Welsh Route Study

March 2016
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We are delighted to present this Route Study which sets out the strategic vision for the railway in Wales between 2019 and 2043. It is an evidence based study that considers demand entirely within the Wales Route and also between Wales and other parts of Great Britain.

The railway in Wales has seen a decade of unprecedented growth, with almost 50 per cent more passenger journeys made to, from and within Wales since 2006, and our forecasts suggest that passenger growth levels will continue to be strong during the next three decades, particularly in the south east of Wales and in the north east of Wales. Demand for rail freight is expected to change to reflect global market conditions, which is likely to see a decline in the volumes of coal and steel traffic in Wales, and continued growth in intermodal container traffic.

Every day the railway supports economic growth, reduces the environmental impact of the transport sector and improves the quality of life for people and for communities. Wales relies on a safe and punctual railway and this Study sets out the industry’s plan to meet future demand so that the railway continues to make a positive difference to the economy, to the environment and to people’s lives. This is the purpose of the railway and now is the right time to set out the future strategy.

Reducing long term subsidy and delivering value to taxpayers and funders are key considerations in this Route Study. The solutions have been developed with the intention of optimising existing capacity first as this is the most efficient approach. Where this is not possible, the solutions are based on enhancing the capacity or capability of the infrastructure so that more services can operate on the network.

These solutions are presented as choices for the industry’s funders to consider. We believe they are ambitious yet realistic and they reflect what can be done in a logical and sequential approach in the immediate future and during the longer term period up to 2043.

This will build on the significant ongoing investment in modernising the rail network in Wales which has included major asset renewals and enhancement of the network such as the planned electrification of the South Wales Main Line and associated new electric rolling stock.

The opportunity for the Digital Railway to address capacity constraints and to improve customer experience is central to the planning approach we have adopted. This Route Study has been developed collaboratively with the railway industry, with funders and with stakeholders. We would like to thank all those involved in the exercise, which has been extensive, and which reflects the high level of interest in the railway in Wales. We are also grateful to the people and the organisations who took the time to respond to the Draft for Consultation published in March 2015. Details on how the consultation responses have informed the final strategy are set out in Chapter 3.

Jo Kaye
Director of Network Strategy and Capacity Planning

Paul McMahon
Route Managing Director, Wales
Executive Summary

Highlights
This Route Study is a key part of the rail industry’s Long Term Planning Process (LTPP).

It sets out proposals and choices for funders for the period up to 2023 and 2043.

Introduction
More and more people are using the railway in Wales and the border counties, and demand will continue to grow strongly in the future.

Every year, millions of tons of freight are transported by rail and there will be growth in new markets.

The railway will continue to support economic growth, the creation of jobs and the development of sustainable communities.

This Route Study sets out a plan for a railway that is fit for the future - a railway that is at the heart of the economy.

It sets out choices for the funders of the railway to sustain economic growth and sustainable communities. These choices would mean more seats for passengers, more frequent services, faster journeys, improved connectivity and more journey opportunities, and accommodating changes in demand for freight services.

Economic Context
The economy of Wales and the bordering regions relies on a safe, punctual and efficient railway. Railways connect people to employment opportunities and transport goods to the marketplace. They are fundamental to our economy and to our lives.

There has been strong growth in demand for rail in the last 10 years with almost 50% more journeys to, from and within Wales. This growth is set to continue and the railway will need more investment so that it can accommodate more people and more passenger and freight services.

Planning Approach
The Welsh Route Study is a key part of the rail industry’s strategic planning process for the future.

It assesses how demand for rail will grow in response to changes in the economy, with strong growth forecast in the commuter and business markets. It also sets out the outputs that the railway will need to deliver for passengers and freight customers, for example more seats or shorter journey times, and these are conditional based upon their affordability and value for money. These are referred to as Conditional Outputs.

Choices for Funders
This Route Study then explains the choices that exist to accommodate these conditional outputs. These are referred to as Choices for Funders and typically require investment in more trains, more services and / or more capacity in the rail infrastructure. The Choices for Funders for Control Period 6 are summarised in Table 1.

The Digital Railway
The Digital Railway is a rail industry-wide programme designed to benefit Great Britain’s economy by accelerating the digital enablement of the railway. The programme is integrating digital modernisation of the railway with industry planning and spans technology, business change and commercial innovation offering a more cost-effective and higher-performing railway that delivers a bigger economic benefit.

The digital modernisation of the railway is one part of the package for delivering a sustainable and growing railway meeting passengers’ and freight customers’ needs. As part of a package of measures the Digital Railway is a vital enabler for long-term growth because it releases latent capacity in the GB rail infrastructure to support the economy.

In most areas, work to develop technical capability is underway. The programme will seek to determine what is required to align and accelerate different initiatives to bring them into a single road map underwritten by the whole industry. The output of the programme will be a business case to Government, presented through the IIP in September 2016.

This Route Study has assessed the capacity benefits that the Digital Railway can provide in future years.
Longer Term Strategy

While the initial focus is on the immediate choices for funders for CO6, the Route Study also sets out a strategic vision for the next 30 years.

This is really the start of a conversation for the industry and funders about the identification and subsequent development of future priorities for sustaining economic growth, job creation and well connected communities.

Table 1: Choices for funders in CP6

<table>
<thead>
<tr>
<th>No</th>
<th>Choices for funders in CP6</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>More passenger capacity on the Valley Lines - operating more frequent trains and/or longer trains.</td>
<td>More seats for passengers &amp; more services</td>
</tr>
<tr>
<td>2</td>
<td>Phased programme of enhancements on Valley Lines - linked to Metro.</td>
<td>More frequent services and faster journey times</td>
</tr>
<tr>
<td>3</td>
<td>Upgrading Relief Lines between Cardiff and Severn Tunnel Junction to improve capacity and connectivity.</td>
<td>More services and faster journey times</td>
</tr>
<tr>
<td>4</td>
<td>Redevelopment of Cardiff Central Station to create a station fit for a capital city.</td>
<td>A better customer experience with more space and more services</td>
</tr>
<tr>
<td>5</td>
<td>Programme of level crossing closures in West Wales.</td>
<td>Public safety and faster journey times</td>
</tr>
<tr>
<td>6</td>
<td>Continuation of additional peak services on the Heart of Wales Line, and further improved generalised journey times.</td>
<td>More services and faster journey times</td>
</tr>
<tr>
<td>7</td>
<td>Selected train lengthening on Cardiff to Manchester services.</td>
<td>More seats for passengers</td>
</tr>
<tr>
<td>8</td>
<td>Modernisation of the North Wales Coast Main Line.</td>
<td>More services and faster journey times</td>
</tr>
<tr>
<td>9</td>
<td>Improved line speeds on the North Wales Coast Main Line.</td>
<td>Faster journey times</td>
</tr>
<tr>
<td>10</td>
<td>Improved connectivity to Deeside.</td>
<td>More services with better connections between trains &amp; buses</td>
</tr>
<tr>
<td>11</td>
<td>Further programme of capacity improvements between Chester and Wrexham.</td>
<td>More services and faster journey times</td>
</tr>
<tr>
<td>12</td>
<td>Improved line speeds between Wrexham and Bidston.</td>
<td>Faster journey times</td>
</tr>
<tr>
<td>13</td>
<td>Improved all day frequency on the Cambrian Main Line.</td>
<td>More services</td>
</tr>
<tr>
<td>14</td>
<td>Improved frequency on the Ebbw Vale Line with connectivity to Newport and Abertillery.</td>
<td>More services to new destinations and new line opening</td>
</tr>
</tbody>
</table>
01: Strategic Planning Process

Highlights:
This Route Study sets out the future direction for the railway in Wales.

It has been developed through collaboration between the rail industry, funders and stakeholders.

It details the governance, structure and scope of this Route Study.

It sets out the strategic priorities and strategic goals that underpin this Route Study.

1.0 Context
The railway in Britain has seen a decade of unprecedented growth and this is set to continue. Wales is a great example of this success where there is strong growth and significant investment from the rail industry, UK Government, Welsh Government and the European Funding Office.

This growth has been driven by a number of different factors. Socioeconomic changes have a big role to play and have changed the way we live, work and commute. Advances in communications technology means people have wider social networks and are inclined to travel further to meet friends or to enjoy leisure time. The cost of car ownership and the impact of congestion mean more people rely on rail. The rail industry has also played a key role in making train services an attractive way to travel through expansion, market segmentation and technology driven changes in ticketing, tariffs and information.

The economy of Wales relies on transportation of freight by rail with a number of rail freight commodities forecast to grow in the future, and the number of time-critical freight flows operating within Wales likely to increase.

The railway industry has a responsibility to understand these drivers of growth and how they interact with each other. This understanding is important to inform the future direction of the railway network.

Continuing this success story requires an evidence based and collaborative approach to strategic planning. This approach underpins the work of this Route Study and the resulting choices for funders.

1.1 Planning Approach
The railway in Wales and the Borders is a critical part of the rail network in Great Britain and the strategic planning process that underpins this Route Study reflects this. It has been developed as part of the Long Term Planning Process (LTTP), which updates the previous Route Utilisation Study (RUS) process, to plan the future of the network up to 2023 and 2043, and provides choices for funders to build on the success story.

This Route Study has been completed through collaboration with the rail industry, funders in UK Government and Welsh Government and, critically, with stakeholders within Wales and those in the English border regions.

It is a collaborative process and Network Rail is privileged to lead this on behalf of the railway industry in Wales.

1.2 Relationship with the Long Term Planning Process
This is one of a number of Route Studies that are being developed across the country and will inform the planning process for Control Period 6 (CP6) and beyond. The current Periodic Review process timeline is set out in Figure 1.3.

It builds on the four Market Studies that are fundamentally important precursors to the Route Studies. The Market Studies identified strategic goals, built up demand forecasts and developed Conditional Outputs for future rail services across the country. These covered the following markets:
- Long distance passenger markets
- London and South East passenger markets
- Regional urban passenger markets
- Freight markets

Web links to these Market Studies can be found in Section 1.8.

1.3 The Cross-Boundary Approach
Many of the passenger and freight services that have been assessed in this Route Study operate across one or more Route Study boundaries. A common set of planning assumptions are required where this is the case, particularly where some route studies are developed at a later date. Therefore as part of the LTTP, a Cross-Boundary Working Group has been established, which consists of Network Rail and passenger and freight operating companies, whose broad remit is to review planning assumptions used in each Route Study and provide advice on resolving capacity issues that might affect more than one Route Study area.

This group has also developed a cross-boundary Indicative Train Service Specification (ITSS) for passenger services which cross Route Study boundaries across Great Britain.
01: Strategic Planning Process

This specification is an interpretation of how the connectivity Conditional Outputs articulated in the established Market Studies could be delivered. Additionally, the Freight Market Study has identified freight service requirements for each route nationally. The Cross-Boundary Working Group will continue to meet as and when required for the duration of the national Route Study programme.

The Welsh Route Study area is served by a number of ‘cross-boundary’ services, all of which are included within the Welsh 2043 ITSS (see Section 5.5). Additionally, the Freight Market Study has identified freight service requirements for every route in Great Britain.

1.4 Governance Process

The governance arrangements that underpin this Route Study have enabled a collaborative and challenging process, and the structure is shown in Figure 1.2.

The Rail Industry Planning Group has set the overall direction for the LTPP and involves representatives from governments, the Office of Rail and Road (ORR) and the rail industry.

The Wales Rail Industry Leaders’ Group comprises representatives from governments, ORR and the rail industry within Wales. It has overseen the development of this Route Study and has ensured that it was completed in a collaborative, challenging and ambitious manner.

The Working Group was at the heart of this Route Study. It comprised of representatives from the passenger and freight operators across the route, the Department for Transport (DfT), Network Rail, Welsh Government, and ORR was invited to attend to act as an observer. It developed demand forecasts up to 2023 and 2043, planned the ITSS and assessed the solutions which have been set out as choices for funders.

The Regional Groups have provided valuable input. Listening to, and understanding the priorities of these stakeholders has enriched this Route Study so that it has balanced regional economic priorities alongside those for the national economy.

The Technical Group comprised of Network Rail asset managers and project delivery teams who helped develop the Conditional Outputs.

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**Figure 1.2: Welsh Route Study governance arrangements**

- Rail Industry Planning Group
- Wales Rail Industry Leaders Group
- Welsh Route Study Working Group
- Welsh Route Study Regional Groups
- Welsh Route Study Technical Working Group
- Cross Boundary Working Group
- Wider Stakeholders

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**Figure 1.3: The periodic review process timeline**

- February 2016: Publication of final Welsh Route Study
- Summer 2017: High Level Output Specification (HLOS)
- Autumn 2018: ORR final determination
- Autumn 2018: Renewal of Wales and Borders franchise
- Early 2018: Network Rail Strategic Business Plan
- Autumn 2016: Initial Industry Plan (IIP)
- April 2019: Start of CP6
Figure 1.4: TEN-T Core Passenger and Freight Networks with Mediterranean to North Sea Corridor

1.5 Strategic goals and priorities

This Route Study sets out a vision up to 2023 and 2043 of a much busier railway – more customers, more journeys, more trains and faster speeds. The railway will need to be better every day, safer every day, and will need to satisfy more passengers more often. This is our challenge.

The LTPP considers the role that rail can play in delivering the following strategic goals of the transport sector:

- enabling economic growth
- reducing carbon and the transport sector’s impact on the environment
- improving the quality of life for communities and individuals
- improving affordability and value for money.

The strategic priorities that underpin this Route Study are:

- **Safety** – to ensure all our customers, staff and suppliers get home safe every day. This is central to the future interventions we are proposing as choices for funders.

- **Economic growth** – the railway is integral to the economy and thus a better railway is pivotal in delivering a better Great Britain. Rail has a big role to play in Wales where gross value added (GVA) per person is around 72 per cent of the national average.

- **Social value** – the railway is crucial in supporting local economies by providing access to employment, education and other social infrastructure as well as the retail and tourism sectors.

- **Digital Railway** – the rail industry’s Digital Railway blueprint will revolutionise train control, ticketing, tariffs and information (see Section 1.7).

- **Capacity** – longer trains and increased frequency of train services to accommodate growth in passenger numbers will require the capability of the railway to be enhanced.

- **Connectivity** – the role rail can play in connecting communities and making interchanges easier and more reliable, both between trains and between trains and other modes. Connectivity with High Speed Two (HS2) is a key economic driver in the future and this Route Study has considered the opportunities at Birmingham and for further connectivity.

- **Punctuality** – more needs to be done to get customers to their connections or destinations on time. The railway system will be much busier and the industry needs to plan for this.

- **Weather Resilience** – future proofing the railway system from the worst effects of climate change is crucial to future plans.

1.6 Interoperability

The trans-European transport network (TEN-T) is comprised of roads, railway lines, inland waterways, inland and maritime ports, airports and rail-road terminals throughout the 28 Member States of the European Union. Building on existing and planned infrastructure, the network aims to provide seamless transport chains for passengers and freight. The TEN-T consists of two planning layers: a comprehensive network and a core network.

Within the Welsh Route Study geographic scope, two parts of the network are defined as TEN-T routes. The North Wales Coast Main Line between Crewe and Holyhead is defined as a core passenger network, and the route between Bristol Parkway and Cardiff Central is defined as a core passenger network, and a core freight network between Bristol Parkway and Milford Haven.

Appendix E sets out the requirements for compliance with these interoperability regulations.
1.7 The Digital Railway

The Digital Railway is a rail industry-wide programme designed to benefit Great Britain’s economy by accelerating the digital enablement of the railway. The programme is integrating digital modernisation of the railway with industry planning and spans technology, business change and commercial innovation offering a more cost-effective and higher-performing railway that delivers a bigger economic benefit.

The digital modernisation of the railway is one part of the package for delivering a sustainable and growing railway meeting passengers’ and freight customers’ needs. As part of a package of measures the Digital Railway is a vital enabler for long-term growth because it releases latent capacity in the GB rail infrastructure to support the economy. Unlike traditional enhancements or renewals the Digital Railway is a system-wide package which collectively delivers benefits on every type of route, new options can be created to meet the local priorities that matter most – be they for:

- More trains where they are needed most, for example, to rapidly growing metropolitan regions;
- Better connections, enabled through more choice about train paths - for example, between our system of cities or prime freight routes;
- Greater reliability and a reduction in the impact of delays when problems do occur.
- Improved passenger experience through provision of wi-fi, electronic ticketing, fares and real time information.

In most areas, work to develop technical capability is underway. The programme will seek to determine what is required to align and accelerate different initiatives to bring them into a single road map underwritten by the whole industry. The output of the programme will be a business case to Government, presented through the IIP in September 2016.

Work has commenced on a plan to consider deployment of European Train Control System (ETCS) nationally. As part of this process the findings in this Route Study will inform the requirements for ETCS deployment throughout Wales and the Borders in terms of future network capacity required.

This Route Study assesses the role that future deployment of the ETCS might play in delivering enhanced network capability and capacity and this is set out in more detail in Section 7.1.2.

1.8 Reference material

Information on other strategic planning documents can be found at:

www.networkrail.co.uk/aspx/4449.aspx

Key documents include:

- Network RUS: Electrification
- Network RUS: Freight
- Network RUS: Passenger Rolling Stock
- Network RUS: Stations
- Network RUS: Alternative Solutions

More information on the Long Term Planning Process and the four established Market Studies can be found at:

www.networkrail.co.uk/long-term-planning-process/

Investment in Stations: A guide for promoters and developers can be found at:

02: The Starting Point for the Welsh Route Study

Highlights:
This chapter is about the baseline for the Route Study which includes all investment schemes planned for delivery in Control Period 5 (up to 2019)

It sets out the starting point for planning the future of the railway network in Wales

It details the current services and markets influencing the Route Study

The industry has plans to deal with existing capacity issues up to 2019

2.0 Context

The railway has come a long way in recent years and needs to build on what has been achieved as there is much more to do.

In Wales, there has been significant growth since 2003, with 46% more passenger journeys made and this keeps growing (see Figure 2.2).

Freight is particularly important to the economy of Wales with approximately 15% of all rail freight services across GB either starting, ending or traversing the Wales route.

Wales is well connected to the national network and there are strong cross-boundary markets for travel to and from England.

The railway is vitally important to the economy in Wales and the border regions. Funders and the railway industry have invested in more capacity and more services to meet growing demand. This is at the heart of the success story.

The railways in Wales serve different markets and this contributes to a rich and diverse baseline.

The geographical scope for this Route Study differs slightly from that of Network Rail’s Wales Route, and a map showing the geographical boundaries of this study can be seen in Figure 2.3.

The scope of this Route Study includes assessment of potential interventions to accommodate the Conditional Outputs identified in the Market Studies and this Route Study.

This Route Study does not assess potential demand for new stations which are either an aspiration of stakeholders or being promoted by third parties. Nevertheless, where these aspirations are known, this study does take a view on how these might accord with the longer term strategy and what impact, if any, they may have on future network capacity.

Additionally, this Route Study does not specifically consider new lines unless they are a potential solution to accommodating the identified Conditional Outputs, and meet affordability and value for money criteria. Where there are aspirations for new lines these are noted in Appendix C.

Figure 2.2: Demand for services within and to/from Wales

Figure 2.1: Growth in passenger journeys since 2003
02: The Starting Point for the Welsh Route Study

Figure 2.3: Welsh Route Study geographical scope

Key
- Primary
- Secondary
- Rural
- Freight only
2.0.1 Changes to the Welsh Route Study starting point

Since publication of the Welsh Route Study Draft for Consultation in March 2015, there has been a review by Sir Peter Hendy to the Secretary of State for Transport on the replanning of Network Rail’s Investment Programme in CP5. The link to the report can be found in Section 2.5.

The electrification of parts of the network in South Wales are being reprogrammed with electrification to Cardiff targeted for completion during CP5, and electrification to Swansea targeted for completion during CP6.

The Welsh Government, which is the primary funder of Valley Lines Modernisation, is currently reviewing this scope and the associated programme as part of the Metro (see Sections 6.1.1 and 6.1.2).

This means that there have been a number of changes to the planning assumptions used in this Route Study, and where this is the case this study describes the associated impact. There has been no material effect on the choices for funders.

2.1 Services

2.1.1 Long Distance

This market is defined by distance of travel, usually greater than 50 miles, or by travel between large towns and cities at least 30 miles apart. The definition includes business and leisure journeys.

There are a number of strong and well established long distance markets between Wales and the wider network. A summary of the key long distance markets are below:

- South Wales to Birmingham and East Midlands
- South Wales to Thames Valley and London
- South Wales to south coast (Southampton, Portsmouth)
- South and West Wales to Shrewsbury, Crewe and Manchester
- North Wales to South Wales via Chester, Wrexham and Shrewsbury
- North Wales to Manchester and Liverpool via Crewe
- North Wales to London via Crewe, Chester and the West Coast Main Line
- Birmingham to Shrewsbury, Machynlleth, Aberystwyth and Pwllheli.

2.1.2 Regional Urban

This market relates to short distance travel to centres of economic activity, generally within a 50 mile radius from origin to destination. These journeys tend to be in areas of concentrated activity, such as city centres, where rail has a competitive advantage. Journeys are usually for the purposes of commuting, leisure purposes or shorter business journeys.

Rail has a strong role in the success of the economy and is a driver of new investment in creating jobs. Indeed, the busiest market of this type in Wales centres around Cardiff and is served by the Valley Lines network as well as longer distance services. This demonstrates the vital role that rail has in supporting economic growth in the banking, insurance and professional services sectors that are the backbone of the capital city’s economy.
The success of the Valley Lines network highlights the direct relationship between the economy and the railway. The inner core of the network provides a typical turn up and go service while frequencies on the outer core are typically every 20 or 30 minutes. Demand for services is growing strongly year on year and crowding is currently an issue at peak times. The industry’s plans for Control Period 5 (CP5), detailed in Section 2.3, which include infrastructure enhancements, will help address the crowding issue.

There are also strong markets between South Wales and Bristol via Severn Tunnel Junction, as well as flows into Swansea, Bridgend, Newport, Chester, Manchester, Liverpool via Bidston, Gloucester, Cheltenham and Birmingham.

### 2.1.3 Rural Services

Rural services typically serve areas of low population where people rely on these services for many different purposes. Typically they are often the only form of public transport in these areas and they tend to serve a number of different markets. Rural services are of particular importance to the economies of West Wales, Mid Wales and North West Wales.

An example is the largely rural Heart of Wales Line which serves different purposes – it is a commuter railway into Swansea and Shrewsbury, it is a leisure railway for visitors and tourists, and it fulfils an important social role for people and communities along the route.

Other rural railways have a similarly important role on the Cambrian Coast, Conwy Valley and lines to Fishguard Harbour, Pembroke Dock and Milford Haven.

### 2.1.4 Freight Services

The transportation of freight by rail plays a key role in supporting the UK economy and in removing many lorries from the congested road network. Freight also has a considerable socioeconomic impact on both a national and local scale. As of 2015, 15 per cent of all UK rail freight originates or terminates in South Wales, the core of this being the steel from Tata plants (such as Port Talbot), freight has a notable impact upon Wales.

Changes to market conditions have and are continuing to impact rail freight volumes in Wales, in particular the distribution of coal and steel due to wider market conditions in the global economy. Therefore, the Conditional Outputs set out in Section 5.2 (derived from the Freight Market Study and work undertaken as part of this Route Study) are sensitive to current market conditions.

The South Wales Main Line, the North Wales Main Line and the Marches Line between Newport and Shrewsbury form the basis of the national freight network in Wales. This network supports the movement of freight from branch lines and a number of freight-only lines.

Steel, coal and petrochemicals are the predominant traffic in South Wales and there is also a moderate flow of container traffic between Cardiff and the Midlands and Southampton. In West Wales, the oil refineries near Milford Haven generate long-distance flows to Westerleigh and to Theale. The Heart of Wales Line is very occasionally used for freight diversionary purposes.

The RWE coal-fired power station at Aberthaw on the Cardiff Valleys network continues as a key power generator in Wales and it attracts traffic from a variety of sources, in South Wales including Tower Colliery, Cwmbran, Onllwyn and Cwmgrwach and also further afield from Avonmouth. Recent investment in the RWE Aberthaw facility to comply with current legislation has extended the life of this power station and means that freight traffic will continue at current levels in CPS.
02: The Starting Point for the Welsh Route Study

The Vale of Glamorgan Line offers a freight diversionary route for the South Wales Main Line between Cardiff and Bridgend. The main traffic over the Swansea District Line is steel traffic to and from the Tata works at Trostre in Llanelli.

A service is operated for Tesco from Daventry to Wentloog in Cardiff, for fast-moving of consumer goods into the retailers regional distribution centre at Magor.

The Marches Line, between Newport and Shrewsbury, has experienced recent freight traffic growth and offers an alternative option to routing traffic to the north via the busier, steeply-graded Lickey route through Bromsgrove and Birmingham. The majority of the traffic is steel, scrap metal, coal, intermodal containers and aggregates. Traffic volumes on this route will continue to be high during CPS.

Steel traffic from Tata Llanwern in South Wales passes over the Marches Line via Shrewsbury and Wrexham (for Deeside). This route is also used by coal traffic from Portbury Docks (Bristol) to Fiddlers Ferry (Warrington) and Rugeley power stations.

Further freight traffic is generated from Celsa Steel UK and its Electric Arc Furnace facility adjacent to Cardiff Tidal Sidings.

Conveyance of aggregates continues to be a growing freight market and within the Wales route, there are aggregate freight facilities at Moreton on Lugg and Neath Abbey Wharf.

The principal driver of freight traffic in North Wales is the Tata steelworks at Deeside.

Ports and their rail connections are particularly important to the freight industry. Within Wales, Newport and Port Talbot docks have regular freight flows and Avonmouth, because of its proximity to Wales, also sees regular freight services traversing the Wales route.

Other traffic flows on the route include automotive flows from Ford’s facility near Bridgend, timber flows to Chirk and Ministry of Defence (MoD) traffic in South Wales.

2.2 Depot and stabling arrangements

A new depot is being built at Swansea to accommodate new SETs (Super Express Trains).

Currently the Wales and Borders franchisee operates out of depots and out-stabling facilities at Carmarthen, Cardiff Canton, Treherbert, Rhymney, Chester, Crewe, Machynlleth and Holyhead. The latter is also used by the West Coast franchisee.

There are freight train facilities at Margam, Cardiff Wentloog and Newport.

Access to most of these depots is satisfactory in terms of infrastructure and paths. However, access to Cardiff Canton is at near capacity because the access/egress points are configured as part of the Cardiff West Junction layout which is heavily utilised by timetabled passenger and freight services, and the option to relieve pressure by stabling more trains at Rhymney and Treherbert instead is constrained by the single line sections to and from these locations.
2.3 Committed schemes – those included in the baseline

The railway in Wales is benefitting from significant investment from funders in CP5 both in terms of rolling stock and infrastructure. As such this Route Study takes 2019 (the end of CP5) as the baseline for this study – assuming that all schemes committed in CP5 will have been delivered by that time. This investment includes schemes of both national and regional significance.

