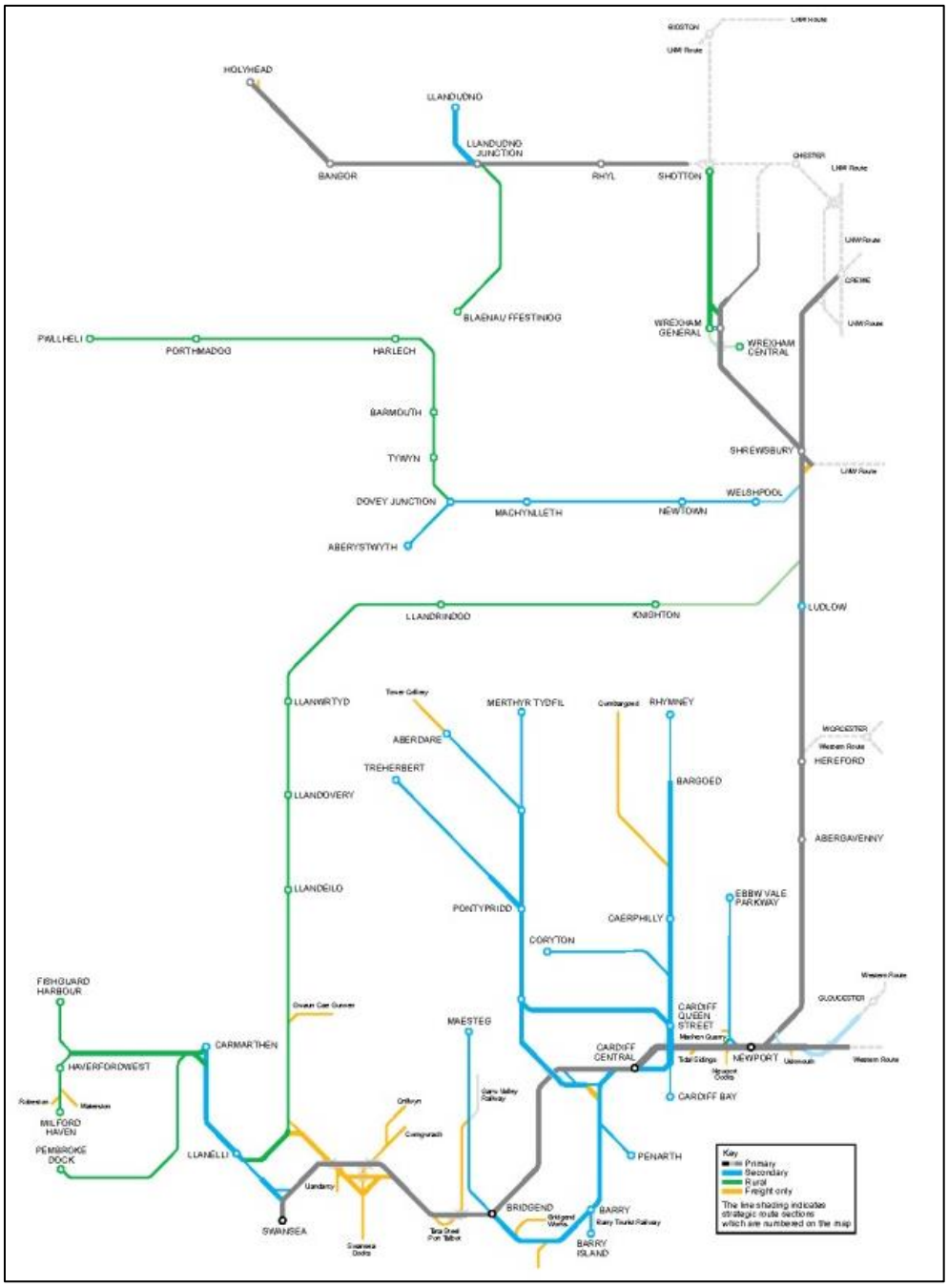

FIGURE 9. ROUTE TYPE. WALES

AP. 1.1. SCOTLAND - REF. (8)

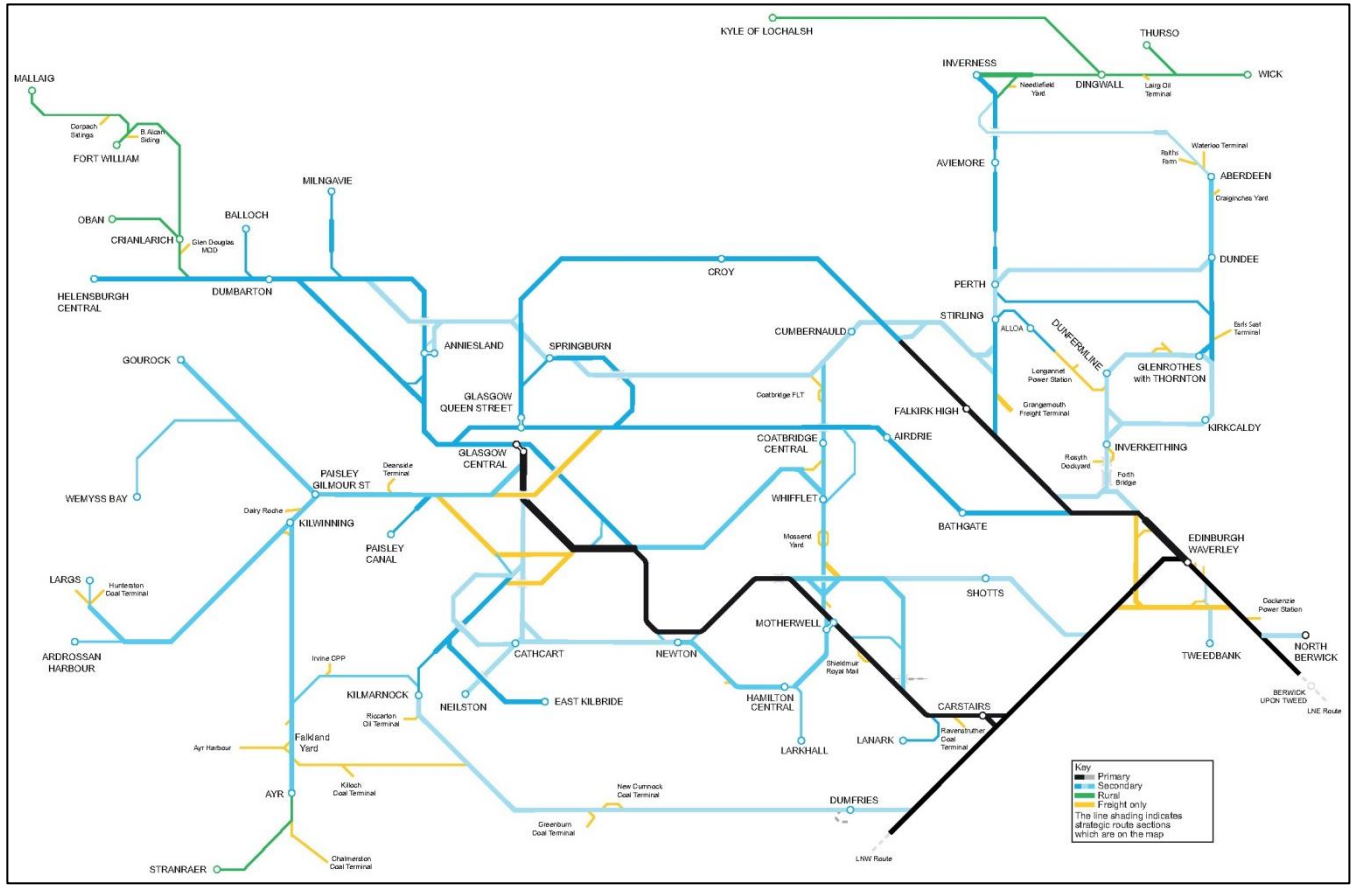

FIGURE 10. ROUTE TYPE. SCOTLAND

AP. 1.1. ANGLIA - REF. (9)

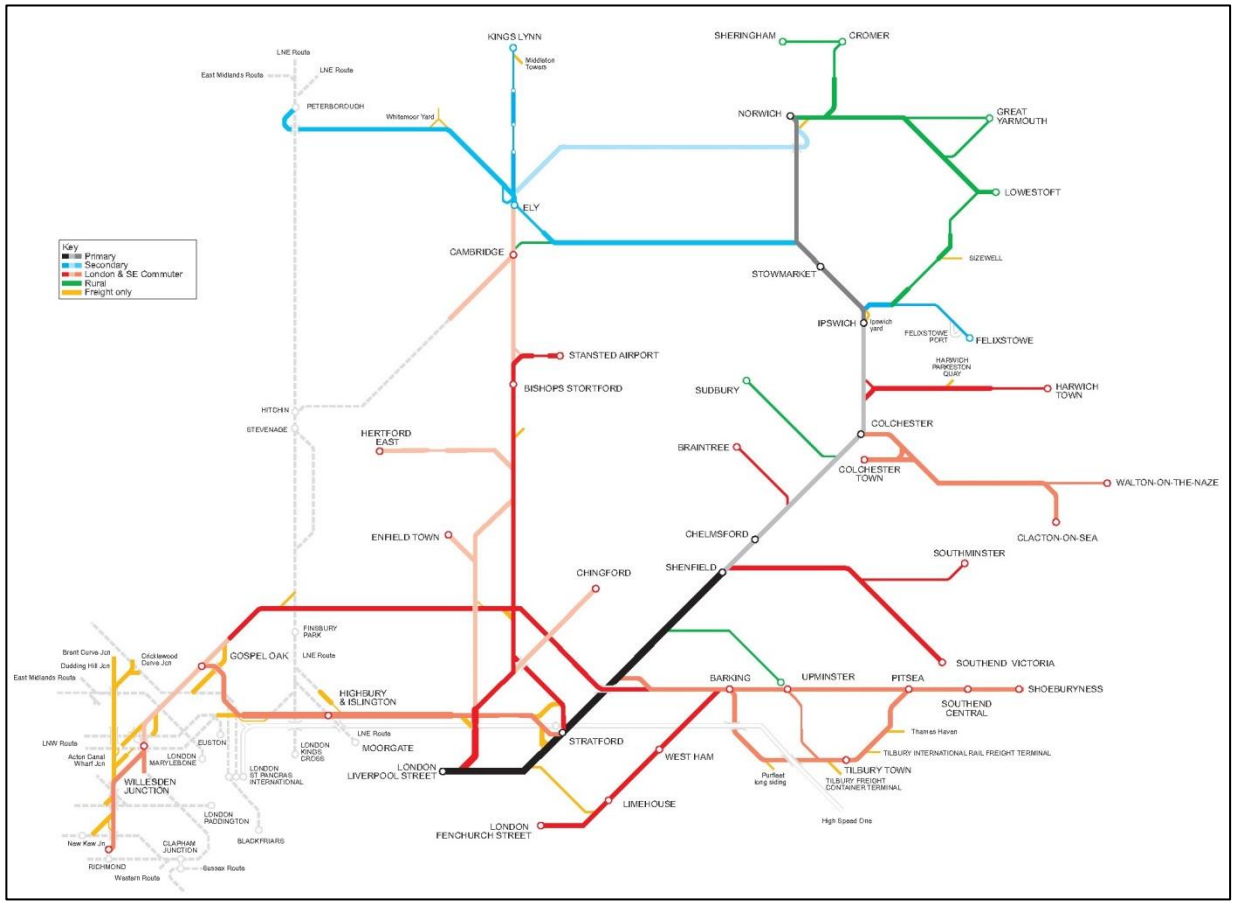

FIGURE 11. ROUTE TYPE. ANGLIA

AP. 1.2. WESSEX - REF. (10)

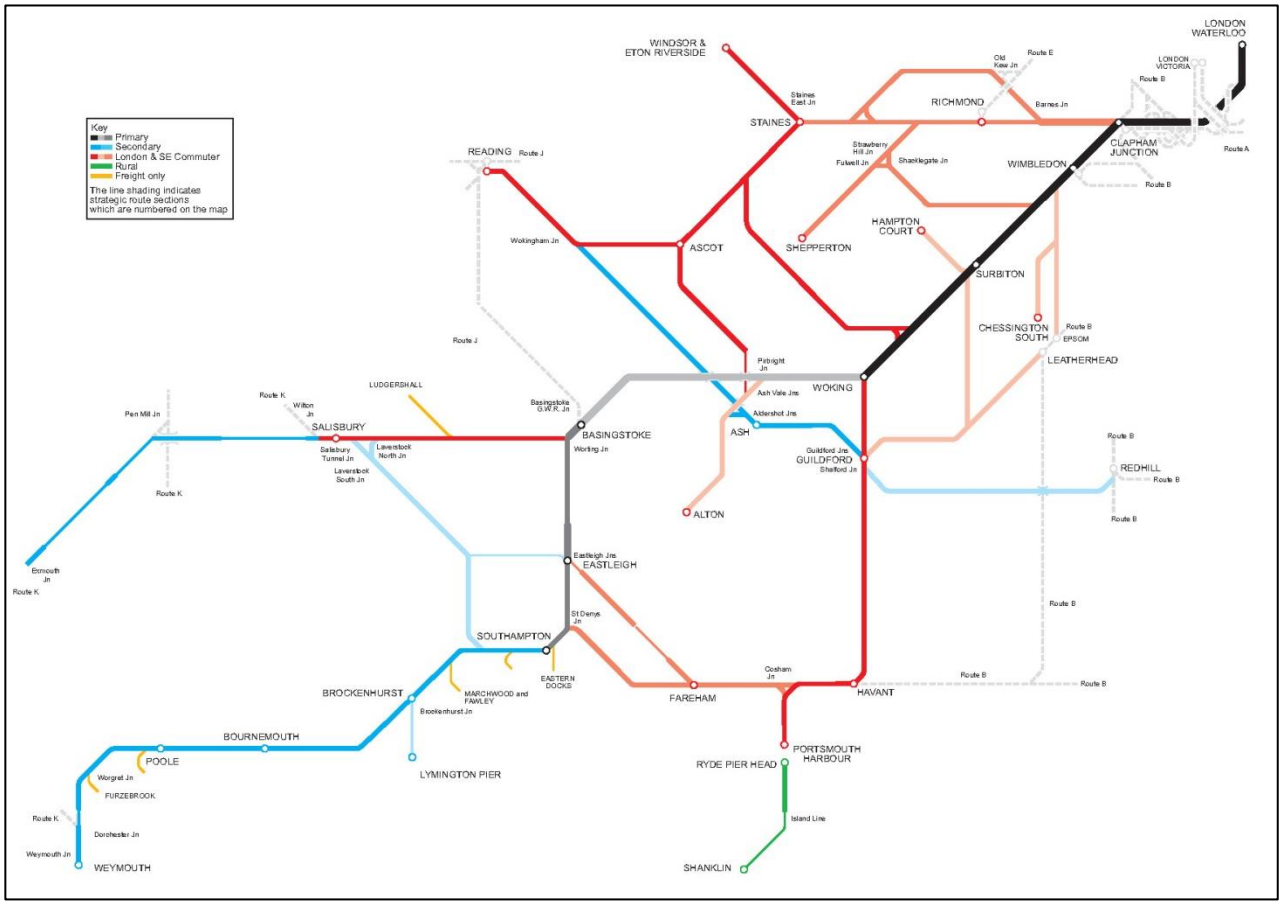

TABLE 54. ROUTE TYPE. WESSEX

AP. 1.3. SOUTH EAST (KENT & SUSSEX) - REF. (11)

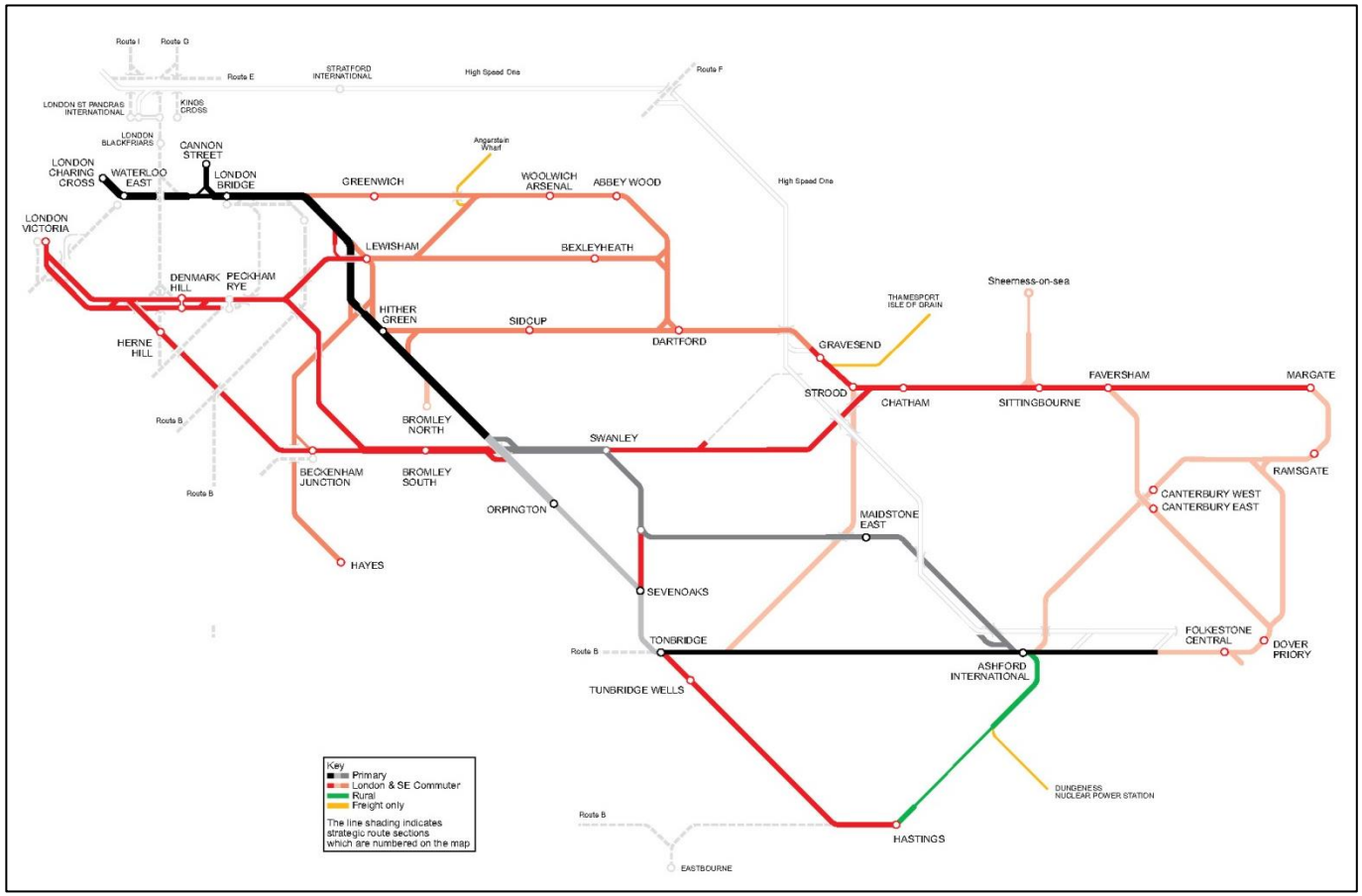

FIGURE 12. ROUTE TYPE. KENT

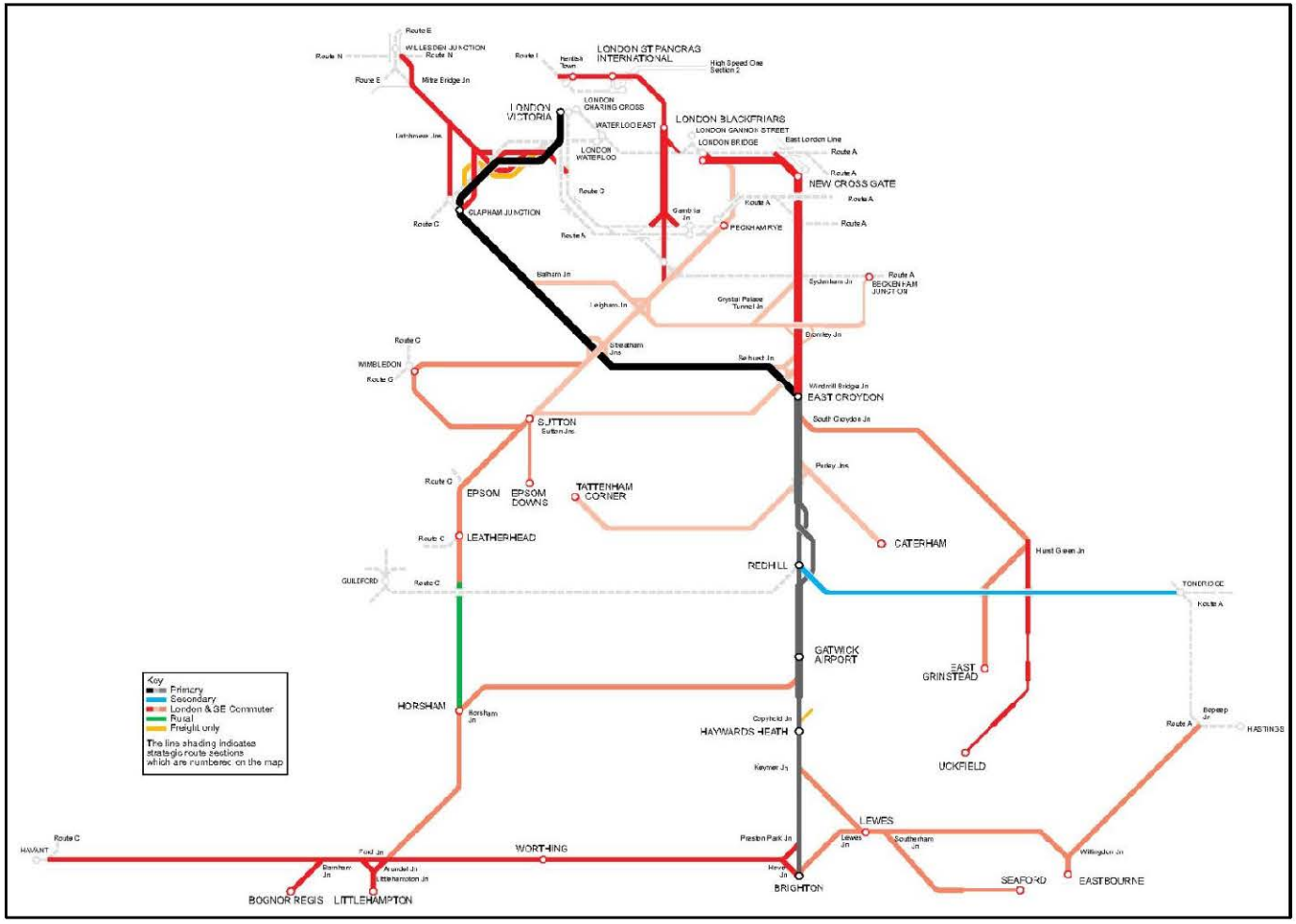

FIGURE 13. ROUTE TYPE. SUSSEX

AP. 1.4. WESTERN - REF. (12)

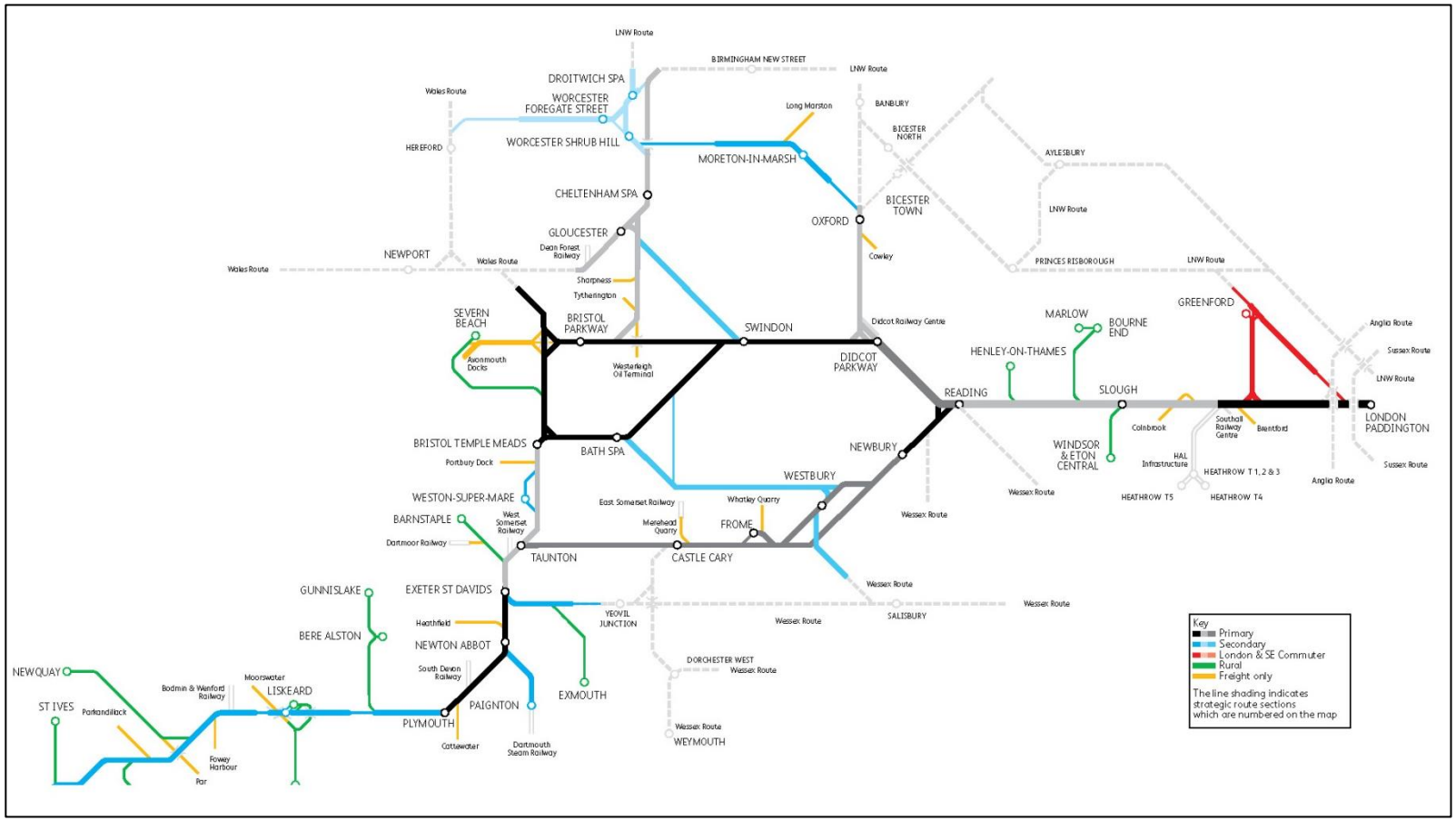

FIGURE 14. ROUTE TYPE. WESTERN

AP. 1.5. LONDON NORTH WESTERN (NORTH AND SOUTH) - REF. (13)