The baseline of this Route Study includes the following committed schemes:

**Great Western Main Line Electrification** from London to Swansea, and new trains. Following Sir Peter Hendy’s review, timescales for delivery of electrification of the Great Western Main Line have been replanned. Network Rail’s updated Enhancements Delivery Plan sets out the regulated outputs for delivery of this scheme. The completion of electrification between London and Cardiff Central has an indicative milestone date of December 2018 for infrastructure ready for new electric passenger services. The regulated output for electrification between Cardiff Central and Swansea has an indicative delivery milestone for CP6.

Under the Railways (Interoperability) Regulations 2011 the route between Bristol Parkway and Cardiff is defined as a core passenger and freight route. Our original planning assumptions for incremental gauge clearance of this route have changed following industry reprioritisation of funding for W12 gauge clearance. The industry Strategic Freight Network (SFN) Group will determine future prioritisation.

**Cardiff Area Signalling Renewal**, with additional Welsh Government and European funding, providing additional infrastructure capacity for up to 16 trains per hour through the central core between Cardiff Central and Cardiff Queen Street during the peak. Our original planning assumptions for incremental gauge clearance of this route have changed following industry reprioritisation of funding for W12 gauge clearance. The industry Strategic Freight Network (SFN) Group will determine future prioritisation.

**Valley Lines Electrification** which enables more efficient and faster electric rolling stock to replace the existing diesel rolling stock. Electric passenger rolling stock will provide greater on-train capacity than the existing diesel passenger rolling stock. The delivery profile, scope and outputs, for this scheme are currently being updated. Electrification of the route was originally planned to be delivered early in CP6, but Welsh Government is currently reviewing options for modernisation of the Valley Lines network.

**Maesteg Frequency Enhancement Scheme** which delivers infrastructure capability for two trains per hour to improve local connectivity and access to jobs. This scheme is currently being reviewed by Welsh Government as part of Valley Lines Modernisation.

Infrastructure enhancement to accommodate additional trains on this route are planned to be delivered as part of renewal of signalling equipment.

**Extension of the Ebbw Vale Line to Ebbw Vale Town and a new station at Pye Corner** have now been completed.

Since publication of the Welsh Route Study Draft for Consultation, the Welsh Government is funding enhancement of the infrastructure between Ebbw Junction (west of Newport) and Ebbw Vale Town to enable two trains per hour to operate along the route. As this scheme was still in the development phase when work commenced on this Route Study it was not included in the 2019 baseline for the purposes of assessing growth in passenger demand. This scheme is planned to be delivered in CP5.

**North-South Journey Time Reduction Scheme** between Shrewsbury and Chester via Wrexham, enables faster journey times and provides some additional capacity.

**Newport to Shrewsbury resignalling.** The plan to renew the signalling between Newport and Shrewsbury during CP5 is currently under review with a decision expected about the time of publication of this document. Renewal of signalling equipment on this route would provide an opportune time to deliver the signalling controls for the longer term aspiration of a bay platform at Abergavenny at an efficient cost (see Section 7.2.5.1).
North Wales Coast Phase 1 (Rockcliffe Hall to Llandudno) resignalling. Renewal of signalling equipment will be delivered between Rockcliffe Hall (west of Chester) and Llandudno Junction during CP5. This work will involve providing signalling capability to operate trains at higher speeds than today, subject to enhancement of other assets such as track. A business case for this enhancement has been assessed and is detailed in Section 6.1.9.

The route including Llandudno Junction and beyond to Holyhead (Phase 2) will be delivered early in CP6.

Valley Lines signalling relock and recontrol. Our plans for CP5 included resignalling of the Valley Lines network, which provided opportunity for further enhancement of the infrastructure to deliver longer term aspirations of Welsh Government for this part of the network. Scope and programme for these works is currently being reviewed to take into account Welsh Government’s emerging plans for the modernisation of this part of the network. The purpose of this review is to avoid any abortive capital cost expenditure.

2.4 Weather Resilience of the network – building resilience to climate change into this Route Study

A safe, reliable and resilient network underpins our future plans for the railway. The resilience of the railway to extreme weather events is a considerable part of this and Network Rail asset policies and plans reflect this.

As in other parts of Great Britain, the extreme weather events in December 2013 and January 2014 caused disruption to parts of the network covered in this Route Study and there was an impact on local and regional economies, particularly in North Wales, West Wales and the Cambrian coast. The heavy rainfall in December 2015 has caused significant flooding damage on the Conwy Valley Line and at time of publication, works are currently underway to reinstate the line.

In September 2014, Network Rail published a series of Weather Resilience and Climate Change Adaptation (WRCCA) plans, identifying appropriate actions to increase weather resilience. The plans focus on improving or strengthening existing assets – e.g. scour protection and sea defences. There is a specific WRCCA plan for Wales.

The WRCCA plan for Wales sets out the plans, policies and actions that are in place to address resilience in the Welsh Route Study area. At this stage of the resilience planning process there are no proposals to consider alternative line scenarios in Wales. However, it is reviewed regularly and areas for future work include the Cambrian Coast Line where Network Rail is working with Natural Resources Wales to understand the long term impact of coastal erosion, plus assessing the long term flood risk on the Conwy Valley line.

This subject area will be updated as appropriate in future strategic plans for Wales.

2.5 Reference material

The Network and Route Specifications for the Wales Route, which publish the capability of the network, can be found at the following link:

[www.networkrail.co.uk/Network_specification_Wales.aspx#map-8](http://www.networkrail.co.uk/Network_specification_Wales.aspx#map-8)

Information about Network Rail’s Weather Resilience and Climate Change Adaptation Plan for Wales can be found at the following link:


The Report from Sir Peter Hendy to the Secretary of State for Transport on the replanning of Network Rail’s Investment Programme, and Network Rail’s updated Enhancements Delivery Plan can be found at the following link:

[http://www.networkrail.co.uk/Hendy-review/](http://www.networkrail.co.uk/Hendy-review/)

Further detail on the Metro, including studies relating to economic impact and regeneration can be found at the following link:

03: Consultation Responses

Highlights:
Ninety consultation responses were received from a wide range of interested parties.

This chapter sets out the main themes raised during consultation and how these are dealt within this Route Study.

3.1 Consultation process
Network Rail has taken a collaborative and consultative approach to the development of the Long Term Planning Process (LTPP). As part of this process Network Rail has sought to provide the opportunity for all interested stakeholders, both within and outside the rail industry, to contribute if they wish to influence the rail industry’s plans for the future.

This Route Study has been developed with the close involvement of a wide range of stakeholders working within a governance structure as set out in Chapter 1. This has sought to ensure that the work has been subject to comment, challenge and review by an informed audience throughout.

The Welsh Route Study Draft for Consultation was published on 4th March 2015 on the Network Rail website, for a consultation period which ended on 9th June 2015. Prior to and during the consultation period stakeholders were briefed on the study findings, and this chapter outlines the general themes and views expressed by respondees to the consultation, explaining how the responses have helped shape the development of the final strategy.

During and post the consultation period, some additional analysis has been undertaken and incorporated into the final document, including some work informed by consultation responses.

3.2 Consultation responses
The consultation received 90 responses in total and respondees fell into 13 broad categories which are detailed in Figure 3.1.

![Figure 3.1 Summary of responses by stakeholder type](image-url)

The pie chart shows the distribution of responses by stakeholder type, with Members of the public accounting for 36 responses, Local authorities and PTEs for 15 responses, and other categories such as Rail Industry, Rail User Groups, and Campaigning organisations also represented.
3.3. Key Themes
The 90 consultation responses Network Rail received raised over 300 specific issues, categorised into broadly 16 themes, summarised in Figure 3.2. These were in many cases comprehensive and detailed. Unless specifically requested, all consultation responses have been published on the Network Rail website in conjunction with the publication of this Route Study.

In general, the reaction of respondents was positive, welcoming a strategy which focused in detail on the Wales and Borders rail network.

The following section outlines the key themes which were the focus of the consultation responses.

3.4 Detailed observations
The following sections of this chapter provide more detail of the main specific issues raised during consultation and how the final strategy considers each of these.

Figure 3.2 Summary of responses by themes

3.4.1 Connectivity
The majority of consultation responses which related to connectivity between regions, centred around the need for improved connections between North Wales and North West England, where the economies of these regions are closely linked, where alternative transport modes are congested, and where journey times are not particularly quick or direct. In particular, consultation responses set out the need to improve rail links between:

- North Wales and Liverpool / Liverpool Airport via Chester and Halton Chord
- Deeside and Wrexham / Liverpool
- North Wales and Manchester, including Manchester Airport.
- Mid Wales and other UK centres.

The following sections set out how this study has considered these specific issues.
03: Consultation Responses

3.4.1.1 North Wales and Liverpool / Liverpool Airport via Chester and Halton Chord
21 specific consultation issues were made with regard to the need to improve connectivity between Liverpool and Chester and North Wales. These were predominantly about the need to provide direct services via the Halton Chord (which links the main line between Liverpool Lime Street and Crewe, with the line between Warrington Bank Quay and Chester) which Network Rail will enhance during CP5 to enable direct services to operate in each direction via Liverpool Lime Street, Liverpool South Parkway, Runcorn and Chester. A number of these responses also set out the need to extend these services into North Wales.

Section 5.1.11 of the Welsh Route Study Draft for Consultation considered options for delivering enhanced network capacity between Wrexham General and Chester, primarily in relation to the development of the business case by Merseytravel and Welsh Government, for new passenger service options which will provide direct services between Liverpool Lime Street, Chester and North Wales destinations. Since the publication of the Welsh Route Study Draft for Consultation, Welsh Government has remitted Network Rail to consider other infrastructure options in support of the development work to introduce new direct services between Liverpool Lime Street, Chester and Wrexham General, and this further work and the resultant choices available to funders are updated in the revised section of this Study and in Section 6.1.11 where some additional infrastructure at Chester would be required.

3.4.1.2 Deeside and Wrexham / Liverpool
20 specific consultation issues were made with regard to the need to improve connectivity to Deeside from both Merseyside and Wrexham.

Section 7.2.9 of this Study has been updated to reflect the findings of further feasibility work undertaken to look at options for increasing frequency on the route between Wrexham and Bidston via Neston.

Additionally, as part of a suite of geographical Network Studies that will inform the North of England Route Study, due to be published in 2017, stakeholders have outlined aspirations for the provision of direct services from the third rail electric network on Merseyside, to destinations south of Bidston towards Wrexham.

Feasibility work has been remitted to develop and assess potential options to meet these outputs which will potentially involve rolling stock and infrastructure choices for funders. These findings will be published in the North of England Route Study.

3.4.1.3 North Wales and Manchester, including Manchester Airport
15 specific consultation issues were made with regard to the need to improve connectivity between North Wales and Manchester, particularly Manchester Airport.

The Long Distance Market Study published by Network Rail in October 2013, identified a long term service level Conditional Output for passenger services between North Wales and Manchester for 2043 of 1-2 travel opportunities per hour. This has been reflected in the 2043 Indicative Train Service Specification for passenger services within Wales which is set out in Figure 5.13. This has formed the basis in this Route Study for assessment of what network capability will be required in the future to deliver this service specification and sections 6.1.8 – 6.1.11 and 7.2.10 of this document set out these requirements.

The North of England Route Study workstream will also assess the network capability requirements for the level of service specification required between North Wales, Chester and Manchester.

Additionally, stakeholders view Manchester Airport as an important link and opportunities will exist through the franchise process to consider the specification of direct services between North Wales and Manchester Airport.
3.4.1.4 Mid Wales and other UK centres
Stakeholders in Mid Wales raised the importance of improving connectivity between mid-Wales to other main UK centres (12 specific issues raised during consultation). These specifically related to the aspiration for an improved all day frequency along the Cambrian Main Line, and improved connectivity between the Heart of Wales Lines and other UK centres. The Conditional Outputs relating to these aspirations have been updated accordingly.

Additionally, this Route Study has been updated to reflect the work being undertaken by Heart of Wales Line Forum (funded by Welsh Government) to develop options for improving the service offering on this route (see Section 6.1.6).

3.4.2 Electrification
31 specific consultation issues were made with regard to electrification of the network within Wales and the Borders. 11 of these specifically to electrification of the North Wales Coast Main Line with a number of associated additional comments about upgrade of this route.

Section 6.1.8 of this Study describes the work undertaken to develop the case for electrification in North Wales. This has been updated to reflect the further work undertaken by Welsh Government and the regional authorities in North Wales to look at the wider economic benefits associated with this proposal.

Section 6.1.9 of this Study sets out the business case for improving line speeds in North Wales between Holyhead and Chester.

Network Rail published “The Network RUS: Electrification” in October 2009, which ranked the case for electrification of the constituent routes not electrified across the UK rail network. This work is now being updated in the light of emerging costs of implementing electrification schemes during CPS and the funds available, and a refresh of this document will be published in spring 2016.

3.4.3 New Lines
20 specific consultation issues were made with regard to the opening of new lines, many of which have been closed for many years. As its starting point, this Route Study assesses how all of the Conditional Outputs can be accommodated on the existing network and what interventions are required.

Network Rail is supporting a number of funders who are promoting the opening of new railway lines.

Two such proposals are Aberystwyth to Carmarthen, where Welsh Government has funded a feasibility study of a new line, and a branch line to Abertillery, running from the Ebbw Vale line, where Network Rail is ensuring that re-signalling works make suitable provision for a future extension, aligned with Welsh Governments planning aspirations.

3.4.4 New stations
Network Rail supports funders with the development and delivery of new stations, and there are some good recent examples of this at Energlyn and Churchill Park, Fishguard and Goodwick, Pye Corner and Ebbw Vale Town.

Network Rail’s “Investment in Stations – A guide for promoters and developers” was updated on the Network Rail website in December 2014 and sets out general guidance for promoters of schemes to build new stations, relocate stations or extend facilities at existing stations.

18 specific consultation issues were made with regard to the opening of new stations. Many of these are reflected in national and regional Stakeholders transport plans (see Appendix C) and Network Rail will continue to work with promoters of such schemes as required.
3.4.5 Passenger experience

18 specific consultation issues were made with regard to the passenger experience. This Route Study, in assessing how a range of Conditional Outputs will be met to accommodate passenger growth and improve connectivity, considers a range of interventions which include upgrade of rolling stock and modernisation of stations to provide increased capacity and improved facilities for passengers. It should also be noted that in conjunction with Welsh Government, Network Rail continues to improve facilities at stations across Wales and the Borders, through the National Stations Improvement Programme (NSIP).

3.4.6 Passenger capacity

18 specific consultation issues were made with regard to the growth in passenger numbers and accommodation of this growth. This Route Study has developed passenger growth forecasts for 2023 and 2043 and these are set out in Chapter 4.

Specific consultation concerns were raised with regard to the growth forecasts for the following:
- Commuting capacity into Chester from North Wales
- Commuting capacity in Swansea
- Capacity on services between Cardiff and Bristol.

These have been reviewed by Network Rail and the findings updated in Chapter 4.

3.4.7 Network capability

17 specific consultation issues were made with regard to capability of the network in Wales and the Borders. The approach adopted in this Route Study has been to assess each specific route and identify what interventions are required and prioritise these with funders. These are reflected in the choices for funders in Chapters 6 and 7.

A further 10 specific comments related to freight capability across the Wales and Borders rail network. This final study has been updated (see Section 1.6 and Appendix E) to provide clarity as to the Trans-European Transport Network (TEN-T) requirements for interoperability in so far as it affects passenger and freight within Wales and the Borders.

3.4.8 Other

There were a wide range of other issues raised during consultation. These have all been reviewed and where appropriate and relevant have been considered in developing the strategy outlined in this document.

3.5 Next Steps

This Route Study will become established 60 days after publication unless the Office of Rail and Road (ORR) issues a notice of objection within this period.

3.6 Planning for Control Period 6 and beyond

As detailed in Chapter 1, the output from both this and other Route Studies will present the case for continuing investment in the rail sector.

The Route Studies will inform plans for CP6, the period from 2019-24. The outputs will be used to inform the Initial Industry Plan in September 2016 and to update the Network and Route Specifications published on the Network Rail website.
04: Future Demand for Rail Services - Capacity and Connectivity

Highlights:
A positive outlook for rail in Wales
High demand for commuting into Cardiff
Continued growth in demand for long distance and regional urban passenger markets

4.0 Context
This Route Study has assessed demand for passenger and freight services up to 2023 and 2043 in order to identify the long term priorities for rail.

The infrastructure and rolling stock components of the railway system have long asset lives and taking a planning horizon of the period up to 2043, provides the opportunity to inform once in a lifetime investment decisions, starting with the opportunities that present themselves for Control Period 6 (CP6).

4.1 Passenger demand forecasts

4.1.1 Passenger priority flows
This Route Study has identified key growth corridors within the Welsh network, which are likely to require changes in capacity or capability to accommodate future demand. These flows are shown in Figure 4.2.

As discussed in Chapter 2, the majority of long distance journeys are made for the purposes of business on behalf of an employer and for leisure. Although long distance commuting is increasingly popular, the predicted growth of the long distance market continues to be driven by the needs of business and leisure passengers. Key priority flows identified for the long distance market are detailed in Section 2.1.1.

The Regional Urban market, in particular commuting into economic centres, is expected to grow with employment and business opportunities. Given the distance between Wrexham and economic centres in North West England, more journeys are made between these locations to access jobs and business opportunities. Key priority flows for the Regional Urban market include:

- Commuting to Cardiff
- Commuting to Swansea
- Commuting from South Wales to Greater Bristol area
- Wrexham to cities in North West England

4.1.2 Long term demand scenario
A “scenario planning” approach is used to consider the range of societal outcomes that can occur over a long time period, and to estimate how rail passenger demand would likely to be influenced by these outcomes.

A series of potential alternative economic futures for Great Britain have been developed and these futures articulated as four scenarios in the established Market Studies (see Section 1.2), are detailed in Figure 4.3 which describes the likely impact on the factors which influence rail and demand.

These four scenarios represent the four most likely combinations of the economic and social/environmental outcomes, but other future combinations may also be possible. The range of growth rate guides the development of schemes to 2023 and 2043.

This Route Study, and specifically its demand forecasts, uses the Prospering in Global Stability (PGS) scenario to identify future capacity requirements, presented in Sections 4.1.4 and 4.1.5. This is to account for the greatest possible demand increases.

The Struggling In Isolation (SII) scenario is used to help understand risks associated with the choices of investments for funders if the economy is not going in the direction we planned for.
04: Future Demand for Rail Services - Capacity and Connectivity

Figure 4.2: Key growth corridors and economic centres

Figure 4.3: Impact of the long term scenarios on the factors which influence demand for rail

Prospering
Technologically enabled

Prospering in isolation

- High employment and low turnover
- Mixed economic structure
- Employment spread between urban and other areas
- High income, unevenly distributed
- Moderate immigration
- Low domestic migration
- Moderately spread social networks
- Low taxation on travel
- Cars are very efficient/environmentally friendly
- Moderate population
- Mixed population age profile and composition of households
- Travel time used productively
- Rail products well matched to consumers’ needs
- High car ownership
- Investment in surface transport including HS2
- No investment in airport capacity

Prospering in global stability

- Very high employment and low turnover
- Knowledge-based economy
- Employment concentrated in towns and cities
- High income, evenly distributed
- High immigration
- High domestic migration from urban areas
- Widespread social networks
- Moderate taxation on travel
- Cars are very efficient/environmentally friendly
- High population
- Mixed population age profile and composition of households
- Travel time used productively
- Rail products well matched to consumers’ needs
- Moderate car ownership
- Investment in all forms of transport including HS2 and airport capacity

Struggling
Technologically limited

Struggling in isolation

- Low employment and low turnover
- Mixed economy
- Employment spread between urban and other areas
- Low income, unevenly distributed
- Low immigration
- Moderate domestic migration from urban areas
- Predominantly local social networks
- Low taxation on travel
- Cars are inefficient/environmentally polluting
- Moderate population
- High population age profile, high proportion of multiple income households
- Travel time not used productively
- Rail products not well matched to consumers’ needs
- Moderate car ownership
- Limited investment in surface transport

Struggling in global turmoil

- Low employment and high turnover
- Mixed economic structure
- Employment concentrated in towns and cities
- Low income, partially equalities of distribution
- Low immigration
- Moderate domestic migration
- Predominantly spread social networks
- High/medium taxation on travel
- Cars are inefficient/environmentally polluting
- Moderate population
- High population age profile, high proportion of multiple income households
- Travel time used productively
- Rail products not well matched to consumers’ needs
- Low car ownership
- Investment in all forms of transport including HS2 and airport capacity

Key

- Long distance priority flows
- Regional urban priority flows

GB Economy

GB social and environmental planning
### 4.1.3 Demand modelling approach

The established Market Studies developed demand forecasts for various long distance and regional urban flows, some of which are to/from Welsh locations. This Route Study has adapted these established demand forecasts to understand future capacity requirements. At the same time, this study has developed its own demand forecasts for those key flows that were not assessed in the four Market Studies. However, the same approach has been used for the purpose of consistency.

The future background growth of the rail market’s size and share is primarily influenced by the following five factors:

- **Macro economic factors**, such as distribution of employment, income and homes
- **Micro economic factors**, such as the cost of travel by car and rail, car ownership, and competition between modes
- **Demographics**, such as population, age of population and household composition
- **Consumer tastes**, such as the use of travel time and travelling alternatives
- **The supply of travel opportunities**, such as rail generalised journey times and punctuality.

More details about these factors are documented in Chapter 6 of the Long Distance Market Study and Regional Urban Market Study, links to which can be found in Section 4.3.

Local factors, such as land use changes and new developments, that affect demand on rail have been discussed within the Working Group and reflected in the background growth as appropriate.

Importantly the forecast also reflects the impact of the CP5 committed service improvements and has applied the changes as an overlay to the background growth.

### 4.1.4 Priority flows for the Long Distance market

The demand models used in the Long Distance Market Study have been used to develop forecasts for this Route Study’s long distance priority flows, using population data updated since the study was published.

The demand forecast for flows between the North Wales Coast and Manchester is adapted from the Northern Route Utilisation Strategy published in May 2011, to ensure consistency with the work undertaken in the Northern Hub Analysis.

Estimated growth on the long distance market priority flows are presented in Table 4.1.

The demand forecasts for North Wales Coast to North West England presented in the Welsh Route Study Draft for Consultation were developed using the Long Distance Market Study Model. The model was calibrated based on long distance flows where demand is driven by economic drivers including income growth and population. The forecasts for North Wales Coast were reviewed during the consultation period as it was observed that the forecasts are relatively low compared to other regions and urban centres that exhibit similar characteristics.

It was concluded that the Regional Urban Market Study demand approach should be adopted instead, to forecast growth between North Wales Coast and North West England.

The model is calibrated based on a combination of shorter distance and inter-urban flows, where employment growth and structural changes are the main demand drivers, as well as income growth.

It is predicted that demand between North Wales Coast and Chester, Liverpool and Manchester will grow by 25 percent to 2023 and 80 percent to 2043. This represents “background growth”, driven by external economic factors. It does not include potential rail intervention schemes that would drive further demand for rail services.

<table>
<thead>
<tr>
<th>Flows between</th>
<th>Estimated growth*</th>
<th>2023</th>
<th>2043</th>
</tr>
</thead>
<tbody>
<tr>
<td>London</td>
<td>Cardiff</td>
<td>34%</td>
<td>142%</td>
</tr>
<tr>
<td></td>
<td>Swansea</td>
<td>28%</td>
<td>111%</td>
</tr>
<tr>
<td></td>
<td>North Wales Coast</td>
<td>27%</td>
<td>151%**</td>
</tr>
<tr>
<td>North Wales Coast</td>
<td>West Midlands</td>
<td>16%</td>
<td>79%**</td>
</tr>
<tr>
<td>North Wales Coast</td>
<td>South Wales</td>
<td>20%</td>
<td>77%</td>
</tr>
<tr>
<td></td>
<td>North West England</td>
<td>25%</td>
<td>80%</td>
</tr>
<tr>
<td>The Cambrian Lines</td>
<td>West Midlands</td>
<td>21%</td>
<td>78%</td>
</tr>
</tbody>
</table>

* based on the Prospering in Global Stability scenario (PGS)
** includes impact of HS2 phase 1 & 2

More details about these factors are documented in Chapter 6 of the Long Distance Market Study and Regional Urban Market Study, links to which can be found in Section 4.3.
4.1.5 Priority flows for the Regional Urban market

The Regional Urban Market Study demand approach has been adopted to develop forecasts for the priority flows from Wales to other large UK economic centres.

Discussions with stakeholders during this Route Study helped to identify whether local factors, such as changes of land use, are expected to bring significant impact to future rail demand. The impacts of committed rail interventions before the end of CP5 are also considered.

4.1.5.1 Demand growth for commuting into Cardiff

Estimated growth on peak demand to Cardiff is shown in Figure 4.4 and Table 4.2.

The demand growth for commuting into Cardiff has taken into account the impact of the committed rail interventions in the Cardiff area, including the electrification of the Great Western Main Line, the introduction of Super Express Trains (SETs) and new stations on the Ebbw Vale Line.

For the purpose of forecasting future passenger growth on the Valley Lines network, the starting point for assessing demand in this Route Study has already assumed electrification and the introduction of electric multiple unit rolling stock. Details of these interventions are discussed in Section 2.3.

The impact from the committed interventions ranged from 7 per cent to 21 per cent depending on the corridor. Although future timetables are still in development, these impacts are indicative and estimated based on the latest timetables available. The new stations at Pye Corner (which opened in December 2014) and Ebbw Vale Town (which opened in Summer 2015), serving the Ebbw Vale Line will contribute to significant passenger growth on the line.

Consultation responses were received highlighting peak crowding on services between Bristol and Cardiff, calling at Severn Tunnel Junction. The baseline for this Route Study includes the committed plan to deploy higher capacity rolling stock on this route by 2019.

The rolling stock that will be cascaded to this route (from the Thames Valley) will provide capacity for up to 2,795 passengers in the three hour morning peak. The load factors would remain at less than 85%, indicating there is sufficient capacity to accommodate forecast demand in 2023 and 2043.

Further information can be found in Section 3.3.4 of the Western Route Study.
04: Future Demand for Rail Services - Capacity and Connectivity

4.1.5.2 Passenger demand growth for commuting into Swansea:
Estimated growth on peak demand to Swansea is shown in Figure 4.5 and Table 4.3. The growth for peak demand to Swansea has included the impact from the introduction of SETs which provide more capacity.

Consultation responses asked this Route Study to review future passenger capacity into Swansea. In developing this Route Study, specific passenger counts were undertaken in the Swansea weekday peak hours and this information together with the estimated passenger growth does not suggest future passenger capacity shortfall given future interventions proposed within the starting point for this Route Study.

4.1.5.3 Growth in passenger demand from Wrexham
Estimated growth for flows between Wrexham and large economic centres in North West England are shown in Table 4.4.

4.2 Freight demand forecast
Freight demand forecasts were developed for the whole of England, Scotland and Wales in the Freight Market Study. The Freight Market Study has produced demand forecasts for freight for the period up to 2023, 2033 and 2043. The study includes preferred routing of services and the implied requirements in terms of network capacity and capability. Figure 4.6 shows the trend of growth for freight traffic in Wales.

Since the publication of the Freight Market Study in 2013, the industry has further reviewed the freight forecasts for construction materials. The impact within Wales and the Borders, forecasts a 1-2% uplift for the freight flows along the South Wales Main Line and the Marches route. This does include some assumption about the freight services to support HS2 construction.

The South Wales Main Line from Swansea to the Severn Tunnel is the primary freight route in Wales. This accounts for a relatively small proportion of the track miles in Wales and this means that the tonne kilometres are not as significant as the absolute tonnage moved might suggest. Key freight flows and sites are detailed in Section 2.1.4.

Forecasted tonnes have been translated into freight train paths per off-peak hour and the forecast off-peak paths per hour are unconstrained. Details of the translation process can be found in Chapter 5 of the Freight Market Study.

Figure 4.7 shows the forecast freight paths for all freight commodities in 2043.

4.2.1 Metals
Metals are the most significant freight commodity in the Welsh Route Study area. No change in the overall markets for metals (i.e. road and rail markets) is assumed, however post-publication of the Freight Market Study, steel manufacturing in Wales (and the UK generally) is under significant economic pressure due to a combination of factors such as the strength of the pound, relatively high electricity prices, the extra cost of climate change policies, and competition from China.
Forecast growth in rail volumes are attributed to the improvements in the economics of rail used within the modelling work underpinning the Freight Market Study. The metals sector is dominated by a small number of steel producers. The potential for growth is intimately connected with their business decisions and the role of rail within their supply chains and logistics.

4.2.2 Petroleum

Petroleum represents the second largest commodity by tonne kilometres in Wales but is not forecast to grow substantially. No change in the size of the total market (i.e. road and rail) has been assumed in development of the updated freight forecast, however this assumption should be reviewed in the light of any potential additional requirements for rail freight that might arise as a result of the Murco refinery at Milford Haven being converted into a storage and distribution facility. Any growth in rail volumes can be attributed to the improvements in the economics for rail. The forecasts do not account for the possibility of additional rail traffic resulting from modal shift from pipelines but do address modal shift from road to rail.

4.2.3 Electricity supply industry (ESI) coal and biomass

The Freight Market Study forecast for ESI coal is based upon the Department of Energy and Climate Change (DECC) projections. This assumes a decline in the use of coal, partially offset by biomass. The long term future of power stations consuming coal in Wales and nationally is not certain, which may impact on the level of coal traffic on routes within Wales and the borders. Coal is either imported or produced in Welsh coal extraction sites. While the forecast assume a universal decline evenly across the entire network, in reality the trajectory will be determined by choices of individual power stations. There is therefore uncertainty about the extent and timing of the decline of ESI Coal transported by rail. More details can be found on specific assumptions in the Freight Market Study.

4.2.4 Ports and domestic intermodal

Ports and domestic intermodal do not represent large current net tonne kilometres. However, this is partly because Wentloog intermodal terminal (the only sizeable intermodal terminal in Wales) is between Cardiff and Newport. This means the distance run in Wales between the Severn Tunnel and Cardiff is a small proportion of the overall journey. Currently there are ports intermodal trains from Southampton and domestic intermodal trains from Daventry. Substantial growth is forecast both for domestic and ports intermodal. There are rail freight facilities at various locations in South East Wales handling the following rail borne traffic:

- Newport - scrap metals, steel export, import and export coal, import locomotives/projects.
- Cardiff - liquid fuels, aggregates, import and export steel slab and coal.
- Barry - containers from deep sea ports and Channel Tunnel.

Good intermodal, and tri-modal, capacity exists at these ports and there is the potential that they may be developed further in the future to provide cross docking and storage capability to service potential new freight flows. In addition Associated British Ports (ABP) has aspirations for future development at Port Talbot and Swansea.
In South West Wales Milford Haven provides a deep water port for freight and in North Wales the port of Holyhead serves Ireland. While forecast freight growth to these port locations are low, economic conditions may in the future offer greater potential to operate rail freight flows to/from these locations.

4.2.5 Network Rail National Supply Chain (NSC)

Freight operators play a significant role in supporting Network Rail in delivering its renewal and enhancement works. For example they provide the trains that convey materials (e.g. track and ballast) used in these projects between local distribution centres (LDC) and renewal or enhancement worksite to and from work sites. There is currently no LDC for NSC within Wales. Should LDCs be required within Wales, route capability will need to be assessed when determining optimum locations for new LDCs.

4.2.6 Energy from Waste

Within the UK there is a growing market for the transportation of materials for recycling and energy generation at the expense of landfill. This is a potential growth market for rail freight within Wales and the Borders.

4.3 Reference material

More information on the Long Term Planning Process and the four established market studies can be found at:

[www.networkrail.co.uk/long-term-planning-process/](http://www.networkrail.co.uk/long-term-planning-process/)

Chapter 6 of the passenger market studies details the demand forecasting methodology used.
05: Conditional Outputs - Capacity and Connectivity

Highlights:
This chapter is about the outputs for meeting future demand.

Capacity and connectivity are key outputs. The outputs have been analysed to see what interventions are required.

These outputs are conditional on being deliverable, value for money and affordable.

5.0 Context
As we have seen in Chapter 4, this Route Study forecasts that the railway in Wales will see continued growth to 2023 and 2043. This reflects the important role that rail has in shaping the competitiveness and the prosperity of the economy.

In this Route Study, the railway industry and funders have identified what needs to be done to meet this future demand. These are referred to as Conditional Outputs – they are conditional on being feasible, effective, value for money and affordable.

Conditional Outputs are descriptions about what needs to be done and there are generally two types of output:
- Outputs relating to capacity (passenger capacity and infrastructure capacity)
- Outputs relating to connectivity (frequency and/or journey time)

This Chapter describes the Conditional Outputs for the period up to 2043. Chapter 6 considers those that are a priority to be accommodated in Control Period 6 (CP6) by 2023, and Chapter 7 considers those that will be required to be accommodated in the longer term to 2043. The length of this planning horizon reflects, in part, the longevity of rail infrastructure assets and investments. It also enables industry to plan the network in the context of major schemes, some of which will take many years to deliver, such as High Speed Two (HS2).

Table 5.1 Conditional Outputs developed by this Route Study relating to capacity

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Passenger market</th>
<th>Conditional Output</th>
<th>Output Options Discussed in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Cardiff commuting.</td>
<td>Meeting demand for people commuting into Cardiff during the peak hour taking account of forecast growth to 2043.</td>
<td>Sections: 5.1.1, 6.1.1, 6.1.3, 6.1.4, 7.2.2, 7.2.4.</td>
</tr>
<tr>
<td>CO2</td>
<td>Swansea commuting.</td>
<td>Meeting demand for people commuting into Swansea during the peak hour taking account of forecast growth to 2043.</td>
<td>Sections: 5.1.2, 6.1.6, 7.2.2.</td>
</tr>
<tr>
<td>CO3</td>
<td>Chester commuting (from Welsh Route Study corridors).</td>
<td>Meeting demand for people commuting into Chester from Welsh Route Study corridors during the peak hour taking account of forecast growth to 2043.</td>
<td>Sections: 5.1.3, 7.2.6, 7.2.10 and North of England Route Study.</td>
</tr>
<tr>
<td>CO4</td>
<td>Shrewsbury commuting (from Welsh Route Study corridors).</td>
<td>Meeting demand for people commuting into Shrewsbury from Welsh Route Study corridors during the peak hour taking account of forecast growth to 2043.</td>
<td>Sections: 5.1.4, 7.2.5, 7.2.6 and West Midland and Chiltern Route Study (for the Birmingham corridor).</td>
</tr>
<tr>
<td>CO5</td>
<td>Marches line all day capacity.</td>
<td>Meeting demand for people travelling on the Marches line during the day taking account of forecast growth to 2043.</td>
<td>Sections: 5.1.5, 6.1.7, 7.2.5, 7.2.6.</td>
</tr>
<tr>
<td>CO6</td>
<td>Cardiff – Manchester all day capacity.</td>
<td>Meeting demand for people travelling on Cardiff – Manchester services during the day taking account of forecast growth to 2043.</td>
<td>Sections: 5.1.6 and West Midland and Chiltern Route Study.</td>
</tr>
<tr>
<td>CO7</td>
<td>Cardiff – Birmingham all day capacity.</td>
<td>Meeting demand for people travelling on Cardiff – Birmingham services during the day taking account of forecast growth to 2043.</td>
<td>Sections: 5.1.7, 6.1.4.</td>
</tr>
<tr>
<td>CO8</td>
<td>Cardiff Central station capacity.</td>
<td>Meeting demand for people travelling to and from Cardiff Central station taking account of forecast growth to 2043 and improve the station environment for all station users including during major events.</td>
<td>Sections: 5.1.6, 6.1.7, 7.2.5, 7.2.6.</td>
</tr>
</tbody>
</table>
5.1 Conditional Outputs relating to capacity

This Route Study sets out the interventions required to deliver sufficient capacity to accommodate growth in demand for passenger services and rail freight to 2023 and 2043. As the starting point for these forecasts is 2019, it already includes all committed CP5 infrastructure capacity schemes, which could solve some of the capacity issues we see today.

This study has used the prospering in global stability (PGS) demand scenario for assessing future demand and then determining what Conditional Outputs are required to meet future growth in demand. Table 5.1 sets out the passenger capacity Conditional Outputs.

For the purpose of assessing passenger growth, this Route Study has considered the high morning peak hour as defined between 08:00 and 09:00, when the railway network is at its busiest. It is acknowledged that shoulder and evening peak dynamics are different and vary between passenger markets and locations. This will drive different requirements for efficient deployment of rolling stock.

5.1.1 Conditional Output CO1 – Cardiff commuting

Overview

This Conditional Output is about meeting the anticipated growth to 2043 for peak hour commuting flows into Cardiff. This is by far the biggest commuting market in Wales.

On average passenger demand is expected to grow by 69 per cent to 2023 and by 145 per cent to 2043 during the peak hours into Cardiff.

The busiest commuter flows into Cardiff are on the Valley Lines network. This is a dense urban network and while most journeys are of relatively short distance the number of station stops means that average journey times are slow. The average speed on most services is less than 20 mph.

This Route Study has assumed as its baseline position that Great Western Route Modernisation (GWRM) will provide longer electric or bi-mode Super Express Trains (SET), and that modernisation of the Valley Lines network will enable longer and more frequent services, which together could provide for a capacity increase of 47 per cent by the end of CP5 for passengers commuting into Cardiff.

Passenger demand analysis

The committed interventions, will allow the potential of up to 49 trains to arrive into the central Cardiff area in the morning peak hour (08:00-09:00) from 2019.

In the Welsh Route Study Draft for Consultation, for planning purposes, the number of passenger trains specified by 2019 was taken as the starting point for assessing future passenger demand. Since publication of this document, Welsh Government has been undertaking a review of the options for modernising the Valley Lines network, which is considering a range of potential scenarios. This work will determine future funding decisions to be made with regard to the scope of modernising the Valley Lines network, and will also influence the next passenger franchise for this part of the passenger network.

The Welsh Route Study Draft for Consultation identified the amount of capacity that could be provided by a combination of more frequent services that could be accommodated on the network as a result of enhancements delivered as part of the Cardiff Area Signalling Renewal (CASR) project, and longer trains. This was defined as the number of seats, plus a further allowance for standing passengers making short trips of up to 20 minutes.

The Welsh Route Study Draft for Consultation baseline position assumed that the Valley Lines network would be electrified, which would result in three-car electric rolling stock being deployed with a generic capacity for 303 passengers. The long distance services from London will be operated by SET trains, formed of either nine-car electric or five-car bi-mode sets, which can be operated as 10-car trains. The nine-car SETs have a total of 647 seats and the five-car bi-mode SETs have a total of 326 seats (which would provide for 652 seats when running as a 10-car train).

Figures 5.2 and 5.3 demonstrate the average train load into Cardiff stations from key corridors during peak hours for 2023 and 2043 based on three-car electric stock being used.

The analysis shows that additional capacity will be required by 2023 for the Caerphilly, Pontypidd, Barry, Penarth and Ebbw Vale corridor and more corridors by 2043.
The Welsh Government is currently funding infrastructure work to increase the service frequency on the Ebbw Vale Line from one train per hour to two trains per hour. This will enable specification of service patterns to accommodate forecast passenger growth in the future as part of the next Wales and Borders franchise.

Section 2.3 identifies that the baseline situation for the Valley Lines has changed since the publication of the Welsh Route Study Draft for Consultation. The change relates to scope definition for modernisation of this part of the network. Nevertheless the planning assumptions used indicated that by the end of CP6, the solution required to deliver the forecast growth for commuting from the Valley Lines network into Cardiff will require a combination of the enhanced frequencies of passenger services, enabled by the committed interventions set out in Section 2.3, together with longer trains that provide the capacity identified as part of this analysis.

While the post electrification rolling stock strategy is under consideration, Figures 5.4 to 5.7 shows the average train load into Cardiff during the peak hours if four or six-car electric stock (2 x three-car) was used.

5.1.2 Conditional Output CO2 – Swansea commuting

Overview
This Conditional Output is about meeting the anticipated growth to 2043 for peak hour commuting flows into Swansea. Most of these journeys originate from Carmarthen to the west including all local stations and from Cardiff to the east including all local stations. On average passenger demand is expected to grow by 30 per cent to 2023 and by 86 per cent to 2043 during peak hours into Swansea. The capacity provided for passenger commuting into Swansea is expected to increase by 19 per cent by the end of CP5 with the use of longer electric or bi-mode SETs as part of the GWRM electrification (see Section 2.3), and an additional morning service from the Heart of Wales Line which is operating initially on a three year trial from 2015.

Passenger demand analysis
With the committed interventions, there will be 6 trains arriving into Swansea in the morning high peak hour (08:00-09:00) from 2019. For planning purposes, the number of passenger trains specified at the end of 2019 is taken as the baseline for assessing future passenger demand. The amount of capacity provided by these services is defined as the number of seats, plus a further allowance for standing passengers making short trips of up to 20 minutes.

The rolling stock to operate on the local service between Cardiff and Swansea is assumed to be three-car electric rolling stock with a generic capacity of 303 passengers. The long distance services from London will be operated by SETs, formed of either nine-car electric or five-car bi-mode sets, which can be operated as 10-car trains. The nine-car SETs have a total of 647 seats and the five-car bi-mode SETs have a total of 326 seats (which would provide for 652 seats when running as a 10-car train).

The average train load arriving into Swansea in the morning peak hour from all corridors is 30 per cent in 2023 and 44 per cent in 2043. The planned capacity is sufficient to accommodate demand growth for the morning peak arrival into Swansea for 2023 and 2043.
05: Conditional Outputs - Capacity and Connectivity

March 2016

Network Rail

Figure 5.2: Capacity utilisation on key corridors arriving into Cardiff stations for the high peak hour in 2023 (assuming capacity of three-car electric stock on electrified local services)

Figure 5.3: Forecasted loading on key corridors arriving into Cardiff stations for the high peak hour in 2043 (assuming capacity of three-car electric stock on electrified local services)

Figure 5.4: Forecasted loading on key corridors arriving into Cardiff stations for the high peak hour in 2023 (assuming capacity of four-car electric stock on electrified local services)

Figure 5.5: Forecasted loading on key corridors arriving into Cardiff stations for the high peak hour in 2043 (assuming capacity of four-car electric stock on electrified local services)

Figure 5.6: Forecasted loading on key corridors arriving into Cardiff stations for the high peak hour in 2023 (assuming capacity of six-car electric stock on electrified local services)

Figure 5.7: Forecasted loading on key corridors arriving into Cardiff stations for the high peak hour in 2043 (assuming capacity of six-car electric stock on electrified local services)

Capacity utilisation by corridor
- **Seats available** - up to 70% seats taken
- **Seats busy** - up to 70% - 85% seats taken
- **Seats full (standing on some trains)** - up to 85% - 100% seats taken
- **Standing** - over 100% capacity used
- Not shown

Not shown
5.1.3 Conditional Output CO3 – Chester peak hour capacity (from Welsh Route Study corridors)

Overview
This Conditional Output is about meeting the anticipated growth to 2043 for peak hour flows into Chester from Welsh Route Study corridors. The most significant commuter flows into Chester from Welsh Route Study corridors, are from stations to the west along the North Wales Coast, from stations to the south including Wrexham, and from Crewe to the east. Capacity for corridors from Liverpool and Manchester will be considered in the North of England Route Study.

On average passenger demand is expected to grow by 30 per cent to 2023 and by 88 per cent to 2043 during peak hour into Chester from Wrexham; and by 25 per cent to 2023 and by 80 per cent to 2043 during peak hours from the North Wales Coast to North West England.

Passenger demand analysis
The number of trains arriving into Chester during the morning high peak hour (08:00-09:00) from 2019 will be the same as today, with five trains arriving from the North Wales Coast, Wrexham and Crewe corridor.

The average train load arriving into Chester from Welsh Route Study Corridors in the morning high peak hour is 47 per cent in 2023 and 68 per cent in 2043. The planned capacity is sufficient to accommodate demand growth for the morning peak arrival into Chester for 2023 and 2043.

5.1.4 Conditional Output CO4 – Shrewsbury peak hour capacity (from Welsh Route Study corridors)

Overview
This Conditional Output is about meeting the anticipated growth to 2043 for peak hour flows into Shrewsbury from the Welsh Route Study corridors. Capacity for the corridor from Birmingham will be discussed in the West Midlands and Chiltern Route Study.

The most significant commuter flows into Shrewsbury from Welsh Route Study corridors are from stations to the west along the Cambrian Main Line, from stations to the north towards Wrexham, to stations to the south towards Hereford and to stations to the east towards Crewe.

On average passenger demand is expected to grow by 24 per cent to 2023 and by 82 per cent to 2043 during peak hour into Shrewsbury from Welsh Route Study corridors.

Passenger demand analysis
The number of trains arriving into Shrewsbury during the morning high peak hour (08:00-09:00) from 2019 will be the same as today, with five trains arriving from the North Wales Coast, the Marches and Crewe corridor. From May 2015, for a trial period of three years, there will be a peak morning arrival at Shrewsbury from the Cambrian main line.

The average train load arriving into Shrewsbury from Welsh Route Study Corridors in the morning peak hour is 35 per cent in 2023 and 51 per cent in 2043. The planned capacity is sufficient to accommodate demand growth for the morning peak arrival into Shrewsbury for 2023 and 2043.
5.1.5 Conditional Output CO5 & CO6 – Marches Line and Cardiff - Manchester all day capacity

Overview
This Conditional Output is about meeting the anticipated growth to 2043 for all day flows along the Marches line between Cardiff, Hereford, Shrewsbury, Crewe and Manchester. This is an important corridor as it serves a number of different markets – local, commuting, leisure and long distance.

On average passenger demand is expected to grow by 34 per cent to 2023 and by 141 per cent to 2043 for this flow.

Passenger demand analysis
The service operating on the corridor between Cardiff and Manchester via the Marches is an hourly service with 15 southbound and 16 northbound trains each day. The same service level is assumed to operate on this corridor in 2023 and 2043. The service serves passengers for the long distance market between South Wales and Manchester and local markets between stations on the Marches. The service is also used by commuting passengers during the morning and evening peak into economic centres, such as Cardiff and Manchester as well as Hereford and Shrewsbury.

Figures 5.8 and 5.9 show the train load on individual trains on the corridor during the day in 2023.

Additional capacity is required for some of the busy services on this corridor by 2023. The loading pattern illustrated in Figures 5.8 and 5.9 shows that extra capacity might only required for some sections on the service to meet local demand on the Marches or commuting stations to Cardiff and Manchester.

This Route Study considers interventions to provide extra capacity for the services identified in the analysis and the choices for funders are presented in Section 6.1.7.

In the longer term capacity to 2043 can be accommodated by additional services set out in the 2043 Indicative Service Specification (ITSS) in Section 5.5.
5.1.6 Conditional Output CO7 – Cardiff - Birmingham all day capacity

**Overview**
This Conditional Output is about meeting the anticipated growth to 2043 in the all day market between Cardiff and Birmingham.

On average passenger demand is expected to grow by 35 per cent to 2023 and by 93 per cent to 2043 for this flow.

The corridor between Cardiff and Birmingham is served by an hourly service throughout the day. The service covers the interurban market between Cardiff and Birmingham, also serving local markets along the corridor and commuting demand into Birmingham and Cardiff during the morning and evening peak.

**Passenger demand analysis**
With the same service level assumed for 2023, several trains in the morning and evening peak hours require extra capacity to meet demand growth for commuting on this line of route into Birmingham. However, the baseline capacity provided is sufficient to accommodate demand for commuting into Cardiff.

Interventions to provide extra capacity on the busy peak services would be required to meet demand in 2023 and this will be considered in the West Midlands and Chilterns Route Study.

5.1.7 Conditional Output CO8 – Cardiff Central station passenger capacity (including major events)

**Overview**
Cardiff Central station is the largest and busiest station in Wales. Based on 2012/13 information, there are 13 million journeys starting, finishing or interchanging at the station. It serves as a key destination for long distance and inter-urban services from various locations within the country, also as an entry point to the capital city for local commuters.

The Welsh Government and Cardiff Council are investing in the Enterprise Zone surrounding Cardiff Central station. This means that Cardiff Central station will be the focal point for connectivity to the Enterprise Zone, and we have started development plans to create a station that is fit for a capital city.

Network Rail is working closely with Cardiff Council and developers to align our plans with the already committed investment plans for the Enterprise Zone.

**Passenger demand analysis**
The demand forecasts suggest the number of journeys will grow from 13 million in 2013 to upwards of 23 million by 2023 and then to upwards of 32 million by 2043 (see Figure 5.10). This reflects the importance of Cardiff as an economic centre and the increase in commuting and business journeys, as well as the host capital city to major events. This means the capacity of the station needs to be improved to accommodate more passengers more often, and improve the customer experience to satisfy more passengers more often. It also needs to consider how best to deal with large numbers of people within short time periods travelling into the city for events. These plans include lengthening Platform 0 so that it becomes a full length facility suitable for SETs – the analysis demonstrates the requirement for this as another full length platform in the London direction is required to meet demand up to 2043 (see Section 7.2.2). The plans also include looking at reinstating a west facing Platform 5.
Synthesis and conclusions

As railway stations are the primary interface with customers, Network Rail is developing plans for creating a station that is fit for a capital city. The plans focus on achieving three outputs:

- More capacity (platforms and station users)
- Excellent customer experience
- Spatial integration with the bus station and the city centre’s facilities

These plans are in the early stages of the development process and Network Rail will develop choices to funders as part of the Initial Industry Plan (IIP) and High Level Output Specification (HLOS) processes. There is close collaboration with Cardiff Council to align these investment plans with the already committed investment in the Enterprise Zone.

Figure 5.11 shows an artists impression of the possible new station.
5.2 Conditional Outputs for freight

Table 5.2 outlines the Conditional Outputs that have been identified for freight flows that operate across Wales, from and to the rest of the UK. These outputs primarily relate to the importance of rail to Welsh industries and businesses and the need to ensure that capacity is provided, especially for the steel and energy industries. The outputs have been established upon the growth forecasts within the Freight Market Study.

The forecasts for future freight growth typically assess the number of freight paths required per day. It is however acknowledged (especially given the growth in freight markets) that many freight movements are particularly time sensitive and therefore journey time is also of significant importance to freight operators and freight customers. It is also acknowledged that freight operation is a 24/7 business and that freight operators are likely to require greater network access in the future. Therefore the development of the Digital Railway is likely to have significant benefits for freight in terms of the capacity and availability of the network.

Table 5.2 Conditional Outputs developed by this Route Study for rail freight capacity

<table>
<thead>
<tr>
<th>Ref</th>
<th>Freight Market</th>
<th>Conditional Output</th>
<th>Conditional Output Analysis Overview</th>
<th>Output Options Discussed in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO9a</td>
<td>Growth in freight markets identified in the Freight Market Study.</td>
<td>Accommodating anticipated freight demand for freight services to 2043.</td>
<td>Rail freight is important to the economy, and sufficient capacity requirements must be identified and accounted for over the long term. The national energy policy heavily influences the freight market within Wales. Improving the competitiveness and resilience of the railway for transporting freight is an underlying priority for these Conditional Outputs.</td>
<td>Section: 6.1, 7.2</td>
</tr>
<tr>
<td>CO9b</td>
<td>Steel traffic between Llanwern and Port Talbot (Margam).</td>
<td>Providing network capacity and capability for the provision of one additional freight path in each hour between Severn Tunnel Junction and Margam to take account of the growth in steel traffic between Llanwern and Port Talbot.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO9c</td>
<td>Freight services on the Marches Line.</td>
<td>Providing network capacity and capability for the provision of one hourly off peak path between Newport and Shrewsbury to take account of freight growth and potential re-routing of freight traffic from other parts of the network.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.3 Conditional Outputs relating to Connectivity

5.3.1 Definition of connectivity
For the purpose of this Route Study, the definition of connectivity relates to the following aspects of the passenger timetable:
- Service frequency between locations
- Journey times
- The provision of direct journeys and effective interchange arrangements

The passenger market studies set out in more detail how Conditional Outputs for connectivity have been developed in the Long Term Planning Process (LTPP). Broadly though, they consider the role that rail can play in growing the national and regional economies and how they can deliver the following strategic goals:
- Enabling economic growth
- Reducing carbon and the transport sector’s impact on the environment
- Improving the quality of life for communities and individuals
- Improving affordability and value for money.

5.3.2 Conditional Outputs from the Long Distance and Regional Urban Market Studies
Tables 5.3 and 5.4 outline Conditional Outputs relating to connectivity which are derived from the Long Distance Passenger Market Study and Regional Urban Market Study respectively. These relate to long distance services between prime economic centres within Wales and the UK.

The Long Distance Market Study set out aspirations that the industry should work towards improving connectivity between major UK centres up to 2043. These aspirations to improve connectivity (and hence provide improvements in generalised journey time) have been set out within the Long Distance Market Study as Conditional Outputs that could deliver a typical end to end improved average journey speed and an improved frequency of service subject to affordability considerations.

For a number of long distant flows to and from Wales, this Route Study has assessed how increased frequency of services might be accommodated on the network in the longer term as achieving end to end average journey speeds of up to 160 mph would in all likelihood require the delivery of new high speed lines. The development of new high speed lines is being led by UK Government and therefore this Route Study does not consider the implications of a potential new high speed line between South Wales and London.

5.3.3 Conditional Outputs for connectivity developed by this Route Study
These are Conditional Outputs developed by this Route Study for passenger markets to, from and within Wales which were not assessed by the Long Distance Market Study and Regional Urban Market Study.

Where a Conditional Output has not been identified it is assumed that the existing level of service (in the baseline) is maintained.

The Welsh Route Study Working Group spent much time on developing the evidence base for these Conditional Outputs and they reflect the input from the industry and funders.