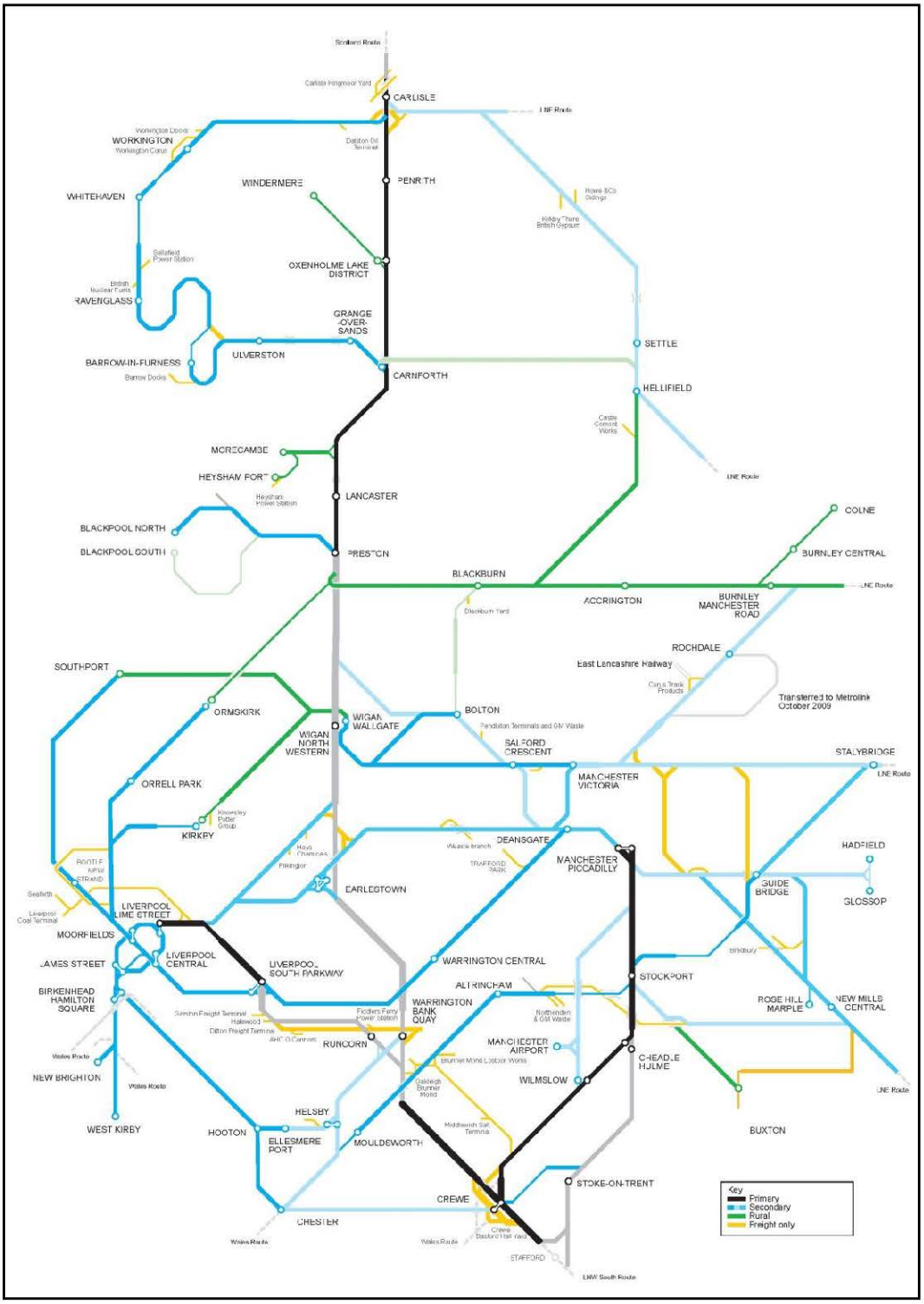

FIGURE 15. ROUTE TYPE. LNW NORTH

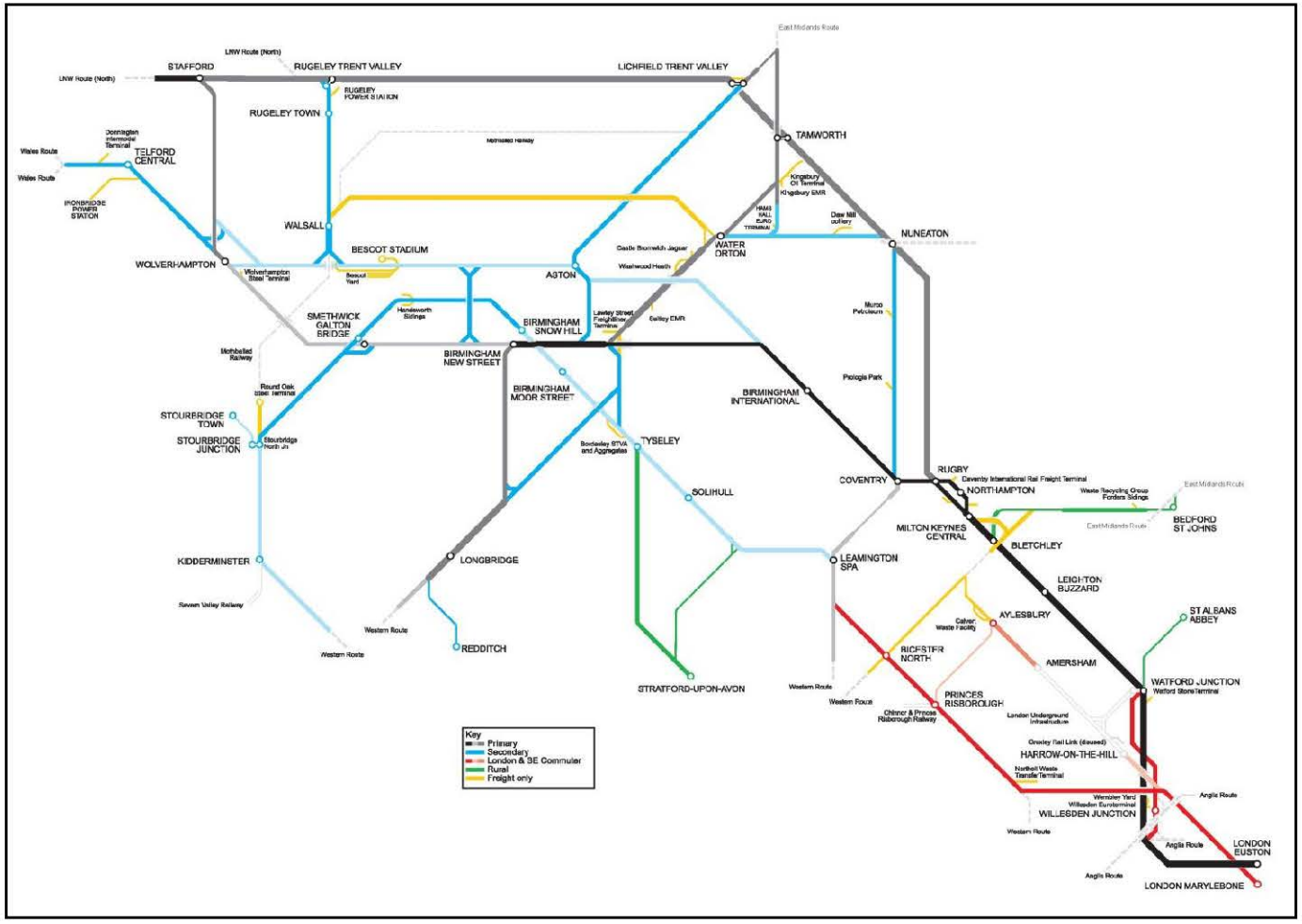

FIGURE 16. ROUTE TYPE. LNW SOUTH

AP. 1.6. LONDON NORTH EAST & EAST MIDLANDS - REF. (14)

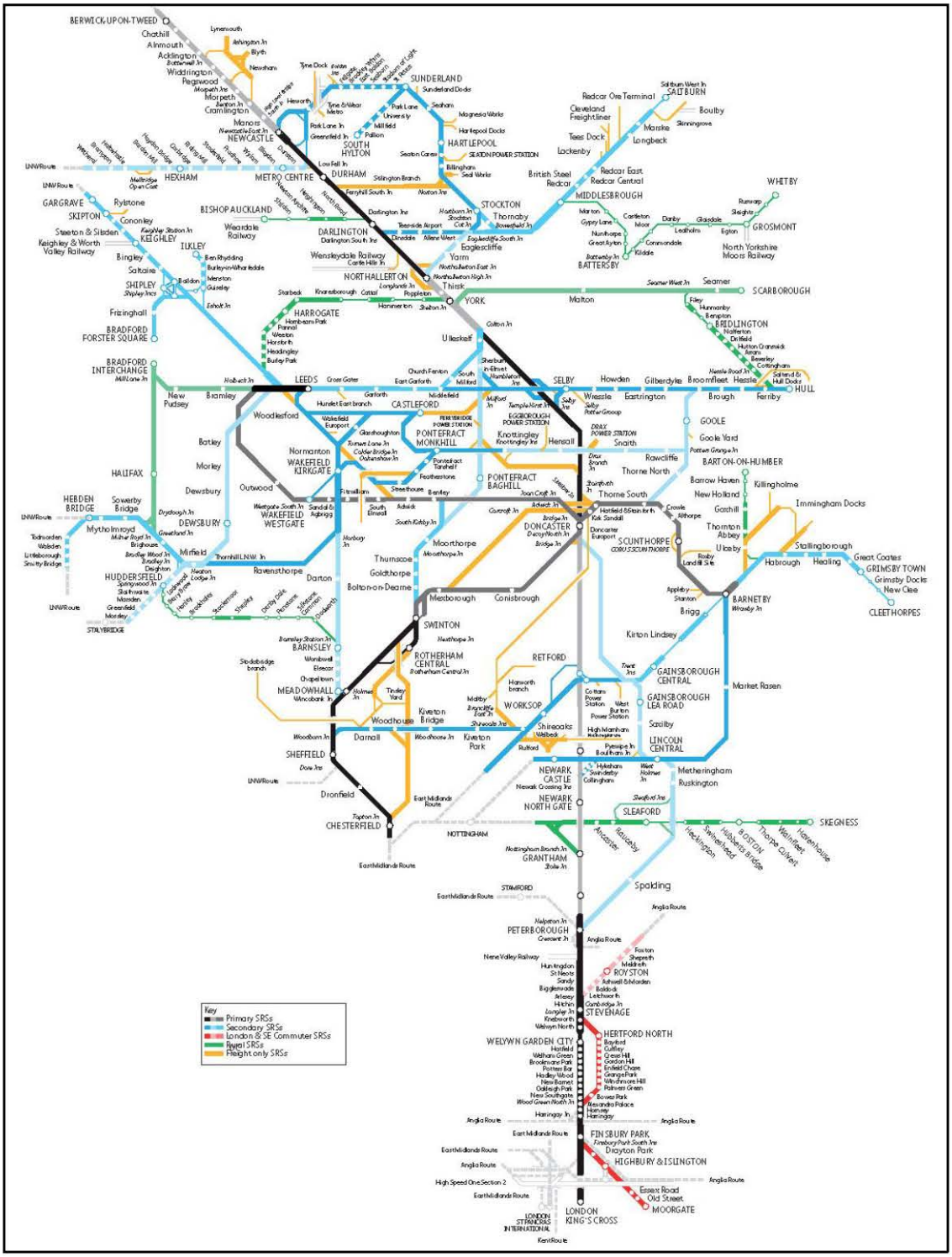

FIGURE 17. ROUTE TYPE. LONDON NORTH EAST

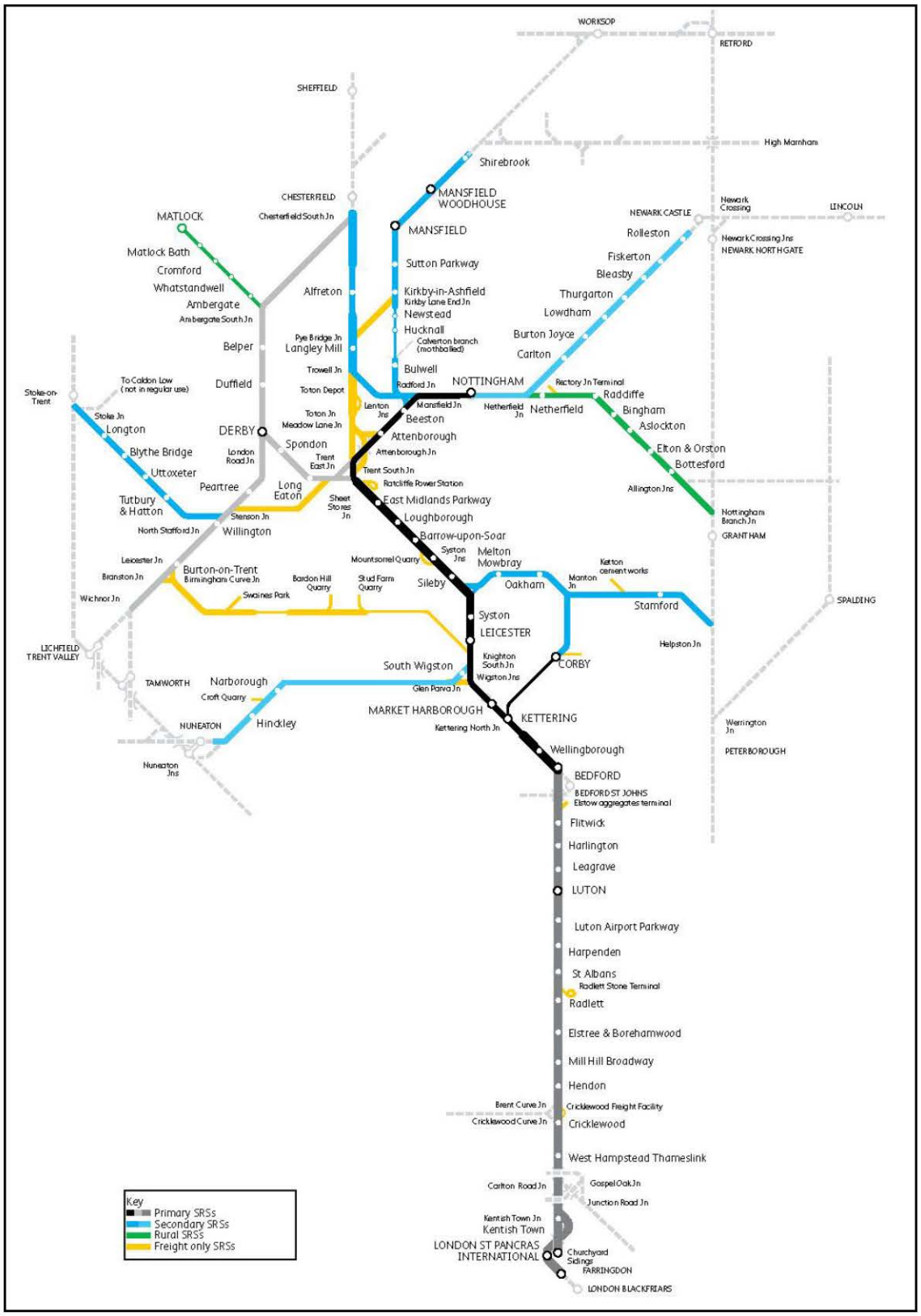

FIGURE 18. ROUTE TYPE. EAST MIDLANDS

Appendix 2. Route specifications and TOC operations

AP. 2.1. WALES - REF. (15)

Strategic route section (SRS)	Route type (P/S)	Lines of route description (LOR)
SRS L.01	Primary	GW900 - PILNING TO FISHGUARD HARBOUR GW9001 - LANDORE JN. TO SWANSEA
SRS L.02-03	Primary	GW700 - GLOUCESTER BARNWOOD JN. TO SEVERN TUNNEL JN.
SRS L.04-05	Primary	GW730 - SEVERN BRIDGE JN. TO NEWPORT, MAINDEE WEST JN. GW735 - SHREWSBURY, CREWE JN TO NANTWICH NW1007 - NANTWICH (EXCL.) TO CREWE SOUTH JN.
SRS L.08-09	Primary	GW733 - SUTTON BRIDGE JUNCTION TO ABERYSTWYTH
SRS L.10-12	Primary	GW731 - ABBEY FOREGATE TO RUABON NW3005 - GOBOWEN (EXCL.) TO SALTNEY JN.
SRS L.13-14	Primary	NW3001 - CREWE NORTH JN TO HOLYHEAD
SRS L.17	Secondary	GW770 - EBBW VALE PARKWAY TO GAER JN.
SRS L.18	Secondary	GW810 - RHYMNEY TO QUEEN STREET NORTH JN. GW828 - CORYTON TO HEATH JN. GW830 - METHYR TYDFIL TO BARRY ISLAND VIA CARDIFF QUEEN STREET GW834 - HIRWAUN TO ABERCYNON GW835 - TREHERBERT TO PONTYPRIDD JN. GW839 - QUEEN ST. SOUTH JN. TO CARDIFF BAY GW840 - RADYR JN TO CARDIFF, RADYR BRANCH JN VIA CITY LINES GW860 - PENARTH CURVE NORTH JN TO PENARTH CURVE SOUTH JN. GW864 - COGAN JN. TO PENARTH GW870 - BARRY TO BRIDGEND, BARRY JN.
SRS L.19	Secondary	GW874 - BRIDGEND, (LLYNFI JN.) TO MAESTEG
SRS L.20-22	Secondary	GW930 - CARMARTHEN JN. TO CARMARTHEN STATION GF

		GW940 - UP SIDINGS NO.2 GF TO CARMARTHEN BRIDGE JN.
SRS L.23	Secondary	NW3015 - LLANDUDNO JN. TO BLAENAU FFESTINIOG NW3017 - LLANDUDNO JN. TO LLANDUDNO

TABLE 55. LINES OF ROUTE DESCRIPTION. WALES

Strategic route section (SRS)	Route type (P/S)	Infrastructure RA	Standard gauge	Signalling method	Max. Speed slow lines [mph]	Max. Speed fast lines [mph]	Electrification system
SRS L.01	Primary	RA7 RA8	W6 W8	TCB	40	90	None
SRS L.02-03	Primary	RA8	W8	TCB	70	90	None
SRS L.04-05	Primary	RA8	W8	TCB AB	70	90	None
SRS L.08-09	Primary	RA5 RA7	W6	ERTMS-L2	50	75	None
SRS L.10-12	Primary	RA8	W6	TCB AB	60	70	None
SRS L.13-14	Primary	RA8	W7	TCB AB	75	90	None
SRS L.17	Secondary	RA5 RA8	W9	TCB OTW	30	50	None
SRS L.18	Secondary	RA6 RA8	W6 W8	NST TCB OTW AB	45	75	None
SRS L.19	Secondary	RA6	W6 W8	NST TCB	50	50	None
SRS L.20-22	Secondary	RA6 RA7 RA8	W6 W7 W8	AB TCB NST NSTR	50	75	None
SRS L.23	Secondary	RA7	W6	ETB NST AB	30	50	None

TABLE 56. ROUTE CAPABILITY OVERVIEW. WALES

Strategic route section (SRS)	Route type (P/S)	Train operator companies (TOC)	Trains per hour (TPH)	Trains per day (TPD)
SRS L.01	Primary	(AW) - Arriva Trains Wales (GW) - Great Western Railway (XC) - Cross Country	(T132) & (GW) &S (AW)(XC) - (9 Trains) East of Cardiff (T128) & (GW) - (2 Trains) to London (T128) & (AW) - (5 Trains) Interurban (T128) & (AW) - (2 Trains) Regional	
SRS L.02-03	Primary	(AW) - Arriva Trains Wales (XC) - Cross Country	(T058) & (AW) &S (XC) - (1 Train) Cheltenham to Cardiff (T128) & (AW) - (1 Train) Cheltenham to Maesteg	
SRS L.04-05	Primary	(AW) - Arriva Trains Wales	(T131) & (AW) - (1 Train) Cardiff to Manchester (T131) & (AW) - (1/2 Train) Cardiff to Holyhead (T131) & (AW) - (1/2 Train) Shrewsbury to Crewe	(T129) & (AW) - (4 Trains) Craven Arms to Shrewsbury
SRS L.08-09	Primary	(AW) - Arriva Trains Wales	(T076) & (AW) - (1/2 Train) Birmingham to Aberystwyth (T076) & (AW) - (1/2 Train) Machynllth to Pwllheli	
SRS L.10-12	Primary	(AW) - Arriva Trains Wales (VT) - Virgin Train West Coast	(T075) & (AW) &S (VT)- (1 Train) Shrewsbury to Chester	
SRS L.13-14	Primary	(AW) - Arriva Trains Wales (VT) - Virgin Train West Coast	(T081) & (AW) - (1 Train) Chester to Holyhead	(T081) & (VT) - (6 Trains)
SRS L.17	Secondary	(AW) - Arriva Trains Wales	(T127) & (AW) - (1 Train) Cardiff to Ebbw Vale Park	
SRS L.18	Secondary	(AW) - Arriva Trains Wales	(T130) & (AW) - (4 Trains) Rhymney to Bargoed (T130) & (AW) - (2 Trains) Cardiff to Aberdare (T130) & (AW) - (2 Trains) Cardiff to Merthyr Tydfil (T130) & (AW) - (2 Trains) Cardiff to Treherbert (T130) & (AW) - (4 Trains) Rhymney to Penath	

			(T130) & (AW) - (3 Trains) Barry to Barry Island (T130) & (AW) - (1 Trains) Cardiff to Bridgend (T130) & (AW) - (2 Trains) Cardiff to Coryton (T130) & (AW) - (2 Trains) Aberdare to Radyr	
SRS L.19	Secondary	(AW) - Arriva Trains Wales	(T128) & (AW) - (1 Trains) Cardiff to Maesteg	
SRS L.20-22	Secondary	(AW) - Arriva Trains Wales (GW) - Great Western Railway	(T128) & (AW) - (1/2 Train) Swansea to Pembroke Dock (T128) & (AW) - (1 Train) Swansea to Carmarthen	(T128) & (AW) - (2 Trains) Swansea to Fishguard Harbour (T128) & (AW) - (5 Trains) Carmarthen to Fishguard (T128) & (GW) - (4 Trains) Wales Line to commuter Swansea
SRS L.23	Secondary	(AW) - Arriva Trains Wales	(T081) & (AW) - (2 Train) Llandudno to Llandudno Jn.	(T102) & (AW) - (6 Trains) Blaenau Ffestioniog to Llandudno Jn.

TABLE 57. TOC SERVICES. WALES

Strategic route section (SRS)	Route type (P/S)	Train operator company (TOC)	Specified equipment
SRS L.01	Primary	(GW) - Great Western Railway	Class 43
			Class Mk3
		(AW) - Arriva Trains Wales	Class 150
		(AW) - Arriva Trains Wales	Class 153
		(AW) - Arriva Trains Wales	Class 158
		(AW) - Arriva Trains Wales	Class 175
		(XC) - Cross Country	Class 170
SRS L.02-03	Primary	(XC) - Cross Country	Class 43
			Class Mk3
		(AW) - Arriva Trains Wales	Class 142
		(AW) - Arriva Trains Wales	Class 143
		(AW) - Arriva Trains Wales	Class 150
		(AW) - Arriva Trains Wales	Class 158
		(XC) - Cross Country	Class 170
		(AW) - Arriva Trains Wales	Class 175
SRS L.04-05	Primary	(AW) - Arriva Trains Wales	Class 175
		(AW) - Arriva Trains Wales	Class 158
SRS L.08-09	Primary	(AW) - Arriva Trains Wales	Class 158
SRS L.10-12	Primary	(AW) - Arriva Trains Wales	Class 150
		(AW) - Arriva Trains Wales	Class 153
		(AW) - Arriva Trains Wales	Class 158
		(AW) - Arriva Trains Wales	Class 175
		(VT) - Virgin Train West Coast	Class 221
SRS L.13-14	Primary	(AW) - Arriva Trains Wales	Class 150
		(AW) - Arriva Trains Wales	Class 153
		(AW) - Arriva Trains Wales	Class 158
		(AW) - Arriva Trains Wales	Class 175
		(VT) - Virgin Train West Coast	Class 221

SRS L.17	Secondary	(AW) - Arriva Trains Wales	Class 150
SRS L.18	Secondary	(AW) - Arriva Trains Wales	Class 142
		(AW) - Arriva Trains Wales	Class 143
		(AW) - Arriva Trains Wales	Class 150
SRS L.19	Secondary	(AW) - Arriva Trains Wales	Class 142
		(AW) - Arriva Trains Wales	Class 143
		(AW) - Arriva Trains Wales	Class 150
SRS L.20-22	Secondary	(GW) - Great Western Railway	Class 43
			Class Mk3
		(AW) - Arriva Trains Wales	Class 150
		(AW) - Arriva Trains Wales	Class 153
		(AW) - Arriva Trains Wales	Class 158
		(AW) - Arriva Trains Wales	Class 175
SRS L.23	Secondary	(AW) - Arriva Trains Wales	Class 150
		(AW) - Arriva Trains Wales	Class 153

TABLE 58. TOC SPECIFIED EQUIPMENT. WALES

AP. 2.2. SCOTLAND - REF. (16)

Strategic route section (SRS)	Route type (P/S)	Lines of route description (LOR)
SRS P.01	Primary	SC107 - EDINBURGH WAVERLEY TO GLASGOW QUEEN STREET
SRS P.02	Primary	SC003 - CARSTAIRS SOUTH JN. TO HAYMARKET EAST JN. SC107 - EDINBURGH WAVERLEY TO GLASGOW QUEEN STREET
SRS P.03	Secondary	SC107 - EDINBURGH WAVERLEY TO GLASGOW QUEEN STREET SC111 - NEWBRIDGE JN. TO BATHGATE
SRS P.04	Secondary	SC119 - GREENHILL UPPER JN. TO DUNDEE SC109 - POLMONT JN. TO GREENHILL UPPER JN.
SRS P.05	Secondary	SC161 - MILLERHILL YARD TO PORTOBELLO
SRS P.06	Secondary	SC171 - EDINBURGH WAVERLEY TO DUNDEE SC173 - INVERKEITHING CENTRAL JN. TO THORNTON NORTH JN. SC113 - WINCHBURGH JN TO DALMENY JN.
SRS P.07	Secondary	SC119 - GREENHILL UPPER JN. TO DUNDEE
SRS P.08	Secondary	SC171 - EDINBURGH WAVERLEY TO DUNDEE SC181 - LADYBANK JN. TO HILTON JN.
SRS P.09	Secondary	SC191 - DUNDEE TO ABERDEEN
SRS P.10	Secondary	SC195 - ABERDEEN TO INVERNESS
SRS P.11	Secondary	SC193 - PERTH TO INVERNESS
SRS P.13	Secondary	SC164 - NEWCRAIGHALL SOUTH JN. TO TWEEDBANK
SRS N.06	Secondary	SC001 - GRETNA JN. TO GLASGOW CENTRAL
SRS Q.01	Primary	SC001 - GRETNA JN. TO GLASGOW CENTRAL
SRS Q.02	Secondary	SC007 - MIDCALDER JN. TO HOLYTOWN JN.
SRS Q.03	Secondary	SC059 - GLASGOW CENTRAL TO STRANRAER SC065 - PAISLEY TO GOUROCK SC067 - WEMYSS BAY JN. TO WEMYSS BAY SC073 - KILWINNING JN. TO LARGS SC077 - ARDROSSAN SOUTH BEACH TO ARDROSSAN HBR

SRS Q.04	Secondary	SC123 - DRUMGELLOCH TO HELENSBURGH SC129 - SPRINGBURN TO BELLGROVE JN. SC133 - WESTERTON JN. TO MILNGAVIE SC135 - DALREOCH JN. TO BALLOCH SC027 - RUTHERGLEN WEST JN. TO RUTHERGLEN NORTH JN.
SRS Q.06	Secondary	SC061 - SHIELDS JN. TO PAISLEY CANAL
SRS Q.07	Secondary	SC031 - GRETNA JN. TO GLASGOW CENTRAL SC045 - EAST KILBRIDE TO BUSBY JN.
SRS Q.08	Secondary	SC031 - GRETNA JN. TO GLASGOW CENTRAL SC039 - KILMARNOCK TO BARASSIE
SRS Q.09	Secondary	SC051 - MUIRHOUSE CENTRAL JN. TO MUIRHOUSE NORTH JN. SC053 - NEILSTON TO CATHCART WEST JN. SC055 - NEWTON, HAMILTON JN. TO CATHCART WEST JN. SC057 - CATHCART EAST JN. TO CATHCART NORTH JN.
SRS Q.10	Secondary	SC011 - LAW JN. TO UDDINGSTON JN. SC023 - MOTHERWELL TO NEWTON, HAMILTON JN. SC024 - LARKHALL TO HAUGHHEAD JN. SC093 - MOTHERWELL TO GREENHILL LOWER JN. SC099 - WHIFFLET NORTH JN. TO RUTHERGLEN EAST
SRS Q.11	Secondary	SC009 - LANARK TO LANARK JN.
SRS Q.12	Secondary	SC093 - MOTHERWELL TO GREENHILL LOWER JN. SC103 - GARNQUEEN NORTH JN. TO COWLAIRS WEST JN. SC1150 - MARYHILL PARK JN. TO ANNIESLAND BAY PLATFORM
SRS Q.13	Secondary	SC031 - GRETNA JN. TO GLASGOW CENTRAL
SRS G.11	Primary	SC147 - BERWICK TO HAYMARKET WEST JN.
SRS G.12	Secondary	SC149 - NORTH BERWICK TO DREM JN.