The full list of Conditional Outputs developed by this Route Study is listed in Table 5.5.
## Table 5.3 Conditional Outputs related to Connectivity - from the Long Distance Market Study

<table>
<thead>
<tr>
<th>Ref</th>
<th>Long Distance Passenger Market</th>
<th>Conditional Output</th>
<th>Conditional Output Analysis Overview</th>
<th>Output Options Discussed in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO10</td>
<td>Cardiff - London.</td>
<td>Very fast service of 3-4 trains per hour with an end to end journey speed of 160 mph.</td>
<td>These Conditional Outputs reflect the existing passenger markets and the need to improve connectivity.</td>
<td>Sections: 6.1.3, 7.2.2, 7.2.5.</td>
</tr>
<tr>
<td>CO11</td>
<td>Swansea - London.</td>
<td>Intercity 2-3 trains per hour with an end to end journey speed of 100 mph.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO12</td>
<td>Cardiff - Bristol.</td>
<td>Medium frequency interurban service 3-4 trains per hour with an end to end journey speed of 60 mph.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO13</td>
<td>Swansea - Bristol.</td>
<td>Interurban/new interurban connection of 1 to 2 trains per hour with an end to end journey speed of 80/45 mph.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO14</td>
<td>Cardiff - Birmingham.</td>
<td>Interurban service of 1 to 2 trains per hour with an end to end journey speed of 80 mph.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO15</td>
<td>Cardiff - Leicester.</td>
<td>Interurban service of 1 to 2 trains per hour with an end to end journey speed of 80 mph.</td>
<td>These Conditional Outputs reflect both the existing passenger markets and consider future direct services to a range of potential new destinations such as Leicester, Sheffield and Leeds.</td>
<td>Sections: 6.1.3, 7.2.2, 7.2.5.</td>
</tr>
<tr>
<td>CO16</td>
<td>Cardiff - Sheffield.</td>
<td>Interurban service of 1 to 2 trains per hour with an end to end journey speed of 80 mph.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO17</td>
<td>Cardiff - Manchester.</td>
<td>Intercity service of 2 to 3 trains per hour with an end to end journey speed of 100 mph.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO18</td>
<td>Cardiff - Leeds.</td>
<td>Interurban service of 1 to 2 trains per hour with an end to end journey speed of 80 mph.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO19</td>
<td>Shrewsbury - London.</td>
<td>Interurban service of 1 to 2 trains per hour with an end to end journey speed of 80 mph.</td>
<td>The Conditional Outputs reflect the need to improve connectivity between regions which currently have no constant direct services. There are some peak services between Wolverhampton and London Euston which will be extended to/from Shrewsbury from December 2014.</td>
<td>Sections: 7.2.5, 7.2.6.</td>
</tr>
<tr>
<td>CO20</td>
<td>Shrewsbury - Liverpool.</td>
<td>Interurban/new interurban connection of 1 to 2 trains per hour with an end to end journey speed of 80/45 mph.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO21</td>
<td>North Wales Coast - London.</td>
<td>Interurban service of 1 to 2 trains per hour with an end to end journey speed of 80 mph.</td>
<td>These Conditional Outputs reflect both the existing passenger markets and the growing demand for direct services to Liverpool. This is considered important as the economies of North Wales and Merseyside are closely linked. Hence the UK Government’s recent provision of funding to improve the Halton Chord to improve rail links between these regions.</td>
<td>Sections: 6.1.8, 6.1.9, 7.2.10.</td>
</tr>
<tr>
<td>CO22</td>
<td>North Wales Coast - Manchester</td>
<td>Interurban service of 1 to 2 trains per hour with an end to end journey speed of 80 mph.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO23</td>
<td>North Wales Coast - Liverpool.</td>
<td>Interurban service of 1 to 2 trains per hour with an end to end journey speed of 80 mph.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO24</td>
<td>North Wales Coast - Chester.</td>
<td>Medium frequency interurban service 3-4 trains per hour with an end to end journey speed of 60 mph.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO25</td>
<td>Wrexham - London.</td>
<td>Intercity service of 2 to 3 trains per hour with an end to end journey speed of 100 mph.</td>
<td>These Conditional Outputs reflect the existing passenger markets and the need to improve connectivity.</td>
<td>Sections: 6.1.11, 7.2.6.</td>
</tr>
<tr>
<td>CO26</td>
<td>Wrexham - Shrewsbury.</td>
<td>Medium frequency interurban service 3-4 trains per hour with an end to end journey speed of 60 mph.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO27</td>
<td>Wrexham - Birmingham.</td>
<td>Interurban/new interurban connection of 1 to 2 trains per hour with an end to end journey speed of 80/45 mph.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The above Conditional Output definitions should be taken as a guide for the LTPP and should be taken to mean “as fast and frequent as operationally feasible given value for money and affordability”.

---

1 These Conditional Outputs reflect the existing passenger markets and the need to improve connectivity.
## Conditional Outputs - Capacity and Connectivity

### Table 5.4 Conditional Outputs related to connectivity - from the Regional Urban Market Study

<table>
<thead>
<tr>
<th>Ref</th>
<th>Regional Urban Passenger Market</th>
<th>Conditional Output</th>
<th>Conditional Output Analysis</th>
<th>Output Options Discussed in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO28</td>
<td>Wrexham - Liverpool.</td>
<td>Improved generalised journey time through either increased service frequency and/or improved journey times.</td>
<td>This Conditional Output reflects the need to improve connectivity between the cities, as currently no direct service exists. Compatibility of trains (Diesel and 3rd Rail Powered) is currently a barrier to improved connectivity but future advances in technology might offer a potential solution. The close economic ties between Wrexham and the Wirral and Merseyside make improvements in connectivity particularly important.</td>
<td>Sections 6.1.11, 6.1.12, 7.2.6 and North of England Route Study.</td>
</tr>
<tr>
<td>CO29</td>
<td>Newport/Severn Tunnel Junction – Bristol/Bath.</td>
<td>Improved generalised journey time through either increased service frequency to three services per hour and/or improved journey times.</td>
<td>These Conditional Outputs reflect the existing passenger markets and the need to improve connectivity between the areas, which is important for commuters and businesses.</td>
<td>Sections 7.2.2 and Western Route Study.</td>
</tr>
</tbody>
</table>
### Table 5.5 Conditional Outputs related to connectivity developed by this Route Study

<table>
<thead>
<tr>
<th>Ref</th>
<th>Passenger Market - Connectivity</th>
<th>Conditional Output</th>
<th>Conditional Output Analysis Overview</th>
<th>Output Options Discussed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO30</td>
<td>South Wales Main Line.</td>
<td>Improved generalised journey times between Bristol and Swansea (service frequency).</td>
<td>This output is about improving connectivity between these locations by utilising all of the available infrastructure to address future capacity constraints.</td>
<td>Sections 6.1.3, 7.2.2.</td>
</tr>
<tr>
<td>CO31</td>
<td>Cardiff - Swansea local Stations.</td>
<td>Improved service frequency to local stations between Cardiff Central and Swansea.</td>
<td>This output focuses on meeting the market for commuting and leisure travel from surrounding local stations. These local stations are currently under used and could help to meet future demand due to their large catchment areas, which would reduce overall journey times for the passengers using these stations.</td>
<td>Sections 7.2.2.</td>
</tr>
<tr>
<td>CO32</td>
<td>Valley Lines.</td>
<td>Improved generalised journey times on the Valley Lines (service frequency and journey time improvements).</td>
<td>Modernisation of the Valley Lines provides an opportunity to improve connectivity and journey times, which are currently relatively slow. This is expected to widen the labour market catchment and improve the area’s economic strength.</td>
<td>Sections 6.1.2, 7.2.4.</td>
</tr>
<tr>
<td>CO33</td>
<td>Ebbw Vale - Newport.</td>
<td>Improved connectivity between Ebbw Vale and Newport (service frequency).</td>
<td>The 2008 Ebbw Vale line reopening has been a considerable success, helping to regenerate the area. There is a strong growth in demand requiring further capacity upgrades. Welsh Government is funding an infrastructure scheme to facilitate improved passenger frequency on the line to two trains per hour, due to be completed in CPS (Note that this scheme is not included in the baseline analysis for this Route Study - see Section 2.3). Network Rail is also working with Welsh Government to explore further options to deliver increased frequency along the route of up to four trains per hour, with the ability to also serve Abertillery, and providing connectivity to Newport and destinations beyond Newport. The scheme includes passive provision for a new station at Crumlin.</td>
<td>Section 7.2.2.</td>
</tr>
<tr>
<td>CO34</td>
<td>Lydney/Chepstow - Bristol.</td>
<td>Improved commuter connectivity between Lydney/Chepstow and Bristol (service frequency).</td>
<td>This output is focused on the role of commuter rail in providing access to employment, education and leisure around these areas. The market is currently constrained by uncompetitive generalised journey times compared to car, resulting from the need to change trains at Severn Tunnel Junction and frequency of service. The 2043 ITSS proposes service frequency enhancements between Severn Tunnel Junction and Gloucester, and on the South Wales Main Line which would provide for improved generalised journey time between these locations.</td>
<td>Section 7.2.2.</td>
</tr>
<tr>
<td>CO35</td>
<td>Cardiff - Birmingham and Cardiff - Gloucester flows.</td>
<td>Improved generalised journey times along the route between Severn Tunnel Junction and Gloucester (service frequency and journey time improvements).</td>
<td>This output is about improving journey times for the local markets between Cardiff and Gloucester via the Lydney route. There is close synergy between this Conditional Output and Conditional Output CO14.</td>
<td>Section 7.2.2.</td>
</tr>
</tbody>
</table>
### Table 5.5 Conditional Outputs related to connectivity developed by this Route Study

<table>
<thead>
<tr>
<th>Ref</th>
<th>Passenger Market - Connectivity</th>
<th>Conditional Output</th>
<th>Conditional Output Analysis Overview</th>
<th>Output Options Discussed in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO36</td>
<td>North-South Wales.</td>
<td>Improved generalised journey time between North and South Wales (Bangor and Holyhead to Cardiff) through increased passenger frequency and/or improvement in journey times.</td>
<td>Connectivity between North and South Wales is important to the economy due to the economic and social links between these two areas. Welsh Government is currently funding enhancement works between Chester and Wrexham to improve journey times and capacity on the route.</td>
<td>Sections 6.1.11, 7.2.2, 7.2.5, 7.2.6, 7.2.10.</td>
</tr>
<tr>
<td>CO37</td>
<td>South West Wales.</td>
<td>Improved generalised journey time through increase passenger service frequency from Fishguard Harbour and Milford Haven to Swansea and improvement in journey times from South West Wales to Swansea.</td>
<td>Connectivity between West Wales and Cardiff, London and the national rail network is important for business and tourism. Redoubling the South Wales Main Line between Gowerton and Loughor has freed up infrastructure capacity for more services from West Wales into Swansea. And electrification will enable Swansea to become a new hub, improving journey times and frequencies. Effective planning around the introduction of SETs will be important to achieve the Output.</td>
<td>Sections 6.1.5, 7.2.3.</td>
</tr>
<tr>
<td>CO38</td>
<td>Heart of Wales Line.</td>
<td>Improved connectivity to/from Heart of Wales Line.</td>
<td>The Heart of Wales and Cambrian Main Lines are largely rural railways that serve a number of commuter markets. These Conditional Outputs are about improving connectivity between these routes and the major economic centres at either end of these routes, and further afield.</td>
<td>Sections 6.1.6, 6.1.13, 7.2.7, 7.2.8.</td>
</tr>
<tr>
<td>CO39</td>
<td>Cambrian line commuting to Aberystwyth &amp; Shrewsbury.</td>
<td>Improved generalised journey time through either increased service frequency from the Cambrian Line to Shrewsbury and beyond and/or improved journey times.</td>
<td>Welsh Government is funding additional peak time journeys on both these routes from 2015 for three years which will then be reviewed.</td>
<td></td>
</tr>
<tr>
<td>CO40</td>
<td>Deeside.</td>
<td>Improved rail accessibility to employment in Deeside by improving connectivity and service frequency.</td>
<td>The Deeside area is important to the manufacturing industry of Wales, with better connectivity to the Enterprise Zone being viewed as possible for journeys from the North of Wales, Chester and Wrexham to Bidston line.</td>
<td>Sections 6.1.10, 6.1.12, 7.2.9, 7.2.10.</td>
</tr>
</tbody>
</table>
5.4 Additional Conditional Outputs

This section is about the more generic Conditional Outputs that are set out in the established market studies and how they specifically relate to this Route Study. These are listed in Table 5.6.

5.4.1 Conditional Output CO41 - Airport Connectivity

This Conditional Output relates to improving rail connectivity to the major airports that serve the different parts of Wales (Cardiff, Bristol, London Heathrow, London Gatwick, Manchester International, Liverpool John Lennon and Birmingham International)

5.4.1.1 Cardiff Airport

Cardiff Airport provides flights to mainly European destinations with some longer haul flights to holiday destinations. The airport has plans to increase the number of flights. While it is not directly connected to the railway it is well served by a frequent bus shuttle service from Cardiff city centre and also by a connecting shuttle bus from nearby Rhoose Station.

The baseline assumes the committed service frequency increases along the Vale of Glamorgan line which will provide a 30 minute service to nearby Rhoose Station. Conditional Output CO32 to achieve generalised journey time improvements on Valley Lines will improve connectivity to the airport.

There are choices for funders about whether Cardiff Airport is best served by connectivity from Cardiff city centre, by connectivity from Rhoose station, or both. Similarly, there are longer term options to connect Cardiff Airport as part of the Cardiff Capital Region Metro aspirations.

5.4.1.2 Bristol Airport

Bristol Airport provides flights to European and African destinations and is well served by shuttle bus links from Bristol Temple Meads station. Bristol Airport does offer a range of domestic and international flight destinations that are not served by Cardiff Airport and as such this is a relatively convenient local airport for the Cardiff and South Wales region. There is a Conditional Output relative to the Cardiff – Bristol rail passenger market which sets out the requirement to improve connectivity between Cardiff and Bristol (frequency and journey time), which does provide for overall improved generalised journey time and connectivity to Bristol Airport from Cardiff and South Wales.

5.4.1.3 London Heathrow Airport

London Heathrow Airport is one of the busiest airports in the world offering flights to worldwide destinations and is situated on a spur off the GWML. The airport is currently well served by rail services from London Paddington.

In CP5, Network Rail is developing plans for a new Western Access rail line from the GWML east of Slough to Heathrow, with delivery planned for CP6. This will provide for more frequent and faster journey opportunities from South Wales by a combination of the Conditional Outputs set for South Wales to London passenger market which will provide for the ability to change into regular Heathrow Airport services at Reading.

5.4.1.4 London Gatwick Airport

London Gatwick Airport is the UK’s second busiest airport offering flights to worldwide destinations. The airport has a dedicated rail station on the main line between London and Brighton and is also served by regular services from Reading.

A combination of the Conditional Outputs set for services between South Wales and London (calling at Reading) and Conditional Outputs set for services between Reading and Gatwick Airport provide for overall improved generalised journey time and connectivity to Gatwick Airport from Cardiff and South Wales.

5.4.1.5 Manchester International Airport

Manchester International Airport is one of the busiest airports within Europe offering scheduled and charter flights to worldwide destinations. The airport has a dedicated rail station with scheduled rail services from many locations in the north of England including a number of direct services to and from North Wales.

Conditional Output CO22 sets out the requirement for passenger connectivity between North Wales and Manchester and this potentially offers the opportunity for extending services to and from Manchester Airport subject to other service specification opportunities in the North of England. Additionally travel opportunities exist by change of train at Crewe.

Table 5.6 Additional Conditional Outputs

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Passenger market</th>
<th>Conditional Output</th>
<th>Output Option Discussed in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO41</td>
<td>Rail-airports.</td>
<td>Airport connectivity.</td>
<td>Section 5.4.1.</td>
</tr>
<tr>
<td>CO42</td>
<td>HS2.</td>
<td>Providing connectivity to the planned HS2 network.</td>
<td>Section 5.4.2.</td>
</tr>
<tr>
<td>CO43</td>
<td>Major ports.</td>
<td>Providing connectivity to major ports within Wales.</td>
<td>Section 5.4.3.</td>
</tr>
<tr>
<td>CO44</td>
<td>Leisure.</td>
<td>Improving capacity and connectivity for weekend and weekday leisure markets.</td>
<td>Section 5.4.4.</td>
</tr>
<tr>
<td>CO45</td>
<td>Higher education and other social infrastructure.</td>
<td>Access to higher education establishments and other social infrastructure.</td>
<td>Section 5.4.5.</td>
</tr>
<tr>
<td>CO46</td>
<td>Passenger satisfaction.</td>
<td>Improved passenger satisfaction.</td>
<td>Section 5.4.6.</td>
</tr>
<tr>
<td>CO47</td>
<td>Integrated transport.</td>
<td>Improved local access to rail to cater for demand.</td>
<td>Section 5.4.7.</td>
</tr>
</tbody>
</table>
5.4.1.6 Liverpool John Lennon Airport
Liverpool John Lennon Airport is situated close to Liverpool South Parkway station on the main line between Runcorn and Liverpool Lime Street. It provides flights to mainly European destinations. Conditional Output CO23 sets out the requirements for improving connectivity between North Wales and Liverpool and CO28 sets out the requirement for improving connectivity between Wrexham and Liverpool (both which currently have no direct rail services) and this offers the opportunity to provide this connection via Liverpool South Parkway station to enable improved connectivity to Liverpool John Lennon Airport.

5.4.1.7 Birmingham International Airport
Birmingham International Airport is situated alongside the main Line between Birmingham New Street and London Euston. It provides flights to Europe, Africa and North and Central American destinations.

There is currently a two-hourly service between North Wales / Mid Wales and Birmingham International providing good connectivity with the airport from North Wales, Wrexham, Shrewsbury and Mid Wales and Conditional Output CO27 sets out the requirement for improving connectivity from Wrexham to Birmingham which in turn offers opportunities for further improving connectivity with the airport.

5.4.2 Conditional Output CO42 - HS2 Connectivity
This Conditional Output relates to the opportunity provided by HS2 to improve journey time and connectivity by either extension of HS2 services onto the Welsh Route network, or by connections into HS2 at Birmingham or Crewe by 2026.

5.4.3 Conditional Output CO43 – Connectivity to Major Ports
This Conditional Output relates to the opportunity to improve access to major ports.

Section 2.1.4 highlighted the importance of the ports at Avonmouth, Newport and Port Talbot. This Route Study has assessed how future forecast growth from these ports can be accommodated on the network. Additionally within Wales, the ports at Fishguard, Pembroke Dock and Holyhead offer passenger and roll on – roll off vehicular services to Ireland.

The range of Conditional Outputs set within this Route Study (CO21-26 and CO37) provide opportunities to improve connectivity to these ports by improving service frequencies and/or generalised journey time to/from other main UK and Wales regional and economic centres.

The Freight Market Study has identified the future demand for freight commodities within the UK and this has been translated into the requirement for freight capacity on the network in Wales. In West Wales, Milford Haven is one of the deepest ports for freight shipping in the UK and there is potential to increase freight services in the future.

Connectivity to ports for passenger markets is important for flows between Ireland and Great Britain and this is amplified during times when flights are disrupted due to weather, volcanic ash or other events. These are generally low frequency events and the industry puts in place short term actions to move capacity around to fulfil demand requirements.

5.4.4 Conditional Output CO44 – Improving capacity and connectivity for the leisure markets
The busiest times for travel to and from urban retail and tourism centres are often at weekends and during weekday evenings. This is in contrast to the typical weekday peak for commuting and business travel, when the highest current levels of train service frequency and capacity are provided. The increase in leisure use of rail in recent years is improving the financial case of rail lines which previously served predominantly commuter flows, as it allows better utilisation of resources that are required to deliver the peak timetable.

The implication of seasonal peaks on demand is an issue very relevant to this Route Study. Rail passenger demand significantly fluctuates in some corridors in West, Mid and North Wales during the year with seasonal demand predominantly driven by leisure and tourism in the summer months. On the North Wales Coast, rail passenger demand is also driven by business passengers and commuters. Figure 5.12 presents the percentage of journeys made to and from these locations in 2013. It shows the rise in rail passenger demand from May, peaking in the summer months and generally declining in the winter.
The busiest time for leisure travel is often at weekends, which coincides with significant railway engineering activities timed to minimise disruption to commuting and business passengers. The evolving leisure market is important to the local economy and therefore the Conditional Output is to provide sufficient capacity to avoid suppression of demand and to reduce potential on-train crowding. This involves the consideration of the potential trade-offs resulting from alternative engineering regimes, including an assessment of the value for money and affordability implications.

The Wales Route Modernisation Plan (see Section 7.1.1) sets out plans to modernise the rail network in Wales. A consequence of this work will be the ability to centralise control of the network and make it more cost efficient to open routes for longer hours (where they are not currently so), offering better opportunity to run services during these hours.

Figure 5.12: Journeys to/from key Welsh tourism corridors in 2013

5.4.5 Conditional Output CO45 – Access to higher educational establishments and other social infrastructure

Improving accessibility to higher education establishments and social infrastructure is important to achieve the strategic goal of improving the quality of life for communities and individuals. In some routes the demand for travel to these markets is high.

This Route Study considers places where a market has a significant impact on demand and affects the level of service provision that is required to meet that demand. Demand scenarios in the Long Distance Market Study show that an increase in demand in long distance travel is predicted in some circumstances and more students are willing to travel for longer distances to gain access to education.

Rail is increasingly becoming the mode of choice for students. There are a number of services in Wales where the timetable and the capacity allocated is geared around school and college times, such as the Cambrian Coast service. There are choices for funders, train operating companies and franchise authorities about connectivity with schools and colleges and capacity allocation. These are local decisions and are best dealt with on a case by case basis. The analysis within this Route Study will help inform decisions about the capacity trade-offs between meeting local demand or meeting longer distance demand. This study identifies Conditional Outputs to improve connectivity to many of these locations – either by enhanced service frequencies or journey time improvements.
5.4.6 Conditional Output CO46 – Improved passenger satisfaction

Passenger travel experiences are important and directly affect demand for rail. This Conditional Output is to seek improvements to station environments, the quality, capacity and consistency of rolling stock, the availability of information to passengers and, where appropriate, train punctuality. Rolling stock needs to meet the requirements and expectations of passengers and to enable an efficient provision of rail services.

A number of the major interventions planned within Wales during CP5 such as electrification of parts of the network will have a significant impact on the rail offering to the passenger. Additionally, during CP5 funding has been made available to improve station environments and to improve accessibility to stations for all users and Network Rail has worked with Welsh Government and operators to identify a programme of priority improvements. It is anticipated that this programme of work will continue into CP6 should funding be made available.

5.4.7 Conditional Output CO47 – Improved local access to rail network to cater for demand.

A key theme of a number of the local and regional transport strategies within Wales and the Border counties is of improving the integrated transport offering. These themes explore the opportunities to develop improved interchange between rail and other transport modes and also opportunities afforded by new technology to improve ticketing and travel choices.

5.5 Indicative Train Service Specification for 2043

The Conditional Outputs described in this chapter have been translated into an Indicative Train Service Specification (ITSS) for 2043. The 2043 ITSS for Wales can be seen in Figure 5.13. The Valley Lines Network is shown separately in Figure 5.14 and this represents an indicative peak hour. Each solid line represents one passenger train per hour (TPH), and the colours represent the suggested calling pattern detailed in the key. A dotted or dashed line represents less than one train per hour, as per the key.

The ITSS sets out the vision of the railway industry and funders about the optimum way of meeting these outputs, focusing on making best use of the existing network capability ahead of building new infrastructure.

The ITSS also provides an opportunity to consider:

- When an intervention might be best timed to coincide with major network renewals such as resignalling
- How a particular Conditional Output might help deliver another Conditional Output (e.g., a connectivity Conditional Output might help deliver increased capacity on parts of the network)
- What new service opportunities might exist where a range of Conditional Outputs can be linked together such as the Conditional Output for Liverpool to Shrewsbury (CO19) being linked to the Conditional Output for North – South Wales (CO35) that provides the opportunity to potentially provide a service between Cardiff and Liverpool that helps deliver a number of Conditional Outputs.

Since publication of the Welsh Route Study Draft for Consultation, the following changes have been made to the 2043 ITSS:

1. The Cardiff to Manchester service that operated via Bristol Parkway, Westerleigh Junction and Cheltenham Spa has been re-routed for planning purposes via Shrewsbury and Crewe. Section 7.2.5.1 details the rationale behind this (which was agreed through the industry Cross Boundary workstream) and how this re-routeing might be accommodated in the longer term to 2043.

2. Heart of Wales Line and Conwy Valley Line minimum specification is now improved to one train every two hours. The requirements to accommodate this level of service specification are assessed in Sections 7.2.8 and 7.2.10.5 respectively.

3. Passenger service specification between Wrexham and Bidston is now shown as 2 trains per hour in each direction. This represents the aspirations of stakeholders who recognise the important role that this route will continue to play in providing connectivity to and from Deeside from both Merseyside and Wrexham. Additionally it also reflects the findings set out in Section 7.2.9.
Figure 5.13: The Indicative Train Service Specification (ITSS) for 2043 - Wales Route (excluding the Valley Lines)
Figure 5.16: An Indicative Train Service Specification (ITSS) for the Valley Lines in 2043 or earlier.
06: Choices for funders to 2024

Highlights:
The railway will need further investment so that it can meet the growth in demand between 2019 and 2024.

There are choices for funders to meet this demand and to provide better connectivity.

This chapter sets out these choices for investment across Wales and the Border counties.

6.0 Context
The choices for funders in Control Period 6 (CP6) have been developed by this Route Study using the agreed prioritisation criteria for the Long Term Planning Process (LTPP). All of the CP6 investment choices identified therefore meet one or more of the following criteria in order to deliver the Conditional Outputs:

- Investments which are required to provide sufficient capacity for the forecast level of passenger and freight demand at the end of CP6, where this investment is also consistent with the longer-term strategy for the route
- Opportunities where Conditional Outputs (or some part of the capital works necessary to deliver Conditional Outputs over a longer period of time) can be delivered most efficiently and provide the lowest whole life cost option for delivery during CP6, for example in conjunction with the planned renewal of life-expired assets
- Investments which reduce rail industry costs
- Other investments which reflect funders’ priorities
- Investing in better connectivity to High Speed Two (HS2).

To meet these drivers of change, CP6 choices for funders have been investigated as part of this Route Study. These are set out in Table 6.1.
<table>
<thead>
<tr>
<th>Option.</th>
<th>CP6 Choices</th>
<th>Conditional Outputs delivered</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>More passenger capacity on Valley Lines – operating more frequent trains and/or longer trains</td>
<td>CO1 Cardiff peak capacity.</td>
<td>More seats for passengers and more services</td>
</tr>
<tr>
<td>2</td>
<td>Phased programme of enhancements on Valley Lines – linked to Metro</td>
<td>CO32 Valley Lines journey time improvement.</td>
<td>More frequent services and faster journey times</td>
</tr>
<tr>
<td>4</td>
<td>Redevelopment of Cardiff Central Station to create a station fit for a capital city</td>
<td>CO1 Cardiff peak capacity. CO8 Cardiff Central station capacity (including major sporting events).</td>
<td>A better customer experience with more space and more services</td>
</tr>
<tr>
<td>5</td>
<td>Continued programme of level crossing closures in South West Wales.</td>
<td>CO37 South West Wales connectivity.</td>
<td>Public safety and faster journey times</td>
</tr>
<tr>
<td>6</td>
<td>Continuation of additional peak services on the Heart of Wales Line, and further improved generalised journey times.</td>
<td>CO2 Swansea commuting. CO4 Shrewsbury commuting. CO38 Improved connectivity to and from Heart of Wales Line..</td>
<td>More services and faster journey times</td>
</tr>
<tr>
<td>7</td>
<td>Selected train lengthening on Cardiff to Manchester services.</td>
<td>CO5 Marches Line all day capacity. CO6 Cardiff – Manchester all day capacity.</td>
<td>More seats for passengers</td>
</tr>
<tr>
<td>8</td>
<td>Modernisation of the North Wales Coast Main Line.</td>
<td>CO21 North Wales Coast connectivity to London. CO22 North Wales Coast connectivity to Manchester. CO23 North Wales Coast connectivity to Liverpool. CO24 North Wales Coast connectivity to Chester.</td>
<td>More services and faster journey times</td>
</tr>
<tr>
<td>9</td>
<td>Improved linespeeds along North Wales Coast Main Line.</td>
<td>CO21 North Wales Coast connectivity to London. CO22 North Wales Coast connectivity to Manchester. CO23 North Wales Coast connectivity to Liverpool. CO24 North Wales Coast connectivity to Chester.</td>
<td>Faster journey times</td>
</tr>
<tr>
<td>10</td>
<td>Improved connectivity to Deeside.</td>
<td>CO40 Connectivity to Deeside.</td>
<td>More services with better connections between trains and buses</td>
</tr>
<tr>
<td>12</td>
<td>Improved linespeeds between Wrexham and Bidston.</td>
<td>CO40 Connectivity to Deeside.</td>
<td>Public safety (by closure/upgrade of crossings) and faster journey times</td>
</tr>
<tr>
<td>13</td>
<td>Improved all day frequency on the Cambrian Main Line.</td>
<td>CO4 Shrewsbury peak hour capacity (from Welsh Route Study corridors). CO39 Cambrian line commuting to Aberystwyth &amp; Shrewsbury.</td>
<td>More services</td>
</tr>
<tr>
<td>14</td>
<td>Improved frequency on the Ebbw Vale line with connectivity to Newport and Abertillery.</td>
<td>CO1 Cardiff peak capacity CO33 Ebbw Vale - Newport</td>
<td>More services to new destinations and new line opening</td>
</tr>
</tbody>
</table>
6.1 Choices for funders in CP6

6.1.1 Option 1: More passenger capacity on Valley Lines – operating more frequent trains and/or longer trains

As shown in Chapter 4, the railway will see strong and continued growth for commuting and other travel into Cardiff. The Valley Lines services will carry much of this additional traffic within the inner urban core.

Section 5.1.2 sets out the analysis for future growth in demand for commuting into Cardiff including the Valley Lines. While train lengthening could meet the forecast growth in demand on the Valley Lines up to 2043, there are other opportunities to further improve connectivity and also to look at freeing-up spare capacity for the future.

As described in Section 2.3, Welsh Government is currently reviewing options for how the Valley Lines network might be modernised. As at the time of publication of this Route Study, options for infrastructure and rolling stock are being evaluated. As detailed in Chapter 4, this Route Study has identified that demand for passenger capacity during CP6 can be met by a combination of increased frequency (delivered by committed interventions in CP5) and longer rolling stock. Specification of longer rolling stock will potentially drive other infrastructure changes such as platform lengthening.

As part of the development of options to modernise the Valley Lines network, the need for platform extensions has been assessed, details for this are provided in Table 6.2. The assumptions used in this analysis assess the requirements for up to six-car 23 metre length electric multiple unit (EMU) rolling stock on most routes, although it should be recognised that 23 metre length vehicles would potentially drive a requirement for other infrastructure interventions (e.g. gauge clearance works).

6.1.2 Option 2: Phased programme of enhancements on Valley Lines – linked to Metro

Following delivery of network enhancements as part of the Cardiff Area Signalling Renewal (CASR) during CP4 and CP5, this section considers the options for further enhancing the Valley Lines network to deliver further growth and improve connectivity in the medium term by assessing options to enable improvements in operating and timetable flexibility.

Digital Railway

The Digital Railway could play a part in addressing this multi-faceted challenge, particularly as it could provide additional capacity without the need for additional civil engineering interventions. Such interventions would be challenging from a feasibility and affordability perspective in the city centre as the layout and immediate environment of the railway is physically constrained by other non-railway infrastructure (see Section 7.2.4).

Cardiff Capital City Region Metro

As set out in Section 5.1.2, the Welsh Government is working with the business sector and the rail industry to develop a multi-modal integrated transport system for the Cardiff Capital City Region. This is branded as Metro (see Figure 6.2). It is particularly welcomed as a multi-modal approach should provide options for considering the most convenient and efficient solutions for meeting the different travel markets.

The Metro approach investigates rail, light rail and tram options which would potentially free up scarce capacity. By converting some short distance routes to a mixture of on-rail and on-street running, capacity could be released to run more long distance services on the Valley Lines network.

There are a number of ideas in development to consider the potential of Metro. The railway industry has an important part to play in helping the Welsh Government to shape the Metro concept to realise the full value of rail as part of a multi-modal integrated transport system. Welsh Government and Network Rail are jointly working on the options.

This Route Study concludes that further work should be undertaken to fully consider how the railway can play its full part in the Metro multi-modal concept.
The Metro is an ambitious programme and the railway industry is equally ambitious to demonstrate how rail can remain at the forefront of enabling economic growth and regeneration around Cardiff.

This Route Study presents a choice for funders in CP6 of further development to realise the potential of rail as part of the Metro system.

**Single line sections on the Valley Lines network**

Welsh Government’s longer term aspirations for Metro include delivering improved passenger connectivity on the Valley Lines network by a combination of more frequent service levels and faster journey times.

Single line sections remain on some parts on the Valley Lines network and, while this does not currently constrain committed plans to meet growth in future peak capacity, it nevertheless restricts flexibility in the ability to optimise the timetable and fully exploit the capability of more modern electric rolling stock.

To the north of Cardiff there are single line sections on the routes north of Pontypridd, between Heath Junction and Coryton and, also, between Bargoed and Rhymney. There are out-based stabling facilities at Treherbert and Rhymney and the single line sections on these routes may also constrain any future plans to increase the capacity of these facilities so they can accommodate more trains.

Potential options for development of the existing heavy rail network as part of the Metro concept for the Valley Lines will need to consider the whole Valley Lines network as an integral route. Operation of increased frequencies to the heads of the valleys at Aberdare, Treherbert, Merthyr Tydfil and Rhymney is likely to require the doubling of these lines throughout, although this in itself will not enable additional services (over and above the CASR outputs) to operate without the ability to increase network capacity through the central Cardiff core between Cardiff Queen Street and Cardiff West Junction. Options that it may therefore be appropriate to consider include operating longer trains as far as Pontypridd with trains splitting there to continue their journeys to Aberdare, Treherbert and Merthyr Tydfil.

Such options would need to assess the infrastructure at Pontypridd including platform lengths, splitting and joining of trains and associated trade-offs in longer journey time; and would also influence the choice of rolling stock to operate on this part of the network.

To the south of Cardiff, the Cardiff Bay branch is a single line, as are the Penarth and Barry Island branches.

The industry planning process that underpins this Route Study has identified that some of these single line sections are a long term strategic constraint to aspirations for future growth, capability and connectivity.

The analysis suggests that the most obvious single lines for further consideration are those on the Treherbert and Rhymney lines taking consideration the stabling facilities at these locations. Redoubling these lines would unlock the potential to stable more trains at these locations provided that more yard space is feasible.

Section 7.2.4 sets out the feasibility work that has been undertaken to look at potential longer term interventions to redouble parts of the routes to Aberdare and Treherbert, which provide some initial indication of the amount of enhancement that would be required to enhance the routes to the heads of the valley network, together with a view on associated costs. It also considers the specific network constraints at Cardiff Queen Street and to the west of Cardiff Central. It should be noted that resolution of these network constraints in isolation will not resolve the ability to increase network capacity throughout the Valley Lines network.

This Route Study concludes that a choice for funders in CP6 (and potentially beyond) is to redouble these single lines on an incremental basis, subject to feasibility, business case and affordability. Such interventions will of course be subject to decisions that Welsh Government make with regard to how they wish to modernise the Valley Lines network and therefore the choices set out in this section seek to inform this process.

It should be recognised that the Valley Lines network also accommodates important freight flows to Tower Colliery at Hirwaun (beyond Aberdare) and Cwmbargoed (off the Rhymney Line). Modernisation of the Valley Lines network will need to consider these ongoing freight requirements which are currently accommodated by removal of timetabled passenger services.
### 6.1.3 Option 3: Upgrading Relief Lines between Cardiff and Severn Tunnel Junction to improve capacity and connectivity.

The South Wales Main Line between Severn Tunnel Junction and Cardiff Central is the busiest main line within Wales. It is a four-track railway line conveying both passenger and freight services. This four-track railway has two Main Lines along which most passenger services are routed. These Main Lines have a maximum operating speed of 95 mph for HSTs (High Speed Trains) and 75 mph for DMUs (Diesel Multiple Units) whilst the two Relief Lines have a much slower maximum operating speed of 60 mph. The Relief Lines are used predominantly by freight services and during times when the Main Lines are closed during planned maintenance or when operation is perturbed for any reason. Network Rail will explore options to enable the speed differential for DMUs to be removed, which centres around how maximum speeds for different types of rolling stock (of which several operate along this part of the network) can be signed in a safe operating manner.

The maximum number of planned services that operate on the busiest stretch of line between Cardiff Central and Newport in the baseline of 2019 in any hour is nine passenger trains. Given the different operating capabilities of the rolling stock used, and timetabling requirements driven by constraints elsewhere on the national network, this can at times mean that there is little additional network capacity available on this part of the network without compromising performance.

In CP5 there are plans to increase the frequency of passenger services between Cardiff Central and Ebbw Vale (see Section 2.3). As currently envisaged any additional service will need to operate along the Relief Lines due to timetable and network capacity constraints with consequential journey time penalty. Additionally, in the medium to longer term, Chapter 4 has highlighted the growing passenger demand between Cardiff and London and Cardiff and Bristol.

With these routes being electrified in CP5, and the existing Wales and Borders and Great Western passenger franchises being due for renewal within the next five years, the opportunities to introduce additional services between these locations (and indeed to other locations for which this arterial route is an important node) will be constrained by the current track layout configuration which would require additional services to operate along the slower Relief Lines with consequent journey time penalty.

It should also be noted that the network connections to the major freight facilities at Alexandra Dock Junction (Newport), Llanwern, Wentloog and Cardiff Tidal Sidings (providing access to Cardiff Port) are all situated on the Relief Lines side of the South Wales Main Line. There may therefore be an opportunity to assess whether the existing linespeeds into and out of these facilities can be improved to support increased capacity on the route.

A study looking at how freight wagon axle weights may be increased in the future is being funded by the Strategic Freight Network (SFN) and will form part of the Freight Network Study, being published as a Draft for Consultation in 2016. The South Wales Main Line has been identified as a possible future scenario whereby the freight flows that operate into and out of Llanwern might benefit from such operation which will have a potential benefit in the number of freight train paths that could be freed up to provide more capacity for other services.

Section 7.2.2, considers the longer term requirements for this route out to 2043 and identifies the need to upgrade the route to provide four lines with the same operating capability. A choice for funders in CP6 is therefore to start this programme by upgrading the existing Relief Lines to the same standard as the existing Main Lines. Recent re-signalling of the route has provided signal spacing to enable line speeds of up to a maximum of 100 mph to be achieved subject to bringing other assets such as track up to a comparable standard. Therefore maximising the capability afforded by the recent re-signalling works is seen as opportune given the emerging network requirements identified, and potential additional services on this part of the network. This will also enable improved service delivery to be provided when two of the four lines are closed for maintenance.

### Table 6.3 Assessment of Option A: Upgrade of Relief Lines between Cardiff Central and Severn Tunnel Junction to a comparable speed profile to the Main Lines.

**Summary of intervention:**
This network enhancement will provide additional capacity and reduce journey times for services that require to be routed along the Relief Lines between Cardiff Central and Severn Tunnel Junction. In effect this provides a more effective four track railway for passenger trains.

**Output assessment:**
Maximise capability afforded by recent re-signalling of the route to provide a line speed profile on the Relief Lines comparable with the existing Main Lines. The closure of Bishton Level Crossing with alternative access provided is included within this option. This goes towards meeting the requirements of Conditional Outputs CO1 and CO30, while also acting as an enabler for future longer term requirements to deliver enhanced network capacity to 2043.

**Affordability assessment**
An appraisal has been carried out assessing the financial viability of this option and this identifies that the option is equivalent to a very high value for money categorisation for investment in CP6. Further detail of the appraisal is included in Appendix A.

Costs for removing Bishton level crossing and replacement by road overbridge are included within the appraisal. There could be a Section 106 contribution towards the cost of a new road overbridge as a result of proposed development of the land to the south of the railway at this location. Should such funding materialise, the value for money appraisal category would be further improved.
As part of the Cardiff City Region Metro development, there are aspirations for new stations between Cardiff Central and Severn Tunnel Junction. It is likely that these would be constructed on the Relief Lines and this option would enable journey times for stopping trains to be maintained or improved.

A further option has been assessed from a feasibility and business case perspective which considers the incremental case for upgrading all four lines between Cardiff Central and Severn Tunnel Junction to a maximum operating speed of 100 mph. This incremental upgrade does not deliver high value for money as the improved journey times are negligible.

Both options have assumed that as part of the infrastructure upgrades required, Bishton level crossing (between Newport and Severn Tunnel Junction) will be closed and replaced by a new road overbridge. Tables 6.3 and 6.4 describe the assessment of options detailed above.
6.1.4 Option 4: Redevelopment of Cardiff Central Station to create a station fit for a capital city

Cardiff Central Station is by far the busiest in Wales in terms of passenger numbers and train services.

As stated in Chapter 4, sustained growth in demand for travel into Cardiff is expected. Indeed, the number of passengers using Cardiff Central Station could grow from 13 million in 2013 to upwards of 23 million by 2023 and to upwards of 32 million by 2043.

The station layout, which originates from 1934, will need to provide much more capacity in order to satisfy the forecast demand growth. Put simply, the railway station will need to satisfy more people, more often.

A modernisation of the station is rapidly required. The railway needs to deliver three key outputs:

- More capacity for passengers and more capacity for trains during the peak hours and also during major events in the capital (including extending Platform 0 into a full length facility for Super Express Trains (SETs) and a new west facing Platform 5)
- Better customer experience
- Spatial integration with the city centre and new bus station.

As the station is at the heart of the city centre’s financial and professional services district, which will include a new BBC headquarters, there are multifaceted development, funding and delivery options for creating a station fit for a capital city.

While some initial work is already underway, largely driven by the new BBC headquarters and a new bus station, more development work needs to be undertaken to understand the different options for the station itself. This work could be completed in CP5 so that construction work could start in CP6 - continuing development work is key to maintaining progress and funding would be required for this. Learning from the Rugby World Cup 2015 will be an important aspect. Network Rail is also collaborating with Cardiff Council to align our proposals with their committed plans for investment in the Enterprise Zone.

This Route Study concludes that a choice for funders in CP6 is the modernisation of Cardiff Central Station so that the railway can continue to play its part in supporting economic growth and prosperity in the capital city of Wales.

6.1.5 Option 5: Continued programme of level crossing closures in South West Wales

Following electrification of the South Wales Main Line to Swansea during CP5, this will in the medium to longer term provide the opportunity to convert passenger services from diesel traction to electric traction to Swansea. Opportunities to extend services west beyond Swansea will therefore require trains to be capable of operating both electrically and on diesel engines (bi-mode technology), or remain diesel operated.

In the shorter term there are opportunities to look at where journey times might be improved in South West Wales to offer significant journey time improvement on this rural part of the network. During CP5 Network Rail is continuing to look at opportunities for closing level crossings which remain the single biggest safety risk on the network. This work builds on the already significant achievements in closing many crossings across the UK rail network during CP4, and does provide a natural strategic alignment on parts of the more rural network where journey time improvements are also required.

The route from Whitland to Pembroke Dock has a number of level crossings where the risk profile requires a low line speed, which then has a detrimental impact on journey times. Network Rail will continue to assess the options associated with closure of these crossings with local authorities and how these might be funded given the safety and potential journey time improvement benefits that could be accrued. Additionally, discussion will also continue with governments, regional and local authorities as to what future train services might be specified as reduction of journey time might also enable more efficient resource of rolling stock deployment on such routes and potentially provide additional route capacity owing to the occupation time of the single line being reduced.

As part of this Route Study, a desktop review has been undertaken to identify potential journey time improvements. Upgrade or closure of the three open level crossings on the Pembroke Dock branch line would enable trains to cross these crossings at prevailing line speed (whereas currently trains have to briefly stop on approach), and journey time savings of between three to three and a half minutes per journey could be achieved dependant on rolling stock deployed.

These opportunities will assist in seeking to deliver Conditional Output CO37.
6.1.6 Option 6: Continuation of additional peak services on the Heart of Wales Line, and further improved generalised journey times

The Heart of Wales Line is a single line with passing places through the rural landscape of Mid and South Wales. Four passenger services run in each direction per day, usually between Swansea and Shrewsbury, serving the considerable number of local stations along this route, some of which are the most remote in Wales. Additional peak time services have been introduced on a three year trial basis from May 2015, running between Llandovery and Swansea in the south, and Llandrindod and Crewe in the north. Additional peak time arrivals at either end of the route will also provide earlier connectional times to other key Welsh and UK destinations. Continuation of these services in the medium to longer term will deliver Conditional Output CO38.

The Heart of Wales Line Forum is a consortium who actively promote the line. Welsh Government has provided funding to the forum to assess the feasibility of improving services along the route to provide better access to employment and social infrastructure, as well as promoting tourism. The forum has produced the ‘Unlocking Mid Wales’ report which details their findings. This report makes reference to future service provision and also highlights work being done to develop community station hubs along the route which is aimed at both the local community and growing the use of the rail network.

The next Wales and Borders franchise in 2018 offers opportunity for continued specification of the recently introduced additional passenger services along the route, together with any other passenger service specification changes. As part of this process, consideration should be given to the requirements to serve the major employment centres at each end of the route (Llanelli and Swansea at the south end, and Shrewsbury at the north end) together with connectivity beyond these points.

Opportunity may therefore exist to optimise passenger train services along the route by a combination of shorter distance services from a central point along the route such as Llandovery to both north and south destinations, together with through services along the route potentially to and from locations beyond Swansea in the south and Shrewsbury in the north.

The ‘Unlocking Mid-Wales’ report makes reference to the potential of having an operating base for the line in Llandovery. This would enable passenger train sets to be stabled and serviced overnight in readiness for commencement of journeys in the morning. This would remove the existing requirement for trains to travel a long distance in order to commence start of service at Llandovery, and at the same time provide employment and skills opportunities in this part of Wales.
6.1.7 Option 7: Selected train lengthening on Cardiff to Manchester services

There is expected to be a capacity gap on the Cardiff – Manchester services via the Marches by the end of CP6. Details of the passenger demand analysis are discussed in Section 5.1.6. This capacity gap can be met through train lengthening.

Cardiff to Manchester services are operated with two-car or three-car trains, lengthening these services with additional vehicles will deliver sufficient capacity to accommodate forecast demand growth on these services.

Tables 6.5 and 6.6 describe the assessment for the train lengthening option.
**Table 6.7: Assessment of Option A: Provision of 25kV electrification from Crewe/Warrington and Llandudno/Holyhead via Chester**

**Summary of intervention:**
This network enhancement will deliver a fully electrified railway between North Wales and London, Liverpool (assuming Halton Chord is also electrified) and Manchester enabling all passenger services on these routes to operate using electric passenger rolling stock.

**Output assessment:**
Electrification of the route(s) between Crewe/Warrington and Llandudno/Holyhead via Chester will deliver improved connectivity between North Wales and London, Liverpool and Manchester.
This goes towards meeting the requirements of Conditional Outputs CO21 CO22, CO23 and CO24.

**Affordability assessment**
Appraisals have been carried out to assess the financial viability of the options outlined in Section 6.1.8 and this identifies that the options assessed represent a poor value for money case for investment in CP6. Further details of the appraisals are included in Appendix A. The appraisal work undertaken does not reflect assessment of any wider economic benefits that would accrue to the region and further afield. Welsh Government and cross-border partners are assessing the wider economic benefits that would accrue to the region and further afield. The appraisal work undertaken does not reflect assessment of any wider economic benefits that would accrue to the region and further afield. Welsh Government and cross-border partners are assessing the wider economic benefits that would accrue to the region and further afield.

**6.1.8 Option 8: Modernisation of the North Wales Coast Main Line**

The Welsh Government and local and regional authorities on both sides of the border want to see the modernisation of the network in North Wales, building on Network Rail’s committed plans for modernising signalling assets along the North Wales Coast during CP5 and CP6. This is important to provide connectivity and reduce journey times between North Wales, North West England and the rest of the UK including future connectivity to High Speed 2 (HS2).

As part of this initiative, Network Rail has developed a socioeconomic case on behalf of Welsh Government for electrification of the route(s) between Crewe/Warrington and Llandudno/Holyhead via Chester. In parallel with this, the Welsh Government and North Wales Economic Ambition Board have undertaken work to identify and quantify the wider economic benefits to the UK economy that could be achieved by modernisation of the route and the specification of additional services to London, Manchester and Liverpool (via Halton Chord, for which enhancement investment has recently been announced by UK Government).

Network Rail’s study reviewed a number of potential passenger service specification options which resulted in a range of appraisal results. The base case option considered conversion of a number of existing diesel passenger services (that operate today) to electric passenger services where these existing services already operate over electrified routes for significant parts of their journeys. In this case the services assumed to be converted from diesel operation to electric operation are:

- services between London Euston and Chester/North Wales in both directions
- services between Manchester Piccadilly and North Wales in both directions
- services between Chester and Crewe in both directions.

An option that would provide an improved business case would require a greater number of passenger services to be specified along the North Wales Coast. An assessment was undertaken using the passenger train service specification developed for the 2043 Indicative Train Service Specification (ITSS) (see Section 5.5).

This assessment assumes that the existing diesel passenger services that operate today and are set out in the base case above, are converted to electric passenger services as in the base case. The additional passenger services specified would include:

- All London Euston services that currently terminate at Chester would be extended into North Wales providing an hourly service between London Euston and North Wales (Bangor/Holyhead) in each direction.
- An additional service in each hour between Manchester Piccadilly and Llandudno in each direction.
- A new direct service between Liverpool and North Wales (Bangor/Holyhead) in each direction.

It is important to note that the business case assessed for this high frequency service option includes only the capital costs of electrification infrastructure, and the costs of converting existing diesel services to electric services. It does not assess the business case for the introduction of the new/additional services specified in the 2043 ITSS for which operating subsidy would likely be required.

Table 6.7 describes the assessment of the option to electrify the network using 25kV overhead electrification between Crewe/Warrington and Llandudno/Holyhead via Chester.

While the economic appraisal of this proposal offers a low value for money case, there are other potential economic and policy drivers for change. Further work is being undertaken by Welsh Government, the North Wales Economic Ambition Board and its partners to quantify these benefits and develop the case for investment in electrification during CP6.

Additionally, it should be noted that the case for electrifying the route from Crewe to Chester provides a high value for money investment, although a journey time penalty for passengers travelling to and from North Wales, so consideration is required between governments as to how an overall scheme to Holyhead and Llandudno would be delivered. This is particularly important in terms of future passenger service specification in northern England, and future rolling stock strategy.
Section 6.1.9 sets out a choice for funders in CP6 to improve linespeeds along the North Wales Coast Main Line, enabled by re-signalling of the route during CP5 and CP6 (see Section 2.3). The route between Llandudno Junction and Holyhead crosses the Menai Straits on the Britannia Bridge to the west of Bangor. The line over the Britannia Bridge is currently a single line with utility services currently occupying the second track bed. In the longer term this single line section could become a timetable constraint to future increased service specification, and therefore the resignalling of this part of the route during CP6 offers an opportunity to consider reinstatement of a two track railway over this structure. This should be considered as part of the development of the resignalling works.

From a freight perspective there is currently little freight on the route, but there remains potential developments with both primary and secondary aggregates (Penmaenmawr, Blaenau Ffestiniog), for intermodal/retail (Llandudno Junction) and the potential new nuclear power station at Wylfa.

Enhancement of the route for 25kV electrification clearance offers the opportunity to consider further enhancements that funders might wish to consider to accommodate future freight flows.

6.1.9 Option 9: Improved linespeeds along North Wales Coast Main Line

Re-signalling of the North Wales Coast Main Line between Rockcliffe Hall (west of Chester) and Llandudno/Holyhead, is planned to be delivered by early CP6. In addition track renewals are planned to be undertaken during CP5. Phase 1 of the signalling programme will see the route re-signalled between Rockcliffe Hall and Llandudno Junction during CP5, with Phase 2 re-signalling the remainder of the route by early CP6.

The signalling design provides capability for improving linespeed up to a maximum of 100 mph where conditions allow. Renewal of the signalling system and some track components will therefore provide latent capability for higher linespeeds. To enable this latent higher linespeed capability to be fully exploited, further work will be required to improve track geometry and provide the necessary route clearances.

Analysis of this option has indicated that, depending upon the stopping patterns of trains and their origin/destination points (Llandudno/Holyhead), a maximum journey time saving of up to eight minutes could potentially be achieved for the long distance limited stop services between Chester and Holyhead. Services that stop at more stations along the route do still achieve journey time savings of up to three minutes between Chester and Holyhead, with services between Chester and Llandudno (that call at most stations) achieving about a one minute journey time saving.

This intervention should be considered as a choice for funders in CP6 as it aligns with the medium to longer term aspirations to modernise the North Wales Coast Main Line (see Section 6.1.8).

Table 6.8 describes the assessment of this option to deliver improved journey time between Chester and Llandudno/Holyhead.
6.1.10 Option 10: Improved connectivity to Deeside

The growth in demand for better connectivity between Deeside, the rest of North Wales and Merseyside provides an opportunity to consider what options exist to improve connectivity from the both the North Wales Coast Main Line and the Wrexham to Bidston line including consideration of options for improved or new integrated transport hub station or stations to serve the Deeside area.

Sections 6.1.8, 6.1.9 and 6.1.12 of this chapter identify a range of proposed choices for funders in CP6 along the North Wales Coast Main Line and between Wrexham and Bidston that act as a step to accommodate future required improvements in connectivity including access to the Deeside Industrial Area which is not currently well served by rail.

A transport planning study to identify potential options to improve travel to Deeside by sustainable modes is being undertaken by Welsh Government. This will identify option(s) for the integrated transport hub station(s) needed to achieve the necessary access for rail passengers. This will provide a potential choice for funders in CP6 to develop these further.

Potential options could include enhancing the purpose and functionality of Shotton Low Level Station (on the North Wales Main Line), Shotton High Level Station (on the Wrexham to Bidston Line), and of Hawarden Bridge (on the Wrexham to Bidston Line).

Interchange between the two Shotton stations is not easy as they are at different levels and locations - see Figures 6.3 and 6.4.

The study is considering opportunities to improve the interchange potential at this location which serves both lines and improves timing of services to optimise interchange. It will also consider the potential for enabling direct rail access between the North Wales Main Line and the Wrexham to Bidston Line by the provision of a new chord line at Shotton.