TABLE 59. LINES OF ROUTE DESCRIPTION. SCOTLAND

Strategic route section (SRS)	Route type (P/S)	Infrastructure RA	Standard gauge	Signalling method	Max. Speed slow lines [mph]	Max. Speed fast lines [mph]	Electrification system
SRS P.01	Primary	RA8 RA10	W6 W10	Colour light up to 4A-IECC	80	100	AC 25kV OHL None
SRS P.02	Primary	RA10	W12	Colour light up to 4A-IECC	70	95	AC 25kV OHL
SRS P.03	Secondary	RA10	W10	Colour light up to 3A-IECC	90	90	AC 25kV OHL
SRS P.04	Secondary	RA10	W8 W9	Colour light up to 3A-SB	95	95	None
SRS P.05	Secondary	RA10	W9	Colour light up to 4A-IECC	30	30	AC 25kV OHL
SRS P.06	Secondary	RA8 RA10	W7 W8	Colour light up to 4A-IECC	70	100	None
SRS P.07	Secondary	RA10	W7 W8	Colour light up to 2A-SB Semaphore-SB	100	100	None
SRS P.08	Secondary	RA8	W7 W8	Colour light up to 3A-IECC Semaphore-SB	100	100	None
SRS P.09	Secondary	RA10	W7 W8S	Colour light up to 3A-SB Semaphore-SB	80	100	None
SRS P.10	Secondary	RA10	W7 W8S	Colour light up to 3A-SB Semaphore-SB	40	75	None
SRS P.11	Secondary	RA8 RA10	W7 W8	Colour light up to 3A-SB Semaphore-SB	80	100	None

SRS P.13	Secondary	RA3	W6a	Colour light up to 2A-SB	90	90	None
SRS N.06	Secondary	RA10	W10	Colour light TCB TASS	125	125	None
SRS Q.01	Primary	RA8 RA10	W7 W8 W10	Colour light up to 4A-IECC	105	105	AC 25kV OHL
SRS Q.02	Secondary	RA10	W6	Colour light up to 2A-IECC	70	70	None
SRS Q.03	Secondary	RA5 RA7 RA8 RA10	W6 W7 W8 W9	Colour light up to 4A-IECC	75	90	AC 25kV OHL
SRS Q.04	Secondary	RA5 RA7 RA8 RA10	W6 W8	Colour light up to 4A-IECC	75	75	AC 25kV OHL
SRS Q.06	Secondary	RA10	W7	Colour light up to 3A-IECC	30	50	AC 25kV OHL
SRS Q.07	Secondary	RA5 RA10	W6 W7	Colour light up to 3A-IECC	75	75	None
SRS Q.08	Secondary	RA10	W8 W9	Colour light up to 3A-SB	80	80	None
SRS Q.09	Secondary	RA3 RA5 RA7	W7	Colour light up to 4A-IECC	55	55	AC 25kV OHL
SRS Q.10	Secondary	RA7 RA10	W6 W10	Colour light up to 4A-IECC	75	75	AC 25kV OHL
SRS Q.11	Secondary	RA5	W6	Colour light up to 4A-IECC	75	75	AC 25kV OHL
SRS Q.12	Secondary	RA5	W6	Colour light up to	75	75	None

		RA8 RA10	W9	4A-IECC			
SRS Q.13	Secondary	RA8	W8	Signal Box Centre	80	80	None
SRS G.11	Primary	RA10	W9	TCB	75	125	AC 25kV OHL
SRS G.12	Secondary	RA5	W7	OTW	50	50	AC 25kV OHL

TABLE 60. ROUTE CAPABILITY OVERVIEW. SCOTLAND

Strategic route section (SRS)	Route type (P/S)	Train operator companies (TOC)	Trains per hour (TPH)	Trains per day (TPD)
SRS P.01	Primary	(SR) - ScotRail	(T228) & (SR) - (4 Trains) Edinburgh to Glasgow (Express) (T230) & (SR) - (2 Trains) Glasgow to Stirling (Express) (T230) & (SR) - (2 Trains) Glasgow to Stirling (T230) & (SR) - (2 Trains) Glasgow to Anniesland (T230) & (SR) - (4 Trains) Edinburgh to Bathgate (T230) & (SR) - (2 Trains) Edinburgh to Stirling (T230) & (SR) - (1 Train) Glasgow to Falkirk Grahamstom	
SRS P.02	Primary	(SR) - ScotRail (GR) - Virgin Trains East Coast (XC) - CrossCountry (TP) - TransPennine Express (VT) - Virgin Trains West Coast	(T065) & (VT) - (1 Train) Edinburgh to Glasgow/Carliste (Long distance) (T224) & (SR) &S (XC) (GR) - (1 Train) Edinburgh to Glasgow (Express) (T224) & (SR) - (1 Train) Edinburgh to Glasgow (Local) (T224) & (SR) &S (TP) - (1/2 Train) Glasgow to Carstairs (Express)	
SRS P.03	Secondary	(CS) - Caledonian Sleeper (SR) - ScotRail	(T226) & (SR) - (4 Trains) Edinburgh to Drumgelloch	
SRS P.04	Secondary	(CS) - Caledonian Sleeper (SR) - ScotRail (GR) - Virgin Trains East Coast	(T230) & (SR) - (1 Train) Alloa to Glasgow (T230) & (SR) &S (GR) - (2 Trains) Dunblane to Edinburgh (T230) & (SR) - (1 Train) Dunblane/Stirling to Glasgow (T229) & (SR) - (1 Train) Glasgow to Aberdeen (T229) & (SR) - (1 Train) Glasgow to Perth / Inverness (T230) & (SR) - (1 Train) Flalkirk Grahamston to Glasgow	(T229) & (CS) - (1 Train) Inverness to London Euston (Sleeper) (T230) & (GR) - (2 Trains) Inverness to London King's Cross (T229) & (GR) - (2 Trains) Stirling to London King's Cross
SRS P.05	Secondary	(SR) - ScotRail	(T243) & (SR) - (2 Trains) Tweedbank/Newcraighall to Edinburgh	
SRS P.06	Secondary	(CS) - Caledonian Sleeper (SR) - ScotRail (GR) - Virgin Trains East Coast (XC) - CrossCountry	(T242) & (SR) - (4 Trains) Edinburgh to Fife (T242) & (SR) - (2 Trains) Edinburgh to Dundee/Aberdeen (T242) & (SR) - (1 Train) Edinburgh to Perth/Inverness	(T242) & (GR) - (4 Trains) King's Cross/Leeds to Aberdeen (T229) & (CS) - (1 Train) Aberdeen to London Euston (Sleeper) (T242) & (XC) - (1 Train) Dundee to

				Plymouth (T242) & (XC) - (1 Train) Aberdeen to Penzance
SRS P.07	Secondary	(CS) - Caledonian Sleeper (SR) - ScotRail (GR) - Virgin Trains East Coast	(T229) & (SR) - (1 Train) Glasgow to Aberdeen (T229) & (SR) - (1 Train) Glasgow to Perth/Dundee/Inverness	(T229) & (GR) - (1 Train) Inverness to London King's Cross (T229) & (CS) - (1 Train) Inverness to London Euston (Sleeper)
SRS P.08	Secondary	(CS) - Caledonian Sleeper (SR) - ScotRail (GR) - Virgin Trains East Coast (XC) - CrossCountry	(T229) & (SR) - (2 Trains) Edinburgh to Dundee/Aberdeen (T229) & (SR) - (1 Train) Edinburgh to Perth/Inverness	(T229) & (GR) - (4 Trains) King's Cross/Leeds to Aberdeen (T229) & (XC) - (1 Train) Dundee to Plymouth (T229) & (XC) - (1 Train) Aberdeen to Penzance (T229) & (CS) - (1 Train) Aberdeen to London Euston (Sleeper)
SRS P.09	Secondary	(CS) - Caledonian Sleeper (SR) - ScotRail (GR) - Virgin Trains East Coast (XC) - CrossCountry	(T229) & (SR) - (1 Train) Edinburgh to Aberdeen (T229) & (SR) - (1 Train) Glasgow to Aberdeen	(T229) & (GR) - (4 Trains) King's Cross to Aberdeen (T229) & (CS) - (1 Train) Aberdeen to London Euston (Sleeper) (T229) & (XC) - (1 Train) Aberdeen to Penzance
SRS P.10	Secondary	(SR) - ScotRail	(T240) & (SR) - (2 Trains) Aberdeen to Inverness	(T240) & (SR) - (2 Trains) Elgin to Inverness (T240) & (SR) - (11 Trains) Inverurie to Aberdeen
SRS P.11	Secondary	(CS) - Caledonian Sleeper (SR) - ScotRail (GR) - Virgin Trains East Coast		(T229) & (GR) - (5 Trains) Edingburgh to Inverness (T229) & (GR) - (5 Trains) Glasgow to Inverness (T229) & (GR) - (1 Train) Inverness to London King's Cross (T229) & (CS) - (1 Train) Inverness to

				London Euston (Sleeper)
SRS P.13	Secondary	(SR) - ScotRail	(T243) & (SR) - (2 Trains) Tweedbank to Edinburgh	
SRS N.06	Secondary	(CS) - Caledonian Sleeper (VT) - Virgin Trains West Coast (TP) - TransPennine Express	(T65) & (VT) - (1 Train) London to Scotland (T65) & (VT) - (1 Train) London via Birminghan to Scotland (T65) & (TP) - (1 Train) Manchester Airport to Scotland	(T65) & (CS) - (1 Train) London to Scotland (Sleeper)
SRS Q.01	Primary	(CS) - Caledonian Sleeper (SR) - ScotRail (GR) - Virgin Trains East Coast (XC) - CrossCountry (VT) - Virgin Trains West Coast (TP) - TransPennine Express	(T225) & (VT) &S (TP) - Glasgow to England (T225) & (SR) - (1 Train) Glasgow to Edinburgh (Express) (T225) & (SR) - (1 Train) Glasgow to Edinburgh (Local) (T224) & (SR) - (1/2 Train) Glasgow to Edinburgh (T224) & (XC) & (GR) - (1/2 Train) To East Coast Main Line Waverley (Long distance) (T225) & (SR) - (2 Trains) Glasgow to Lanark (T225) & (SR) - (2 Trains) Argyle line to Motherwell/Cumbernauld (T225) & (SR) - (2 Trains) Argyle line to Larkhall (T225) & (SR) - (2 Trains) Argyle line to Whifflet/Motherwell	
SRS Q.02	Secondary	(SR) - ScotRail	(T225) & (SR) - (1 Train) Edinburgh to Glasgow (Express) (T225) & (SR) - (1 Train) Edinburgh to Glasgow (Local)	
SRS Q.03	Secondary	(SR) - ScotRail	(T221) & (SR) - (4 Trains) Glasgow to Ayr (T119) & (SR) - (4 Trains) Glasgow to Gourock (T219) & (SR) - (1 Train) Glasgow to Wemyss Bay (T221) & (SR) - (1 Train) Glasgow to Largs (T221) & (SR) - (1 Train) Glasgow to Ardrossan Harbour (T218) & (SR) - (1/2 Train) Kilmarnock to Ayr	
SRS Q.04	Secondary	(CS) - Caledonian Sleeper (SR) - ScotRail	(T226) & (SR) - (2 Trains) To/from Helensburgh Central (T226) & (SR) - (2 Trains) To/from Balloch (T226) & (SR) - (4 Trains) To/from Milngavie (T226) & (SR) - (2 Trains) To/from Springburn (T226) & (SR) - (4 Trains) To/from Drumgelloch (T225) & (SR) - (6 Trains) Argyle line (T225) & (SR) - (2 Trains)To/from Airdrie (T225) & (SR) - (6 Trains) To/from Dalmuir	(T226) & (SR) &S (CS) - (6 Trains) To/from West Highland line

SRS Q.06	Secondary	(SR) - ScotRail	(T217) & (SR) - (2 Trains) Glasgow to Paisley Canal	
SRS Q.07	Secondary	(SR) - ScotRail	(T217) & (SR) - (2 Trains) Glasgow to Barrhead (T217) & (SR) - (2 Trains) Glasgow to East Kilbride (T217) & (SR) - (2 Trains) Glasgow to Kilmarnock	
SRS Q.08	Secondary	(SR) - ScotRail	(T216) & (SR) - (2 Trains) Glasgow to Carliste	(T216) & (SR) - (4 Trains) Dumfries to Carliste
SRS Q.09	Secondary	(SR) - ScotRail	(T223) & (SR) - (2 Trains) Glasgow to Neilston (T223) & (SR) - (2 Trains) Glasgow to Newton (T223) & (SR) - (2 Trains) Cathcart Circle	
SRS Q.10	Secondary	(SR) - ScotRail	(T225) & (SR) - (2 Trains) Argyle line to Motherwell (T225) & (SR) - (2 Trains) Argyle line to Larkhall (T225) & (SR) - (2 Trains) Argyle line to Whifflet/Motherwell (T225) & (SR) - (2 Trains) Glasgow to Lanark (T224) & (SR) - (2 Trains) Glasgow to Shotts and Edinburgh	
SRS Q.11	Secondary	(SR) - ScotRail	(T225) & (SR) - (2 Trains)	
SRS Q.12	Secondary	(SR) - ScotRail	(T232) & (SR) - (2 Trains) Glasgow Queen Street to Anniesland (T226) & (SR) - (1 Train) Falkirk Grahamston to Glasgow Queen Street (T226) & (SR) - (2 Trains) Dalmuir to Cumbernauld	
SRS Q.13	Secondary	(SR) - ScotRail	(T216) & (SR) - (1/2 Train) Glasgow to Carlisle	(T216) & (SR) - (4 Trains) Dumfries to Carlisle
SRS G.11	Primary	(SR) - ScotRail (GR) - Virgin Trains East Coast (XC) - CrossCountry	(T026) & (GR) - (2 Trains) London King's Cross to Scotland (T051) & (XC) - (1 Train) Penzance/Plymouth to Edinburgh (T238) & (SR) - (1 Train) North Berwick to Edinburgh (T243) & (SR) - (2 Trains) Tweedbank to Edinburgh	(T051) & (XC) - (5 Trains) Edinburgh Waverley to Dunbar
SRS G.12	Secondary	(SR) - ScotRail	(T238) & (SR) - (1 Train) North Berwick to Edinburgh	

TABLE 61. TOC SERVICES. SCOTLAND

Strategic route section (SRS)	Train operator company (TOC)	Specified equipment
SRS P.01	(SR) - ScotRail	Class 170
	(SR) - ScotRail	Class 158
	(SR) - ScotRail	Class 156
SRS P.02	(GR) - Virgin Trains East Coast	Class 91
		Class Mk4
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
	(TP) - TransPennine Express	Class 350
	(SR) - ScotRail	Class 380
	(VT) - Virgin Trains West Coast	Class 390
SRS P.03	(SR) - ScotRail	Class 334
	(SR) - ScotRail	Class 318
	(SR) - ScotRail	Class 320
SRS P.04	(CS) - Caledonian Sleeper	Class 73
		Class Mk3
	(CS) - Caledonian Sleeper	Class 66
		Class Mk3
	(GR) - Virgin Trains East Coast	Class 43
		Class Mk3
	(SR) - ScotRail	Class 156
	(SR) - ScotRail	Class 158
	(SR) - ScotRail	Class 170
	(SR) - ScotRail	Class 318
	(SR) - ScotRail	Class 320
	(SR) - ScotRail	Class 334
SRS P.05	(SR) - ScotRail	Class 158
	(SR) - ScotRail	Class 170
SRS P.06	(SR) - ScotRail	Class 68

		Class Mk2
	(SR) - ScotRail	Class 170
	(XC) - CrossCountry	Class 170
	(SR) - ScotRail	Class 158
SRS P.07	(SR) - ScotRail	Class 170
SRS P.08	(SR) - ScotRail	Class 68
		Class Mk2
	(SR) - ScotRail	Class 170
	(XC) - CrossCountry	Class 170
	(SR) - ScotRail	Class 158
SRS P.09	(SR) - ScotRail	Class 170
	(XC) - CrossCountry	Class 170
SRS P.10	(SR) - ScotRail	Class 170
	(XC) - CrossCountry	Class 170
SRS P.11	(GR) - Virgin Trains East Coast	Class 43
		Class Mk3
	(SR) - ScotRail	Class 158
	(SR) - ScotRail	Class 170
SRS P.13	(SR) - ScotRail	Class 158
	(SR) - ScotRail	Class 170
SRS N.06	(CS) - Caledonian Sleeper	Class 86
		Class Mk3
	(CS) - Caledonian Sleeper	Class 87
		Class Mk3
	(CS) - Caledonian Sleeper	Class 90
		Class Mk3
	(CS) - Caledonian Sleeper	Class 92
		Class Mk3
	(TP) - TransPennine Express	Class 185
	(VT) - Virgin Trains West Coast	Class 221

	(TP) - TransPennine Express	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS Q.01	(CS) - Caledonian Sleeper	Class 86
		Class Mk3
	(CS) - Caledonian Sleeper	Class 87
		Class Mk3
	(GR) - Virgin Trains East Coast	Class 90
		Class Mk4
	(GR) - Virgin Trains East Coast	Class 91
		Class Mk4
	(CS) - Caledonian Sleeper	Class 92
		Class Mk3
	(TP) - TransPennine Express	Class 185
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
	(VT) - Virgin Trains West Coast	Class 221
	(TP) - TransPennine Express	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS Q.02	(SR) - ScotRail	Class 156
	(SR) - ScotRail	Class 158
SRS Q.03	(SR) - ScotRail	Class 380
	(SR) - ScotRail	Class 314
SRS Q.04	(SR) - ScotRail	Class 334
	(SR) - ScotRail	Class 320
	(SR) - ScotRail	Class 318
	(SR) - ScotRail	Class 380
SRS Q.06	(SR) - ScotRail	Class 314
	(SR) - ScotRail	Class 380
SRS Q.07	(SR) - ScotRail	Class 156
SRS Q.08	(SR) - ScotRail	Class 156

SRS Q.09	(SR) - ScotRail	Class 314
	(SR) - ScotRail	Class 320
	(SR) - ScotRail	Class 380
SRS Q.10	(SR) - ScotRail	Class 318
	(SR) - ScotRail	Class 320
	(SR) - ScotRail	Class 334
	(SR) - ScotRail	Class 380
SRS Q.11	(SR) - ScotRail	Class 318
	(SR) - ScotRail	Class 320
	(SR) - ScotRail	Class 334
	(SR) - ScotRail	Class 380
SRS Q.12	(SR) - ScotRail	Class 156
	(SR) - ScotRail	Class 158
	(SR) - ScotRail	Class 170
	(SR) - ScotRail	Class 318
	(SR) - ScotRail	Class 320
	(SR) - ScotRail	Class 334
SRS Q.13	(SR) - ScotRail	Class 156
SRS G.11	(SR) - ScotRail	Class 158
	(SR) - ScotRail	Class 170
	(XC) - CrossCountry	Class 170
	(SR) - ScotRail	Class 380
SRS G.12	(SR) - ScotRail	Class 158
	(SR) - ScotRail	Class 380

TABLE 62. TOC SPECIFIED EQUIPMENT. SCOTLAND

AP. 2.3. ANGLIA - REF. (17)

Strategic route section (SRS)	Route type (P/S)	Lines of route description (LOR)
SRS D.06	Secondary	EA1161 - BISHOPS STORTFORD TO ELY NORTH JN EA1162 - ELY NORTH JN TO KINGS LYNN
SRS D.07	Secondary	EA1560 - ELY NORTH JN TO PETERBOROUGH EA1161 - BISHOPS STORTFORD TO ELY NORTH JN EA1540 - CHIPPENHAM JN TO ELY DOCK JN EA1530 - COLDHAM LANE JN TO HAUGHLEY JN
SRS D.09	Secondary	EA1580 - ELY NORTH JN TO TROWSE JN
SRS D.10	Primary	EA1010 - LIVERPOOL STREET TO SEVEN KINGS EA1011 - SEVEN KINGS TO IPSWICH
SRS D.11	Primary	EA1011 - SEVEN KINGS TO IPSWICH
SRS D.12	Primary	EA1012 - IPSWICH TO TROWSE JUNCTION EA1013 - TROWSE JN TO NORWICH
SRS D.20	Secondary	EA1430 - EAST SUFFOLK JN TO OULTON BROAD NORTH EA1440 - WESTERFIELD JN TO FELIXSTOWE TOWN EA1460 - FELIXSTOWE BEACH JN TO FELIXSTOWE BEACH

TABLE 63.LINES OF ROUTE DESCRIPTION. ANGLIA

Strategic route section (SRS)	Route type (P/S)	Infrastructure RA	Standard gauge	Signalling method	Max. Speed slow lines [mph]	Max. Speed fast lines [mph]	Electrification system
SRS D.06	Secondary	RA8	W8 W9 W10	TCB	75	75	AC 25kV OHL
SRS D.07	Secondary	RA8 RA9	W10	TCB	75	75	None
SRS D.09	Secondary	RA8	W8	TCB AB	75	75	None
SRS D.10	Primary	RA8	W6 W8 W9 W10	TCB	60	90	AC 25kV OHL
SRS D.11	Primary	RA8	W9 W10	TCB	100	100	AC 25kV OHL
SRS D.12	Primary	RA8	W9 W10	TCB	100	100	AC 25kV OHL None
SRS D.20	Secondary	RA7 RA8	W10	TCB	75	75	None

TABLE 64. ROUTE CAPABILITY OVERVIEW. ANGLIA

Strategic route section (SRS)	Train operator companies (TOC)	Trains per hour (TPH)	Trains per day (TPD)
SRS D.06	(GN) - Great Northern (LE) - Greater Anglia	(T017) & (GN) - (2 Trains) - Kings Lynn to London Kings Cross (Peak) (T017) & (GN) - (1 Train) - Kings Lynn to London Kings Cross (Off - peak) (T017) & (LE) - (1 Train) - Kings Lynn to London Liverpool Street (Peak) (T017) & (LE) - (1 Train) - Cambridge to Norwich (T022) & (LE)- (1 Train) - Birmingham to Stanstead Airport (T017) & (LE) - (1/2 Train) - Ipswich to Peterborough	
SRS D.07	(EM) - East Midlands Trains (LE) - Greater Anglia (XC) - CrossCountry	(T014) & (LE) - (1 Train) - Cambridge to Ipswich (T017) & (LE) - (1 Train) - Cambridge to Norwich (T014) & (LE) &S (EM) (XC) - (1/2 Trains) - Ipswich to Peterborough (T017) & (XC) &S (EM) (LE) - (1 Train) - Birmingham to Stanstead Airport	
SRS D.09	(EM) - East Midlands Trains (LE) - Greater Anglia	(T017) & (LE) - (1 Train) - Cambridge to Norwich (T049) & (EM) - (1 Train) - Norwich to Liverpool Lime Street	
SRS D.10	(LE) - Greater Anglia (XR) - TfL Rail	(T005) & (XR) - (1 Train) - London Liverpool Street to Ilford (T005) & (XR) - (5 Trains) - London Liverpool Street to Gidea Park (T005) & (XR) - (6 Trains) - London Liverpool Street to Shenfield (T006) & (LE) - (3 Trains) - London Liverpool Street to Southern Victoria (Off-peak) (T011) & (LE) - (2 Trains) - London Liverpool Street to Chelmsford (Peak) (T011) & (LE) - (2 Trains) - London Liverpool Street to Witham (Peak) (T011) & (LE) - (1 Train) - London Liverpool Street to Braintree (T011) & (LE) - (1 Train) - London Liverpool Street to Colchester Town (T011) & (LE) - (3 Trains) - London Liverpool Street to Clacton on Sea (Peak) (T011) & (LE) - (1 Train) - London Liverpool Street to Clacton on Sea (Off - peak) (T011) & (LE) - (1 Train) - London Liverpool Street to Harwich International (T011) & (LE) - (1 Train) - London Liverpool Street to Harwich Town (T011) & (LE) - (2 Trains) - London Liverpool Street to Ipswich (Peak) (T011) & (LE) - (1 Train) - London Liverpool Street to Stowmarket (Peak) (T011) & (LE) - (2 Trains) - London Liverpool Street to Norwich (T022) & (LE) - (2 Trains) - London Liverpool Street to Hertford East (Peak) (T022) & (LE) - (2 Trains) - London Liverpool Street to Hertford East (Off -Peak)	

		(T022) & (LE) - (4 Trains) - London Liverpool Street to Stanstead Airport (Peak) (T022) & (LE) - (4 Trains) - London Liverpool Street to Stanstead Airport (Off -Peak) (T022) & (LE) - (3 Trains) - London Liverpool Street to Cambridge (Peak) (T022) & (LE) - (2 Trains) - London Liverpool Street to Cambridge (Off -Peak) (T017) & (LE) - (3 Trains) - London Liverpool Street to Kings Lynn (Peak)	
SRS D.11	(LE) - Greater Anglia	(T011) & (LE) - (2 Trains) - London Liverpool Street to Ipswich (Peak) (T011) & (LE) - (1 Train) - London Liverpool Street to Ipswich (Off - peak) (T011) & (LE) - (1 Train) - London Liverpool Street to Braintree (T011) & (LE) - (2 Trains) - London Liverpool Street to Chelmsford (Peak) (T011) & (LE) - (4 Trains) - London Liverpool Street to Clacton on Sea (Peak) (T011) & (LE) - (1 Train) - London Liverpool Street to Clacton on Sea (Off - peak) (T011) & (LE) - (1 Train) - Clacton on Sea to Colchester (Peak) (T011) & (LE) - (1 Train) - London Liverpool Street to Colchester Town (T011) & (LE) - (2 Trains) - Colchester Town to Colchester (Off-peak) (T011) & (LE) - (1 Train) - Walton on the Naze to Colchester (Peak) (T011) & (LE) - (1 Train) - Walton on the Naze to Colchester (Off-peak) (T011) & (LE) - (1 Train) - London Liverpool Street to Harwich International (Peak) (T011) & (LE) - (2 Train) - London Liverpool Street to Harwich Town (T011) & (LE) - (2 Trains) - London Liverpool Street to Norwich (T011) & (LE) - (1 Train) - London Liverpool Street to Stowmarket (Peak) (T011) & (LE) - (2 Trains) - London Liverpool Street to Witham (Peak)	
SRS D.12	(LE) - Greater Anglia	(T011) & (LE) - (1 Train) - Ipswich to Cambridge (T013) & (LE) - (1 Train) - Ipswich to Lowestoft (T013) & (LE) - (1 Train) - Ipswich to Saxmundham (T011) & (LE) - (1/2 Train) - Ipswich to Peterborough (T011) & (LE) - (2 Trains) - Norwich to London Liverpool Street (T011) & (LE) - (1 Train) - Norwich to Cambridge (T015) & (LE) - (1 Train) - Norwich to Great Yarmouth (T049) & (LE) - (1 Train) - Norwich to Liverpool Lime Street (T015) & (LE) - (1 Train) - Norwich to Lowestoft (T016) & (LE) - (1 Train) - Norwich to Sheringham	
SRS D.20	(LE) - Greater Anglia	(T013) & (LE) - (1 Train) - Felixstowe to Ipswich (Peak)	

		(T013) & (LE) - (1 Train) - Felixstowe to Ipswich (Off-peak) (T013) & (LE) - (1 Train) - Ipswich to Lowestoft (T013) & (LE) - (1 Train) - Ipswich to Saxmundham	

TABLE 65. TOC SERVICES. ANGLIA

Strategic route section (SRS)	Train operator company (TOC)	Specified equipment
SRS D.06	(LE) - Greater Anglia	Class 170
	(GN) - Great Northern	Class 317
	(LE) - Greater Anglia	Class 317
	(GN) - Great Northern	Class 365
	(LE) - Greater Anglia	Class 379
SRS D.07	(LE) - Greater Anglia	Class 153
	(EM) - East Midlands Trains	Class 153
	(LE) - Greater Anglia	Class 156
	(EM) - East Midlands Trains	Class 156
	(EM) - East Midlands Trains	Class 158
	(LE) - Greater Anglia	Class 170
	(XC) - CrossCountry	Class 170
SRS D.09	(LE) - Greater Anglia	Class 153
	(EM) - East Midlands Trains	Class 153
	(LE) - Greater Anglia	Class 156
	(EM) - East Midlands Trains	Class 156
	(EM) - East Midlands Trains	Class 158
	(LE) - Greater Anglia	Class 170
SRS D.10	(LE) - Greater Anglia	Class 90
		Class Mk3
	(LE) - Greater Anglia	Class 170
	(XR) - TfL Rail	Class 315
	(LE) - Greater Anglia	Class 317
	(LE) - Greater Anglia	Class 321
	(LE) - Greater Anglia	Class 360
	(LE) - Greater Anglia	Class 379
SRS D.11	(LE) - Greater Anglia	Class 90
		Class Mk3