Section 7.2.9 considers longer term options for improving connectivity along the route between Wrexham and Bidston and identifies that improved frequency of service along the route would be of far greater benefit than providing turn back facilities at Hawarden Bridge. However, Hawarden Bridge is the closest railway station to the Deeside Industrial Park and Northern Gateway development site – key locations in the Deeside Enterprise Zone. The Welsh Government’s study is also considering how the current poor level of facilities at this location can be improved to support improved rail access to Deeside, including potentially a new station at this location with integrated transport links. While no detailed analysis of costs has been undertaken to date it is envisaged that provision of effectively a new station would cost in the region of £10m subject to the scope of facilities required.

In addition the ‘Wrexham to Bidston (Borderlands) Line: Service Enhancements Economic Appraisal Report’ was produced in June 2015, funded jointly by Merseytravel and Welsh Government. The study looked at increasing frequency on the line, new stations, and improving existing stations, and developed a number of recommendations to support development of rail services on the line. Network Rail will continue to work with Merseytravel and Welsh Government to support continued development of the recommendations pertaining from this report.
6.1.11 Option 11: Further programme of capacity improvements between Chester and Wrexham

6.1.11.1 Emerging development of new service options between North West England and Chester/North Wales

The economies of North Wales, Deeside, Merseyside and Manchester are closely linked and the road networks in this part of the country are operating at maximum capacity during peak times.

During 2016, as part of a range of transport improvements in the North West, UK Government announced plans to enhance the Halton Chord (a short piece of railway line that links Runcorn on the Liverpool Lime Street to Weaver Junction line to Frodsham on the Warrington Bank Quay to Chester line) to enable operation of regular direct train services between Liverpool Lime Street and North Wales/Wrexham. This also provides the ability to improve connectivity between North Wales and Liverpool John Lennon Airport via Liverpool South Parkway station.

The Welsh Government has been working with Merseytravel and Network Rail to explore options and develop the case for delivering improved connectivity between Liverpool and Wrexham, and has also been in discussions about how future train services operating in the north of England might be extended to destinations in North Wales – including Wrexham.

6.1.11.2 Options for an extension of an hourly service between Liverpool Lime Street and Chester to Wrexham General

Since publication of the Welsh Route Study Draft for Consultation, Welsh Government has remitted Network Rail to consider a number of further options that would enable accommodation of additional passenger train services between Wrexham General and Chester. This additional network capacity would provide options to introduce direct services between Wrexham General and Liverpool Lime Street (via Halton Chord) and potentially Manchester.

These options would not in their own right deliver the requirements set out in the 2043 Indicative Train Service Specification (ITSS), which is likely to require full redoubling of the line between Wrexham General and Chester, and for which this final Welsh Route Study assesses the feasibility findings in Section 7.2.6.2. The options outlined below, provide an incremental approach to delivering the longer term requirements for 2043.

As part of the development of options for providing additional capacity between Wrexham General and Chester, Welsh Government wished to understand whether network capability will exist (once the North-South Journey Time Improvement enhancement scheme is delivered during 2016) for a single hourly Wrexham to Liverpool Lime Street service (via Halton Chord) without requiring infrastructure enhancement. Analysis undertaken concluded that:

- a new direct service between Liverpool Lime Street and Chester via Halton Chord cannot be extended through Chester to Wrexham in the majority of hours on the existing infrastructure
- provision of an additional through platform at Chester would enable extension of this new service to/from Wrexham General on an hourly basis, without further network enhancement between Chester and Wrexham General. This would however result in some variable arrival and departure times between Chester and Wrexham General, and some sub-optimal (extended) journey times due to the remaining single line section of route between Saltney Junction (west of Chester) and Wrexham General.
- turn round times at Wrexham General would be in the order of 20-35 minutes which may not be optimal in terms of the most efficient use of rolling stock.
- a further review of the timing and platforming of conflicting services at Chester (which is also likely to have impact elsewhere on the network) might offer the opportunity to improve timing of the new services through Chester, and journey time by the avoidance of dwell times at Chester.
Further feasibility work has therefore looked at a range of potential interventions to overcome the constraints identified in Section 6.1.11.2. This feasibility has assessed options necessary for accommodating both one and two additional passenger services in each hour between Wrexham General and Chester that would provide service options to improve connectivity between Wrexham General, Chester and North West England (Liverpool/Manchester).

Tables 6.9 to 6.13 set out the range of options developed. Options 1a and 1b (Tables 6.9 and 6.10) deliver 1 additional passenger train in each hour between Wrexham General and Chester, and options 2a and 2b (Tables 6.11 and 6.12) deliver 2 additional passenger train in each hour between Wrexham General and Chester. Table 6.13 sets out 2 potential options for an additional platform at Chester, which is required in addition to each of the options set out for Wrexham General.

6.1.11.4 Infrastructure enhancement options to support additional services between North West England and Wrexham

Construction of HS2 to Crewe by 2027 will release network capacity on the West Coast Main Line for additional passenger and freight services. The 2043 Welsh Route Study ITSS identifies enhanced service levels between London and North Wales that could, subject to specification, be introduced once West Coast Main Line capacity becomes available.

Therefore a further choice for funders exists to provide the necessary network capacity between Wrexham General and Chester in advance of specification of additional services between Wrexham and London (via West Coast Main Line) during CP6. This option would improve connectivity between Wrexham and London via West Coast Main Line locations.

This option will require the remaining single line sections between Wrexham General and Chester to be redoubled. These requirements are set out in Table 6.14.

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Table 6.9: Option 1a: Provision of one additional passenger service in each hour between Wrexham General and Chester (Wrexham General to Liverpool Lime Street via Halton Chord).

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<th>Summary of intervention:</th>
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<tr>
<td>This intervention will require the provision of bi-directional signalling in Platforms 1 and 2 at Wrexham General to enable turn-back of an additional hourly service from Chester. Figure 6.5 shows the proposed option layout. This intervention assumes the existing level of passenger and freight services are maintained in addition to the proposed new service.</td>
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<th>Output assessment:</th>
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<td>Accommodates an additional hourly passenger service between Wrexham General and Chester. Timing of the new services are reliant on train paths elsewhere on the network which could potentially impact upon performance and operational flexibility. An additional through platform at Chester is still required in addition to this intervention (see Table 6.13 and Figure 6.9). This goes towards meeting the requirements of Conditional Outputs CO28 and CO41.</td>
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<th>Indicative cost</th>
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<td>Up to £10 million.</td>
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<thead>
<tr>
<th>Affordability assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering feasibility work has been undertaken to establish the likely range of capital costs to deliver this intervention. No appraisal of this option has been conducted as part of this Route Study. Merseytravel, supported by Welsh Government, has developed the case for extension of new services between Liverpool Lime Street and Chester/Wrexham. It is suggested that this work be further developed by the industry to consider the infrastructure options necessary to support extension of services beyond Chester to Wrexham.</td>
</tr>
</tbody>
</table>

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Table 6.10: Option 1b: Provision of one additional passenger service in each hour between Wrexham General and Chester (Wrexham General to Liverpool Lime Street via Halton Chord).

<table>
<thead>
<tr>
<th>Summary of intervention:</th>
</tr>
</thead>
<tbody>
<tr>
<td>This intervention will require the provision of bi-directional signalling in Platforms 1 and 2 at Wrexham General to enable turn-back of an additional hourly service from Chester. Additionally, this option builds on Option 1a by extending the double line section north of Wrexham General from Wrexham North Junction by approximately 1½ miles towards Gresford, recovering the existing Wrexham North Junction and replicating this at Gresford. Figure 6.6 shows the proposed option layout. This intervention assumes the existing level of passenger and freight services are maintained in addition to the proposed new service.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodates an additional hourly passenger service between Wrexham General and Chester. This option provides additional performance resilience and greater operational flexibility from a timetabling perspective. This option also provides an incremental step towards potential longer term full redoubling of the route to meet the 2043 ITSS. An additional through platform at Chester is still required in addition to this intervention (see Table 6.13 and Figure 6.9). This goes towards meeting the requirements of Conditional Outputs CO28 and CO41.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indicative cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>£15 - £35 million.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Affordability assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering feasibility work has been undertaken to establish the likely range of capital costs to deliver this intervention. No appraisal of this option has been conducted as part of this Route Study. Merseytravel, supported by Welsh Government, has developed the case for extension of new services between Liverpool Lime Street and Chester/Wrexham. It is suggested that this work be further developed by the industry to consider the infrastructure options necessary to support extension of services beyond Chester to Wrexham.</td>
</tr>
</tbody>
</table>
Summary of intervention:
This intervention will require the provision of bi-directional signalling in Platforms 1 and 2 at Wrexham General. A new connection into Platform 3 would also be provided to allow operational capacity and flexibility to turn round trains from the north at this location. Figure 6.7 shows the proposed option layout.
This intervention assumes the existing level of passenger and freight services are maintained in addition to the proposed new services.

Output assessment:
Accommodates two additional passenger services in each hour between Wrexham General and Chester.
The timing of the new services are reliant on train paths elsewhere on the network which could potentially impact upon performance and operational flexibility. An additional through platform at Chester is still required in addition to this intervention (see Table 6.13 and Figure 6.9).
This goes towards meeting the requirements of Conditional Outputs CO28 and CO41.

Indicative cost
Up to £10 million.

Affordability assessment
Engineering feasibility work has been undertaken to establish the likely range of capital costs to deliver this intervention.
No appraisal of this option has been conducted as part of this Route Study. Merseytravel, supported by Welsh Government, has developed the case for extension of new services between Liverpool Lime Street and Chester/Wrexham. It is suggested that this work be further developed by the industry to consider the infrastructure options necessary to support extension of services beyond Chester to Wrexham.

Table 6.11: Option 2a: Provision of two additional passenger services in each hour between Wrexham General and Chester (Wrexham General to Liverpool Lime Street and/or Manchester).

Summary of intervention:
This intervention will require the provision of bi-directional signalling in Platforms 1 and 2 at Wrexham General. A new connection into Platform 3 would also be provided to allow operational capacity and flexibility to turn round trains from the north at this location. Figure 6.7 shows the proposed option layout.
This intervention assumes the existing level of passenger and freight services are maintained in addition to the proposed new services.

Output assessment:
Accommodates two additional passenger services in each hour between Wrexham General and Chester.
The timing of the new services are reliant on train paths elsewhere on the network which could potentially impact upon performance and operational flexibility. An additional through platform at Chester is still required in addition to this intervention (see Table 6.13 and Figure 6.9).
This goes towards meeting the requirements of Conditional Outputs CO28 and CO41.

Indicative cost
Up to £10 million.

Affordability assessment
Engineering feasibility work has been undertaken to establish the likely range of capital costs to deliver this intervention.
No appraisal of this option has been conducted as part of this Route Study. Merseytravel, supported by Welsh Government, has developed the case for extension of new services between Liverpool Lime Street and Chester/Wrexham. It is suggested that this work be further developed by the industry to consider the infrastructure options necessary to support extension of services beyond Chester to Wrexham.

Table 6.12: Option 2b: Provision of two additional passenger services in each hour between Wrexham General and Chester (Wrexham General to Liverpool Lime Street and/or Manchester).

Summary of intervention:
This intervention will require the provision of bi-directional signalling in Platforms 1 and 2 at Wrexham General. A new connection into Platform 3 would also be provided to allow operational capacity and flexibility to turn round trains from the north at this location. Figure 6.7 shows the proposed option layout.
Additionally, this option builds on Option 2a by extending the double line section north of Wrexham General from Wrexham North Junction by approximately 1½ miles towards Gresford, recovering the existing Wrexham North Junction and replicating this at Gresford. Figure 6.8 shows the proposed option layout.
This intervention assumes the existing level of passenger and freight services are maintained in addition to the proposed new service.

Output assessment:
Accommodates an additional hourly passenger service between Wrexham General and Chester.
This option provides additional performance resilience and greater operational flexibility from a timetabling perspective. This option also provides an incremental step towards potential longer term full redoubling of the route to meet the 2043 ITSS.
An additional through platform at Chester is still required in addition to this intervention (see Table 6.13 and Figure 6.9).
This goes towards meeting the requirements of Conditional Outputs CO28 and CO41.

Indicative cost
£15 - £35 million.

Affordability assessment
Engineering feasibility work has been undertaken to establish the likely range of capital costs to deliver this intervention.
No appraisal of this option has been conducted as part of this Route Study. Merseytravel, supported by Welsh Government, has developed the case for extension of new services between Liverpool Lime Street and Chester/Wrexham. It is suggested that this work be further developed by the industry to consider the infrastructure options necessary to support extension of services beyond Chester to Wrexham.
**Table 6.13: Provision of an additional platform at Chester to accommodate additional passenger services between Wrexham General and North West England (Liverpool Lime Street/Manchester)**

<table>
<thead>
<tr>
<th>Summary of intervention:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of infrastructure interventions required to accommodate additional services between Wrexham General and Chester (Liverpool Lime Street and/or Manchester to Wrexham General) are principally constrained by available network capacity and operational flexibility at Chester. It will therefore be necessary to provide an additional platform at Chester to accommodate the range of new service options considered in this section. An initial view of this option is that potentially there are two options for how this additional platform might be accommodated. These are shown in Figure 6.9. This intervention assumes the existing level of passenger and freight services are maintained in addition to the proposed new services.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodates a range of new service options between Wrexham General and North West England up to 2 additional services per hour. This requirement will also help meet the longer term ITSS for 2043, in conjunction with potential future layout enhancement.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indicative cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>No development work has yet been undertaken to assess this option. This work is planned to be undertaken during 2016 in order to inform the Initial Industry Plan. Based upon comparable interventions this intervention is likely to be in the cost range £15 - £35 million.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Affordability assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>No appraisal of this option has been conducted as part of this Route Study. Merseytravel, supported by Welsh Government, has developed the case for extension of new services between Liverpool Lime Street and Chester/Wrexham. It is suggested that this work be further developed by the industry to consider the infrastructure options necessary to support extension of services beyond Chester to Wrexham.</td>
</tr>
</tbody>
</table>

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**Table 6.14. Deliver the ability to provide an additional passenger service in each hour between Chester and Wrexham**

<table>
<thead>
<tr>
<th>Summary of intervention:</th>
</tr>
</thead>
<tbody>
<tr>
<td>This network enhancement will require the redoubling of the remaining single line section between Saltney Junction and Wrexham General and layout changes at Wrexham General.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliver increased network capacity between Chester and Wrexham General. This goes towards meeting the requirements of Conditional Outputs CO28 and CO41.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indicative cost:</th>
</tr>
</thead>
<tbody>
<tr>
<td>£35 - 75 million. Costs exclude additional platform at Chester.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Affordability assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering feasibility work has assessed the engineering works necessary and the associated range of capital costs to redouble this part of the network. No appraisal of this option has been conducted as part of this Route Study. It is suggested that if this option is pursued, the business case be developed by the industry to assess all of the connectivity requirements (i.e. Wrexham - North West England and Wrexham - London).</td>
</tr>
</tbody>
</table>

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**Figure 6.9 Provision of an additional platform at Chester**

To Liverpool via Merseyrail
To Manchester via Warrington & Liverpool via Halton Curve
To Manchester via Northwich
To Wrexham
To North Wales
To Crewe
To Wrexham General
6.1.12 Option 12: Improved linespeeds between Wrexham and Bidston

During CP5 Network Rail is continuing to look at opportunities for closing Level Crossings (including user and footpath crossings) which remain the single biggest safety risk on the network.

During CP4 track renewals have been completed on parts of this route. Where these track renewals have been undertaken, opportunity exists to raise linespeeds subject to closing or upgrading level crossings. A high level assessment has been undertaken to assess replacement of 14 user crossings by footbridges with an indicative cost range of £5 million - £15 million.

As part of this Route Study, a desktop review has taken place which has identified that the journey time savings which could be achieved through closure or upgrade of these crossings, based on the rolling stock and stopping pattern currently used on the route. Depending on the direction of travel the savings range from one to two minutes.

Section 7.2.9 describes the work being developed by the North of England Route Study which is considering potential options for extending electrification south of Bidston towards Shotton and Wrexham. Potential future electrification of the route and deployment of electric rolling stock would also deliver journey time savings on this route.

By delivering improved journey times along the route, this will also improve the performance of the route where current end to end journey time between Wrexham Central and Bidston is approximately one hour with minimal turn around times at each end of the route.

During CP5 and CP6 options for improving the service offering on this route will be further developed, working closely with local and regional stakeholders. Section 6.1.10 highlights recent work undertaken by Merseytravel and Welsh Government to look at improving connectivity along this route. This work considers options for frequency enhancement.

Throughout the development of this Route Study and the bordering work on the North of England Route Study, stakeholders have expressed their strong aspirations to see improved connectivity, both on the route to Deeside and from the route to Merseyside. Opportunities therefore exist through the refranchising process to consider specification of additional services. This is likely to require some additional signalling works along the route to provide increased capacity for additional passenger services and existing freight users. Should such services be specified either before or during CP6, the intervention of additional signalling block sections identified in Section 7.2.9 would need to be delivered.
6.1.13 Option 13: Improved all day frequency on the Cambrian Main Line.

No specific capacity issues are envisaged in peak hour commuting into Shrewsbury from origin points in the Welsh Route Study area during CP6. However, it is recognised that the ability to commute into Shrewsbury by rail from locations situated on the Cambrian Main Line (particularly Newtown and Welshpool) are currently constrained by the current timetable which offers limited morning peak arrival time opportunities and also limited evening peak departure time opportunities.

With effect from May 2015, for a trial period of three years, Welsh Government is funding additional services on this route which will provide an hourly service during peak times and which improve the ability to commute into Shrewsbury from the Cambrian Main Line. These additional services will also provide improved connectivity into Aberystwyth at the west end of the route.

Regional authorities aspire to see the current trial hourly peak services along the route become an hourly all day service, thereby providing improved connectivity to and from the region. An improved all day frequency on the Cambrian Main Line will deliver improved connectivity along the route offering improved generalised journey time opportunities, improved peak and off peak travel opportunities to both ends of the route, and improved connectivity with other major UK centres. It will also provide additional capacity to meet any constrained demand and at such times as when services on the route are particularly busy either prior to the start of or at the end of student term times at Aberystwyth University.

Network Rail is currently supporting Ceredigion County Council who are promoting development of a potential new station at Bow Street to the north of Aberystwyth. There is also an aspiration for a new station at Carno between Caersws and Machynlleth. The present infrastructure between Shrewsbury and Aberystwyth is only likely to be able to support an hourly service in each direction with one new station. The rail industry is assessing what potential timetable options may be available to support an hourly service along this route that could accommodate both these stations. Additionally Network Rail is assessing what further infrastructure enhancement is required along the route to support the provision of both of these proposed stations.

6.1.14 Option 14: Improved frequency on the Ebbw Vale Line with connectivity to Newport and Abertillery

Sections 2.3, 6.1.1 and 6.1.2 describe the work funded by Welsh Government, which is currently being delivered to enhance infrastructure on the Ebbw Vale line to enable an increase in passenger rail frequency from one train per hour to two trains per hour in each direction. This work is planned to be delivered in 2017. This will enable Conditional Output CO1, Cardiff peak commuting (insofar as the route to/from Ebbw Vale is concerned) to be met by in advance of CP6. The outputs being delivered as part of the Ebbw Vale Phase 1 scheme are described in Figure 6.10.

The scheme delivers the following:

- approximately seven miles of redoubled railway
- new platform and extension of existing platform at Newbridge & Llanhilleth Stations to accommodate 6 x 23m passenger rolling stock
- resignalling of the line (5 minute headways)
- linespeed improvements between Crosskeys Junction and Aberbeeg Junction
- passive provision for reintroduction of Abertillery branch through signalling at Aberbeeg Junction.

This scheme would enable a second service to be introduced between either Ebbw Vale and Cardiff Central, or Ebbw Vale and Cardiff Central via Newport, see Figure 6.10.

Welsh Government has subsequently remitted Network Rail to investigate options for further enhancing passenger service frequency along the route, with options to provide enhanced capacity to cater for longer term passenger growth, and improve connectivity between the route and Newport, and provide a newly re-instated rail link to Abertillery. These are described in Figures 6.11 and 6.12, and Tables 6.15 and 6.16.
6.1.14.1 Option 1 – Provision for 3 passenger trains per hour on Ebbw Vale Line

Ebbw Vale Phase 1 works currently being delivered for 2017, include passive provision for the signalling works necessary to provide a junction at Aberbeeg (north of Llanhilleth). This provides the capacity to run up to three or four trains per hour in each direction along the route as far as Llanhilleth. The third service in each hour would then either turnback just north of this location or could be extended on a new line to Abertillery.

Resignalling works in the Park Junction area currently planned for CP6, are an enabler for this option as they provide an incremental enhancement opportunity for funders.

A service option would then exist for this new service to run between Abertillery and Newport with potential option to extend beyond Newport. This would require either a new turnback facility at Newport (see Section 7.2.2.4). A potential location to extend the service beyond Newport could be Abergavenny, which would require provision of a new turnback facility (see Section 7.2.5.1), which subject to funding could be delivered earlier and is likely to be more affordable than a new bay platform at Newport.

Connectivity between Abertillery and Cardiff would be provided by the ability to change trains at stations between Llanhilleth and Pye Corner, with Ebbw Vale to Cardiff trains flighted closely behind Abertillery to Newport/Abergavenny trains in one direction, with Abertillery services flighted closely behind an Ebbw Vale service in the opposite direction.

6.1.14.2 Option 2 – Provision for four passenger trains per hour on Ebbw Vale Line

Ebbw Vale Phase 1 works currently being delivered for 2017, include passive provision for the signalling works necessary to provide a junction at Aberbeeg (north of Llanhilleth). To provide capacity for four trains per hour along the route the following additional infrastructure works would be required over and above those being delivered as part of Phase 1:

- doubling of track south of Risca Junction
- new additional platform at Rogerstone Station
- new additional platform at Pye Corner Station
- linespeed improvement works south of Risca

As with Option 1, the Phase 1 works provide the necessary capacity to run up to four trains per hour in each direction along the route as far as Llanhilleth. Should a third passenger train in each hour be required between Ebbw Vale and Cardiff, this would also require track redoubling north of Aberbeeg Junction to Ebbw Vale Parkway.

An alternative service pattern could potentially provide for the following service specification in each direction that aligns with the 2043 Indicative Train Service Specification (ITSS):

- one train per hour between Ebbw Vale and Cardiff Central extended to Maesteg
- one train per hour between Ebbw Vale and Newport extended to Abergavenny
- one train per hour between Abertillery and Newport and beyond
- one train per hour between Abertillery and Cardiff Central and beyond.

As with Option 1, these works would require the reinstatement of the line to Abertillery.

Also as with Option 1 work would also be required in the Park Junction area which would be undertaken as part of the resignalling of this area with re-control of the signalling from Park Junction Signal Box to the Wales Rail Operating centre in Cardiff.

6.1.14.3 Journey Time Improvement Opportunities

Journey time opportunities have been identified as part of the Ebbw Vale Frequency Enhancement project where potential speed increases north of Aberbeeg can result in a journey time saving of between one to two minutes depending on rolling stock that might be specified for the route.

Additional speed improvements can be implemented between Ebbw Junction and Park Junction, and there is an opportunity for this to take place as part of the Valleys Relock and Recontrol project. These options are being developed in conjunction with Welsh Government.
**06: Choices for funders to 2024**

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**Table 6.15. Assessment of Option 1: Provision of three passenger trains per hour in each direction on Ebbw Vale line (CO1 & CO33)**

**Summary of intervention:**
Enhancement of infrastructure to enable three passenger trains per hour to operate along the Ebbw Vale line as far north as Llanhilleth, with the option to re-instate the route from Aberbeeg Junction to Abertillery.

**Output assessment:**
Provides three passenger trains per hour, two per hour between Cardiff Central and Ebbw Vale Town in each direction, and one train per hour between Abertillery and Newport/Abergavenny in each direction. This will deliver increased passenger capacity on the route and provide new connectivity to Abertillery, and from the route to Newport and beyond.

**Affordability assessment**
Welsh Government is developing the Business Case for this option.

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**Table 6.16. Assessment of Option 2: Provision of four passenger trains per hour in each direction on Ebbw Vale line (CO1 & CO33)**

**Summary of intervention:**
Enhancement of infrastructure to enable four passenger trains per hour to operate along the Ebbw Vale line as far north as Llanhilleth, with the option to re-instate the route from Aberbeeg Junction to Abertillery.

**Output assessment:**
Provides four passenger trains per hour, providing direct connectivity between Ebbw Vale and Cardiff and beyond, Ebbw Vale and Newport and beyond, Abertillery and Cardiff and beyond, and Abertillery and Newport and beyond. This will also deliver increased passenger capacity on the route.

**Indicative costs:**
£35m - £75m excluding reinstatement of line to Abertillery. Welsh Government is developing the Business Case for this option.
**07: Longer Term Strategy to 2043**

**Highlights:**
This chapter sets out the strategy for the period 2024-2043.

Demand for rail is expected to continue to grow in this period.

The railway is important to the long term economic growth of the country - it helps create jobs and helps build sustainable communities.

Planning for the future starts now so there is a clear line of sight for the period up to 2043.

### 7.0 Context

This chapter highlights the longer term choices for funders to accommodate the Conditional Outputs set out in the established Market Studies and this Route Study to 2043. In each case the approach has been to establish the long term challenges in meeting the Conditional Outputs and ensure that the Control Period 6 (CP6) options set out in Chapter 5 are consistent with the potential longer term solutions set out in this chapter. As this chapter covers options for beyond CP6, appraisals have not been included at this stage though in some cases some initial engineering feasibility, operational planning and costing work has been completed.

### 7.1 Developing the longer term strategy

In developing the longer term strategy for the Wales Route, several key aspects have been used as fundamental building blocks:

1. the Wales Route Modernisation Plan
2. digital train control technology
3. safety
4. the 2043 Indicative Train Service Specification (ITSS).

#### 7.1.1 The Wales Route Modernisation Plan

The Wales Route Modernisation Plan sets out Network Rail’s plans to modernise the infrastructure and train control technology on a phased basis throughout the Welsh network. While the Plan is hinged on re-signalling schemes, it offers a series of ‘once in a generation’ opportunities to further enhance the network in the areas being re-signalled to deliver longer term capacity for both passenger and freight. This is particularly relevant for this Route Study as it allows choices for funders to be developed as part of the Modernisation Plan.

The Wales Route Modernisation Plan is set out in Figure 7.2.

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**Figure 7.1: Choices for funders to 2043**

**Figure 7.2: Wales Route Modernisation Plan**
7.1.2 Digital Railway

The railway industry is developing a business case for the acceleration of the Digital Railway across the network. This Route Study is one of a number of route studies that will help inform the case for the Digital Railway.

The Digital Railway will deliver the following outputs:

- Additional capacity
- Improved passenger experience
- Train control and operation
- Asset management
- Improved punctuality.

The accelerated introduction of European Train Control System (ETCS) underpins the train control element of the Digital Railway.

For the purposes of this Route Study this has been considered at a high level. The introduction of ETCS onto the network, coupled with the continued development of this technology, will support the creation of longer term solutions to some of the network capability constraints identified in this chapter. Therefore the assessment of these future anticipated network constraints identifies what additional network capability will be required in the future thus informing the development of ETCS.