	(LE) - Greater Anglia	Class 170
	(LE) - Greater Anglia	Class 317
	(LE) - Greater Anglia	Class 321
	(LE) - Greater Anglia	Class 360
	(LE) - Greater Anglia	Class 379
SRS D.12	(LE) - Greater Anglia	Class 90
		Class Mk3
	(LE) - Greater Anglia	Class 170
	(LE) - Greater Anglia	Class 317
	(LE) - Greater Anglia	Class 321
	(LE) - Greater Anglia	Class 360
	(LE) - Greater Anglia	Class 379
SRS D.20	(LE) - Greater Anglia	Class 153

TABLE 66. TOC SPECIFIED EQUIPMENT. ANGLIA

AP. 2.4. WESSEX - REF. (18)

Strategic route section (SRS)	Route type (P/S)	Lines of route description (LOR)
SRS C.01	Primary	SW100 - WATERLOO TO CLAPHAM JN. SW105 - CLAPHAM JN. TO WEYMOUTH
SRS C.02	Primary	SW105 - CLAPHAM JN. TO WEYMOUTH
SRS C.03	Primary	SW105 - CLAPHAM JN. TO WEYMOUTH
SRS C.04	Secondary	SW105 - CLAPHAM JN. TO WEYMOUTH
SRS C.05	Secondary	SW160 - BROCKENHURST TO LYMINGTON PIER
SRS C.08	Secondary	SW300 - GOMSHALL TO SHALFORD JN. SO560 - REDHILL TO GUILDFORD
SRS C.09	Secondary	SW265 - GUILDFORD TO WOKINGHAM SW120 - PIRBRIGHT JN. TO ALTON
SRS C.15	Secondary	SW115 - WORTING JN. TO EXETER ST. DAVIDS
SRS C.16	Secondary	SW150 - REDBRIDGE TO SALISBURY TUNNEL JN. SW130 - EASTLEIGH TO ROMSEY

TABLE 67.LINES OF ROUTE DESCRIPTION. WESSEX

Strategic route section (SRS)	Route type (P/S)	Infrastructure RA	Standard gauge	Signalling method	Max. Speed slow lines [mph]	Max. Speed fast lines [mph]	Electrification system
SRS C.01	Primary	RA4 RA8	W6 W8 W9	TCB	90	90	DC 750V
SRS C.02	Primary	RA8	W7 W8	TCB	100	100	DC 750V
SRS C.03	Primary	RA8	W7 W8 W10	TCB	100	100	DC 750V
SRS C.04	Secondary	RA8	W6 W7 W8	TCB	90	90	DC 750V
SRS C.05	Secondary	RA8	W6	TCB	60	60	DC 750V
SRS C.08	Secondary	RA8	W6	TCB	65	65	DC 750V None
SRS C.09	Secondary	RA8	W6	TCB	70	70	DC 750V None
SRS C.15	Secondary	RA6 RA7 RA8	W6 W7	TCB TB	85	85	None
SRS C.16	Secondary	RA8	W12	TCB	60	85	None

TABLE 68. ROUTE CAPABILITY OVERVIEW. WESSEX

Strategic route section (SRS)	Train operator companies (TOC)	Trains per hour (TPH)	Trains per day (TPD)
SRS C.01	(SW) - South West Trains	(T155) & (SW) - (58 Trains) Woking to Waterloo (Peak) (T155) & (SW) - (43 Trains) Woking to Waterloo (Off peak)	
SRS C.02	(SW) - South West Trains	(T155) & (SW) - (15 Trains) Basingstoke to Woking (Peak) (T155) & (SW) - (14 Trains) Basingstoke to Woking (Off peak) (T155) & (SW) - (23 Trains) Woking to Basingstoke (Peak) (T155) & (SW) - (16 Trains) Woking to Basingstoke (Off peak)	
SRS C.03	(SW) - South West Trains (XC) - CrossCountry	(T158) & (SW) &S (XC) - (12 Trains) Southampton Central to Basingstoke (Peak) (T158) & (SW) &S (XC) - (11 Trains) Southampton Central to Basingstoke (Off peak)	
SRS C.04	(SW) - South West Trains (XC) - CrossCountry	(T158) & (SW) &S (XC) - (5 Trains) Bournemouth to Southampton (Peak) (T158) & (SW) &S (XC) - (4 Trains) Bournemouth to Southampton (Off peak)	
SRS C.05	(SW) - South West Trains	(T159) & (SW) - (2 Trains) Lymington Pier to Brockenhurst	
SRS C.08	(GW) - Great Western Railway	(T148) & (GW) - (5 Trains) Reigate to Shalford (Peak) (T148) & (GW) - (3 Trains) Reigate to Shalford (Off peak)	
SRS C.09	(GW) - Great Western Railway	(T148) & (GW) - (3 Trains) Blackwater to Guilford (Peak) (T148) & (GW) - (2 Trains) Blackwater to Guilford (Off peak) (T148) & (GW) - (5 Trains) Ash to Guilford (Peak) (T148) & (GW) - (4 Trains) Ash to Guilford (Off peak)	
SRS C.15	(SW) - South West Trains	(T160) & (SW) - (2 Trains) Yeovil Jn. To Salisbury (Peak) (T160) & (SW) - (1 Train) Yeovil Jn. To Salisbury (Off peak)	
SRS C.16	(SW) - South West Trains (GW) - Great Western Railway	(T158) & (SW) - (2 Trains) Romsey to Eastleigh	(T158) & (GW) - (1 Train) Eastleigh to Romsey

TABLE 69. TOC SERVICES. WESSEX

Strategic route section (SRS)	Train operator company (TOC)	Specified equipment
SRS C.01	(SW) - South West Trains	Class 444
	(SW) - South West Trains	Class 450
	(SW) - South West Trains	Class 455
SRS C.02	(SW) - South West Trains	Class 444
	(SW) - South West Trains	Class 450
	(SW) - South West Trains	Class 455
SRS C.03	(SW) - South West Trains	Class 444
	(SW) - South West Trains	Class 450
	(SW) - South West Trains	Class 455
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
SRS C.04	(SW) - South West Trains	Class 444
	(SW) - South West Trains	Class 450
	(SW) - South West Trains	Class 455
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
SRS C.05	(SW) - South West Trains	Class 158
	(SW) - South West Trains	Class 159
	(SW) - South West Trains	Class 450
SRS C.08	(GW) - Great Western Railway	Class 166
SRS C.09	(GW) - Great Western Railway	Class 166
SRS C.15	(SW) - South West Trains	Class 158
	(SW) - South West Trains	Class 159
SRS C.16	(SW) - South West Trains	Class 158
	(GW) - Great Western Railway	Class 158

TABLE 70. TOC SPECIFIED EQUIPMENT. WESSEX

AP. 2.5. SOUTH EAST (KENT AND SUSSEX) - REF. (19)

Strategic route section (SRS)	Route type (P/S)	Lines of route description (LOR)
SRS A.03	Primary	SO130 - CHARING CROSS/CANNON STREET TO DOVER
SRS A.04	Primary	SO130 - CHARING CROSS/CANNON STREET TO DOVER
SRS A.05	Primary	SO110 - VICTORIA TO RAMSGATE SO140 - SWANLEY TO ASHFORD
SRS A.14	Primary	SO130 - CHARING CROSS/CANNON STREET TO DOVER

TABLE 71. LINES OF ROUTE DESCRIPTION. KENT

Strategic route section (SRS)	Route type (P/S)	Infrastructure RA	Standard gauge	Signalling method	Max. Speed slow lines [mph]	Max. Speed fast lines [mph]	Electrification system
SRS A.03	Primary	RA8	W6 W8	TCB	70	70	DC 750V
SRS A.04	Primary	RA8	W7	TCB	80	90	DC 750V
SRS A.05	Primary	RA8	W9	TCB	70	90	DC 750V
SRS A.14	Primary	RA8	W9	TCB	90	100	DC 750V

TABLE 72. ROUTE CAPABILITY OVERVIEW. KENT

Strategic route section (SRS)	Train operator companies (TOC)	Trains per hour (TPH)	Trains per day (TPD)
SRS A.03	(SE) - Southeastern	(T204) & (SE) - (29 Trains) To London Charing Cross via Kent route (Peak) (T204) & (SE) - (24 Trains) To London Canon Street (Peak) (T204) & (SE) - (30 Trains) To London Bridge via Sussex route (Peak)	
SRS A.04	(SE) - Southeastern	(T204) & (SE) - (29 Trains) To London Charing Cross via Kent route (Peak) (T204) & (SE) - (24 Trains) To London Canon Street (Peak) (T204) & (SE) - (30 Trains) To London Bridge via Sussex route (Peak)	
SRS A.05	(SE) - Southeastern	(T196) & (SE) - (4 Trains) Swanley to Ahsford (Peak) (T196) & (SE) - (2 Trains) Swanley to Ahsford (Off peak)	
SRS A.14	(SE) - Southeastern	(T207) & (SE) - (6 Trains) Ahsford to Tonbridge (Peak) (T207) & (SE) - (3 Trains) Ahsford to Tonbridge (Off peak) (T207) & (SE) - (5 Trains) Ahsford to Dover Priory (Peak) (T207) & (SE) - (3 Trains) Ahsford to Dover Priory (Off peak)	

TABLE 73. TOC SERVICES. KENT

Strategic route section (SRS)	Train operator companie (TOC)	Specified equipment
SRS A.03	(SE) - Southeastern	Class 375
	(SE) - Southeastern	Class 376
	(SE) - Southeastern	Class 395
	(SE) - Southeastern	Class 465
	(SE) - Southeastern	Class 466
SRS A.04	(SE) - Southeastern	Class 375
	(SE) - Southeastern	Class 376
	(SE) - Southeastern	Class 395
	(SE) - Southeastern	Class 465
	(SE) - Southeastern	Class 466
SRS A.05	(SE) - Southeastern	Class 375
	(SE) - Southeastern	Class 395
	(SE) - Southeastern	Class 465
	(SE) - Southeastern	Class 466
SRS A.14	(SE) - Southeastern	Class 375
	(SE) - Southeastern	Class 376
	(SE) - Southeastern	Class 395
	(SE) - Southeastern	Class 465
	(SE) - Southeastern	Class 466

TABLE 74. TOC SPECIFIED EQUIPMENT. KENT

Strategic route section (SRS)	Route type (P/S)	Lines of route description (LOR)
SRS B.01	Primary	SO500 - VICTORIA TO BRIGHTON
SRS B.02	Primary	SO500 - VICTORIA TO BRIGHTON
SRS B.15	Secondary	SO550 - REDHILL TO TONBRIDGE

TABLE 75. LINES OF ROUTE DESCRIPTION. SUSSEX

Strategic route section (SRS)	Route type (P/S)	Infrastructure RA	Standard gauge	Signalling method	Max. Speed slow lines [mph]	Max. Speed fast lines [mph]	Electrification system
SRS B.01	Primary	RA8	W6 W7 W8 W9	TCB	60	70	DC 750V
SRS B.02	Primary	RA8	W6 W9	TCB	90	90	DC 750V
SRS B.15	Secondary	RA8	W8	TCB	85	85	DC 750V

TABLE 76. ROUTE CAPABILITY OVERVIEW. SUSSEX

Strategic route section (SRS)	Train operator companies (TOCs)	Trains per hour (TPH)	Trains per day (TPD)
SRS B.01	(GX) - Gatwick express (SN) - Southern	(T170) & (SN) &S (GX) - (17 Trains) To Victoria (Peak fast) (T170) & (SN) &S (GX) - (15 Trains) To Victoria (Off peak fast) (T170) & (SN) &S (GX) - (14 Trains) To Victoria (Peak slow) (T170) & (SN) &S (GX) - (13 Trains) To Victoria (Off peak slow)	
SRS B.02	(GX) - Gatwick express (SN) - Southern (TL) - Thameslink	(T183) & (SN) &S (GX)(TL) - (19 Trains) From East Croydon (Peak fast) (T183) & (SN) &S (GX)(TL) - (20 Trains) From East Croydon (Off peak fast) (T183) & (SN) &S (GX)(TL) - (15 Trains) From East Croydon (Peak slow) (T183) & (SN) &S (GX)(TL) - (11 Trains) From East Croydon (Off peak slow)	
SRS B.15	(SN) - Southern	(T183) & (SN) - (2 Trains) Tonbridge to Redhill (Peak) (T183) & (SN) - (1 Train) Tonbridge to Redhill (Off peak)	

TABLE 77. TOC SERVICES. SUSSEX

Strategic route section (SRS)	Train operator company (TOC)	Specified equipment
SRS B.01	(SN) - Southern	Class 171
	(SN) - Southern	Class 377
	(SN) - Southern	Class 387
	(GX) - Gatwick express	Class 387
	(SN) - Southern	Class 455
SRS B.02	(SN) - Southern	Class 171
	(TL) - Thameslink	Class 319
	(SN) - Southern	Class 377
	(TL) - Thameslink	Class 377
	(SN) - Southern	Class 387
	(GX) - Gatwick express	Class 387
	(SN) - Southern	Class 455
	(TL) - Thameslink	Class 700
SRS B.15	(SN) - Southern	Class 377

TABLE 78. TOC SPECIFIED EQUIPMENT. SUSSEX

AP. 2.6. WESTERN-REF. (20)

Strategic route section (SRS)	Route type (P/S)	Lines of route description (LOR)
SRS J.01	Primary	GW103 - PADDINGTON TO UFFINGTON
SRS J.02	Primary	GW103 - PADDINGTON TO UFFINGTON
SRS J.03	Primary	GW103 - PADDINGTON TO UFFINGTON
SRS J.04	Primary	GW103 - PADDINGTON TO UFFINGTON GW105 - UFFINGTON TO FORDGATE GW600 - WOOTTON BASSETT JN. TO PILNING
SRS J.05	Primary	GW220 - READING, OXFORD ROAD JN. TO READING WEST JN. GW500 - READING TO COGLOAD JN.
SRS J.06	Primary	GW500 - READING TO COGLOAD JN. GW560 - HEYWOOD ROAD JN. TO FAIRWOOD JN. GW570 - CLINK ROAD JN. TO BLATCHBRIDGE JN.
SRS J.07	Primary	GW200 - DIDCOT TO HEYFORD GW240 - DIDCOT EAST JN. TO DIDCOT NORTH JN. GW250 - FOXHALL JN. TO DIDCOT WEST CURVE JN.
SRS J.10	Secondary	GW480 - SWINDON TO STANDISH JN.
SRS J.11	Secondary	GW310 - WOLVERCOT JN. TO NORTON JN.
SRS K.01	Primary	GW105 - UFFINGTON TO FORDGATE GW108 - FORDGATE TO PENZANCE
SRS K.02	Primary	GW108 - FORDGATE TO PENZANCE
SRS K.03	Secondary	GW108 - FORDGATE TO PENZANCE
SRS K.04	Secondary	GW510 - WESTBURY NORTH JN. TO BATHAMPTON JN. GW523 - THINGLEY JN. TO BRADFORD JN. GW5001 - BEECHGROVE GF TO WESTBURY SOUTH JN. SW170 - WESTBURY TO WILTON JUNCTION
SRS K.06	Secondary	GW610 - CRANNAFORD LC TO EXETER ST. DAVIDS
SRS K.07	Secondary	GW620 - NEWTON ABBOT WEST JN. TO PAIGNTON

SRS K.15	Primary	GW105 - UFFINGTON TO FORDGATE GW450 - STOKE GIFFORD JN. TO BRISTOL EAST JN. GW530 - BRISTOL, NORTH SOMERSET JN. TO DR. DAYS JN
SRS K.16	Primary	GW400 - BARNT GREEN TO WESTERLEIGH JN.

TABLE 79. LINES OF ROUTE DESCRIPTION. WESTERN

Strategic route section (SRS)	Route type (P/S)	Infrastructure RA	Standard gauge	Signalling method	Max. Speed slow lines [mph]	Max. Speed fast lines [mph]	Electrification system
SRS J.01	Primary	RA8	W6 W8	TCB	90	125	AC 25kV OHL
SRS J.02	Primary	RA8	W8	TCB	90	125	None
SRS J.03	Primary	RA8	W8	TCB	90	125	None
SRS J.04	Primary	RA8	W8	TCB	125	125	None
SRS J.05	Primary	RA8	W8	TCB	100	100	None
SRS J.06	Primary	RA8	W7 W8	TCB	100	100	None
SRS J.07	Primary	RA8	W8 W10	TCB	90	90	None
SRS J.10	Secondary	RA8	W8	TCB	90	100	None
SRS J.11	Secondary	RA7	W6 W8	TCB AB	90	100	None
SRS K.01	Primary	RA8	W8	TCB	80	100	None
SRS K.02	Primary	RA8	W7	TCB	80	105	None
SRS K.03	Secondary	RA7 RA8	W6a W7	TCB AB	40	75	None
SRS K.04	Secondary	RA8	W6 W7 W8	TCB	40	75	None
SRS K.06	Secondary	RA8	W6	TCB	30	50	None
SRS K.07	Secondary	RA6	W6	TCB	30	45	None
SRS K.15	Primary	RA8	W6 W8	TCB	110	125	None
SRS K.16	Primary	RA8	W6 W7 W8	TCB	80	105	None

TABLE 80. ROUTE CAPABILITY OVERVIEW. WESTERN

Strategic route section (SRS)	Train operator companies (TOC)	Trains per hour (TPH)	Trains per day (TPD)
SRS J.01	(GW) - Great Western Railway (HX) - Heatrow Express (HC) - Heathrow Connect	(T117) & (GW) - (8 Trains) (LDHS) (T118) & (HX) - (4 Trains) London Paddington to Heathrow (Express) (T117) & (GW) - (7 Trains) London to Thames Valley (T117) & (HC) - (2 Trains) London Paddington to Heathrow (Connect)	
SRS J.02	(GW) - Great Western Railway	(T117) & (GW) - (8 Trains) (LDHS) (T117) & (GW) - (5 Trains) London to Thames Valley	
SRS J.03	(GW) - Great Western Railway (XC) - CrossCountry	(T116) & (GW) - (11 Trains) (LDHS) (T116) & (GW) - (2 Trains) London to Thames Valley (T116) & (XC) - (2 Trains) Reading to Oxford/Birmingham	
SRS J.04	(GW) - Great Western Railway	(T125) & (GW) - (5 Trains) (LDHS)	
SRS J.05	(GW) - Great Western Railway	(T116) & (GW) - (1 Train) (LDHS) (T116) & (GW) - (2 Trains) London to Thames Valley	
SRS J.06	(GW) - Great Western Railway	(T116) & (GW) - (1 Train) (LDHS) (T116) & (GW) - (1 Trains) London to Thames Valley (T135) & (GW) - (1 Train) (Regional)	
SRS J.07	(GW) - Great Western Railway (XC) - CrossCountry	(T116) & (GW) - (2 Trains) (LDHS) (T116) & (GW) - (2 Trains) London to Thames Valley (T116) & (XC) - (2 Trains) Reading to Oxford/Birmingham	
SRS J.10	(GW) - Great Western Railway	(T125) & (GW) - (1 Train) (LDHS) (T125) & (GW) - (1 Train) (Local)	
SRS J.11	(GW) - Great Western Railway	(T126) & (GW) - (1 Train) (LDHS) (T126) & (GW) - (1 Train) (Local)	
SRS K.01	(GW) - Great Western Railway (XC) - CrossCountry	(T135) & (GW) &S (XC) - (1 Train) (LDHS) (T135) & (GW) &S (XC) - (1 Train) (LDHS)(Off-peak) (T135) & (GW) &S (XC) - (1 Train) (Local)	
SRS K.02	(GW) - Great Western Railway (XC) - CrossCountry	(T135) & (GW) &S (XC) - (1 Train) (LDHS) (T135) & (GW) &S (XC) - (1 Train) (LDHS) (Off-peak)	(T135) & (GW) &S (XC) - (4 Trains) (Local)

SRS K.03	(GW) - Great Western Railway (XC) - CrossCountry	(T135) & (GW) &S (XC) - (2 Trains) (LDHS)	(T135) & (GW) &S (XC) - (9 Trains) (Local)
SRS K.04	(GW) - Great Western Railway (SW) - South West Trains	(T123) & (GW) &S (SW) - (2 Trains) (Local) (T123) & (GW) &S (SW) - (1 Train) (Regional) (T123) & (GW) &S (SW) - (2 Train) (Interurban and Local)	
SRS K.06	(GW) - Great Western Railway	(T136) & (SW) - (1 Train) (LDHS)	(T136) & (GW) - (2 Trains) (Local)
SRS K.07	(GW) - Great Western Railway (XC) - CrossCountry	(T135) & (GW) - (2 Trains) (Local)	(T135) & (GW) &S (XC) - (6 Trains) (LDHS)
SRS K.15	(GW) - Great Western Railway (XC) - CrossCountry	(T135) & (XC) - (1 Train) (LDHS) (T135) & (GW) - (1 Train) (Local) (T135) & (GW) - (1 Train) (Regional)	(T135) & (GW) - (8 Trains) (Local)
SRS K.16	(GW) - Great Western Railway (XC) - CrossCountry	(T134) & (XC) - (2 Trains) (LDHS) (T134) & (GW) - (1 Train) (Local)	

TABLE 81. TOC SERVICES. WESTERN

Strategic route section (SRS)	Train operator company (TOC)	Specified equipment
SRS J.01	(GW) - Great Western Railway	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 57
		Class Mk3
	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
	(GW) - Great Western Railway	Class 158
	(GW) - Great Western Railway	Class 165
	(GW) - Great Western Railway	Class 166
	(GW) - Great Western Railway	Class 180
	(HC) - Heathrow Connect	Class 360
	(HX) - Heatrow Express	Class 360
	(GW) - Great Western Railway	Class 387
SRS J.02	(GW) - Great Western Railway	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 57
		Class Mk3
	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
	(GW) - Great Western Railway	Class 158
	(GW) - Great Western Railway	Class 165
	(GW) - Great Western Railway	Class 166
	(GW) - Great Western Railway	Class 180
SRS J.03	(GW) - Great Western Railway	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 57
		Class Mk3
	(XC) - CrossCountry	Class 43

		Class Mk3
	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
	(GW) - Great Western Railway	Class 158
	(GW) - Great Western Railway	Class 165
	(GW) - Great Western Railway	Class 166
	(GW) - Great Western Railway	Class 180
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
SRS J.04	(GW) - Great Western Railway	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 57
		Class Mk3
	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
	(GW) - Great Western Railway	Class 158
	(GW) - Great Western Railway	Class 165
	(GW) - Great Western Railway	Class 166
	(GW) - Great Western Railway	Class 180
SRS J.05	(GW) - Great Western Railway	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 57
		Class Mk3
	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
	(GW) - Great Western Railway	Class 165
SRS J.06	(GW) - Great Western Railway	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 57
		Class Mk3

	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
SRS J.07	(GW) - Great Western Railway	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 165
	(GW) - Great Western Railway	Class 166
	(GW) - Great Western Railway	Class 180
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
SRS J.10	(GW) - Great Western Railway	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
SRS J.11	(GW) - Great Western Railway	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
	(GW) - Great Western Railway	Class 158
	(GW) - Great Western Railway	Class 165
	(GW) - Great Western Railway	Class 166
	(GW) - Great Western Railway	Class 180
SRS K.01	(GW) - Great Western Railway	Class 43
		Class Mk3
	(XC) - CrossCountry	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
	(GW) - Great Western Railway	Class 158
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221

SRS K.02	(GW) - Great Western Railway	Class 43
		Class Mk3
	(XC) - CrossCountry	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
	(GW) - Great Western Railway	Class 158
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
SRS K.03	(GW) - Great Western Railway	Class 43
		Class Mk3
	(XC) - CrossCountry	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
	(GW) - Great Western Railway	Class 158
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
SRS K.04	(GW) - Great Western Railway	Class 43
		Class Mk3
	(XC) - CrossCountry	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
	(GW) - Great Western Railway	Class 165
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
SRS K.06	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
SRS K.07	(GW) - Great Western Railway	Class 43

		Class Mk3
	(XC) - CrossCountry	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
	(GW) - Great Western Railway	Class 158
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
SRS K.15	(GW) - Great Western Railway	Class 43
		Class Mk3
	(GW) - Great Western Railway	Class 57
		Class Mk3
	(GW) - Great Western Railway	Class 150
	(GW) - Great Western Railway	Class 153
	(GW) - Great Western Railway	Class 158
	(GW) - Great Western Railway	Class 165
	(GW) - Great Western Railway	Class 166
	(XC) - CrossCountry	Class 170
	(GW) - Great Western Railway	Class 180
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
SRS K.16	(GW) - Great Western Railway	Class 43
		Class Mk3
	(XC) - CrossCountry	Class 43
		Class Mk3
	(XC) - CrossCountry	Class 170
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221

TABLE 82. TOC SPECIFIED EQUIPMENT

AP. 2.7. LONDON NORTH WESTERN (NORTH AND SOUTH)-REF. (21)

Strategic route section (SRS)	Route type (P/S)	Lines of route description (LOR)
SRS N.03	Primary	MD101 - EUSTON TO ARMITAGE JUNCTION NW1001 - ARMITAGE JN. TO PRESTON FYLDE JN.
SRS N.04	Secondary	NW1001 - ARMITAGE JN. TO PRESTON FYLDE JN. NW1019 - ACTON GRANGE JN. TO WARRINGTON SOUTH JN. NW1021 - WINWICK JN. TO GOLBORNE JN.
SRS N.05	Primary	NW4001 - PRESTON RIBBLE JN. TO COVE L.C.
SRS N.06	Secondary	SC0001 - GRETNA JN. TO GLASGOW CENTRAL
SRS N.07	Secondary	NW2001 - WEAVER JN. TO LIVERPOOL LIME STREET
SRS N.08	Secondary	NW5008 - NORTON BRIDGE TO STONE JN. NW5009 - COLWICH JN TO CHEADLE HULME
SRS N.09	Secondary	NW1005 - KIDSGROVE JN. TO CREWE SOUTH JN.
SRS N.13	Secondary	NW3001 - CREWE NORTH JN. TO HOLYHEAD
SRS H.05	Secondary	NW5021 - STALYBRIDGE TO GUIDE BRIDGE WEST JN. NW7021 - MILES PLATTING JN. TO MARSDEN LN860 - DIGGLE JN. TO COPLEY HILL EAST JN.
SRS H.10	Secondary	NW7001 - MANCHESTER VICTORIA WEST JN. TO HEBDEN BRIDGE NW7021 - MILES PLATTING JN. TO MARSDEN
SRS H.17	Secondary	NW9001 - DORE WEST JN. TO EDGELEY JN.
SRS H.22	Primary	NW5001 - CREWE NORTH JN. TO MANCHESTER PICCADILLY
SRS H.23	Secondary	NW6001 - MANCHESTER PICCADILLY EAST JN. TO EUXTON JN.
SRS H.24	Secondary	NW6003 - CASTLEFIELD JN. TO ALLERTON JN.
SRS H.25	Primary	NW2001 - WEAVER JN. TO LIVERPOOL LIME STREET
SRS H.26	Secondary	NW5015 - HADFIELD TO ARDWICK JN.
SRS H.27	Secondary	NW6001 - MANCHESTER PICCADILLY EAST JN. TO EUXTON JN.
SRS H.28	Secondary	NW9007 - NEW MILLS SOUTH JN. TO ASHBURYS EAST JN. NW9009 - MARPLE WHARF JN. TO ROSE HILL

		NW9011 - ROMILEY JN. TO HYDE JN.
SRS H.29	Secondary	NW5015 - HADFIELD TO ARDWICK JN. NW5019 - GLOSSOP TO DINTING WEST JN.
SRS H.30	Secondary	NW5011 - HEATON NORRIS JN. TO GUIDE BRIDGE STATION JN. NW5001 - CREWE NORTH JN. TO MANCHESTER PICCADILLY NW3023 - EDGELEY JN. TO MICKLE TRAFFORD
SRS H.31	Secondary	NW5003 - WILMSLOW TO SLADE LANE JN. NW5007 - MANCHESTER AIRPORT TO HEALD GREEN NORTH JN. NW5001 - CREWE NORTH JN. TO MANCHESTER PICCADILLY
SRS H.32	Secondary	NW4005 - PRESTON FYLDE JN. TO BLACKPOOL NORTH
SRS H.33	Secondary	NW2001 - WEAVER JN. TO LIVERPOOL LIME STREET NW2015 - ORDSALL LANE JN. TO EDGE HILL NW2023 - SPRINGS BRANCH JN. TO HUYTON JN. NW1021 - WINWICK JN. TO GOLBORNE JN.
SRS H.35	Secondary	NW6009 - WINDSOR BRIDGE NORTH JN. TO SOUTHPORT NW6001 - MANCHESTER PICCADILLY EAST JN. TO EUXTON JN. NW6005 - MANCHESTER VICTORIA EAST JN. TO WINDSOR BRIDGE SOUTH NW6013 - LOSTOCK JN. TO CROW NEST JN.
SRS H.37	Secondary	NW6011 - BOLTON EAST JN. TO BLACKBURN BOLTON JN.
SRS H.38	Secondary	NW9001 - DORE WEST JN. TO EDGELEY JN.
SRS H.39	Secondary	NW4033 - CARNFORTH NORTH JN. TO CARLISLE SOUTH JN.
SRS H.40	Secondary	NW9901 - GARGRAVE TO CARLISLE SOUTH JN.
SRS H.42	Secondary	NW9903 - SETTLE JN. TO CARNFORTH STATION JN.
SRS H.45	Secondary	NW3003 - CHESTER EAST JN. TO ACTON GRANGE JN. NW3013 - HOOTON SOUTH JN. TO HELSBY JN. NW3021 - FRODSHAM JN. TO HALTON JN.
SRS H.46	Secondary	NW4007 - KIRKHAM NORTH JN. TO BLACKPOOL SOUTH
SRS O.01	Secondary	NW8001 - HUNTS CROSS WEST JN. TO SOUTHPORT NW8003 - PARADISE JN. TO JAMES STREET NW8005 - SANDHILLS JN. TO ORMSKIRK NW8007 - BOOTLE JN. TO AINTREE EMERGENCY G.F.