Other than a trial installation on the Cambrian Route, there is no further ETCS signalling currently planned in Wales in the short term. While there is currently ETCS train control on the Cambrian Route, there are no short term plans for further installation. However the Digital Railway team is developing a GB roll out programme for the medium to long term and this will be included in the IIP. All current and future modular signalling renewals are technologically compatible with future fitment of ETCS.

Section 7.2 considers the longer term vision for the network within Wales and the Borders on a route by route basis. It seeks to highlight where Digital Railway train control will support areas where network capability enhancements are required to deliver the Conditional Outputs necessary by 2043.

Table 7.1 summarises the opportunities for Digital Railway to address future capacity constraints and avoid major capital cost infrastructure enhancements.

<table>
<thead>
<tr>
<th>Route</th>
<th>2023 capacity requirements</th>
<th>2043 capacity requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bristol Parkway - Swansea</td>
<td>Relief Line speed increase required</td>
<td>Some interventions likely to be required to utilise DR potential</td>
</tr>
<tr>
<td>Cardiff Valleys</td>
<td>Redoubling of some single lines may be required</td>
<td></td>
</tr>
<tr>
<td>South West Wales</td>
<td>Extension/relocation of freight loops likely to be required</td>
<td></td>
</tr>
<tr>
<td>Newport - Shrewsbury</td>
<td>Full redoubling likely to be required</td>
<td></td>
</tr>
<tr>
<td>Shrewsbury - Chester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Wales Coast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cambrian</td>
<td>ETCS Level 2 in operation. No additional capacity requirements to 2023.</td>
<td></td>
</tr>
<tr>
<td>Shrewsbury - Crewe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrexham - Bidston</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The busiest parts of the Welsh rail network are the Valley Lines in South East Wales and the South Wales Main Line between Severn Tunnel Junction and Cardiff Central. It is considered that in the longer term (beyond CP6), these parts of the network offer opportunities for early deployment of ETCS, particularly if future development of this system delivers the ability to further increase capacity on the network whilst also avoiding the need for more costly and disruptive civil engineering solutions.
This chapter of the Welsh Route Study identifies network constraints on the South Wales Main Line east of Cardiff, which will constrain the ability to deliver the 2043 ITSS and freight growth, and on the Valley Lines network, which will limit the flexibility to operate metro type frequency of services to the furthest points on this part of the network, for which the Welsh Government has aspirations to do.

The findings of feasibility studies, looking at options for how these network constraints might be overcome, are set out in the following sections of this chapter. These have identified potential enhancements using conventional technological interventions. In the case of these two specific parts of the network, to deliver some of these interventions would be significantly challenging from an engineering perspective, highly disruptive to rail and other transport mode users, and require high levels of capital cost investment and the affordability will need to be assessed. This work therefore provides a view on the outputs that are required to be delivered in the longer term, which development of digital technology (for example, evolution of ETCS) might help to deliver in a more affordable manner, and which would incur far less disruption. This work has therefore been used as case study input to inform the development of the Outline Business Case for Digital Railway, which will be set out the case for further development of the Digital Railway during CP6, in the Initial Industry Plan.

### 7.1.3 Safety

The rail industry has made significant progress in recent years in improving safety on the rail network. More can be done in this area to drive continuous improvement in passenger and work place safety.

In considering the future of the network, Section 7.1.2 sets out how digital technology is being embedded into the future strategic vision for the railway. Digital train control not only offers significant opportunity to deliver additional network capacity, it will also provide the ability to control trains in a safer manner and reduce the need in the future to maintain line side signalling equipment reducing the need for railway industry staff to be exposed to the open operating railway environment. This Route Study considers the reduction of risk at level crossings when assessing all future interventions on a linear basis. This means that reducing risk at level crossings is embedded into the strategic vision for the network. The reduction of risk at level crossings is included in the choices for funders where appropriate.

### 7.1.4 2043 Indicative Train Service Specification (ITSS)

Chapter 5 explained how the 2043 ITSS has been developed for Wales. This Route Study has used the 2043 ITSS and the freight forecasts for 2043 to provide a guide for how the network should be developed. This chapter therefore assesses how these factors might be accommodated on the network in the future by:

- first, making best use of the baseline (2019) network infrastructure
- second, considering what future network capability enhancement is required.
7.2 Accommodating the Conditional Outputs to 2043

7.2.1 Introduction

The following sections set out future choices for funders to deliver the range of Conditional Outputs identified in the longer term to 2043. These follow broad geographical routes related to the longer term interventions that have been developed as future choices for funders by this Route Study. The interventions have been developed to meet the Conditional Outputs.

7.2.2 Bristol Parkway/Gloucester (via Chepstow) to Swansea including Maesteg and Ebbw Vale lines (South Wales Main Line)

7.2.2.1 Overview of the South Wales Main Line as a whole

The South Wales Main Line is the arterial route connecting Cardiff with destinations across England and Wales. It runs through Bristol Parkway, Patchway and the Severn Tunnel as a double track line, becoming a four-track layout at Severn Tunnel Junction, where the Gloucester to Newport Line joins. It remains as four tracks, grouped into two pairs – the Up and Down Main and Up and Down Relief Lines – as far as Cardiff Central, where it reverts to a two track line serving a number of intermediate stations.

Another significant junction is Maindee West Junction, just east of Newport station, where the Marches route joins the South Wales Main Line.

There are also a number of junctions with smaller branch lines, including the Ebbw Vale and Maesteg branches. Although technically Valley lines, these are included in this chapter because all their services use the South Wales Main Line running through Newport or Cardiff. There are also links to the Vale of Glamorgan Line at Cardiff and Bridgend, which is considered under Section 7.2.4, and a number of freight-only lines. There are multiple rail connections into industrial complexes, particularly around Newport and Port Talbot.

The South Wales Main Line is intensively used by a mix of long distance, regional and local passenger services, alongside heavy freight trains, and is forecast to see substantial growth up to 2043. The 2043 ITSS and 2043 freight forecast are shown alongside the 2019 baseline services in Figure 7.3.
The South Wales Main Line as currently used, with passenger services operating at different speeds on the Main Lines, and freight on the Relief Lines, is already operating at a level close to capacity. Therefore, the required increase in service frequency and intensity will necessitate a rethink of the operation of this line, and the utilisation of facilities at Newport and Cardiff Central stations. Any increase over today’s level of service using the South Wales Main Line, even towards meeting CP6 requirements, is likely to require routine use of the Relief Lines for enhanced levels of passenger services.

Section 7.1.3 sets out a choice for funders to upgrade the Relief Lines between Severn Tunnel Junction and Cardiff Central, to provide broadly the same level of operating capability. The longer term strategy for this route set out below builds upon this intervention to meet the requirements to 2043.

The Severn Tunnel limits the number of services that can be routed directly between London / Bristol and South Wales. This is because there are no intermediate signals within the tunnel itself which means that the signalling section is relatively long which limits future capacity. The 2043 ITSS can only be accommodated, therefore, through redirecting two passenger services via Gloucester, a finding which is in line with the conclusions of the Western Route Study. For the avoidance of doubt, these additional services are longer term aspirations developed by the market studies and are not committed or specified in the baseline.

One of the main consumers of capacity from Severn Tunnel Junction to Cardiff Central is crossing moves (the crossing of one service, via a junction, over the route required by another). This is particularly critical at Severn Tunnel Junction, and at Maindee West Junction outside Newport. Therefore, this Route Study has assessed in detail two longer term operating philosophies to deliver the 2043 ITSS on this part of the network. These two philosophies assess the options for reducing crossing moves at these key points as far as possible, therefore freeing up capacity to operate more services.

Two models are required because each addresses different constraints, and therefore drives different service and performance trade-offs and infrastructure interventions. These are detailed in Tables 7.2 and 7.3.

There is a ‘hierarchy of constraints’ between Severn Tunnel Junction and Cardiff Central. There are five critical points: the Severn Tunnel, Severn Tunnel Junction, Newport, Cardiff Central, and the line between Severn Tunnel Junction and Cardiff Central. Each of these restricts the total number of trains that can be accommodated on the South Wales Main Line to some degree, and each will need to be addressed in order to meet the 2043 ITSS and 2043 freight forecast. These constraints, and their relative severity, are illustrated in Figure 7.4.

The constraints, trade-offs and possible infrastructure interventions driven by the two Routeing Models are considered in depth on a section-by-section basis. A composite diagram is set out in Figure 7.9.
This model is built on the basis of minimal crossing moves between the Relief and Main Lines, thereby restricting the interventions necessary at Severn Tunnel Junction. However, it drives other infrastructure requirements, including the need for an additional platform serving the Main Lines at Newport. As many passenger services as possible are routed along the Main Lines, limiting the number of services sharing the Relief Lines with freight. The 2043 ITSS and 2043 freight forecast can be accommodated in theory if all passenger services between Severn Tunnel Junction and Cardiff Central have similar operating characteristics which it is assumed is likely by 2043. This solution is built around the assumption that services from London, Bristol and Shrewsbury can be timetabled to arrive and depart the South Wales Main Line at consistent intervals and times. If this is not achievable due to network constraints elsewhere, further service trade-offs (i.e. potential re-routing or reduction in service levels where Conditional Output can still be maintained) or infrastructure interventions will be required. See Figure 7.5.

**Table 7.3 Routeing Model 2: reduction of crossing moves through grade separation**

This model avoids the need to reconfigure or extend Newport station, but requires a grade separated crossing in the vicinity of Severn Tunnel Junction, wider signalling improvements, and increases the number of passenger services mixing with freight on the Relief Lines. The 2043 ITSS and 2043 freight forecast can be accommodated in theory if all passenger services between Severn Tunnel Junction and Cardiff Central have similar operating characteristics which it is assumed is likely by 2043. This solution is built around the assumption that services from London, Bristol and Shrewsbury can be timetabled to arrive and depart the South Wales Main Line at consistent intervals and times. If this is not achievable due to network constraints elsewhere, further service trade-offs (i.e. potential re-routing or reduction in service levels where Conditional Output can still be maintained) or infrastructure interventions will be required. See Figure 7.5.
Overview

The line between Gloucester and Severn Tunnel Junction winds along the northern bank of the River Severn, serving three intermediate stations. Double tracked, it currently accommodates a mix of regional and local passenger services, and freight trains. These flows are forecast to increase in the 2043 ITSS and 2043 freight forecast.

The line between Patchway and Severn Tunnel Junction is dominated by the Severn Tunnel, which takes the line between England and Wales under the Severn Estuary. Double track throughout, it accommodates a mix of Long Distance High Speed, regional and local passenger services, and freight trains. These flows are envisaged to increase significantly in the 2043 ITSS and 2043 freight forecast.

Constraints in 2043

There are two constrained areas in this section: the Severn Tunnel itself, and Severn Tunnel Junction. Other pieces of infrastructure are theoretically capable of accommodating the level of service required to 2043.

The tunnel can, in theory, accommodate up to nine trains per hour in each direction. These nine trains may consist of either eight passenger services and one freight train, or seven passenger services and two freight trains. The 2043 ITSS and 2043 freight forecast indicate that eleven paths per hour are required.

Severn Tunnel Junction can theoretically accommodate up to nine trains passing to and from the Severn Tunnel, alongside five services to and from the Gloucester lines. This includes one freight train passing to and from the Relief Lines through the Severn Tunnel. However, this takes occupation to its maximum practical level. Additionally, this presumes the ability to provide optimum timings over this junction, which is likely to be difficult to achieve given network constraints elsewhere.

There are some additional safety requirements placed on certain freight trains operating through the Severn Tunnel conveying dangerous goods, where no other services may operate through the tunnel in the opposite direction at the same time.

Making best use of current infrastructure, up to 2043 specification

The maximum number of services that can be run through the Severn Tunnel is nine, including one or two freight trains. Therefore, at least two of the passenger services specified in the 2043 ITSS cannot be accommodated through the tunnel. However, the two planned services between Cardiff and Gloucester via Bristol Parkway could be routed along the direct route between Severn Tunnel Junction and Gloucester, since there is sufficient capacity along this line.

While this routeing alteration, in theory, would permit the accommodation of the 2043 ITSS east of Severn Tunnel Junction, it is likely that the junction itself would become a constraint. Even assuming a fundamental change in routeing along the South Wales Main Line, to either Model 1 or 2 above, it would only be possible to timetable all the required services over this junction by timing them to arrive in the optimum pattern. This would entail building the South Wales Main Line timetable around this point, which may not be possible given more constrained parts of the networks through which these services also operate.

Severn Tunnel Junction is likely, therefore, to drive service trade-offs or require an infrastructure intervention before the anticipated level of service required in 2043 is reached.

Interventions for 2043

In order to deliver the 2043 ITSS and projected freight growth to 2043, this Route Study has identified a series of interventions that are described below. It is crucial that any such infrastructure interventions are part of an integrated package designed to respect and address the multiple constraints along the South Wales Main Line between Severn Tunnel Junction and Cardiff Central. Tables 7.3, 7.4 and 7.5 detail these interventions.
Table 7.4. Assessment of Option A: Reduced headways through the Severn Tunnel

<table>
<thead>
<tr>
<th>Summary of intervention:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The current number of services able to use the Severn Tunnel is limited to an absolute maximum of nine per hour and direction. This could be improved through running services closer together.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Severn Tunnel is currently incapable of accommodating the required level of service, due to the time required between successive trains, in each direction. The planning values are currently 5-7 minutes, depending on the mix of trains; however, with a reduction of values by 1 ½ minutes, the required ITSS could be accommodated. This reduction may be achievable through conventional signalling. However, timing of this particular intervention should be considered in the light of the evolving national deployment of Digital Railway, and the developing status of this technology. This technology is likely to provide a more cost-effective longer term solution with additional safety benefits. However, it should be noted that the flow of traffic through the Severn Tunnel is likely to be dictated by network constraints considered as part of the Western Route Study. These will need to be addressed before more services can be presented at the eastern end of the tunnel. This flow is also likely then to dictate constraints along the length of the South Wales Main Line to the west of the tunnel. Specifically, a greater flow of services through the tunnel may require larger scale interventions at Severn Tunnel Junction in order to be accommodated. It is considered that the optimum solution to enhance network capacity through the Severn Tunnel should be assessed as part of the future deployment of Digital Railway. Other considerations will also be necessary in terms of the safety regime for the Tunnel, in particular the plan for emergency evacuation of services in the case of any incident in the tunnel, especially if more than one train in any direction at any one time can operate in the tunnel.</td>
</tr>
</tbody>
</table>

**Journey Time Improvement Opportunities**

As part of this Route Study, a desktop review has taken place based on rolling stock and stopping patterns currently used on the route, to identify potential opportunities to reduce journey time.

These savings range between half and two and a half minutes per journey between Severn Tunnel Junction and Gloucester. The maximum journey time saving potential that could be achieved is by use of the most modern high performing rolling stock used on this corridor, together with limited station calls. These savings could be achieved with improvements to track condition, track geometry and gauge clearance works at various locations specifically at Severn Tunnel Junction, Chepstow Station and between Chepstow and Lydney.

Opportunity is likely to exist during CP6 and beyond to incrementally assess these options as part of planned track renewals as the future track renewals work bank matures.
Table 7.5. Assessment of Option B: Redesign of Severn Tunnel Junction (Routeing Model 1)

Summary of intervention:
If Routeing Model 1 were to be adopted, in order to address the constraints along the whole length of the South Wales Main Line, it would drive the need for a flat junction and layout changes at Severn Tunnel Junction.

Output assessment:
Under Routeing Model 1, there would be a requirement for a flat junction to permit freight services to move between the Relief Lines and the Tunnel Lines. This could replace Bishton Flyover, reducing maintenance requirements associated with an elevated structure and improving line speeds through the section. In addition, there would be a need for related layout alterations at the west end of Severn Tunnel Junction station to separate Main Line and Relief Line flows. These are illustrated in Figure 7.6. Feasibility work has identified that as well as the need to demolish the existing Bishton flyover, significant signalling and layout alterations would be required, and this work would impact on the access and egress to Llanwern, which would require significant phasing to be agreed with the freight operators due to the time critical nature of steel production and associated transportation requirements to and from this location.

Indicative Cost
£15-35 million

Table 7.6. Assessment of Option C: Redesign of Severn Tunnel Junction (Routeing Model 2)

Summary of intervention:
If Routeing Model 2 were to be adopted, in order to address the constraints along the whole length of the South Wales Main Line, it would drive the need for a new grade separated junction, in conjunction with layout changes at Severn Tunnel Junction.

Output assessment:
Under Routeing Model 2, there would be a need for a grade separated junction between the Up Relief and Up Main Lines, to permit freight to cross without interacting with Down Main Line traffic. This would replace Bishton flyover, which cannot provide the required routeing. In addition, there would be a need for related layout alterations at the west end of Severn Tunnel Junction station to separate Main Line and Relief Line flows. These are illustrated in Figure 7.6. Feasibility work has been undertaken to identify options for replacing the existing Bishton grade separated flyover with a new structure capable of line speeds up to 100mph. This has identified that there would be significant land purchase required, together with further assessment needed as to the suitability of this land for an unreinforced embankment, and access constraints to the site that might prevent a steel through truss solution.

Indicative Cost
£50-100 million excluding land costs.

Table 7.7. Assessment of Option A: Headway reduction on Relief Lines (Routeing Model 2)

Summary of intervention:
Under Routeing Model 2, an increase in capacity on the Relief Lines will be required. This can be achieved through an improvement in the current signalling.

Output assessment:
Due to the number of Up services using the Relief Lines under this Routeing Model, coupled with the freight and passenger service speed differential, a headway improvement is required. This would be necessary between Maindee Junction, and the new crossing/flyover allowing transfer between Main and Relief Lines.

Affordability assessment:
It is envisaged that headway improvements required to accommodate anticipated 2043 traffic levels would be delivered as part of future deployment of ETCS on the route.

7.2.2.3 South Wales Main Line: Severn Tunnel Junction (exclusive) to Maindee Juncions (exclusive)

Overview
This section of line is four tracked, and accommodates the services outlined above. Freight destinations are located on the south side of the four track railway, and are served through connections with the Relief Lines.

Constraints in 2043
Since delivery of the 2043 ITSS and 2043 service specification are dependent on rethinking the current routeing of the South Wales Main Line, the constraints vary according to the routeing applied.

Under Routeing Model 1, there are no constraints other than in the Bishton area, covered in Table 7.5).

Under Routeing Model 2, an increase in capacity will be required between Severn Tunnel Junction and Maindee East Junction with a new grade separated junction in the Bishton area (see Table 7.6).

Interventions for 2043
In order to deliver the 2043 ITSS and projected freight growth to 2043, this Route Study has identified the intervention that is described in Table 7.7. It is crucial that any such infrastructure interventions are part of an integrated package designed to respect and address the multiple constraints along the South Wales Main Line between Severn Tunnel Junction and Cardiff Central.

The timing of this particular intervention should be considered in the light of the evolving national deployment of ETCS, and the developing status of this technology. ETCS will provide a more affordable and efficient solution in maximising the capacity available and delivering performance improvement along this part of the route.
7.2.2.4 Newport station, including Maindee and Gaer/Ebbw Junctions

Overview

Newport is an important mainline station, with all passenger services timetabled to stop. It is situated at a key point on the network, with Maindee Junctions – which give access to and from the Marches Lines – to the east, and Gaer and Ebbw Junctions – giving access to the Ebbw Vale Line – to the west.

As outlined in the introduction, above, the 2043 ITSS and 2043 freight forecast predict a significant increase in the number of services operating through this station. Currently, in addition to the services outlined in the introduction, there are a number of short distance freight workings between Alexandra Dock Junction and East Usk Junction.

Constraints in 2043

Since delivery of the 2043 ITSS and 2043 freight forecast are dependent on rethinking the current routeing of the South Wales Main Line, the constraints vary according to the routeing applied. Newport is one of the most restricted points on this line, both in terms of the infrastructure available, and potential space to carry out any large-scale infrastructure interventions. Consequently, it drives the need for two routeing models.

One of the key constraining points, which is treated differently by the two Routeing Models, is Maindee West Junction. Based on the capabilities of existing technology, the timetabling of the 2043 ITSS and 2043 freight forecast would necessitate a grade separated junction to carry freight over the Main Lines, and onto the Relief Lines.

Under Routeing Model 1, passenger services would not use this flyover, and would be routed along the Main Lines. This means that eleven through services would have to be routed through the Main Line platforms at Newport, with only two platforms – 3 and 4 – available for Main Line use. This number of services cannot be accommodated with these platforms, requiring an additional platform (see Table 7.8).

During the consultation period we received feedback from local stakeholders about lack of direct passenger services between Lydney/Chepstow and Bristol. This is considered to be an important market with rail potentially providing a comparable journey time to road.

To enable such a service, trains would need to turn back in the Severn Tunnel Junction area which would have an impact on network capacity. In addition to this the signalling between Lydney and Chepstow would need to be enhanced to enable turn back of trains at these locations.

In the longer term to 2043, this Route Study identifies the need for more services on both the Cardiff – Bristol and Cardiff – Gloucester corridors which would provide greater opportunities to travel between Lydney/Chepstow and Bristol which interchange at Severn Tunnel Junction.
Alternatively, under Routeing Model 2, Down Marches services would make use of the grade separated junction, with a corresponding number of Up services also transferred onto the Relief Lines. Consequently, Platforms 3 and 4 would be required to accommodate eight through services each, which is possible.

Neither Routeing Model results in sufficient platform availability to accommodate the two terminating services per hour from the Ebbw Vale branch line. However, there may be the possibility of connecting these into other services, for instance into services terminating at Abergavenny. This would be dependent upon achievable timings at Newport, and therefore timetable and service development in the future.

**Interventions for 2043**

In order to deliver the 2043 ITSS and projected freight growth to 2043, this Route Study has identified the intervention that is described below. It is crucial that any such infrastructure interventions are part of an integrated package designed to respect and address the multiple constraints along the South Wales Main Line between Severn Tunnel Junction and Cardiff Central. The infrastructure interventions in this area are detailed in Tables 7.8, 7.9 and 7.10, and Figure 7.7.

**7.2.2.5 Ebbw Vale Line**

**Overview**

Section 6.1.14 describes the work being undertaken to upgrade capacity on the Ebbw Vale line, and also sets out further choices for funders to deliver further capacity enhancement and improvements in connectivity to/from the route.
### Table 7.8: Assessment of Option C: New/relocated through platforms at Newport (Routeing Model 1)

**Summary of intervention:**
Routeing Model 1 requires a third through platform on the Main Line side of the station. However, this will be difficult to achieve, due to the constraints of the current station location. See Figure 7.7.

**Output assessment:**
Routeing Model A, in conjunction with the 2043 ITSS, sends 11 services per hour and direction along the Main Lines through Newport. Due to the physical constraints of the area, which limit line speeds, sighting distances, and platform lengths, Newport can, even in the best case, accommodate only ten trains per hour at each platform. The frequency with which the Relief Lines are used means that there are no opportunities to cross over at Newport to use the Relief Line platforms. Consequently, at least one new through line platform will be required on the Main Line side of the station.

Feasibility work has been undertaken which suggests significant civil engineering work, together with associated track and signalling works. The existing island platform width would need to be reduced to provide space for an additional platform and that from an engineering perspective this would provide significant challenge in providing suitable width on both the existing and proposed additional island platform for stair wells and lifts. This might be mitigated to some extent if the space footprint of the station could be widened but this would require compulsory purchase of property. Delivery of such a solution would also be significantly disruptive.

**Indicative Cost and affordability assessment**
£35-75 million excluding land costs. This is not considered a viable longer term option, as future deployment of ETCS on the route will provide the longer term solution to network capacity along this part of the route.

### Table 7.9: Assessment of Option A: Grade separation at Maindee West Junction

**Summary of intervention:**
Under the 2043 ITSS and 2043 freight forecast, a grade separated junction will be required to carry freight services over the Main Lines, and onto the Relief Lines. See Figure 7.7.

**Output assessment:**
Regardless of the Routeing Model used, introduction of the 2043 ITSS and 2043 freight forecast will leave no opportunities for freight to cross over Maindee West Junction between the Marches Lines and the Relief Lines. Consequently, a single track grade separated bi-directional line, constructed alongside the south side of the River Usk viaduct, and swinging over the South Wales Main Line, is likely to be required for such freight services. Additionally, it could be utilised by passenger services leaving the Marches Line, in order to avoid the need for additional through platforms at Newport.

Feasibility work has been undertaken to assess the engineering viability of providing a grade separated junction a Maindee West Junction. Findings suggest that this would be possible, however any solution would entail steep gradients (requiring more powerful freight locomotives) and potential encroachment on adjacent land approaching to the station.

**Indicative Cost and affordability assessment**
£35-75 million excluding land costs. This is not considered a viable longer term option, as future deployment of ETCS on the route will provide the longer term solution to network capacity along this part of the route.

### Table 7.10: Assessment of Option B: Bay platform at Newport

**Summary of intervention:**
It is likely that a bay platform will be required to accommodate Ebbw Vale services turning round at Newport. See Figure 7.7.

**Output assessment:**
Regardless of the Routeing Model used, there is insufficient time for services to turn round in either Platforms 3 or 4 at Newport, and where opportunities to use Platform 2 exist, there are unlikely to be opportunities to cross over to/from Gaer Junction. If services from the Ebbw Vale line terminate at Newport, it is likely that a bay platform will be required at the end of Platform 4.

Feasibility work has been undertaken to consider the option of providing a west facing bay platform at Newport Station. This would require a reduction in car park spaces and would entail additional redesign of the station buildings and footbridge, infrastructure that has only recently been installed.

**Indicative cost**
£5-15 million. Significant cost elements are likely to be incurred in re-design of the station building and station footbridge infrastructure.
7.2.6 South Wales Main Line: Ebbw Junction (exclusive) to Cardiff Central (exclusive)

Overview
This section of track is four tracked, and accommodates the services outlined above. Freight destinations are located to the south of this section of the South Wales Main Line, and are served through connections with the Relief Lines.

Constraints in 2043
Since delivery of the 2043 ITSS is dependent on rethinking the current routing of the South Wales Main Line, the constraints vary according to the routing applied.

Under Routeing Model 1, an increase in capacity will be required between Newport and Cardiff Central on the Main Lines only.

Under Routeing Model 2, an increase in capacity will be required between Newport and Cardiff Central on both the Main and Relief Lines.

Making best use of baseline infrastructure, up to 2043 specification
As outlined above, depending on the routing strategy adopted, this section may be able to accommodate the services required under the 2043 ITSS and 2043 freight forecast.

Interventions for 2043
In order to deliver the 2043 ITSS and projected freight growth to 2043, this Route Study has identified the intervention that is described below. It is crucial that any such infrastructure interventions are part of an integrated package designed to respect and address the multiple constraints along the South Wales Main Line between Severn Tunnel Junction and Cardiff Central.

Details of the required infrastructure interventions are detailed in Table 7.11.