		NW8009 - WALTON JN. TO KIRKBY NW8011 - MANN ISLAND JN. TO WEST KIRBY NW8013 - CANNING STREET JN. TO HOOTON SOUTH JN. NW8015 - BIDSTON EAST JN. TO NEW BRIGHTON NW8017 - CANNING STREET NORTH TO ROCK FERRY SOUTH JN. NW3011 - CHESTER WEST JN. TO HOOTON SOUTH JN. NW3013 - HOOTON SOUTH JN. TO HELSBY JN.

TABLE 83. LINES OF ROUTE DESCRIPTION. LNW NORTH

Strategic route section (SRS)	Route type (P/S)	Infrastructure RA	Standard gauge	Signalling method	Max. Speed slow lines [mph]	Max. Speed fast lines [mph]	Electrification system
SRS N.03	Primary	RA8	W10	Colour light TCB TASS	75	125	AC 25kV OHL
SRS N.04	Secondary	RA8	W9 W10	Colour light TCB TASS	75	125	AC 25kV OHL
SRS N.05	Primary	RA8	W9 W10	Colour light TCB TASS	75	125	AC 25kV OHL
SRS N.06	Secondary	RA10	W10	Colour light TCB TASS	75	125	AC 25kV OHL
SRS N.07	Secondary	RA8	W9 W10	Colour light TCB TASS	75	100	AC 25kV OHL
SRS N.08	Secondary	RA8	W6a W10	Colour light TCB TASS	75	125	AC 25kV OHL
SRS N.09	Secondary	RA8	W9	Colour light TCB	60	70	AC 25kV OHL
SRS N.13	Secondary	RA8	W6a	Colour light TCB AB	65	90	None
SRS H.05	Secondary	RA8 RA9	W6 W7 W8 W9	TCB	80	80	None
SRS H.10	Secondary	RA8 RA9	W6 W7	TCB AB	60	60	None

			W8				
SRS H.17	Secondary	RA8	W6 W7	TCB AB	90	90	None
SRS H.22	Primary	RA8	W9 W10	Colour light TCB	110	110	AC 25kV OHL
SRS H.23	Secondary	RA8	W9 W10	TCB	35	35	AC 25kV OHL
SRS H.24	Secondary	RA7 RA8	W9	TCB	85	85	AC 25kV OHL None
SRS H.25	Primary	RA8	W6 W9 W10	TCB	80	80	AC 25kV OHL
SRS H.26	Secondary	RA8	W9	TCB	60	60	AC 25kV OHL
SRS H.27	Secondary	RA8	W6 W7 W8 W9 W10	TCB	75	75	None
SRS H.28	Secondary	RA7 RA8	W6 W7	TCB	60	60	None
SRS H.29	Secondary	RA8	W6 W9	TCB	60	60	AC 25kV OHL
SRS H.30	Secondary	RA8	W6 W7	Colour light Semaphore	90	90	None
SRS H.31	Secondary	RA8	W6 W9 W10	TCB	75	75	AC 25kV OHL
SRS H.32	Secondary	RA8	W6	AB	75	75	None
SRS H.33	Secondary	RA7 RA8	W8 W9 W10	TCB	75	75	AC 25kV OHL

SRS H.35	Secondary	RA8	W6 W7 W8 W9	AB TCB	60	60	None
SRS H.37	Secondary	RA8	W6	TCB	60	60	None
SRS H.38	Secondary	RA8	W6 W8	TCB	75	75	AC 25kV OHL
SRS H.39	Secondary	RA7 RA8	W6 W7 W8	AB	60	60	None
SRS H.40	Secondary	RA8	W6 W7	AB TCB	60	60	None
SRS H.42	Secondary	RA8	W6	AB	60	60	None
SRS H.45	Secondary	RA8	W7 W8 W9	AB TCB	75	75	None
SRS H.46	Secondary	RA8	W6	AB	70	70	None
SRS H.O01	Secondary	RA6 RA7 RA8	W6 W7 W8	Colour light	35	70	DC 750V None

TABLE 84. ROUTE CAPABILITY OVERVIEW. LNW NORTH

Strategic route section (SRS)	Train operator companies (TOC)	Trains per hour (TPH)	Trains per day (TPD)
SRS N.03	(VT) - Virgin Trains West Coast (XC) - CrossCountry (LM) - London Midland (CS) - Caledonial Sleeper	(T065) & (VT) - (3 Trains) London to Manchester (LDHS) (T065) & (VT) - (1 Train) London to Liverpool (LDHS) (T065) & (VT) - (1 Train) London to Chester/North Wales (LDHS) (T065) & (VT) - (1 Train) London to Scotland (LDHS) (T067) & (VT) - (1 Train) London to Crewe (LDHS)	(T065) & (CS) - (1 Train) Euston to Abeerdeen (Sleeper) (T065) & (CS) - (1 Train) Euston to Inverness (Sleeper)
SRS N.04	(NT) - Northern (TP) - TransPennine Express (VT) - Virgin Trains West Coast (CS) - Caledonial Sleeper (LM) - London Midland	(T065) & (VT) - (1 Train) London to Liverpool (LDHS) (T065) & (VT) - (1 Train) London to Scotland (LDHS) (T065) & (VT) - (1 Train) Birmingham to Scotland (LDHS) (T065) & (VT) - (1 Train) Birmingham to Crewe (LDHS) (T065) & (LM) - (2 Trains) Birmingham to Liverpool (Regional) (T065) & (TP) - (1 Train) Manchester airport to Scotland (Regional) (T082) & (NT) - (1 Train) Manchester airport to Blackpool North (Regional) (T082) & (NT) - (1 Train) Manchester Victoria to Blackpool North (Regional) (T082) & (NT) - (1 Train) Buxton/Hazel/Grove/Manchester Picadilly to Preston/Blackpool North (Regional) (T097) & (NT) - (1 Train) Liverpool to Blackpool (Regional)	(T082) & (NT) - (9 Trains) Manchester airport to Barrow in Furness (Regional) (T082) & (NT) - (6 Trains) Manchester airport to Barrow in Furness in opposite direction (Regional) (T082) & (NT) - (2 Trains) Manchester airport to Windermere (Regional) (T065) & (NT) - (1 Train) Manchester airport to Preston (Regional) (T065) & (NT) - (1 Train) Manchester airport to Lancaster (Regional urban) (T082) & (NT) - (1 Train) Windemere to Manchester airport (Regional) (T065) & (NT) - (1 Train) Preston to Barrow in Furness (Regional) (T065) & (NT) - (2 Trains) Barrow in Furness to Preston (Regional) (T082) & (NT) - (1 Train) Windemere to Preston (Regional) (T065) & (CS) - (1 Train) Euston to Abeerdeen (Sleeper) (T065) & (CS) - (1 Train) Euston to Inverness (Sleeper)

SRS N.05	(CS) - Caledonial Sleeper (VT) - Virgin Trains West Coast (TP) - TransPennine Express (NT) - Northern	(T065) & (VT) - (1 Train) London to Scotland (LDHS) (T065) & (VT) - (1 Train) Birmingham to Scotland (LDHS) (T065) & (TP) - (1 Train) Manchester airport to Scotland (Regional) (T082) & (NT) - (1 Train) Manchester airport to Blackpool North (Regional) (T065) & (TP) &S (NT) - (2 Trains) Preston to Manchester airport (Regional) (T065) & (NT) - (2 Trains) Preston to Barrow in Furness (Regional) (T097) & (NT) - (1 Train) Liverpool to Blackpool (Regional)	(T082) & (NT) - (6 Trains) Manchester airport to Barrow in Furness (Regional) (T082) & (NT) - (4 Trains) Manchester airport to Barrow in Furness in opposite direction (Regional) (T082) & (NT) - (2 Trains) Manchester airport to Windermere (Regional) (T082) & (NT) - (3 Train) Windemere to Preston (Regional) (T065) & (CS) - (1 Train) Euston to Abeerdeen (Sleeper) (T065) & (CS) - (1 Train) Euston to Inverness (Sleeper)
SRS N.06	(CS) - Caledonial Sleeper (VT) - Virgin Trains West Coast (TP) - TransPennine Express	(T065) & (VT) - (1 Train) London to Scotland (LDHS) (T065) & (VT) - (1 Train) Birmingham to Scotland (LDHS) (T065) & (TP) - (1 Train) Manchester airport to Scotland (Regional)	(T065) & (CS) - (1 Train) Euston to Abeerdeen (Sleeper) (T065) & (CS) - (1 Train) Euston to Inverness (Sleeper)
SRS N.07	(LM) - London Midland (VT) - Virgin Trains West Coast	(T065) & (VT) - (1 Train) London to Liverpool (LDHS) (T065) & (LM) - (2 Trains) Birmingham to Liverpool (Regional)	
SRS N.08	(NT) - Northern (VT) - Virgin Trains West Coast (XC) - CrossCountry (EM) - East Midlands Trains	(T065) & (VT) - (3 Trains) London to Manchester (LDHS) (T084) & (XC) - (2 Trains) South West to Manchester (LDHS) (T067) & (VT) - (1 Train) London to Crewe (LDHS) (T050) & (EM) - (1 Train) Derby to Crewe (Regional) (T084) & (NT) - (1 Train) Stoke on Trent to Manchester (Regional)	
SRS N.09	(EM) - East Midlands Trains (LM) - London Midland	(T050) & (LM) - (1 Train) London Euston to Crewe (T050) & (EM) - (1 Train) Derby to Crewe	
SRS N.13	(AW) - Arriva Trains Wales (VT) - Virgin Trains West Coast	(T081) & (VT) - (1 Train) London Euston to Crewe (T081) & (AW) - (1/2 Train) Birmingham to Llandudno (T081) & (AW) - (1 Train) Crewe to Chester	
SRS H.05	(TP) - TransPennine Express (NT) - Northern	(T039) & (TP) - (4 Trains) Leeds to Guide Bridge (T039) & (TP) - (1 Train) Huddersfield to east of Leeds &	

		Manchester (T039) & (NT) - (1 Train) Huddersfield & Mirfield East Jn.	
SRS H.10	(NT) - Northern (TP) - TransPennine Express (GC) - Grand Central	(T039) & (TP) - (2 Trains) Manchester to Stalybridge (T041) & (NT) - (4 Trains) Manchester to Rochdale (T041) & (NT) - (3 Trains) Rochdale to Hall Royd Jn. (T041) & (NT) - (4 Trains) Hall Royd Jn. To Milner Royd Jn. (T041) & (NT) - (1 Train) Milner Royd Jn. to Greetland Jn. (T041) & (NT) - (2 Trains) Greetland Jn. to Bradley Wood Jn. (T041) & (NT) - (1 Train) Bradley Wood Jn. to Heaton Lodge Jn. (T041) & (NT) - (1 Train) Bradley Jn. to Bradley Wood Jn.	
SRS H.17	(TP) - TransPennine Express (NT) - Northern (EM) - East Midlands Trains	(T078) & (NT) &S (EM)(TP) - (3 Trains) Dore Station Jn. To New Mills South Jn. (T078) & (NT) &S (EM)(TP) - (2 Trains) New Mills South Jn. To Hazel Grove	
SRS H.22	(NT) - Northern (VT) - Virgin Trains West Coast (XC) - CrossCountry (AW) - Arriva Trains Wales	(T084) & (NT) &S (AW)(VT)(XC) - (3 Trains) Manchester Picadilly to Crewe North Jn	
SRS H.23	(EM) - East Midlands Trains (NT) - Nothern (TP) - TransPennine Express (AW) - Arriva Trains Wales	(T084) & (AW) &S (EM)(TP)(NT) - (12 Trains) 12 trains Manchester Picadilly to Deansgate	
SRS H.24	(EM) - East Midlands Trains (NT) - Nothern (AW) - Arriva Trains Wales	(T089) & (NT) - (2 Trains) Deansgate to Liverpool South Parkway	
SRS H.25	(VT) - Virgin Trains West Coast (LM) - London Midland (EM) - East Midlands Trains (TP) - TransPennine Express (AW) - Arriva Trains Wales	(T065) & (VT) - (1 Train) Liverpool Lime Street to London Euston (T065) & (LM) - (2 Trains) Liverpool Lime Street to Birmingham New Street (T039) & (TP) - (1 Train) Liverpool Lime Street to Scarborough (T049) & (EM) - (1 Train) Liverpool Lime Street to Norwich (T089) & (NT) - (2 Trains) Liverpool Lime Street to Manchester	

		Oxford Road (T065) & (NT) - (1 Train) Blackpool North to Liverpool South Parkway	
SRS H.26	(NT) - Nothern (TP) - TransPennine Express	(T079) & (NT) - (6 Trains) Ardwick Jn. To Guide Bridge (Peak) (T079) & (NT) - (4 Trains) Ardwick Jn. To Guide Bridge (Off-peak)	
SRS H.27	(NT) - Nothern	(T082) & (NT) - (2 Trains)	
SRS H.28	(NT) - Nothern	(T078) & (NT) - (1/2 Train) Manchester Picadilly to New Mills Centre (T078) & (NT) - (1/2 Train) Manchester Picadilly to Sheffield (T078) & (NT) - (2 Trains) Manchester Picadilly to Rosehill/Marple (Peak) (T078) & (NT) - (1 Train) Manchester Picadilly to Rosehill/Marple (Off-peak) (T078) & (NT) - (2 Trains) Guide Bridge to Rosehill/Marple (Peak) (T078) & (NT) - (1 Train) Guide Bridge to Rosehill/Marple (Off-peak)	(T078) & (NT) - (1 Train) Manchester Picadilly to Chinley
SRS H.29	(NT) - Nothern	(T079) & (NT) - (3 Trains) Manchester Picadilly to Hadfield (Peak) (T079) & (NT) - (3 Trains) Manchester Picadilly to Hadfield (Off-peak)	
SRS H.30	(NT) - Nothern	(T088) & (NT) - (2 Trains) (T088) & (NT) - (1 Train)	
SRS H.31	(NT) - Nothern (TP) - TransPennine Express (AW) - Arriva Trains Wales	(T085) & (NT) &S (TP) - (9 Trains) Manchester Airport to Manchester Picadilly (Peak) (T085) & (NT) - (2 Trains) Wilmslow to Manchester Airport (Peak) (T085) & (NT) - (1 Train) Wilmslow to Manchester Airport (Off-peak)	
SRS H.32	(NT) - Nothern	(T097) & (NT) - (6 Trains) (Peak) (T097) & (NT) - (4 Trains) (Off-peak)	

SRS H.33	(NT) - Nothern (TP) - TransPennine Express (AW) - Arriva Trains Wales	(T090) & (NT) &S (TP) - (2 Trains) Liverpool Lime Street to Mancherter Victoria (Peak) (T090) & (NT) - (1 Train) Liverpool Lime Street to Mancherter Victoria (Off-peak) (T090) & (NT) - (3 Trains) Liverpool Lime Street to Wigan North Western (Peak)	
SRS H.35	(NT) - Nothern	(T082) & (NT) - (4 Trains) Wigan Wallgate to Manchester Victoria	
SRS H.37	(NT) - Nothern	(T086) & (NT) - (2 Trains) (Peak) (T086) & (NT) - (1 Train) (Off-peak)	
SRS H.38	(NT) - Nothern (EM) - East Midlands Trains	(T086) & (NT) &S (EM) - (4 Trains) (Peak) (T086) & (NT) - (2 Trains) (Off-peak)	
SRS H.39	(NT) - Nothern		(T082) & (NT) - (3 Trains) Kents Bank to Carliste
SRS H.40	(NT) - Nothern		(T042) & (NT) - (7 Trains)
SRS H.42	(NT) - Nothern		(T042) & (NT) - (5 Trains)
SRS H.45	(NT) - Nothern (AW) - Arriva Trains Wales	(T081) & (AW) - (1 Train) Chester to Warrington Bank Quay	(T081) & (NT) - (4 Trains) Helsby to Ellesmere Port
SRS H.46	(NT) - Nothern	(T097) & (NT) - (1 Train) Kirkham & Wesham to Blackpool South	
SRS O.01	(ME) - Merseyrail	(T107) & (ME) - (4 Trains) Liverpool Central to Chester (T107) & (ME) - (2 Trains) Liverpool Central to Ellesmere (T106) & (ME) - (4 Trains) Liverpool Central to West Kirby (T106) & (ME) - (4 Trains) Liverpool Central to New Brighton (T103) & (ME) - (4 Trains) Liverpool Central to Southport (T103) & (ME) - (4 Trains) Liverpool Central to Hunts Cross (T105) & (ME) - (4 Trains) Liverpool Central to Ormskirk (T104) & (ME) - (4 Trains) Liverpool Central to Kirkby	

TABLE 85. TOC SERVICES. LNW NORTH

Strategic route section (SRS)	Train operator company (TOC)	Sepecified equipment
SRS N.03	(CS) - Caledonial Sleeper	Class 90
		Class Mk2
		Class Mk3
	(CS) - Caledonial Sleeper	Class 92
		Class Mk2
		Class Mk3
	(LM) - London Midland	Class 150
	(LM) - London Midland	Class 153
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
	(VT) - Virgin Trains West Coast	Class 221
	(LM) - London Midland	Class 319
	(LM) - London Midland	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS N.04	(CS) - Caledonial Sleeper	Class 90
		Class Mk2
		Class Mk3
	(CS) - Caledonial Sleeper	Class 92
		Class Mk2
		Class Mk3
	(NT) - Northern	Class 142
	(LM) - London Midland	Class 150
	(NT) - Northern	Class 150
	(LM) - London Midland	Class 153
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 185
	(TP) - TransPennine Express	Class 185

	(VT) - Virgin Trains West Coast	Class 221
	(LM) - London Midland	Class 319
	(NT) - Northern	Class 319
	(LM) - London Midland	Class 350
	(TP) - TransPennine Express	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS N.05	(CS) - Caledonial Sleeper	Class 90
		Class Mk2
		Class Mk3
	(CS) - Caledonial Sleeper	Class 92
		Class Mk2
		Class Mk3
	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 185
	(TP) - TransPennine Express	Class 185
	(VT) - Virgin Trains West Coast	Class 221
	(NT) - Northern	Class 319
	(TP) - TransPennine Express	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS N.06	(CS) - Caledonial Sleeper	Class 90
		Class Mk2
		Class Mk3
	(CS) - Caledonial Sleeper	Class 92
		Class Mk2
		Class Mk3
	(TP) - TransPennine Express	Class 185
	(VT) - Virgin Trains West Coast	Class 221

	(LM) - London Midland	Class 319
	(NT) - Northern	Class 319
	(TP) - TransPennine Express	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS N.07	(LM) - London Midland	Class 153
	(LM) - London Midland	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS N.08	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(LM) - London Midland	Class 153
	(NT) - Northern	Class 156
	(EM) - East Midlands Trains	Class 156
	(NT) - Northern	Class 158
	(EM) - East Midlands Trains	Class 158
	(VT) - Virgin Trains West Coast	Class 221
	(NT) - Northern	Class 323
	(VT) - Virgin Trains West Coast	Class 390
SRS N.09	(LM) - London Midland	Class 153
	(EM) - East Midlands Trains	Class 153
	(EM) - East Midlands Trains	Class 156
	(EM) - East Midlands Trains	Class 158
SRS N.13	(AW) - Arriva Trains Wales	Class 67
		Class Mk3
	(AW) - Arriva Trains Wales	Class 150
	(AW) - Arriva Trains Wales	Class 153
	(AW) - Arriva Trains Wales	Class 158
	(AW) - Arriva Trains Wales	Class 175
	(VT) - Virgin Trains West Coast	Class 221
SRS H.05	(NT) - Northern	Class 142
	(NT) - Northern	Class 150

	(NT) - Northern	Class 156
	(TP) - TransPennine Express	Class 185
SRS H.10	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(TP) - TransPennine Express	Class 185
SRS H.17	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(EM) - East Midlands Trains	Class 158
	(TP) - TransPennine Express	Class 185
SRS H.22	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(AW) - Arriva Trains Wales	Class 158
	(AW) - Arriva Trains Wales	Class 175
	(XC) - CrossCountry	Class 221
	(NT) - Northern	Class 323
	(VT) - Virgin Trains West Coast	Class 390
SRS H.23	(NT) - Northern	Class 142
	(AW) - Arriva Trains Wales	Class 142
	(NT) - Northern	Class 156
	(EM) - East Midlands Trains	Class 156
	(NT) - Northern	Class 158
	(AW) - Arriva Trains Wales	Class 158
	(EM) - East Midlands Trains	Class 158
	(AW) - Arriva Trains Wales	Class 175
	(TP) - TransPennine Express	Class 185

	(EM) - East Midlands Trains	Class 222
	(NT) - Northern	Class 319
	(TP) - TransPennine Express	Class 350
SRS H.24	(NT) - Northern	Class 142
	(AW) - Arriva Trains Wales	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(EM) - East Midlands Trains	Class 156
	(AW) - Arriva Trains Wales	Class 158
	(EM) - East Midlands Trains	Class 158
	(AW) - Arriva Trains Wales	Class 175
	(NT) - Northern	Class 185
	(EM) - East Midlands Trains	Class 222
SRS H.25	(NT) - Northern	Class 142
	(LM) - London Midland	Class 150
	(EM) - East Midlands Trains	Class 156
	(AW) - Arriva Trains Wales	Class 158
	(EM) - East Midlands Trains	Class 158
	(LM) - London Midland	Class 170
	(AW) - Arriva Trains Wales	Class 175
	(TP) - TransPennine Express	Class 185
	(EM) - East Midlands Trains	Class 222
	(LM) - London Midland	Class 319
	(TP) - TransPennine Express	Class 350
	(LM) - London Midland	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS H.26	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(TP) - TransPennine Express	Class 185

	(NT) - Northern	Class 323
SRS H.27	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 185
SRS H.28	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
SRS H.29	(NT) - Northern	Class 323
SRS H.30	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
SRS H.31	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(AW) - Arriva Trains Wales	Class 175
	(NT) - Northern	Class 185
	(TP) - TransPennine Express	Class 185
	(NT) - Northern	Class 319
	(NT) - Northern	Class 323
	(TP) - TransPennine Express	Class 350
SRS H.32	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(NT) - Northern	Class 185
SRS H.33	(NT) - Northern	Class 142
	(AW) - Arriva Trains Wales	Class 142

	(NT) - Northern	Class 150
	(AW) - Arriva Trains Wales	Class 150
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(AW) - Arriva Trains Wales	Class 158
	(AW) - Arriva Trains Wales	Class 175
	(NT) - Northern	Class 185
	(TP) - TransPennine Express	Class 185
	(NT) - Northern	Class 319
	(TP) - TransPennine Express	Class 350
SRS H.35	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
SRS H.37	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
SRS H.38	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(EM) - East Midlands Trains	Class 156
SRS H.39	(NT) - Northern	Class 37
		Class Mk2
	(NT) - Northern	Class 142
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
SRS H.40	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153

	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
SRS H.42	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 158
SRS H.45	(AW) - Arriva Trains Wales	Class 67
		Class Mk3
	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(AW) - Arriva Trains Wales	Class 175
SRS H.46	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(NT) - Northern	Class 185
SRS O.01	(ME) - Merseyrail	Class 507
	(ME) - Merseyrail	Class 508

TABLE 86. TOC SPECIFIED EQUIPMENT. LNW NORTH

Strategic route section (SRS)	Route type (P/S)	Lines of route description (LOR)
M.12	Primary	MD401 - HEYFORD TO BORDESLEY JN. MD435 - SMALL HEATH SOUTH JN. TO STOURBRIDGE NORTH JN.
M.05	Primary	MD301 - RUGBY TO PENKRIDGE
M.06-07	Primary	MD301 - RUGBY TO PENKRIDGE NW1002 - PENKRIDGE STATION TO TRENT VALLEY JN.
M.08-09-19-21	Primary-Secondary	MD305 - BIRMINGHAM NEW STREET TO BLACKWELL MD310 - BARNT GREEN JN. TO REDDITCH MD570 - SALTLEY TO KING S NORTON JN. MD580 - LIFFORD EAST JN. TO LIFFORD WEST JN. GW400 - BARNT GREEN TO WESTERLEIGH JN.
M.10-22	Primary-Secondary	LN3501 - DERBY LONDON ROAD JN. TO TAMWORTH MD501 - TAMWORTH TO BIRMINGHAM, PROOF HOUSE JN. MD545 - KINGSBURY JN. TO WHITACRE JN. MD555 - NUNEATON NORTH JN. TO WATER ORTON EAST JN.
M.11-23	Primary-Secondary	MD410 - COVENTRY NORTH JN. TO NUNEATON SOUTH JN. MD405 - LEAMINGTON SPA JN. TO COVENTRY SOUTH JN. MD401 - HEYFORD TO BORDESLEY JN. GW200 - DIDCOT TO HEYFORD
M.13-18-24	Primary-Secondary	MD315 - STECHFORD SOUTH JN. TO ASTON SOUTH JN. MD320 - PROOF HOUSE JN. TO BUSHBURY JN. MD325 - SOHO SOUTH JN. TO PERRY BARR NORTH JN. MD345 - BESCOT JN. TO RUGELEY NORTH JN. MD365 - PORTOBELLO JN. TO WOLVERHAMPTON CRANE STREET JN. NW1002 - PENKRIDGE STATION TO TRENT VALLEY JN. NW1004 - RUGELEY TOWN TO RUGELEY NORTH JN.
M.14-25	Secondary	MD435 - SMALL HEATH SOUTH JN. TO STOURBRIDGE NORTH JN. MD445 - STOURBRIDGE JN. TO STOURBRIDGE TOWN
M.15	Primary	MD430 - DROITWICH SPA TO STOURBRIDGE NORTH JN. GW370 - DROITWICH SPA TO CUTNALL GREEN GW300 - ABBOTSWOOD JN. TO STOKE WORKS JN. VIA WORCESTER SHRUB

		GW340 - WORCESTER SHRUB HILL TO SHELWICK JN. GW370 - DROITWICH SPA TO CUTNALL GREEN
M.17	Secondary	MD320 - PROOF HOUSE JN. TO BUSHBURY JN. MD340 - ASTON NORTH JN. TO ALREWAS
M.20	Secondary	MD801 - WOLVERHAMPTON NORTH JN. TO ABBEY FOREGATE
SRS N.01	Primary	MD101 - EUSTON TO ARMITAGE JUNCTION MD105 - HANSLOPE JN. TO RUGBY MD165 - NORTH POLE JN. TO ACTON WELLS JN.
SRS N.02	Primary	MD101 - EUSTON TO ARMITAGE JUNCTION

TABLE 87. LINES OF ROUTE DESCRIPTION. LNW SOUTH

Strategic route section (SRS)	Route type (P/S)	Infrastructure RA	Standard gauge	Signalling method	Max. Speed slow lines [mph]	Max. Speed fast lines [mph]	Electrification system
M.12	Primary	RA8	W6 W10	TCB	60	100	None
M.05	Primary	RA8	W8 W10	TCB	100	125	AC 25kV OHL
M.06-07	Primary	RA8	W8 W10	TCB	40	125	AC 25kV OHL
M.08-09-19-21	Primary-Secondary	RA8	W6a W8 W10	TCB	60	90	AC 25kV OHL None
M.10-22	Primary-Secondary	RA8	W8 W10	TCB	45	125	None
M.11-23	Primary-Secondary	RA8	W10	TCB	45	95	None
M.13-18-24	Primary-Secondary	RA8	W6 W8 W9 W10	TCB	45	75	AC 25kV OHL None
M.14-25	Secondary	RA8	W7 W8	TCB	50	60	None
M.15	Primary	RA7 RA8	W6 W8	TCB	35	75	None
M.17	Secondary	RA8	W8	TCB	50	60	AC 25kV OHL None
M.20	Secondary	RA8	W6a W7	TCB	50	70	None
SRS N.01	Primary	RA8	W9 W10	Colour light TCB TASS	75	125	AC 25kV OHL
SRS N.02	Primary	RA8	W9 W10	Colour light TCB	75	125	AC 25kV OHL

				TASS			

TABLE 88. ROUTE CAPABILITY OVERVIEW. LNW SOUTH

Strategic route section (SRS)	Train operator companies (TOC)	Trains per hour (TPH)	Trains per day (TPD)
M.12	(LM) - London Midland (CH) - Chilten Railways	(T071) & (CH) - (2 Trains) London Marylebone to Birmingham Snow Hill (T071) & (CH) - (2 Trains) Leamington Spa to Birmingham Snow Hill (T071) & (LM) - (3 Trains) Stratford-upn-Avon/Dorridge to Birmingham Snow Hill (T071) & (LM) - (3 Trains) Dorridge to Birmingham Snow Hill	
M.05	(LM) - London Midland (XC) - CrossCountry (VT) - Virgin Trains West Coast (AW) - Arriva Trains Wales	(T068) & (LM) &S (VT) (XC) - (7 Trains) Birmingham New Street to Coventry (T068) & (LM) &S (VT) - (3 Trains) Birmingham New Street to Rugby	
M.06-07	(LM) - London Midland (XC) - CrossCountry (VT) - Virgin Trains West Coast (AW) - Arriva Trains Wales	(T068) & (LM) &S (VT) (XC) (AW) - (10 Trains) Birmingham New Street to Wolverhampton (T068) & (LM) &S (XC) - (3 Trains) Birmingham New Street to Stafford	
M.08-09-19-21	(LM) - London Midland (XC) - CrossCountry	(T069) & (LM) - (6 Trains) Birmingham New Street to Longbridge (T069) & (LM) - (2 Trains) Birmingham New Street to Redditch (T069) & (LM) - (2 Trains) Birmingham New Street to Bromsgrove (Peak) (T069) & (LM) - (1 Train) Birmingham New Street to Bromsgrove (Off -peak)	
M.10-22	(XC) - CrossCountry	(T057) & (XC) - (2 Trains) Birmingham New Street to Tamworth (T047) & (XC) - (2 Trains) Birmingham New Street to Nuneaton	
M.11-23	(LM) - London Midland	(T116) & (XC) - (1 Train) Coventry to Leamington Spa	

	(CH) - Chiltern Railways (XC) - CrossCountry (GW) - Great Western Railway	(T063) & (LM) - (1 Train) Coventry to Nuneaton (T116) & (XC) - (1 Train) Coventry to Banbury	
M.13-18-24	(LM) - London Midland	(T070) & (LM) - (4 Trains) Walsall to Birmingham New Street (T070) & (LM) - (2 Trains) Walsall to Aston (T070) & (LM) - (1 Train) Rugeley Trent Valley to Birmingham New Street (T070) & (LM) - (2 Trains) Wolverhampton and Walsall	
M.14-25	(CH) - Chiltern Railways (LM) - London Midland	(T071) & (LM) - (6 Trains) Birmingham Snow Hill to Stourbridge Jn. (T072) & (LM) - (6 Trains) Stourbridge Town to Stourbridge Jn.	
M.15	(CH) - Chiltern Railways (LM) - London Midland (GW) - Great Western Railway	(T071) & (LM) - (2 Trains) Birmingham Snow Hill to Kidderminster (T071) & (LM) - (2 Trains) Birmingham Snow Hill to Worcester Foregate Street/Worcester Shrub Hill (Peak) (T071) & (LM) - (1 Train) Birmingham Snow Hill to Worcester Foregate Street/Worcester Shrub Hill (Off-peak) (T071) & (LM) - (1 Train) Birmingham Snow Hill to Worcester Foregate Street (T071) & (LM) - (1/2 Train) Worcester Shrub Hill to Malvern	(T071) & (LM) - (10 Train) Birmingham Snow Hill to Worcester Shrub Hill
M.17	(LM) - London Midland	(T069) & (LM) - (6 Trains) Birmingham New Street to Four Oaks (T069) & (LM) - (2 Trains) Birmingham New Street to Lichfield Trent Valley	
M.20	(LM) - London Midland (VT) - Virgin Trains West Coast (AW) - Arriva Trains Wales	(T074) & (LM) &S (AW) - (2 Trains) Birmingham New Street to Shrewsbury (T069) & (LM) - (2 Trains) Birmingham New Street to Lichfield Trent Valley (T068) & (LM) &S (VT) (AW) - (10 Trains) Birmingham New Street to Wolverhampton	

		(T074) & (LM) &S (AW) - (2 Trains) Wolverhampton to Shrewsbury	
SRS N.01	(CS) - Caledonial Sleeper (LM) - London Midland (VT) - Virgin Trains West Coast (SN) - Southern	(T066) & (VT) - (3 Trains) London to Manchester (LDHS) (T066) & (VT) - (3 Trains) London to Birmingham (LDHS) (T066) & (VT) - (1 Train) London to Birmingham through Wolverhampton (LDHS) (T066) & (VT) - (1 Train) London to Liverpool (LDHS) (T066) & (VT) - (1 Train) London to Chester/North Wales (LDHS) (T066) & (VT) - (1 Train) London to Scotland (Glasgow/Edingburgh) (LDHS) (T066) & (VT) - (4 Trains) London to Milton Keynes (LDHS) (T066) & (LM) - (1 Train) London to Crewe (LDHS) (T066) & (LM) - (3 Trains) London to Birmingham (Regional) (T066) & (LM) - (3 Trains) London to Northampton (Regional) (T066) & (LM) - (2 Trains) London to Milton Keynes Central (Regional) (T066) & (LM) - (5 Trains) London to Watford Jn. (Regional urban) (T066) & (LM) - (3 Trains) London to Tring (Regional) (T066) & (SN) - (1 Train) London to Milton Keynes Central to East/South Croydon (Regional)	(T065) & (CS) - (1 Train) Euston to Abeerdeen/Inverness/Fort William (Sleeper) (T065) & (CS) - (1 Train) Euston to Edinburgh/Glasgow (Sleeper)
SRS N.02	(CS) - Caledonial Sleeper (LM) - London Midland (VT) - Virgin Trains West Coast	(T066) & (VT) - (3 Trains) London to Manchester (LDHS) (T066) & (VT) - (1 Train) London to Liverpool (LDHS) (T066) & (VT) - (1 Train) London to Chester/North Wales (LDHS) (T066) & (VT) - (1 Train) London to Scotland (LDHS) (T066) & (LM) - (1 Train) London to Crewe (LDHS)	(T065) & (CS) - (1 Train) Euston to Abeerdeen (Sleeper) (T065) & (CS) - (1 Train) Euston to Inverness (Sleeper)

TABLE 89. TOC SERVICES. LNW SOUTH

Strategic route section (SRS)	Train operator company (TOC)	Sepecified equipment
SRS N.03	(CS) - Caledonial Sleeper	Class 90
		Class Mk2
		Class Mk3
	(CS) - Caledonial Sleeper	Class 92
		Class Mk2
		Class Mk3
	(LM) - London Midland	Class 150
	(LM) - London Midland	Class 153
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
	(VT) - Virgin Trains West Coast	Class 221
	(LM) - London Midland	Class 319
	(LM) - London Midland	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS N.04	(CS) - Caledonial Sleeper	Class 90
		Class Mk2
		Class Mk3
	(CS) - Caledonial Sleeper	Class 92
		Class Mk2
		Class Mk3
	(NT) - Northern	Class 142
	(LM) - London Midland	Class 150
	(NT) - Northern	Class 150
	(LM) - London Midland	Class 153
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 185
	(TP) - TransPennine Express	Class 185

	(VT) - Virgin Trains West Coast	Class 221
	(LM) - London Midland	Class 319
	(NT) - Northern	Class 319
	(LM) - London Midland	Class 350
	(TP) - TransPennine Express	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS N.05	(CS) - Caledonial Sleeper	Class 90
		Class Mk2
		Class Mk3
	(CS) - Caledonial Sleeper	Class 92
		Class Mk2
		Class Mk3
	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 185
	(TP) - TransPennine Express	Class 185
	(VT) - Virgin Trains West Coast	Class 221
	(NT) - Northern	Class 319
	(TP) - TransPennine Express	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS N.06	(CS) - Caledonial Sleeper	Class 90
		Class Mk2
		Class Mk3
	(CS) - Caledonial Sleeper	Class 92
		Class Mk2
		Class Mk3
	(TP) - TransPennine Express	Class 185
	(VT) - Virgin Trains West Coast	Class 221

	(LM) - London Midland	Class 319
	(NT) - Northern	Class 319
	(TP) - TransPennine Express	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS N.07	(LM) - London Midland	Class 153
	(LM) - London Midland	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS N.08	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(LM) - London Midland	Class 153
	(NT) - Northern	Class 156
	(EM) - East Midlands Trains	Class 156
	(NT) - Northern	Class 158
	(EM) - East Midlands Trains	Class 158
	(VT) - Virgin Trains West Coast	Class 221
	(NT) - Northern	Class 323
	(VT) - Virgin Trains West Coast	Class 390
SRS N.09	(LM) - London Midland	Class 153
	(EM) - East Midlands Trains	Class 153
	(EM) - East Midlands Trains	Class 156
	(EM) - East Midlands Trains	Class 158
SRS N.13	(AW) - Arriva Trains Wales	Class 67
		Class Mk3
	(AW) - Arriva Trains Wales	Class 150
	(AW) - Arriva Trains Wales	Class 153
	(AW) - Arriva Trains Wales	Class 158
	(AW) - Arriva Trains Wales	Class 175
	(VT) - Virgin Trains West Coast	Class 221
SRS H.05	(NT) - Northern	Class 142
	(NT) - Northern	Class 150

	(NT) - Northern	Class 156
	(TP) - TransPennine Express	Class 185
	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(TP) - TransPennine Express	Class 185
SRS H.17	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(EM) - East Midlands Trains	Class 158
	(TP) - TransPennine Express	Class 185
SRS H.22	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(AW) - Arriva Trains Wales	Class 158
	(AW) - Arriva Trains Wales	Class 175
	(XC) - CrossCountry	Class 221
	(NT) - Northern	Class 323
	(VT) - Virgin Trains West Coast	Class 390
SRS H.23	(NT) - Northern	Class 142
	(AW) - Arriva Trains Wales	Class 142
	(NT) - Northern	Class 156
	(EM) - East Midlands Trains	Class 156
	(NT) - Northern	Class 158
	(AW) - Arriva Trains Wales	Class 158
	(EM) - East Midlands Trains	Class 158
	(AW) - Arriva Trains Wales	Class 175
	(TP) - TransPennine Express	Class 185

	(EM) - East Midlands Trains	Class 222
	(NT) - Northern	Class 319
	(TP) - TransPennine Express	Class 350
SRS H.24	(NT) - Northern	Class 142
	(AW) - Arriva Trains Wales	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(EM) - East Midlands Trains	Class 156
	(AW) - Arriva Trains Wales	Class 158
	(EM) - East Midlands Trains	Class 158
	(AW) - Arriva Trains Wales	Class 175
	(NT) - Northern	Class 185
	(EM) - East Midlands Trains	Class 222
SRS H.25	(NT) - Northern	Class 142
	(LM) - London Midland	Class 150
	(EM) - East Midlands Trains	Class 156
	(AW) - Arriva Trains Wales	Class 158
	(EM) - East Midlands Trains	Class 158
	(LM) - London Midland	Class 170
	(AW) - Arriva Trains Wales	Class 175
	(TP) - TransPennine Express	Class 185
	(EM) - East Midlands Trains	Class 222
	(LM) - London Midland	Class 319
	(TP) - TransPennine Express	Class 350
	(LM) - London Midland	Class 350
	(VT) - Virgin Trains West Coast	Class 390
SRS H.26	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(TP) - TransPennine Express	Class 185

	(NT) - Northern	Class 323
SRS H.27	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 185
SRS H.28	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
SRS H.29	(NT) - Northern	Class 323
SRS H.30	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
SRS H.31	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(AW) - Arriva Trains Wales	Class 175
	(NT) - Northern	Class 185
	(TP) - TransPennine Express	Class 185
	(NT) - Northern	Class 319
	(NT) - Northern	Class 323
	(TP) - TransPennine Express	Class 350
SRS H.32	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(NT) - Northern	Class 185
SRS H.33	(NT) - Northern	Class 142
	(AW) - Arriva Trains Wales	Class 142

	(NT) - Northern	Class 150
	(AW) - Arriva Trains Wales	Class 150
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(AW) - Arriva Trains Wales	Class 158
	(AW) - Arriva Trains Wales	Class 175
	(NT) - Northern	Class 185
	(TP) - TransPennine Express	Class 185
	(NT) - Northern	Class 319
	(TP) - TransPennine Express	Class 350
SRS H.35	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
SRS H.37	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
SRS H.38	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(EM) - East Midlands Trains	Class 156
SRS H.39	(NT) - Northern	Class 37
		Class Mk2
	(NT) - Northern	Class 142
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
SRS H.40	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153

	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
SRS H.42	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 158
SRS H.45	(AW) - Arriva Trains Wales	Class 67
		Class Mk3
	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 156
	(AW) - Arriva Trains Wales	Class 175
SRS H.46	(NT) - Northern	Class 142
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(NT) - Northern	Class 185
SRS O.01	(ME) - Merseyrail	Class 507
	(ME) - Merseyrail	Class 508

TABLE 90. TOC SPECIFIED EQUIPMENT. LNW SOUTH

AP. 2.8. LONDON NORTH EAST & EAST MIDLANDS-REF. (22)

Strategic route section (SRS)	Route type (P/S)	Lines of route description (LOR)
SRS G.01	Primary	LN101 - KINGS CROSS TO SHAFTHOLME JN.
SRS G.05	Primary	LN101 - KINGS CROSS TO SHAFTHOLME JN.
SRS G.06	Primary	LN836 - DONCASTER, MARSHGATE JN. TO NEVILLE HILL EAST JN.
SRS G.07	Primary	LN101 - KINGS CROSS TO SHAFTHOLME JN. LN600 - SHAFTHOLME JN. TO RESTON GSP
SRS G.08	Primary	LN600 - SHAFTHOLME JN. TO RESTON GSP LN724 - HOLGATE JN. TO SKELTON JN.
SRS G.09	Primary	LN600 - SHAFTHOLME JN. TO RESTON GSP
SRS G.10	Primary	LN600 - SHAFTHOLME JN. TO RESTON GSP
SRS G.13	Secondary	LN682 - KING EDWARD BRIDGE SOUTH JN. TO CARLISLE NORTH JN.
SRS G.16-17	Secondary	LN627 - NORTHALLERTON LONGLANDS JN. TO NEWCASTLE EAST JN.
SRS G.18-19	Secondary	LN631 - DARLINGTON SOUTH JN. TO EAGLESCLIFFE SOUTH JN.
SRS G.20-23	Secondary	LN170 - WERRINGTON JN. TO FLYOVER EAST JN.
SRS G.21	Secondary	LN206 - NEWARK FLAT CROSSING TO WEST HOLMES JN. LN200 - WRAWBY JN. TO PELHAM STREET JN.
SRS G.22	Secondary	LN736 - CLEETHORPES TO NUNNERY MAIN LINE JN.
SRS H.01	Primary	LN836 - DONCASTER, MARSHGATE JN. TO NEVILLE HILL EAST JN. LN852 - HOLBECK JN. TO BRADFORD INTERCHANGE
SRS H.03	Secondary	LN922 - WHITEHALL WEST JN. TO HELLIFIELD SOUTH JN. LN924 - APPERLEY JN. TO ILKLEY LN926 - DOCKFIELD JN. TO ESHOLT JN.
SRS H.05	Secondary	LN860 - DIGGLE JN. TO COPLEY HILL EAST JN. NW7021 - MILES PLATTING JN. TO MARSDEN
SRS H.06	Secondary	LN836 - DONCASTER, MARSHGATE JN. TO NEVILLE HILL EAST JN. LN898 - NEVILLE HILL EAST JN. TO HULL LN854 - HALL ROYD JN. TO SKELTON JN.

SRS H.07	Secondary	LN898 - NEVILLE HILL EAST JN. TO HULL
SRS H.08	Secondary	LN912 - THORNE JN. TO GILBERDYKE JN. LN898 - NEVILLE HILL EAST JN. TO HULL LN882 - WAKEFIELD KIRKGATE WEST JN. TO GOOLE POTTERS GRANGE JN. LN854 - HALL ROYD JN. TO SKELTON JN.
SRS H.09	Secondary	LN882 - WAKEFIELD KIRKGATE WEST JN. TO GOOLE POTTERS GRANGE JN. LN854 - HALL ROYD JN. TO SKELTON JN. LN875 - CASTLEFORD WEST JN. TO PONTEFRACT WEST JN.
SRS H.12	Primary	LN880 - YORK TO SCARBOROUGH
SRS H.13	Primary	LN804 - TAPTON JN. TO GASCOIGNE WOOD LN830 - ALDWARKE JN. TO WOODBURN JN.
SRS H.14	Primary	LN752 - WRAWBY JN. TO MARSHGATE JN. LN736 - CLEETHORPES TO NUNNERY MAIN LINE JN. LN826 - DONCASTER SOUTH YORKSHIRE JN. TO SWINTON JN. NORTH
SRS H.15	Secondary	LN804 - TAPTON JN. TO GASCOIGNE WOOD
SRS H.16	Secondary	LN736 - CLEETHORPES TO NUNNERY MAIN LINE JN.
SRS H.18	Secondary	LN868 - WINCOBANK JN. TO HORBURY JN.
SRS H.19	Secondary	LN736 - CLEETHORPES TO NUNNERY MAIN LINE JN.

TABLE 91- LINES OF ROUTE DESCRIPTION. LNE

Strategic route section (SRS)	Route type (P/S)	Infrastructure RA	Standard gauge	Signalling method	Max. Speed slow lines [mph]	Max. Speed fast lines [mph]	Electrification system
SRS G.01	Primary	RA9	W10 W12	TCB	75	125	AC 25kV OHL
SRS G.05	Primary	RA9	W10	TCB	80	125	AC 25kV OHL
SRS G.06	Primary	RA9	W9	TCB	75	100	AC 25kV OHL
SRS G.07	Primary	RA9 RA10	W10	TCB	125	125	AC 25kV OHL
SRS G.08	Primary	RA9	W10	TCB	70	125	AC 25kV OHL
SRS G.09	Primary	RA9	W10 W12	TCB	75	125	AC 25kV OHL
SRS G.10	Primary	RA8 RA9	W10	TCB	110	125	AC 25kV OHL
SRS G.13	Secondary	RA8	W7	TCB AB	60	65	None
SRS G.16-17	Secondary	RA5 RA8	W6 W8	TCB AB	60	70	DC 1500V OHL None
SRS G.18-19	Secondary	RA8	W8	TCB AB	30	60	None
SRS G.20-23	Secondary	RA8	W12	TCB	60	75	None
SRS G.21	Secondary	RA8	W7	TCB AB	70	75	None
SRS G.22	Secondary	RA8	W8	TCB AB	60	60	None
SRS H.01	Primary	RA8 RA9	W8	TCB	30	40	AC 25kV OHL
SRS H.03	Secondary	RA5 RA7 RA8	W8	TCB	90	90	AC 25kV OHL
SRS H.05	Secondary	RA8 RA9	W6 W7	TCB	80	80	None

			W8 W9				
SRS H.06	Secondary	RA8 RA9	W8 W9	TCB	90	90	None
SRS H.07	Secondary	RA8	W8 W12	TCB AB	90	90	None
SRS H.08	Secondary	RA8 RA9	W6 W8 W9 W12	TCB AB	70	70	None
SRS H.09	Secondary	RA8 RA9	W6 W8 W9 W12	TCB	30	60	None
SRS H.12	Primary	RA8	W6	TCB AB	90	90	None
SRS H.13	Primary	RA8 RA10	W8 W12	TCB	90	90	None
SRS H.14	Primary	RA8	W8 W12	TCB	55	80	None
SRS H.15	Secondary	RA8	W12	TCB	80	80	None
SRS H.16	Secondary	RA8	W6 W7 W8 W9 W10 W12	TCB AB	60	60	None
SRS H.18	Secondary	RA6 RA7	W6	TCB AB	70	70	None
SRS H.19	Secondary	RA8	W6 W8	TCB AB	40	60	None

TABLE 92. ROUTE CAPABILITY OVERVIEW. LNE

Strategic route section (SRS)	Train operator companies (TOC)	Trains per hour (TPH)	Trains per day (TPD)
SRS G.01	(GR) - Virgin Trains East Coast (GN) - Great Northern (GC) - Grand Central (HT) - Hull Trains	(T025) & (GR) - (3 Trains) King's Cross to Newcastle/Scotland (LDHS) (Peak) (T025) & (GR) - (2 Trains) King's Cross to Newcastle/Scotland (LDHS) (Off peak) (T025) & (GR) &S (GC) - (1 Train) King's Cross to Newark/York (LDHS) (T025) & (GR) - (3 Trains) King's Cross to Leeds (LDHS) (Peak) (T025) & (GR) - (2 Trains) King's Cross to Leeds (LDHS) (Off peak) (T025) & (GR) &S (HT) (GC) - (1 Train) King's Cross to Lincoln/Hull/Sunderland/Bradford Interchange (LDHS) (T024) & (GN) - (4 Trains) King's Cross to Royston/Cambridge/King's Lynn (T024) & (GN) - (6 Trains) King's Cross to Peterborough (Peak) (T024) & (GN) - (2 Trains) King's Cross to Peterborough (Off peak) (T024) & (GN) - (4 Trains) Moorgate to Welwyn Garden City (Peak) (T024) & (GN) - (3 Trains) Moorgate to Welwyn Garden City (Off peak) (T024) & (GN) - (7 Trains) Moorgate to Gordon Hill/Hertford North (Peak) (T024) & (GN) - (2 Trains) Moorgate to Gordon Hill/Hertford North (Off peak) (T024) & (GN) - (2 Trains) Moorgate to Stevenage/Letchworth via Hertford North (Peak)	

		(T024) & (GN) - (1 Train) Moorgate to Stevenage/Letchworth via Hertford North (Off peak)	
SRS G.05	(GR) - Virgin Trains East Coast (EM) - East Midlands Trains (GC) - Grand Central (HT) - Hull Trains	(T026) & (GR) - (3 Trains) King's Cross to Newcastle/Scotland (LDHS) (Peak) (T026) & (GC) - (1 Train) King's Cross to Newark/York (LDHS) (T026) & (GR) - (3 Trains) King's Cross to Leeds (LDHS) (Peak) (T026) & (GR) - (2 Trains) King's Cross to Leeds (LDHS) (Off peak) (T026) & (GC) & (HT) - (1 Train) King's Cross to Lincoln/Hull/Sunderland/Bradford Interchange (LDHS) (T026) & (EM) - (1 Train) Norwich to Liverpool (T026) & (EM) - (1 Train) Peterborough to Spalding/Lincoln	
SRS G.06	(NT) - Northern (XC) - CrossCountry (GR) - Virgin Trains East Coast	(T031) & (GR) - (3 Trains) King's Cross to Leeds (LDHS) (Peak) (T031) & (GR) - (2 Trains) King's Cross to Leeds (LDHS) (Off peak) (T031) & (XC) - (1 Train) Plymouth to Edinburgh (LDHS) (T031) & (NT) - (2 Trains) Doncaster to Leeds (Peak) (T031) & (NT) - (1 Train) Doncaster to Leeds (Off peak) (T031) & (NT) - (1 Train) Sheffield to Leeds (Local) (T031) & (NT) - (1 Train) Sheffield to Adwick (Local)	
SRS G.07	(XC) - CrossCountry (GR) - Virgin Trains East Coast (GC) - Grand Central (NT) - Northern (HT) - Hull Trains	(T025) & (GR) &S (XC) - (3 Trains) King's Cross to Newcastle/Scotland (LDHS) (Peak) (T025) & (GR) &S (XC) - (2 Trains) King's Cross to Newcastle/Scotland (LDHS) (Off peak) (T026) & (GC) - (1 Train) King's Cross to York/Sunderland (LDHS) (T026) & (XC) - (1 Train) Reading to Newcastle (LDHS)	(T029) & (HT) - (8 Trains) King's Cross to Hull (LDHS) (T029) & (NT) - (1 Train) Selby to Doncaster (Local)
SRS G.08	(GC) - Grand Central (GR) - Virgin Trains East	(T025) & (GR) - (3 Trains) King's Cross to Newcastle/Scotland (LDHS) (Peak)	

	Coast (XC) - CrossCountry (TP) - TransPennine Express (NT) - Northern	(T025) & (GR) - (2 Trains) King's Cross to Newcastle/Scotland (LDHS) (Off peak) (T026) & (GC) - (1 Train) King's Cross to York/Sunderland (LDHS) (T031) & (XC) - (1 Train) Plymouth to Edinburgh (LDHS) (T026) & (XC) - (1 Train) Reading to Newcastle (LDHS) (T039) & (TP) - (1 Train) Hull/Selby to York (T035) & (NT) - (2 Trains) York to Harrogate/Leeds (Peak) (T035) & (NT) - (1 Train) York to Harrogate/Leeds (Off peak) (T039) & (TP) - (1 Train) Liverpool to Newcastle (T039) & (TP) - (1 Train) Manchester Airport to Middlesbrough (T039) & (TP) - (1 Train) Liverpool to Scarborough (T097) & (NT) - (Train) Blackpool to York	
SRS G.09	(GR) - Virgin Trains East Coast (XC) - CrossCountry (TP) - TransPennine Express (NT) - Northern	(T025) & (GR) - (3 Trains) King's Cross to Newcastle/Scotland (LDHS) (Peak) (T025) & (GR) - (2 Trains) King's Cross to Newcastle/Scotland (LDHS) (Off peak) (T031) & (XC) - (1 Train) Plymouth to Edinburgh (LDHS) (T026) & (XC) - (1 Train) Reading to Newcastle (LDHS) (T039) & (TP) - (1 Train) Liverpool to Newcastle (Local)	(T044) & (NT) - (3 Trains) Saltburn/Middlesbrough to Newcastle via Durham (Local)
SRS G.10	(GR) - Virgin Trains East Coast (XC) - CrossCountry (NT) - Northern	(T025) & (GR) - (2 Trains) King's Cross to Newcastle/Scotland (LDHS) (T031) & (XC) - (1 Train) Plymouth to Edinburgh (LDHS) (T048) & (NT) - (2 Trains) MetroCentre/Newcaste to Morpeth/Chathill (Peak) (T048) & (NT) - (1 Train) MetroCentre/Newcaste to Morpeth/Chathill (Off peak)	
SRS G.13	(NT) - Northern (SR) - ScotRail	(T048) & (NT) - (1 Train) Morpeth to MetroCentre (T048) & (NT) - (1 Train) Newcastle to MetroCentre (T044) & (NT) - (1 Train) Middlesbrough to Hexham (T048) & (SR) - (1 Train) Newcastle to Carliste/Glasgow Central	

SRS G.16-17	(GC) - Grand Central (NT) - Northern (TP) - TransPennine Express	(T039) & (TP) - (1 Train) Manchester Airport to Middlesbrough (T044) & (NT) - (3 Trains) Darlington to Middlesbrough/Saltburn (Peak) (T044) & (NT) - (2 Trains) Darlington to Middlesbrough/Saltburn (Off peak) (T026) & (GC) - (4 Train) King's Cross to Sunderland (LDHS)	
SRS G.18-19	(NT) - Northern (TP) - TransPennine Express	(T044) & (NT) - (3 Trains) Darlington to Middlesbrough/Saltburn (Peak) (T044) & (NT) - (2 Trains) Darlington to Middlesbrough/Saltburn (Off peak) (T039) & (TP) - (1 Train) Manchester Airport to Middlesbrough (T044) & (NT) - (1 Train) Middlesbrough to Newcastle/Hexham	
SRS G.20-23	(NT) - Northern (EM) - East Midlands Trains	(T018) & (NT) - (1 Train) Sheffield to Lincoln (T018) & (NT) - (5 Trains) Doncaster to Lincoln	(T018) & (EM) - (8 Trains) Lincoln to Peterborough (T018) & (EM) - (5 Trains) Spalding to Perterborough
SRS G.21	(EM) - East Midlands Trains (GR) - Virgin Trains East Coast	(T027) & (EM) - (1 Train) Leicester to Lincoln	(T027) & (EM) - (7 Trains) Grimsby to Newark North Gate
SRS G.22	(NT) - Northern		(T028) & (NT) - (3 Trains) Cleethorpes to Sheffield (Saturday only)
SRS H.01	(NT) - Northern	(Txxx) & (NT) - (28 Trains) (Peak) (Txxx) & (NT) - (24 Trains) (Off peak)	
SRS H.03	(NT) - Northern	(T038) & (NT) - (2 Trains) Leeds to Ilkley (T036) & (NT) - (2 Trains) Leeds to Skipton (T036) & (NT) - (2 Trains) Leeds to Bradford Forster Square (T036) & (NT) - (2 Trains) Skipton to Carliste or Morecambe/Lancaster	
SRS H.05	(NT) - Northern (TP) - TransPennine Express	(T039) & (TP) - (5 Trains) Manchester/Liverpool to North East via Leeds (T039) & (TP) &S (NT) - (1 Train) Huddersfield to east of	

		Leeds & Manchester (T039) & (NT) - (1 Train) Huddersfield & Mirfield East Jn.	
SRS H.06	(NT) - Northern (TP) - TransPennine Express	(T040) & (NT) - (8 Trains) Leeds to Micklefield (T040) & (NT) - (2 Trains) Leeds to Micklefield (T040) & (NT) - (6 Trains) Micklerfield to Church Fenton (T040) & (TP) &S (NT) - (6 Trains) Church Fenton to Colton Jn. (T040) & (TP) &S (NT) - (1 Train) Leeds to Colton	
SRS H.07	(NT) - Northern (TP) - TransPennine Express (HT) - Hull Trains (GR) - Virgin Trains East Coast	(T040) & (NT) - (2 Trains) Micklefield to Selby (T040) & (NT) - (1 Train) Micklerfield to Hull (T029) & (HT) - (8 Trains) King's Cross to Hull (LDHS) (T029) & (NT) - (1/1,5 Train) Hull and York	(T029) & (NT) - (1 Trains) Hull to Doncaster
SRS H.08	(NT) - Northern	(T029) & (NT) - (2 Trains) Gilberdyke to Thorne (T034) & (NT) - (3 Trains) Turner Lane Jn. To Normanton (T032) & (NT) - (1 Train) Knottingley West Jn. To Pontefract East Jn.	(T032) & (NT) - (2 Trains) Goole to Knottingley (T031) & (NT) - (2 Trains) Moorthorpe to Ferrybridge (T031) & (NT) - (2 Trains) Ferrybridge to Milford Jn. (T039) & (NT) - (2 Trains) Milford Jn. To Sherburn South Jn. (T026) & (GC) - (3 Trains) Bradford to London
SRS H.09	(NT) - Northern (GC) - Grand Central	(T026) & (GC) - (3 Trains) Mirfield East Jn. To Thornhill LNW Jn. (LDHS) (T026) & (GC) - (1 Train) Thornhill LNW Jn. To Horbury Jn. (T026) & (GC) - (3 Trains) To Horbury Jn. To Wakefield Kirkgate (LDHS) (T031) & (NT) - (1 Train) Wakefield Kirkgate to Wakefield Westgate (LDHS) (T034) & (NT) - (3 Trains) Normanton to Altofts (T034) & (NT) - (2 Trains) Altofts to Methley (T034) & (NT) - (1 Train) Altofts to Whitwood (T034) & (NT) - (3 Trains) Whitwood Jn. to Castleford (T034) & (NT) - (2 Trains) trains Whitwood Jn. to Methley Jn.	(T026) & (GC) - (3 Trains) Thornhill LNW Jn. To Horbury Jn. (LDHS) (T026) & (GC) - (3 Trains) To Horbury Jn. To Wakefield Kirkgate (LDHS)

		(T034) & (NT) - (4 Trains) Methley Jn. to Leeds (T032) & (NT) - (1 Train) Castleford to Pontefract West Jn. (T032) & (NT) - (1 Train) Walkefield Kirkgate to Pontefract West Jn. (T032) & (NT) - (2 Train) Pontefract West Jn. to Pontefract East Jn. (T026) & (GC) - (3 Trains) Bradford to London	
SRS H.12	(TP) - TransPennine Express	(T029) & (TP) - (1 Train) Liverpool to Scarborough	
SRS H.13	(EM) - East Midlands Trains (TP) - TransPennine Express (NT) - Northern	(Txxx) & (NT) &S (EM) - (6 Trains) Tapton Jn. To Dore Station Jn. (Txxx) & (NT) &S (TP) - (10 Trains) Nunnery Main Line Jn. To Wincobank Station Jn. (Txxx) & (NT) &S (TP) - (7 Trains) Wincobank Station Jn. To Holmes Jn. & Aldwarke Jn. To Swinton (Txxx) & (NT) &S (TP) - (4 Trains) Holmes Jn. To Aldwarke Jn. (Txxx) & (NT) &S (TP) - (3 Trains) Holmes Jn. To Aldwarke Jn.	(Txxx) & (NT) &S (EM) - (9 Trains) Dore Station Jn. To Sheffield (Txxx) & (NT) &S (TP) - (11 Trains) Sheffield to Nunnery Main Line Jn. (T033) & (NT) - (2 Trains) Sheffield to York
SRS H.14	(TP) - TransPennine Express (NT) - Northern	(T029) & (NT) - (5 Trains) Swinton to Doncaster (T029) & (NT) - (4 Trains) Doncaster to Kirk Sandall (T029) & (NT) - (6 Trains) Kirk Sandall to Thorne Jn. (T029) & (NT) &S (TP) - (2 Trains) Thorne Jn. To Scunthorpe (T029) & (NT) - (1 Train) Scunthorpe to Wrawby Jn. (T029) & (TP) - (1 Train) Wrawby Jn. To Brocklesby Jn. (Inter-regional)	(T027) & (EM) - (7 Trains) Grimsby to Lincoln/Newark (T033) & (NT) - (2 Trains) Sheffield to York between Swinton and Moorthorpe
SRS H.15	(NT) - Northern	(T031) & (NT) - (2 Trains) Moorthorpe to Swinton	(T031) & (EM) - (4 Trains) London to Leeds
SRS H.16	(NT) - Northern	(T030) & (NT) - (1 Train) Sheffield to Retford	
SRS H.18	(NT) - Northern	(T034) & (NT) - (4 Trains) Wincobank Jn. To Barnsley (T034) & (NT) - (3 Trains) Barnsley to Horbury Jn.	
SRS H.19	(EM) - East Midlands Trains	(T029) & (TP) - (1 Train) Cleethorpes to Doncaster (T028) & (NT) - (1/2 Train) Cleethorpes to Barton on Humber	(T027) & (EM) - (7 Trains) Grimsby to Lincoln/Newark

	(TP) - TransPennine Express (NT) - Northern		

TABLE 93. TOC SERVICES. LNE

Strategic route section (SRS)	Train operator company (TOC)	Specified equipment
SRS G.01	(GR) - Virgin Trains East Coast	Class 43
		Mk4
	(GC) - Grand Central	Class 43
		Mk4
	(GR) - Virgin Trains East Coast	Class 91
		Mk4
	(GC) - Grand Central	Class 180
	(HT) - Hull Trains	Class 180
	(GN) - Great Northern	Class 313
	(GN) - Great Northern	Class 317
	(GN) - Great Northern	Class 365
	(GN) - Great Northern	Class 387
SRS G.05	(GR) - Virgin Trains East Coast	Class 43
		Mk3
	(GC) - Grand Central	Class 43
		Mk3
	(EM) - East Midlands Trains	Class 43
		Mk3
	(GR) - Virgin Trains East Coast	Class 91
		Mk4
	(EM) - East Midlands Trains	Class 153
	(EM) - East Midlands Trains	Class 156
	(EM) - East Midlands Trains	Class 158
	(HT) - Hull Trains	Class 180
	(GC) - Grand Central	Class 180
	(EM) - East Midlands Trains	Class 222
SRS G.06	(GR) - Virgin Trains East Coast	Class 43
		Mk3

	(XC) - CrossCountry	Class 43
		Mk3
	(GR) - Virgin Trains East Coast	Class 91
		Mk4
	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
	(NT) - Northern	Class 321
SRS G.07	(GR) - Virgin Trains East Coast	Class 43
		Mk3
	(GC) - Grand Central	Class 43
		Mk3
	(XC) - CrossCountry	Class 43
		Mk3
	(GR) - Virgin Trains East Coast	Class 91
		Mk4
	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
	(NT) - Northern	Class 321

	(GC) - Grand Central	Class 180
	(HT) - Hull Trains	Class 180
SRS G.08	(GR) - Virgin Trains East Coast	Class 43
		Mk3
	(GC) - Grand Central	Class 43
		Mk3
	(XC) - CrossCountry	Class 43
		Mk3
	(GR) - Virgin Trains East Coast	Class 91
		Mk4
	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
	(GC) - Grand Central	Class 180
	(NT) - Northern	Class 321
	(TP) - TransPennine Express	Class 185
SRS G.09	(GR) - Virgin Trains East Coast	Class 43
		Mk3
	(GR) - Virgin Trains East Coast	Class 91
		Mk4
	(XC) - CrossCountry	Class 43
		Mk3
	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150

	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(TP) - TransPennine Express	Class 185
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
	(NT) - Northern	Class 321
SRS G.10	(GR) - Virgin Trains East Coast	Class 43
		Mk3
	(GR) - Virgin Trains East Coast	Class 91
		Mk4
	(XC) - CrossCountry	Class 43
		Mk3
	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
	(NT) - Northern	Class 321
SRS G.13	(NT) - Northern	Class 142
	(NT) - Northern	Class 156
	(SR) - ScotRail	Class 156
	(NT) - Northern	Class 158
	(SR) - ScotRail	Class 158
SRS G.16-17	(GC) - Grand Central	Class 43
		Mk3
	(NT) - Northern	Class 142

	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(TP) - TransPennine Express	Class 185
SRS G.18-19	(NT) - Northern	Class 142
	(NT) - Northern	Class 156
	(TP) - TransPennine Express	Class 185
SRS G.20-23	(NT) - Northern	Class 153
	(EM) - East Midlands Trains	Class 153
	(NT) - Northern	Class 156
	(EM) - East Midlands Trains	Class 156
SRS G.21	(GR) - Virgin Trains East Coast	Class 43
		Mk3
	(EM) - East Midlands Trains	Class 43
		Mk3
	(EM) - East Midlands Trains	Class 153
	(EM) - East Midlands Trains	Class 156
	(EM) - East Midlands Trains	Class 158
	(EM) - East Midlands Trains	Class 222
SRS G.22	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 153
SRS H.01	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 158
	(NT) - Northern	Class 321
	(NT) - Northern	Class 322
	(NT) - Northern	Class 333
SRS H.03	(NT) - Northern	Class 158

	(NT) - Northern	Class 321
	(NT) - Northern	Class 322
	(NT) - Northern	Class 333
SRS H.05	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 155
	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
	(TP) - TransPennine Express	Class 185
SRS H.06	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 155
	(NT) - Northern	Class 158
	(TP) - TransPennine Express	Class 185
SRS H.07	(GR) - Virgin Trains East Coast	Class 43
		Mk3
	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 158
	(NT) - Northern	Class 180
	(HT) - Hull Trains	Class 180
	(TP) - TransPennine Express	Class 185
SRS H.08	(NT) - Northern	Class 144
	(NT) - Northern	Class 155
	(NT) - Northern	Class 158
SRS H.09	(GC) - Grand Central	Class 43
		Mk3

	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 158
	(GC) - Grand Central	Class 180
SRS H.12	(TP) - TransPennine Express	Class 185
SRS H.13	(EM) - East Midlands Trains	Class 43
		Mk3
	(NT) - Northern	Class 153
	(EM) - East Midlands Trains	Class 153
	(EM) - East Midlands Trains	Class 156
	(NT) - Northern	Class 158
	(EM) - East Midlands Trains	Class 158
	(EM) - East Midlands Trains	Class 222
SRS H.14	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153
	(NT) - Northern	Class 158
	(TP) - TransPennine Express	Class 185
SRS H.15	(NT) - Northern	Class 144
	(NT) - Northern	Class 155
	(NT) - Northern	Class 158
SRS H.16	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 153
SRS H.18	(NT) - Northern	Class 142
	(NT) - Northern	Class 144
	(NT) - Northern	Class 150
	(NT) - Northern	Class 153

	(NT) - Northern	Class 156
	(NT) - Northern	Class 158
SRS H.19	(NT) - Northern	Class 142
	(NT) - Northern	Class 153
	(EM) - East Midlands Trains	Class 153
	(TP) - TransPennine Express	Class 185

TABLE 94. TOC SPECIFIED EQUIPMENT. LNE

Strategic route section (SRS)	Route type (P/S)	Lines of route description (LOR)
SRS I.01	Primary	LN3201 - ST. PANCRAS TO TAPTON JN
SRS I.02	Primary	LN3201 - ST. PANCRAS TO TAPTON JN LN3204 - TRENT SOUTH JN. TO NOTTINGHAM EAST JN.
SRS I.03	Primary	LN3201 - ST. PANCRAS TO TAPTON JN LN3501 - DERBY LONDON ROAD JN. TO TAMWORTH
SRS I.04	Secondary	LN3252 - MANSFIELD JN. TO TROWELL SOUTH JN. LN3207 - TRENT EAST JN. TO CLAY CROSS NORTH JN. LN3255 - RADFORD JN. TO KIRKBY LANE END JN. LN3273 - CODNOR PARK JN. TO SHIREBROOK JN. LN768 - MANSFIELD WOODHOUSE TO SHIREOAKS EAST JN. LN782 - WOODEND JN. TO SHIREOAKS WEST JN.
SRS I.05	Secondary	LN3625 - NOTTINGHAM EAST JN. TO NEWARK FLAT CROSSING
SRS I.09	Secondary	LN3232 - WIGSTON NORTH JN. TO HINCKLEY
SRS I.10	Secondary	LN3615 - HELPSTON JN. TO SYSTON SOUTH JN. LN3601 - KETTERING NORTH JN. TO MANTON JN.
SRS I.11	Secondary	LN3505 - NORTH STAFFORD JN. TO STOKE JN.

TABLE 95. LINES OF ROUTE DESCRIPTION. EM

Strategic route section (SRS)	Route type (P/S)	Infrastructure RA	Infrastructure gauge	Signalling method	Slow lines speed S1 [mph]	Fast lines speed S2 [mph]	Electrification system
SRS I.01	Primary	RA8	W7 W8	TCB	90	125	AC 25kV OHL None
SRS I.02	Primary	RA8	W6 W7 W8 W10 W12	TCB	90	125	AC 25kV OHL None
SRS I.03	Primary	RA8	W7 W8 W12	TCB	70	125	None
SRS I.04	Secondary	RA7 RA8	W6 W8 W10 W12	TCB AB	75	80	None
SRS I.05	Secondary	RA8	W8	TCB AB	60	60	None
SRS I.09	Secondary	RA8	W8 W10	TCB	75	75	None
SRS I.10	Secondary	RA8 RA9	W7 W8 W10	TCB AB	75	90	None
SRS I.11	Secondary	RA8	W7	TCB AB	70	70	None

TABLE 96. ROUTE CAPABILITY OVERVIEW. LE

Strategic route section (SRS)	Train operator companies (TOC)	Trains per hour (TPH)	Trains per day (TPD)
SRS I.01	(TL) - Thameslink (EM) - East Midlands Trains	(T052) & (EM) - (5 Trains) (LDHS) (T052) & (TL) - (15 Trains) (Peak) (T052) & (TL) - (8 Trains) (Off peak)	
SRS I.02	(EM) - East Midlands Trains	(T053) & (EM) - (4 Trains) Bedford to Nottingham (LDHS) (T053) & (EM) - (2 Trains) Bedford to Sheffield (LDHS) (T053) & (EM) - (2 Trains) Leicester to Nottingham (LDHS) (T053) & (EM) - (1 Train) Leicester to Nottingham (Local) (T053) & (EM) - (1 Train) Wigston North Jn. to Syston East Jn. (Interurban) (T053) & (EM) - (2 Trains) Trent East Jn. to Nottingham (LDHS) (T053) & (EM) - (3 Trains) Trent East Jn. to Nottingham (Local) (T053) & (EM) - (1 Train) Trent East Jn. to Nottingham (Interurban)	
SRS I.03	(EM) - East Midlands Trains (XC) - CrossCountry	(T057) & (XC) - (4 Train) (LDHS) (T057) & (XC) - (1 Train) (Interurban) (T056) & (EM) - (3 Trains) (Local)	
SRS I.04	(EM) - East Midlands Trains (NT) - Northern	(T034) & (NT) - (1 Train) (LDHS) (T055) & (EM) - (3 Trains) (Local)	
SRS I.05	(EM) - East Midlands Trains	(T027) & (EM) - (2 Trains) Nottingham to Newark	
SRS I.09	(XC) - CrossCountry	(T047) & (XC) - (1 Train) Nuneaton to Wigston North Jn. (Interurban) (T047) & (XC) - (1 Train) Nuneaton to Wigston North Jn. (Local)	
SRS I.11	(EM) - East Midlands Trains	(T050) & (EM) - (1 Train) (Local)	

TABLE 97. TOC SERVICES. EM

Strategic route section (SRS)	Train operator company (TOC)	Specified equipment
SRS I.01	(EM) - East Midlands Trains	Class 43
		Class Mk3
	(EM) - East Midlands Trains	Class 153
	(EM) - East Midlands Trains	Class 156
	(EM) - East Midlands Trains	Class 158
	(EM) - East Midlands Trains	Class 222
	(TL) - Thameslink	Class 319
	(TL) - Thameslink	Class 377
	(TL) - Thameslink	Class 700
SRS I.02	(EM) - East Midlands Trains	Class 43
		Class Mk3
	(EM) - East Midlands Trains	Class 153
	(EM) - East Midlands Trains	Class 156
	(EM) - East Midlands Trains	Class 158
	(EM) - East Midlands Trains	Class 222
SRS I.03	(XC) - CrossCountry	Class 43
		Class Mk3
	(EM) - East Midlands Trains	Class 153
	(EM) - East Midlands Trains	Class 156
	(EM) - East Midlands Trains	Class 158
	(EM) - East Midlands Trains	Class 222
	(XC) - CrossCountry	Class 170
	(XC) - CrossCountry	Class 220
	(XC) - CrossCountry	Class 221
SRS I.04	(NT) - Northern	Class 150
	(EM) - East Midlands Trains	Class 153
	(NT) - Northern	Class 153
	(EM) - East Midlands Trains	Class 156

	(NT) - Northern	Class 156
	(EM) - East Midlands Trains	Class 158
	(NT) - Northern	Class 158
	(NT) - Northern	Class 185
	(EM) - East Midlands Trains	Class 222
SRS I.05	(EM) - East Midlands Trains	Class 153
	(EM) - East Midlands Trains	Class 156
	(EM) - East Midlands Trains	Class 158
SRS I.09	(XC) - CrossCountry	Class 170
SRS I.10	(EM) - East Midlands Trains	Class 43
		Class Mk3
	(XC) - CrossCountry	Class 43
		Class Mk3
	(EM) - East Midlands Trains	Class 156
	(EM) - East Midlands Trains	Class 158
	(XC) - CrossCountry	Class 170
	(EM) - East Midlands Trains	Class 222
SRS I.11	(EM) - East Midlands Trains	Class 153
	(EM) - East Midlands Trains	Class 156
	(EM) - East Midlands Trains	Class 158

TABLE 98. TOC SPECIFIED EQUIPMENT. EM

Appendix 3. Specified equipment technical information

British class	RSM type	Manufacturer	Year of manufacture
Class 139	-	Parry People Movers	2008
Class 142	DMU	BREL	1985-1987
Class 143	DMU	BREL	1985-1986
Class 144	DMU	BREL	1986-1987
Class 150	DMU	BREL	1987
Class 153	DMU	Leyland bus	1987-1988
Class 155	DMU	Leyland bus	1988
Class 156	DMU	Metro-Cammell	1988
Class 158	DMU	BREL	1989-1992
Class 159	DMU	BREL	1989-1993
Class 165	DMU	BREL	1990-1992
Class 166	DMU	ABB	1992-1993
Class 168	DMU	Bombardier	1998-2004
Class 170	DMU	Bombardier	1998-2005
Class 171	DMU	Bombardier	2003-2005
Class 172	DMU	Bombardier	2010-2011
Class 175	DMU	Alstom	1999-2001
Class 180	DMU	Alstom	2000-2001
Class 185	DMU	Siemens	2005-2006
Class 220	DEMU	Bombardier	2000-2001
Class 221	DEMU	Bombardier	2001-2002
Class 222	DEMU	Bombardier	2003-2005
Class 313	EMU	BREL	1976-1977
Class 314	EMU	BREL	1979
Class 315	EMU	BREL	1980-1985

Class 317	EMU	BREL	1981-1982
Class 318	EMU	BREL	1985-1986
Class 319	EMU	BREL	1987-1990
Class 320	EMU	BREL	1990
Class 321	EMU	BREL	1988-1990
Class 322	EMU	BREL	1990
Class 323	EMU	Hunslet TPL	1992-1993
Class 333	EMU	CAF	2001-2003
Class 334	EMU	Alstom	1999-2002
Class 350	EMU	Siemens	2004-2014
Class 360	EMU	Siemens	2002-2008
Class 365	EMU	BREL	1996
Class 37	Diesel locomotive	English Electric	1960-1965
Class 375	EMU	Bombardier	2002-2004
Class 376	EMU	Bombardier	2004-2005
Class 377	EMU	Bombardier	2001-2014
Class 379	EMU	Bombardier	2010-2011
Class 380	EMU	Siemens	2009-2011
Class 387	EMU	Bombardier	2014-2016
Class 390	EMU	Alstom	2001-2012
Class 395	EMU	Hitachi	2007-2009
Class 43	Diesel locomotive	BREL	1975-1982
Class 444	EMU	Siemens	2003-2004
Class 450	EMU	Siemens	2003-2006
Class 455	EMU	BREL	1982-1985
Class 465	EMU	Metro-Cammell	1991-1993
Class 466	EMU	Alstom	1993-1994
Class 507	EMU	BREL	1978-1980
Class 508	EMU	BREL	1978-1980
Class 57	Diesel locomotive	Brush Traction	1964-1967

Class 66	Diesel & Electric locomotive	EMD	1998-2015
Class 67	Diesel locomotive	Alstom	1999-2000
Class 68	Diesel & Electric locomotive	Vossloh	2013-2017
Class 700	EMU	Siemens	2014
Class 73	Diesel & Electric locomotive	BR Eastleigh Works	1962-1967
Class 90	Electric locomotive	BREL	1987-1990
Class 91	Electric locomotive	BREL	1988-1991
Class 92	Electric locomotive	ABB	1993-1996
Class Mk2	Coach	BREL	1963-1975
Class Mk3	Coach	BREL	1975-1988
Class Mk4	Coach	Metro-Cammell	1989

FIGURE 19. RAILWAY VEHICLE MANUFACTURER INFORMATION

British class	RSM type	Length [m]	Width [m]	Height [m]	Vehicle RA	Nº Wheelsets	Tare [tons]	Max. Speed [mph]	Traction type	Safety systems	Coupling type
Class 139	-	9,60	2,40	3,20	RA1	2	12,00	32	Self powered	-	N/A
Class 142	DMU	15,55	2,80	3,86	RA1	4	25,00	75	Self powered	AWS TPWS	BSI
Class 143	DMU	15,55	2,70	3,73	RA1	2	12,50	75	Self powered	AWS TPWS	BSI
Class 144	DMU	15,55	2,70	3,73	RA1	2	24,96	75	Self powered	AWS TPWS	BSI
Class 150	DMU	20,00	2,82	3,77	RA1	4	37,50	75	Self powered	AWS TPWS	BSI
Class 153	DMU	23,00	2,70	3,77	RA1	4	45,00	75	Self powered	AWS TPWS	BSI
Class 155	DMU	23,00	2,70	3,77	RA1	4	39,40	75	Self powered	AWS TPWS	BSI
Class 156	DMU	23,00	2,73	3,77	RA1	4	36,00	75	Self powered	AWS TPWS	BSI
Class 158	DMU	23,00	2,70	3,71	RA2	4	40,80	90	Self powered	AWS TPWS ERTMS	BSI
Class 159	DMU	23,00	2,70	3,81	RA1	4	40,80	90	Self powered	AWS TPWS	BSI
Class 165	DMU	23,00	2,81	3,79	RA1	4	40,10	90	Self powered	AWS TPWS GW ATP	BSI
Class 166	DMU	23,00	2,81	3,58-3,86	RA1	4	39,60	90	Self powered	AWS TPWS	BSI
Class 168	DMU	23,00	2,70	3,77	RA1-RA3	4	34,75-57,5	100	Self powered	AWS TPWS GW ATP	BSI

Class 170	DMU	23,00	2,69	3,77	RA2	4	45,00	100	Self powered	AWS TPWS	BSI
Class 171	DMU	23,00	2,69	3,77	RA2	4	42,00	100	Self powered	AWS TPWS	Dellner
Class 172	DMU	23,00	2,69	3,77	RA2	4	41,60	100	Self powered	AWS TPWS GW ATP	BSI
Class 175	DMU	23,00	2,73	3,58-3,85	RA1	4	57,50	100	Self powered	AWS TPWS	Scharfenberg
Class 180	DMU	23,00	2,73	3,85-3,85	RA1	4	57,50	125	Self powered	AWS TPWS GW ATP	Scharfenberg
Class 185	DMU	23,00	2,67	3,85	RA1-RA3	4	56,10	100	Self powered	AWS TPWS	Dellner
Class 220	DEMU	23,00	2,73	3,85-3,85	RA2	4	46,40	125	N/A	AWS TPWS	Dellner
Class 221	DEMU	23,00	2,73	3,85-3,85	RA2	4	56,75	125	N/A	AWS TPWS TASS	Dellner
Class 222	DEMU	23,00	2,73	3,85-3,85	RA2	4	48,00	125	N/A	AWS TPWS	Dellner
Class 313	EMU	20,00	2,82	3,58	RA1-RA3	4	34,83	75	AC 25kV OHL DC 750V	AWS TPWS	Tightlock
Class 314	EMU	20,00	2,82	3,58	RA1	4	34,50	75	AC 25kV OHL	N/A	Tightlock
Class 315	EMU	20,00	2,82	3,58	RA1	4	35,00	75	AC 25kV OHL	N/A	Tightlock
Class 317	EMU	20,00	2,82	3,70	RA1	4	35,00	100	AC 25kV OHL	N/A	Tightlock
Class 318	EMU	20,00	2,82	3,77	RA1-RA3	4	24,96-45	90	AC 25kV OHL	N/A	Tightlock
Class 319	EMU	20,00	2,82	3,58	RA1	4	50,60	100	AC 25kV OHL DC 750V	AWS TPWS	Tightlock
Class 320	EMU	20,00	2,82	3,76	RA1-RA3	4	24,96-45	90	AC 25kV OHL	N/A	Tightlock
Class 321	EMU	20,00	2,82	3,78	RA1	4	35,00	100	AC 25kV OHL	N/A	Tightlock

Class 322	EMU	20,00	2,82	3,78	RA1-RA3	4	35,45	100	AC 25kV OHL	N/A	Tightlock
Class 323	EMU	23,00	2,80	3,73	RA3	4	41,16	90	AC 25kV OHL	AWS TPWS	Tightlock
Class 333	EMU	23,00	2,75	3,58-3,85	RA1	4	50,60	100	AC 25kV OHL	AWS	Scharfenberg
Class 334	EMU	20,00	2,81	3,77	RA1-RA3	4	41,57	90	AC 25kV OHL	AWS	Tightlock
Class 350	EMU	20,00	2,79	3,73	RA2	4	45,10	100	AC 25kV OHL DC 750V	N/A	Dellner
Class 360	EMU	20,00	2,80	3,58-3,85	RA2	4	45,00	100	AC 25kV OHL	N/A	Dellner
Class 365	EMU	20,00	2,81	3,74	RA1-RA3	4	37,80	100	AC 25kV OHL DC 750V	N/A	Tightlock
Class 37	Diesel locomotive	18,75	2,71	3,89	RA5	6	100,00	90	Self powered	N/A	Screw
Class 375	EMU	20,00	2,80	3,77	RA1-RA3	4	44,36	100	AC 25kV OHL DC 750V	N/A	Dellner
Class 376	EMU	20,00	2,80	3,77	RA1-RA3	4	24,96-45	75	DC 750V	N/A	Dellner
Class 377	EMU	20,00	2,80	3,78	RA1-RA3	4	44,36	100	AC 25kV OHL DC 750V	N/A	Dellner
Class 379	EMU	20-23	2,67-2,82	3,58-3,85	RA1-RA3	4	34,75-57,5	100	AC 25kV OHL	N/A	Dellner
Class 380	EMU	23,00	2,80	3,77	RA1-RA3	4	34,75-57,5	100	AC 25kV OHL	N/A	Dellner
Class 387	EMU	20,00	2,80	3,77	RA1-RA3	4	46,64	110	AC 25kV OHL DC 750V	N/A	Dellner
Class 390	EMU	25,00	2,73	3,85-3,85	RA1-RA2	4	55,60	125	AC 25kV OHL	AWS TPWS TASS	Dellner
Class 395	EMU	20,00	2,81	3,85	RA1-RA2	4	44,10	140	AC 25kV OHL DC 750V	TPWS TVM430 ERTMS KVB	Scharfenberg
Class 43	Diesel locomotive	18,00	2,74	3,76-3,93	RA5	4	70,25	125	Self powered	N/A	Alliance
Class 444	EMU	23,00	2,80	3,58-3,85	RA3	4	51,30	100	DC 750V	N/A	Dellner

Class 450	EMU	20,00	2,80	3,58-3,85	RA3	4	48,60	100	DC 750V	N/A	Dellner
Class 455	EMU	20,00	2,82	3,77	RA1-RA3	4	34,00	75	DC 750V	N/A	Tightlock
Class 465	EMU	20,00	2,81	3,77	RA1	4	39,20	75	DC 750V	N/A	Tightlock
Class 466	EMU	20,00	2,80	3,77	RA1	4	40,60	75	DC 750V	N/A	Tightlock
Class 507	EMU	20,00	2,82	3,58	RA1	4	37,00	75	DC 750V	AWS	Tightlock
Class 508	EMU	20,00	2,82	3,58	RA1	4	37,00	75	DC 750V	AWS	Tightlock
Class 57	Diesel locomotive	20,00	2,79	3,96-3,96	RA6	6	120,60	100	Self powered	N/A	Screw Dellner
Class 66	Diesel & Electric locomotive	21,40	2,65	3,90	RA7	6	129,60	75	N/A	N/A	Screw Swinghead
Class 67	Diesel locomotive	20,00	2,71	3,93	RA8	4	90,00	125	Self powered	N/A	Swinghead
Class 68	Diesel & Electric locomotive	20-18,8	2,74-2,79	3,96-3,96	RA7	6	85,00	100	N/A	N/A	N/A
Class 700	EMU	20,00	2,80	3,58-3,85	RA1-RA3	4	34,75	100	AC 25kV OHL DC 750V	AWS TPWS ERTMS	N/A
Class 73	Diesel & Electric locomotive	16,36	N/A	3,89-3,9	RA6	4	76,80	90	DC 750V	AWS	Screw
Class 90	Electric locomotive	18,80	2,74	3,96	RA7	4	84,00	110	25 kV 50 Hz AC	N/A	N/A
Class 91	Electric locomotive	20,00	2,74	3,76	RA7	4	81,50	125	25 kV 50 Hz AC	N/A	Drophead buckeye
Class 92	Electric locomotive	21,36	2,64	3,89-3,9	RA8	6	126,00	90	AC 25kV OHL DC 750V	N/A	Screw
Class Mk2	Coach	20,00	2,82	3,65	RA1	4	35,00	100	N/A	N/A	Drawhook Drophead buckeye
Class Mk3	Coach	23,00	2,74	3,81	RA1	4	33-38	125	N/A	N/A	Drawhook Drophead buckeye
Class Mk4	Coach	23	2,73	3,79	RA1	4	39,9-43,5	125	N/A	N/A	Tightlock

FIGURE 20. RAILWAY VEHICLE TECHNICAL INFORMATION

Appendix 4. RA assessment results

The results of the RA assessment carried out for primary and secondary lines are provided below. For each strategic route section, the minimum infrastructure RA values are checked and labelled into one of these categories:

- Location ASS 1
- Location ASS 2
- Location ASS 3

AP. 4.1. WALES

Strategic route section (SRS)	Route type (P/S)	Min. Infras. RA	Max. Infras. RA	RA assessment
SRS L.08-09	Primary	RA5	RA7	Loc. ASS 2
SRS L.17	Secondary	RA5	RA8	Loc. ASS 2
SRS L.18	Secondary	RA6	RA8	Loc. ASS 2
SRS L.19	Secondary	RA6	RA6	Loc. ASS 2
SRS L.20-22	Secondary	RA6	RA8	Loc. ASS 2
SRS L.01	Primary	RA7	RA8	Loc. ASS 2
SRS L.23	Secondary	RA7	RA7	Loc. ASS 2
SRS L.02-03	Primary	RA8	RA8	Loc. ASS 2
SRS L.04-05	Primary	RA8	RA8	Loc. ASS 2
SRS L.10-12	Primary	RA8	RA8	Loc. ASS 2
SRS L.13-14	Primary	RA8	RA8	Loc. ASS 2

TABLE 99. MAX. AND MIN. RA VALUES FOR P/S ROUTES. WALES

AP. 4.2. SCOTLAND

Strategic route section (SRS)	Route type (P/S)	Min. Infras. RA	Max. Infras. RA	RA assessment
SRS P.13	Secondary	RA3	RA3	Loc. ASS 1
SRS Q.09	Secondary	RA3	RA7	Loc. ASS 1
SRS Q.03	Secondary	RA5	RA10	Loc. ASS 2
SRS Q.04	Secondary	RA5	RA10	Loc. ASS 2
SRS Q.07	Secondary	RA5	RA10	Loc. ASS 2
SRS Q.11	Secondary	RA5	RA5	Loc. ASS 2
SRS Q.12	Secondary	RA5	RA10	Loc. ASS 2
SRS G.12	Secondary	RA5	RA5	Loc. ASS 2

SRS Q.10	Secondary	RA7	RA10	Loc. ASS 2
SRS P.01	Primary	RA8	RA10	Loc. ASS 2
SRS P.06	Secondary	RA8	RA10	Loc. ASS 2
SRS P.08	Secondary	RA8	RA8	Loc. ASS 2
SRS P.11	Secondary	RA8	RA10	Loc. ASS 2
SRS Q.01	Primary	RA8	RA10	Loc. ASS 2
SRS Q.13	Secondary	RA8	RA8	Loc. ASS 2
SRS P.02	Primary	RA10	RA10	Loc. ASS 3
SRS P.03	Secondary	RA10	RA10	Loc. ASS 3
SRS P.04	Secondary	RA10	RA10	Loc. ASS 3
SRS P.05	Secondary	RA10	RA10	Loc. ASS 3
SRS P.07	Secondary	RA10	RA10	Loc. ASS 3
SRS P.09	Secondary	RA10	RA10	Loc. ASS 3
SRS P.10	Secondary	RA10	RA10	Loc. ASS 3
SRS N.06	Secondary	RA10	RA10	Loc. ASS 3
SRS Q.02	Secondary	RA10	RA10	Loc. ASS 3
SRS Q.06	Secondary	RA10	RA10	Loc. ASS 3
SRS Q.08	Secondary	RA10	RA10	Loc. ASS 3
SRS G.11	Primary	RA10	RA10	Loc. ASS 3

TABLE 100. MAX. AND MIN. RA VALUES FOR P/S ROUTES. SCOTLAND

AP. 4.3. ANGLIA

Strategic route section (SRS)	Route type (P/S)	Min. Infras. RA	Max. Infras. RA	RA assessment
SRS D.20	Secondary	RA7	RA8	Loc. ASS 2
SRS D.06	Secondary	RA8	RA8	Loc. ASS 2
SRS D.07	Secondary	RA8	RA9	Loc. ASS 2
SRS D.09	Secondary	RA8	RA8	Loc. ASS 2
SRS D.10	Primary	RA8	RA8	Loc. ASS 2
SRS D.11	Primary	RA8	RA8	Loc. ASS 2
SRS D.12	Primary	RA8	RA8	Loc. ASS 2

TABLE 101. MAX. AND MIN. RA VALUES FOR P/S ROUTES. ANGLIA

AP. 4.4. WESSEX

Strategic route section (SRS)	Route type (P/S)	Min. Infras. RA	Max. Infras. RA	RA assessment
SRS C.01	Primary	RA4	RA8	Loc. ASS 1
SRS C.15	Secondary	RA6	RA8	Loc. ASS 2
SRS C.02	Primary	RA8	RA8	Loc. ASS 2
SRS C.03	Primary	RA8	RA8	Loc. ASS 2
SRS C.04	Secondary	RA8	RA8	Loc. ASS 2
SRS C.05	Secondary	RA8	RA8	Loc. ASS 2
SRS C.08	Secondary	RA8	RA8	Loc. ASS 2
SRS C.09	Secondary	RA8	RA8	Loc. ASS 2

SRS C.16	Secondary	RA8	RA8	Loc. ASS 2

TABLE 102. MAX. AND MIN. RA VALUES FOR P/S ROUTES. WESSEX

AP. 4.5. SOUTH EAST (KENT AND SUSSEX)

Strategic route section (SRS)	Route type (P/S)	Min. Infras. RA	Max. Infras. RA	RA assessment
SRS A.03	Primary	RA8	RA8	Loc. ASS 2
SRS A.04	Primary	RA8	RA8	Loc. ASS 2
SRS A.05	Primary	RA8	RA8	Loc. ASS 2
SRS A.14	Primary	RA8	RA8	Loc. ASS 2

TABLE 103. MAX. AND MIN. RA VALUES FOR P/S ROUTES. KENT

Strategic route section (SRS)	Route type (P/S)	Min. Infras. RA	Max. Infras. RA	RA assessment
SRS B.01	Primary	RA8	RA8	Loc. ASS 2
SRS B.02	Primary	RA8	RA8	Loc. ASS 2
SRS B.15	Secondary	RA8	RA8	Loc. ASS 2

TABLE 104. MAX. AND MIN. RA VALUES FOR P/S ROUTES. SUSSEX

AP. 4.6. WESTERN

Strategic route section (SRS)	Route type (P/S)	Min. Infras. RA	Max. Infras. RA	RA assessment
SRS K.07	Secondary	RA6	RA6	Loc. ASS 2
SRS J.11	Secondary	RA7	RA7	Loc. ASS 2
SRS K.03	Secondary	RA7	RA8	Loc. ASS 2
SRS J.01	Primary	RA8	RA8	Loc. ASS 2
SRS J.02	Primary	RA8	RA8	Loc. ASS 2
SRS J.03	Primary	RA8	RA8	Loc. ASS 2
SRS J.04	Primary	RA8	RA8	Loc. ASS 2
SRS J.05	Primary	RA8	RA8	Loc. ASS 2
SRS J.06	Primary	RA8	RA8	Loc. ASS 2
SRS J.07	Primary	RA8	RA8	Loc. ASS 2
SRS J.10	Secondary	RA8	RA8	Loc. ASS 2
SRS K.01	Primary	RA8	RA8	Loc. ASS 2
SRS K.02	Primary	RA8	RA8	Loc. ASS 2
SRS K.04	Secondary	RA8	RA8	Loc. ASS 2
SRS K.06	Secondary	RA8	RA8	Loc. ASS 2
SRS K.15	Primary	RA8	RA8	Loc. ASS 2
SRS K.16	Primary	RA8	RA8	Loc. ASS 2

TABLE 105. MAX. AND MIN. RA VALUES FOR P/S ROUTES. WESTERN

AP. 4.7. LONDON NORTH WESTERN (NORTH AND SOUTH)

Strategic route section (SRS)	Route type (P/S)	Min. Infras. RA	Max. Infras. RA	RA assessment
SRS H.O01	Secondary	RA6	RA8	Loc. ASS 2
SRS H.24	Secondary	RA7	RA8	Loc. ASS 2
SRS H.28	Secondary	RA7	RA8	Loc. ASS 2
SRS H.33	Secondary	RA7	RA8	Loc. ASS 2
SRS H.39	Secondary	RA7	RA8	Loc. ASS 2
SRS H.22	Primary	RA8	RA8	Loc. ASS 2
SRS H.25	Primary	RA8	RA8	Loc. ASS 2
SRS N.03	Primary	RA8	RA8	Loc. ASS 2
SRS N.05	Primary	RA8	RA8	Loc. ASS 2
SRS H.05	Secondary	RA8	RA9	Loc. ASS 2
SRS H.10	Secondary	RA8	RA9	Loc. ASS 2
SRS H.17	Secondary	RA8	RA8	Loc. ASS 2
SRS H.23	Secondary	RA8	RA8	Loc. ASS 2
SRS H.26	Secondary	RA8	RA8	Loc. ASS 2
SRS H.27	Secondary	RA8	RA8	Loc. ASS 2
SRS H.29	Secondary	RA8	RA8	Loc. ASS 2
SRS H.30	Secondary	RA8	RA8	Loc. ASS 2
SRS H.31	Secondary	RA8	RA8	Loc. ASS 2
SRS H.32	Secondary	RA8	RA8	Loc. ASS 2
SRS H.35	Secondary	RA8	RA8	Loc. ASS 2
SRS H.37	Secondary	RA8	RA8	Loc. ASS 2
SRS H.38	Secondary	RA8	RA8	Loc. ASS 2
SRS H.40	Secondary	RA8	RA8	Loc. ASS 2
SRS H.42	Secondary	RA8	RA8	Loc. ASS 2
SRS H.45	Secondary	RA8	RA8	Loc. ASS 2
SRS H.46	Secondary	RA8	RA8	Loc. ASS 2
SRS N.04	Secondary	RA8	RA8	Loc. ASS 2
SRS N.07	Secondary	RA8	RA8	Loc. ASS 2
SRS N.08	Secondary	RA8	RA8	Loc. ASS 2
SRS N.09	Secondary	RA8	RA8	Loc. ASS 2
SRS N.13	Secondary	RA8	RA8	Loc. ASS 2
SRS N.06	Secondary	RA10	RA10	Loc. ASS 3

TABLE 106. MAX. AND MIN. RA VALUES FOR P/S ROUTES. LNW NORTH

Strategic route section (SRS)	Route type (P/S)	Min. Infras. RA	Max. Infras. RA	RA assessment
M.15	Primary	RA7	RA8	Loc. ASS 2
M.12	Primary	RA8	RA8	Loc. ASS 2
M.05	Primary	RA8	RA8	Loc. ASS 2
M.06-07	Primary	RA8	RA8	Loc. ASS 2
M.08-09-19-21	Primary-Secondary	RA8	RA8	Loc. ASS 2
M.10-22	Primary-Secondary	RA8	RA8	Loc. ASS 2
M.11-23	Primary-Secondary	RA8	RA8	Loc. ASS 2

M.13-18-24	Primary-Secondary	RA8	RA8	Loc. ASS 2
M.14-25	Secondary	RA8	RA8	Loc. ASS 2
M.17	Secondary	RA8	RA8	Loc. ASS 2
M.20	Secondary	RA8	RA8	Loc. ASS 2
SRS N.01	Primary	RA8	RA8	Loc. ASS 2
SRS N.02	Primary	RA8	RA8	Loc. ASS 2

TABLE 107. MAX. AND MIN. RA VALUES FOR P/S ROUTES. LNW SOUTH

AP. 4.8. LONDON NORTH EAST & EAST MIDLANDS

Strategic route section (SRS)	Route type (P/S)	Min. Infras. RA	Max. Infras. RA	RA assessment
SRS H.03	Secondary	RA5	RA8	Loc. ASS 2
SRS G.16-17	Secondary	RA5	RA8	Loc. ASS 2
SRS H.18	Secondary	RA6	RA7	Loc. ASS 2
SRS G.10	Primary	RA8	RA9	Loc. ASS 2
SRS G.13	Secondary	RA8	RA8	Loc. ASS 2
SRS G.18-19	Secondary	RA8	RA8	Loc. ASS 2
SRS G.20-23	Secondary	RA8	RA8	Loc. ASS 2
SRS G.21	Secondary	RA8	RA8	Loc. ASS 2
SRS G.22	Secondary	RA8	RA8	Loc. ASS 2
SRS H.01	Primary	RA8	RA9	Loc. ASS 2
SRS H.05	Secondary	RA8	RA9	Loc. ASS 2
SRS H.06	Secondary	RA8	RA9	Loc. ASS 2
SRS H.07	Secondary	RA8	RA8	Loc. ASS 2
SRS H.08	Secondary	RA8	RA9	Loc. ASS 2
SRS H.09	Secondary	RA8	RA9	Loc. ASS 2
SRS H.12	Primary	RA8	RA8	Loc. ASS 2
SRS H.13	Primary	RA8	RA10	Loc. ASS 2
SRS H.14	Primary	RA8	RA8	Loc. ASS 2
SRS H.15	Secondary	RA8	RA8	Loc. ASS 2
SRS H.16	Secondary	RA8	RA8	Loc. ASS 2
SRS H.19	Secondary	RA8	RA8	Loc. ASS 2
SRS G.01	Primary	RA9	RA9	Loc. ASS 3
SRS G.05	Primary	RA9	RA9	Loc. ASS 3
SRS G.06	Primary	RA9	RA9	Loc. ASS 3
SRS G.07	Primary	RA9	RA10	Loc. ASS 3
SRS G.08	Primary	RA9	RA9	Loc. ASS 3
SRS G.09	Primary	RA9	RA9	Loc. ASS 3

TABLE 108. MAX. AND MIN. RA VALUES FOR P/S ROUTES. LNE

Strategic route section (SRS)	Route type (P/S)	Min. Infras. RA	Max. Infras. RA	RA assessment
SRS I.04	Secondary	RA7	RA8	Loc. ASS 2
SRS I.01	Primary	RA8	RA8	Loc. ASS 2
SRS I.02	Primary	RA8	RA8	Loc. ASS 2
SRS I.03	Primary	RA8	RA8	Loc. ASS 2
SRS I.05	Secondary	RA8	RA8	Loc. ASS 2
SRS I.09	Secondary	RA8	RA8	Loc. ASS 2
SRS I.10	Secondary	RA8	RA9	Loc. ASS 2
SRS I.11	Secondary	RA8	RA8	Loc. ASS 2

TABLE 109. MAX. AND MIN. RA VALUES FOR P/S ROUTES. EM

Appendix 5. Detailed information about critical locations ASS 1

AP. 5.1. STRATEGIC ROUTE SECTION SRS P.13

Strategic route section SRS P.13 is located at Scotland area, close to Edinburg Waverley station. It is comprised by the line:

- SC164 - NEWCRAIGHALL SOUTH JN. TO TWEEDBANK

Scotland Route Sectional Appendix[7] specifies more in detail the location, (miles and chains), where each route availability value is to be considered. Therefore, the document shows RA values of 3 for the whole line, i.e., form Shawfair to Tweedbank.

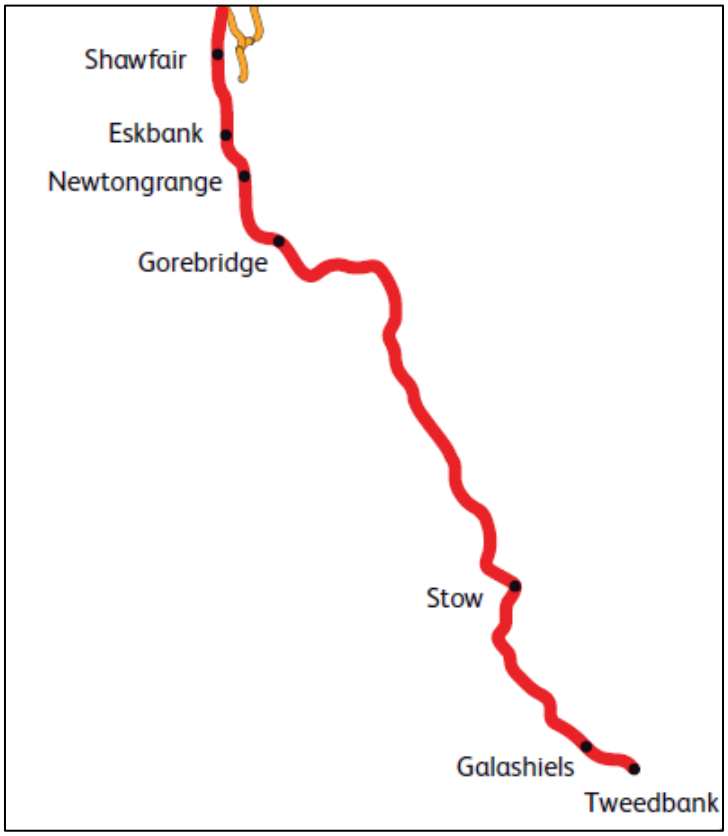

FIGURE 21. SECTIONAL ROUTE SPECIFICATION P.13

[7] Network Rail (2017), Scotland Route Sectional Appendix, http://archive.nr.co.uk/browse%20documents/sectional%20appendix/sectional%20appendix%20full%20pdf%20copies/scotland%20sectional%20appendix.pdf

Location	Line of route description (LOR)	Mileage (Mile & Chain)	Infrastructure RA	RA assessment
Nwecraighall North junction	SC164	4m 63ch	RA3	Location ASS 1
Nwecraighall South junction	SC164	5m 02ch	RA3	Location ASS 1
Tweedbank	SC164	35m 34ch	RA3	Location ASS 1

FIGURE 22. RA ASSESSMET. SRS P.13. DETAILED INFORMATION

AP. 5.2. STRATEGIC ROUTE SECTION SRS Q.09

Located at Scotland area and close to Glasgow Central station, the route runs via the Cathcart Circle. The lines comprised the Strategic route section SRS Q.09:

- SC051 - MUIRHOUSE CENTRAL JN. TO MUIRHOUSE NORTH JN.
- SC053 - NEILSTON TO CATHCART WEST JN.
- SC055 - NEWTON, HAMILTON JN. TO CATHCART WEST JN.
- SC057 - CATHCART EAST JN. TO CATHCART NORTH JN.

According to the Scotland Route Sectional Appendix RA values of 3 are restricted the route only Muirhouse Central junction via Pollshields West and up to Cathcart junction.

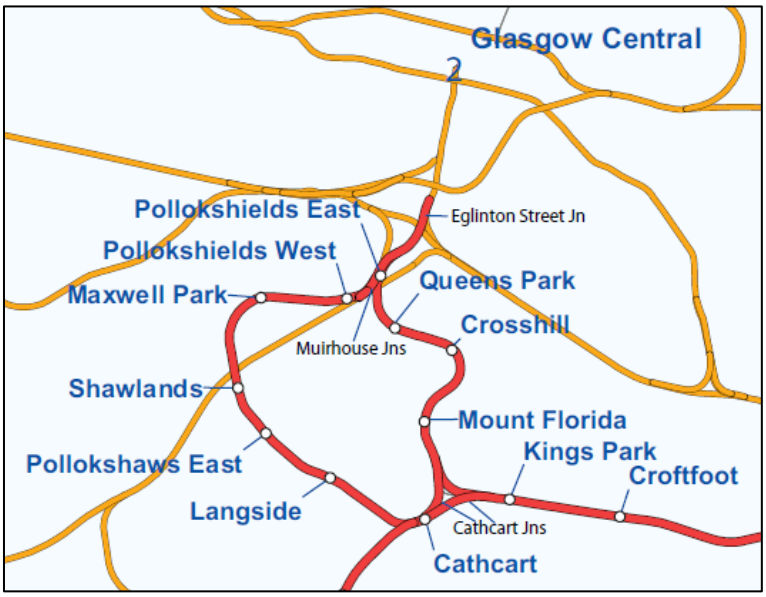

FIGURE 23. SETIONAL ROUTE SPECIFICATION Q.09

Location	Line of route description (LOR)	Mileage (Miles & Chains)	Infrastructure RA	RA assessment
Muirhouse North junction	SC031	0m 32ch	RA10	Location ASS 3
Muirhouse Central junction	SC051	0m 42ch	RA3	Location ASS 1
Pollokshields West	SC051	4m 76ch	RA3	Location ASS 1
Maxwell Park	SC051	4m 36ch	RA3	Location ASS 1
Shawlands	SC051	3m 63ch	RA3	Location

				ASS 1
Pollokshaws East	SC051	3m 33ch	RA3	Location ASS 1
Langside	SC051	2m 71ch	RA3	Location ASS 1
Carthcart	SC051	2m 13ch	RA3	Location ASS 1
Carthcart North junction	SC051	1m 63ch	RA3	Location ASS 1

FIGURE 24. RA ASSESSMENT. SRS Q.09. DETAILED INFORMATION

AP. 5.3. WESSEX PRIMARY ROUTE SRS C.01

Strategic route section SRS C01 is located at Wessex area. It departs from London Waterloo station and comprises the lines:

- SW100 - WATERLOO TO CLAPHAM JN.

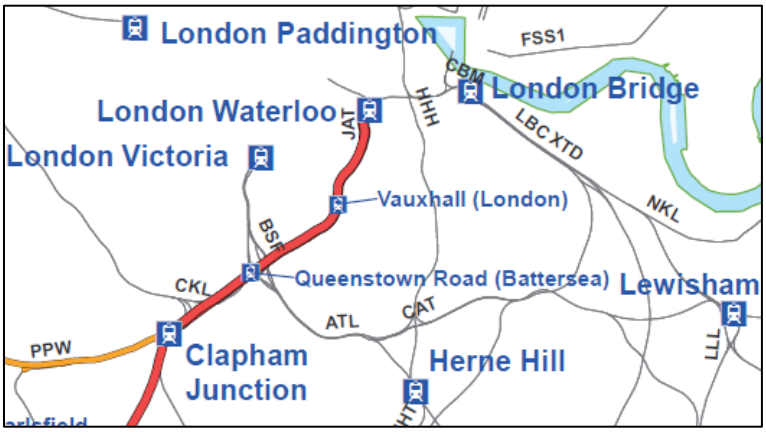

FIGURE 25. SETIONAL ROUTE SPECIFICATION C.01

Wessex Route Sectional Appendix[8] details the location, expressed in miles and chains, where each route availability value is to be considered. According to the table below, SW100 shows RA4 values from Carlisle Lane junction (close to London Waterloo station) up to Queenstown Road station

Location	Line of route description (LOR)	Mileage (Miles & Chains)	Infrastructure RA	RA assessment
London Waterloo station	SW100	0m 00ch	RA8	Location ASS 2
Carlisle Lane junction	SW100	0m 42ch	RA4	Location ASS 1
Vauxhall station	SW100	1m 29ch	RA4	Location ASS 1
Queenstown Road (Battersea) station.	SW100	2m 50ch	RA4	Location ASS 1
Crossover point	SW100	2m 65ch	RA8	Location ASS 2

FIGURE 26. RA ASSESSMENT SRS C.01. DETAILED INFORMATION

[8]Network Rail (2017), Wessex Route Sectional Appendix, http://archive.nr.co.uk/browse%20documents/sectional%20appendix/sectional%20appendix%20full%20pdf%20copies/kent%20sussex%20and%20wessex%20sectional%20appendix.pdf

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II. TABLE LIST