Table 7.11. Assessment of Option A: Headway reduction between Ebbw Junction and Cardiff Central (Routeing Models 1 and 2)

<table>
<thead>
<tr>
<th>Summary of intervention:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under either Routeing Model, an increase in capacity will be required, on the Main Lines under Model 1, and on both Main and Relief Lines under Model 2. This can be achieved through an improvement in the current signalling.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under Model 1, the number of services using the Main Lines between Ebbw Junction and Cardiff Central (13 tph) necessitates a headway improvement of one minute.</td>
</tr>
<tr>
<td>Under Model 2, the number of services using the Relief Lines between Ebbw Junction and Cardiff Central (11 tph), coupled with the freight and passenger service speed differential, necessitates a headway improvement of one minute on the Relief Lines as well as the Main Lines. This can be achieved through adding to and re-spacing the existing signalling. However, the timing of this particular intervention should be considered in the light of the evolving national deployment of ETCS, and the developing status of this technology. ETCS will provide a more affordable and efficient solution in maximising the capacity available and delivering performance improvement along this part of the route.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Affordability assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is envisaged that headway improvements required to accommodate anticipated 2043 traffic levels would be delivered as part of future deployment of ETCS on the route.</td>
</tr>
</tbody>
</table>
7.2.2.7 Cardiff Central layout

Overview
Cardiff Central is the busiest station in Wales, and a key stop for all passenger services on both the South Wales Main Line and the Valley Lines. Section 6.1.4 sets out the CP6 choice for funders to modernise Cardiff Central Station to meet future growth in passenger demand. This section looks specifically at the rail infrastructure required to meet the 2043 ITSS and projected freight growth through this area.

Many services on the Main Line side of the station terminate at Cardiff in the southern pair of platforms, and have to move across the face of the station in order to depart from the northern platforms. Due to these moves, which consume substantial track capacity, and due to current platform utilisation, which requires all Main Line services arriving at Cardiff Central to cross the Relief Lines, the station is a significant constraint to increasing services beyond the baseline level. However, the 2043 ITSS and 2043 freight forecast predict a substantial increase in the number of services through this station.

Constraints in 2043
Altering the routeing into and out of Cardiff Central is crucial to freeing up sufficient capacity, at the station, to accommodate the services envisaged under the 2043 ITSS and 2043 freight forecast. However, unlike other parts of the South Wales Main Line, the points of constraint remain the same, regardless of which Routeing Model is used.

On the Main Line side of the station, there will be limited platform availability. Successful operation of the station will require significant changes in how services are received from the east. In order to accommodate the required services, Platform 0 will need to be primarily used for eastbound arrivals and departures, Platform 2 for westbound arrivals and departures, and Platform 1 in both directions, as required. However, Platform 0 is currently unable to accommodate Long Distance services, due to both platform length and accessibility. Section 6.1.4 describes how the modernisation of the station will incorporate a new full length Platform 0 as part of the station redesign.
07: Longer Term Strategy to 2043

Summary of intervention:
In order to permit platforming of all the required services on the Main Line side of Cardiff Central, it will be necessary to extend Platform 0 so that it is a full-length platform.

Output assessment:
Regardless of the routeing model chosen, it will be necessary to extend Platform 0 so that there are three full platforms capable of taking all types of passenger train on the north (Main Line) side of the station. This will then become the main platform for eastbound services. Under Routeing Model 1, platform usage on this side of the station will still be at a considerable level, and may depend on platform sharing for regional and local services. Under Routeing Model 2, platform usage will be lower, due to the transfer of services onto the Relief Lines, and all services may be able to be accommodated without platform sharing. In both these instances, successful operation is dependent on sufficient stabling sidings being available on the north side of the station, in order to remove the need for terminating services to cross the station while turning round. This intervention is currently being developed as part of the Cardiff Central Station enhancement scheme. See Figure 7.8.

Affordability assessment
Provision of a new full length Platform 0 is being assessed as part of the overall scheme to enhance Cardiff Central station (see Section 6.1.4). The indicative costs for the layout changes at Cardiff East to facilitate the associated new connections to Platform 0 are included within the overall costs for Options A, B and C (see Tables 7.13 and 7.14).

Table 7.12. Assessment of Option A: Extension of Platform 0

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative costs</td>
<td>£10-20 million</td>
</tr>
</tbody>
</table>

Table 7.13. Assessment of Option B: Centre turnback sidings

Summary of intervention:
The change in routeing means that services from the Main Lines utilise the northern set of platforms only. This, coupled with the significantly greater intensity in services, means that more stabling sidings will be required on the northern side of the station.

Output assessment:
Long distance services take some considerable time to be turned round (this process usually consisting of a crew change, clean, and where necessary refuel, which provides a performance buffer). This is not usually possible while remaining at the platform at Cardiff Central, due to a lack of platform availability, so services shunt out of the west end of the station to stabling areas north and south of the main running lines. The current stabling facilities situated on the north side of the running lines will not be able to accommodate the increase in services to meet the 2043 ITSS, especially when this is coupled with the change in routeing which will lead to heavier use of Platforms 0, 1 and 2. In order to address this, and to reduce the number of conflicting moves as far as possible, it is proposed that the north-west end of the station is reconfigured, with the eastbound Main Line being the northernmost line, and 2-3 turn back sidings in the centre of the layout, providing easy access out of and into Platforms 0, 1 and 2. This will also require appropriate associated switches and crossings, but may permit rationalisation of other parts of the layout in this area. See Figure 7.8.

Feasibility work has been undertaken to assess this intervention, which has identified that only two turnback sidings could be provided within the spatial constraints. This requirement is driven by the maximum number of services set out in the 2043 ITSS. This planning basis is based upon all passenger services in the 2043 ITSS being specified and an indicative high level view of what a future timetable may look like. Therefore the actual number of turnaround sidings required is somewhat theoretical and would be dependent upon actual arrival and departure times of trains. Additionally, there may be scope for some operational management of services as is the case at present whereby shorter trains can share platforms, which would reduce the number of turnaround sidings required in the longer term.

Indicative costs
£10-20 million. Costs include all layout changes at Cardiff Central associated with Options A, B and C.

Table 7.14. Assessment of Option C: Separation of Main Line and Valley Line flows

Summary of intervention:
Services departing Platform 4 currently conflict with Valley Line services approaching Platform 6 from the City Lines. These traffic flows are likely to require separating, to increase the available opportunities to clear Platform 4, and reduce performance risk to Valley Line services. Any intervention should be considered in the context of options for the junction as a whole, since addressing the lack of stabling facilities on the north side of the station, and the constraints that Cardiff West Junction and Radyr Branch Junction present to Valley Lines services, is likely to permit some rationalisation of the junction. However, fundamentally the flows can be separated through installation of a new set of switches, permitting access from Platform 4 onto the running lines without crossing Valley Lines flows. Feasibility work has identified that this intervention could be achieved with some reorganisation of the track layouts at Cardiff West Junction and Radyr Branch Junctions, together with associated signalling works. This would retain the existing grade crossing for services departing Cardiff Central for Radyr via the City Lines. The feasibility study has identified that grade separation at this location is not viable from an engineering perspective due to the spatial constraints at this location. See Figure 7.8.

Indicative costs
£10-20 million. Costs include all layout changes at Cardiff Central associated with Options A, B and C.
7.2.2.8 South Wales Main Line: Cardiff Central to Swansea

Overview

This lengthy section of line is double tracked throughout, with freight passing loops. Currently, it accommodates a limited mix of long distance high speed, regional and local passenger services alongside freight trains. The line serves a number of stations of varying sizes, with particularly large stations including Bridgend, which provides links to the Vale of Glamorgan line, and Maesteg branch line, and Port Talbot Parkway and Neath.

Peak demand into Swansea from the east is forecast to be close to capacity by 2043. However additional services identified in the 2043 ITSS will accommodate this increased demand.

Constraints in 2043

Theoretically, there are no constraints to delivery of the 2043 ITSS and 2043 freight forecast. These come close to utilising the full capacity of the line, with an appropriate performance buffer, but the re-timings dictated by the South Wales Main Line capacity east of Cardiff do permit the running of the required number and mix of services west of Cardiff. However, this does depend on looping freight services, and practical timetable development may demand extension and relocation of loops.

A feasibility assessment has been undertaken to establish engineering viability and indicative costs for lengthening both loop lines at Stormy to accommodate longer freight trains (over 700 metres), details of this can be found in Table 7.15.

Interventions for 2043

Practical timetable development may demand extension and relocation of loops, for the purposes of timetable flexibility or establishing a performance buffer. However, this will if necessary be timetable dependent; no such infrastructure interventions are required on a theoretical basis.

Journey Time Improvement opportunities

As part of this Route Study, a desktop review has taken place based on rolling stock and stopping patterns currently used on the route, to identify potential opportunities to reduce journey time.

The journey time savings identified as a result of improvement to track condition and track geometry west of Bridgend and through Port Talbot, are negligible.

Opportunity is likely to exist during CP6 and beyond to assess this as part of planned track renewals as the future track renewals work bank matures.
7.2.2.9 Maesteg branch line

Overview

The Maesteg branch is a passenger line, single tracked throughout, serving a number of local stations. While it currently accommodates one train per hour, a scheme is currently being developed to provide the capacity for two trains per hour and direction, as required under the 2043 ITSS (see Section 2.3).

Journey Time Improvement Opportunities

As part of early work carried out to inform options for electrification of the Valley Lines, analysis was undertaken to determine locations where line speed improvements could provide journey time reductions. The rolling stock modelled for this analysis assumed use of existing diesel multiple units as well as a range of electric multiple units.

Based upon the analysis undertaken, the potential journey time savings range from one and half to two and a half minutes. This assumes a calling pattern at all stations, with the greater journey time savings being achieved as a result of electrification of the route and deployment of high performing electric multiple unit rolling stock.

Opportunities to deliver these journey time savings by enhancing the route are being assessed as part of the frequency enhancement project for this route.

7.2.2.10 Swansea Station

While the layout at and on the approaches to Swansea offers no constraint to the delivery of the 2043 ITSS, the Port Talbot West re-signalling works programmed for delivery in CP5 has taken the opportunity to provide signalling to enable passenger services to either depart or arrive from both the west (Llanelli) and east (Port Talbot) directions simultaneously. This will allow for improved performance and timetable flexibility, particularly in the future should additional passenger services be specified.

7.2.2.11 Conclusions

Constraints Summary

The South Wales Main Line has been shown to have a number of interacting constraining areas which will need to be addressed in order to deliver the 2043 ITSS for passenger services and 2043 freight forecast. It is crucial that these are treated and addressed as an integrated whole: specific interventions should be developed with the long-term aim of altering the routeing principles of the South Wales Main Line, thereby unlocking the latent capacity potential provided by the current infrastructure. Table 7.16 summarises the constraints along this route which are likely to require such interventions.

The suggested interventions, which are based on current technology, vary according to the Routeing Model chosen. These different demands made by the two models are summarised in Figure 7.9.

These interventions are based on existing technology; developing technology may present alternative solutions.
Digital Railway
Network Rail is currently developing the Digital Railway which will have a significant impact on the South Wales Main Line, removing or reducing the need for conventional major civil engineering interventions with their associated significant capital costs.

There are a number of areas where ETCS will provide enhanced capabilities and capacity. Table 7.17 informs the capability that will be required as part of future deployment of ETCS.

However, in the shorter term, there is also the possibility of making best use of existing capacity, with no or limited infrastructure interventions.

Table 7.17: Planning headways required to accommodate 2043 ITSS

<table>
<thead>
<tr>
<th>Area</th>
<th>Current planning values</th>
<th>Required future planning values</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severn Tunnel.</td>
<td>Four minute headway.</td>
<td>Three minute headway</td>
<td>Improved headway could only be used if constraints addressed elsewhere.</td>
</tr>
<tr>
<td>Severn Tunnel Junction.</td>
<td>Variable</td>
<td>Some improvement</td>
<td>Likely improvement required is c. one minute reduction in values for all services.</td>
</tr>
<tr>
<td>Severn Tunnel Junction-Newport</td>
<td>Relief Lines: five minute headway</td>
<td>Four minute headway</td>
<td>Four minute headway currently on Main Lines through this section.</td>
</tr>
<tr>
<td>Newport.</td>
<td>Two minute dwell, three minute reoccupation.</td>
<td>Two minute reoccupation</td>
<td>Reduction in platform reoccupation value by at least one minute likely to be extremely beneficial.</td>
</tr>
<tr>
<td>Ebbw/Gaer Junctions.</td>
<td>Usually three minutes before and after conflicting move</td>
<td>Some improvement beneficial</td>
<td>Improvement would be beneficial for performance, but not required subject to timetable development.</td>
</tr>
<tr>
<td>Ebbw Junction - Cardiff.</td>
<td>Four minutes, Relief and Main Lines</td>
<td>Three minutes</td>
<td>Improvements on Main Lines required regardless of Routeing Model.</td>
</tr>
<tr>
<td>Cardiff Central.</td>
<td>Three minute dwell, three minute reoccupation</td>
<td>Two minute reoccupation</td>
<td>Reduction in reoccupation values may permit Routeing Option 1 to be operated without platform sharing.</td>
</tr>
<tr>
<td>Cardiff West Junction.</td>
<td>Variable</td>
<td>Some improvement beneficial</td>
<td>Improvement would be beneficial for performance, but not required subject to timetable development.</td>
</tr>
<tr>
<td>Cardiff-Swansea.</td>
<td>Four/five minute headway</td>
<td>Some improvement beneficial</td>
<td>Improvement would be beneficial for performance, but not required subject to timetable development.</td>
</tr>
<tr>
<td>Swansea station.</td>
<td>Six minute platform reoccupation</td>
<td>Some improvement beneficial</td>
<td>Improvement would be beneficial for performance, but not required subject to timetable development.</td>
</tr>
</tbody>
</table>

*Primary constraints are those which most immediately limit increases in service specification beyond the 2019 baseline assumption. Secondary constraints will become a significant constraint once the primary constraints are addressed.
Figure 7.9: SWML options by Routeing Model

Routeing Model 1

Routeing Model 2

Legend
- New track
- Removed track
- Platform alteration
- Cardiff West Junction area (detailed alternative options represented in boxes below)
- Area where improved headway is suggested

Simplified indicative diagram; not to scale
Making best use of baseline infrastructure, up to 2043 specification

Along the South Wales Main Line between Severn Tunnel Junction and Cardiff, any significant increase in service beyond the levels timetabled today is likely to require utilisation of this line as a four track railway. This would be in line with – for example – the use of the southern end of the West Coast Main Line, with Long Distance High Speed and regional passenger services on one set of lines, and local and regional passenger services running alongside freight trains on the other.

However, services using the Relief Lines are currently likely to incur a journey time penalty, due to there being a substantial difference between the permitted line speeds on the Main and Relief lines. This currently limits the practicality of running passenger services along the Relief Lines. It also limits the practical use of Platform 1 at Newport; this asset is currently under-utilised, due to the capacity consumed by crossing over the Relief Lines into and out of this platform. There are also constraints to turning round services from Ebbw Vale at Newport which might be addressed by moving some passenger services onto the Relief Lines, and operating them through Platforms 1 and 2.

The current use of the South Wales Main Line also leads to a high number of conflicting crossing moves outside Cardiff Central, with all westbound passenger services crossing the Relief Lines in order to access Platforms 3 and 4, and all terminating services currently crossing the layout while empty in order to depart from Platforms 0, 1 or 2. These conflicting moves might be able to be reduced through use of Platform 2 for westbound services, and some use of the Relief Lines by passenger services, potentially increasing the number of paths available through the station.

Ultimately, the infrastructure is capable of accommodating a greater level of service, but only with a change in routeing strategy.

New stations

As part of the longer-term vision, stops at new stations, built on the Relief Lines, might need to be accommodated within the Routeing Models developed. Certain services are theoretically capable of calling at these stations, with the precise destinations of these services dependent on timetable development, and the manner in which the identified constraints are addressed. However, it is likely that, under the level of service identified in the 2043 ITSS and 2043 freight forecast, the choice of destinations east to and from such stations will be limited.

This is because, under either Routeing Model developed in this study, the services using the Relief Lines are likely to be those to/from destinations accessed via Gloucester. Providing consistent links in both directions with services travelling in the London/Bristol direction, or along the Marches Line, will require greater numbers of crossing moves across the key congested junctions. This is not possible while maintaining the total required level of service, and is likely, with current technology, to necessitate some form of future intervention.
### 7.2.3 South West Wales

**Overview**

This route accommodates local services on a fairly frequent (1-2 trains per hour) basis between Swansea and Carmarthen with less frequent services then extended to Fishguard (with ferry connections to Ireland), Milford Haven and Pembroke Dock. There are some freight flows along the route, primarily serving facilities at Llanelli and Milford Haven.

Section 6.1.5 outlines opportunities for improving journey times linked to closure of level crossing in South West Wales. In the longer term, the 2043 ITSS predict an increase in passenger services. This is reflected in Figure 7.10.

The route between Bristol Parkway and Cardiff Central is defined as a core TEN-T passenger and freight route, and between Cardiff Central and Milford Haven is defined as a core TEN-T freight route. There are currently no plans to enhance this route to meet the requirements set out in these regulations (see Appendix E).

### Constraints in 2043

The 2043 ITSS provides for additional services to Milford Haven, with potentially some services splitting/adjoining at Clarbeston Road. This would also afford an increase in frequency on the busiest section of the route between Carmarthen and Swansea. In addition Section 6.1.6 outlines the three-year trial operation of additional peak services on the Heart of Wales line which joins this route near Llanelli. All of these additional services can be accommodated on the existing network infrastructure.

A gauging study would be required to assess the implications of running 26 metre vehicles to/from destinations west of Swansea and it is considered likely that there would be structural clearance works required to enable such length trains to be accommodated.

#### Journey time improvement opportunities

As part of this Route Study, a desktop review has been undertaken utilising existing diesel multiple unit rolling stock, as well as future bi-mode SET services, and stopping patterns currently specified on the route as far west as Carmarthen, to identify potential opportunities to reduce journey time.

Between Swansea and Carmarthen, the maximum journey time saving is up to one and a half minutes per journey which could be achieved by use of the most modern high performing rolling stock used on this corridor. These savings could be achieved with improvements to track condition and geometry between Gowerton and Lougher Viaduct, and between Llanelli and Carmarthen.

There are also opportunities for journey time savings between Carmarthen and Whitland, where potential time savings of up to one minute per journey could be achieved by use of the most modern high performing rolling stock used on this corridor. Again these journey time savings could be realised with improvements to track condition and geometry between Carmarthen and Whitland Tunnel.

Opportunity is likely to exist during CP6 and beyond to incrementally assess these options as part of planned track renewals as the future track renewals work bank matures. There may also be opportunity to incorporate these options as part of the resignalling of the area, currently scheduled for CPS.
### 7.2.4 Valley Lines

**Overview**

The Valley Lines network provides for commuting, business and leisure flows into Cardiff city centre. Enhancements delivered as part of resignalling works in the Cardiff area will enable up to 16 trains per hour to operate through the central Cardiff core between Cardiff Queen Street and Cardiff Central during peak hours.

There are a number of single line sections and junctions which would require further intervention in order to enable more flexibility and more resilience in delivery of future all day timetable requirements. Within the planning horizon of this Route Study these are described as network constraints.

The potential future development of a multi-modal ‘Metro’ transport system (see sections 2.3, 6.1.1 and 6.1.2) also highlights the need to consider holistically, the transport needs for the Cardiff metropolitan area, and the need to assess future transport interventions in a co-ordinated manner that deliver future affordability and best value for money.

Sections 6.1.1 and 6.1.2 describe how Welsh Government is currently assessing options for modernisation of the Valley Lines Network during CP5 and CP6, as part of the Metro concept. This Route Study has assessed a suite of potential interventions to address major constraints on this part of the network. This feasibility work has assumed traditional heavy rail options however the feasibility work will inform future choices for modernisation of the Valley Lines network.

Network Rail will continue to support the development of the optimum integrated transport network options that deliver overall affordability and value for money and which identify the roles that heavy rail modes and light rail modes are best placed to address future capacity requirements and overcome existing and future anticipated network constraints.

### Constraints in 2043

**Table 7.18** details the key long term constraints on the Valley Lines Network. These would need addressing to optimise delivery of an all day timetable that delivers 16 trains per hour through the central Cardiff core.

**Interventions required**

In order to deliver the 2043 ITSS and projected freight growth to 2043, this Route Study has identified the series of interventions that are outlined in **Table 7.18** alongside the constraints.

It should be recognised that there would still remain a significant challenge to accommodate freight to and from Cwmbargoed alongside an enhanced passenger service frequency on the Rhymney Line which would still see a requirement to remove passenger services to accommodate freight services on the route, although these are limited in number. Additionally, the future continued development and evolution of ETCS provides opportunity to address more affordable solutions to increase network capacity in the medium to longer term and this will continue to be reviewed through the strategic planning process.

Since publication of the Welsh Route Study Draft for Consultation, feasibility work has been concluded to look at what options might exist for overcoming key identified network constraints on the Valley Lines network. It is important to recognise that none of these interventions in their own right will overcome all of the challenges identified in delivering a higher frequency, (i.e. above the assumed starting point of 2019) high performing network which allows for flexible timetabling and diagramming of passenger trains. The purpose of this work undertaken by this Route Study is to help inform funders of potential options that might be considered further in developing plans to modernise the Valley Lines network and incrementally provide further capacity in future years. **Table 7.18** also describes the interventions assessed.
## Table 7.18 Constraints and interventions required on the Valley Lines Network to meet longer term strategic requirements to build on the outputs delivered by CASR

<table>
<thead>
<tr>
<th>Area</th>
<th>Constraint</th>
<th>Intervention</th>
<th>Feasibility findings</th>
<th>Indicative cost range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiff West Junction.</td>
<td>Point of conflict between Cardiff-bound services from the Bridgend direction, and Valleys-bound services moving out of Cardiff onto the City Lines. Inherent in flat junction, but exacerbated by current layout.</td>
<td>Simplified flat junction, with targeted redoubling of single branch lines to reduce timing constraints OR Grade separated junction, removing constraint and separating traffic flows.</td>
<td>A new double junction could be provided at Radyr Branch Junction and the existing linespeed would be unchanged. Upon installation of the new double junction, the Up Barry Relief line would be recovered between Radyr Branch Junction and Penarth Curve South Junction. The option of installing a grade separated junction, either using a dive under or fly over solution has been reviewed. However due to spatial constraints neither option is viable as the extents of the track to achieve a suitable gradient cannot be feasibly installed without significantly modifying the existing layout. Therefore this option has not been developed further.</td>
<td>£15-£35m. This does not include any additional works to redouble single lines elsewhere.</td>
</tr>
<tr>
<td>Cardiff Central.</td>
<td>Platforms 6 and 8 cannot accommodate all services in either direction. Therefore Platform 7 will be required to be used in both directions, to allow some services to be accommodated. Constraints at Cardiff West Junction and Cardiff Queen Street mean that the timetable must make use of 100% of the capacity of Platform 7, which presents a significant performance risk.</td>
<td>See feasibility findings.</td>
<td>This constraint should be considered in conjunction with potential interventions at Cardiff West Junction and Cardiff Queen Street (and with any other options to remove single line constraints on the network) which would improve operating flexibility through this part of the network.</td>
<td>n/a</td>
</tr>
<tr>
<td>Cardiff Queen Street.(south and north options).</td>
<td>The physical constraints of the station’s location limit the ability of current signalling technology, which restricts services in both directions from approaching the platforms at optimum timings or a flexible pattern. This has to be addressed through extending the station dwell times of services, with a consequent journey time impact, and by fixing times of arrival and departure at the station at sub-optimal intervals, given other network constraints.</td>
<td>Extension of platform loops would enable improved operating flexibility as this would enable the signalling to be configured to allow trains to depart from either platform 4 or 5 (in the northbound direction) while a train arrives simultaneously at the other platform (4 or 5), and from either platform 2 or 3 (in the southbound direction) while a train arrives simultaneously at the other platform (2 or 3).</td>
<td>Reconfiguration of the layout to the south of Cardiff Queen Street station as shown below would improve operating flexibility in the southbound direction. Some structural support work would be required in addition to track and signalling works. In the northbound direction the challenge is more significant due to the proximity of the Newport Road rail overbridge immediately north of Cardiff Queen Street station. While it would be feasible to provide a third bridge span as indicated below this would present significant engineering challenges to enable the required height above the Newport Road to be achieved for buses or lorries. This would either require the track level through the station to be raised with the associated need to raise the height of platforms, or the Newport Road to be lowered. See Figures 7.11 and 7.12. Layout alterations to the south of Cardiff Queen Street station are assessed in the cost range up to £10m. At this point, costs for the interventions identified to the north of Cardiff Queen Street station have not been assessed, due to wider impacts on adjacent non-railway infrastructure.</td>
<td>£35-£75m.</td>
</tr>
<tr>
<td>Radyr-Pontypridd.</td>
<td>Current signalling does not permit the operation of freight trains alongside the full passenger specification. The operation of freight services requires passenger services to be removed from the timetable.</td>
<td>Signalling headway improvements.</td>
<td>Signalling headway improvements should be considered as part of the emerging option development for modernisation of the Valley Lines network.</td>
<td>n/a</td>
</tr>
<tr>
<td>Aberdare Line.</td>
<td>Single line track, coupled with the length and position of current loops, does not permit the operation of freight trains alongside the full passenger specification. The operation of freight services requires passenger services to be removed from the timetable.</td>
<td>Redoubling of the route between Abercynon and Mountain Ash would enable freight services to/from Hirwaun to operate without removal of passenger services (subject to also providing improved headways between Pontypridd and Radyr. This could also be an enabler of longer term Metro vision to re-double routes to the Heads of the Valleys to provide improved passenger frequencies.</td>
<td>Re-doubling of the route will require: signal, track, earth and drainage works remodelling of Abercynon Junction new S&amp;C at Mountain Ash relocation of lineside signalling cabinets and cable routes replacement of existing single track road (B4275) over-bridge with 2 new single track bridges side by side bridge works over River Cynon and elsewhere.</td>
<td>£35-£75m. This does not include any additional works to redouble single lines elsewhere.</td>
</tr>
</tbody>
</table>
### Table 7.19 Journey Time Improvement Opportunities on the Valley Lines

<table>
<thead>
<tr>
<th>Route Section</th>
<th>Journey time savings range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>From</td>
</tr>
<tr>
<td>Cardiff Central to Pontypridd (all stops)</td>
<td>1/2 minute</td>
</tr>
<tr>
<td>Cardiff Central to Pontypridd (excluding Trefforest Estate)</td>
<td>1 minute</td>
</tr>
<tr>
<td>Pontypridd to Abercynon</td>
<td>0 minutes</td>
</tr>
<tr>
<td>Abercynon to Merthyr Tydfil</td>
<td>1 minute</td>
</tr>
<tr>
<td>Abercynon to Aberdare</td>
<td>0 minutes</td>
</tr>
<tr>
<td>Pontypridd to Treherbert</td>
<td>1 1/2 minutes</td>
</tr>
<tr>
<td>Cardiff Central to Penarth</td>
<td>1 minute</td>
</tr>
<tr>
<td>Cardiff Central to Coryton</td>
<td>0 minutes</td>
</tr>
<tr>
<td>Cardiff Central to Rhymney</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Cardiff Central to Radyr (via City Line)</td>
<td>1/2 minute</td>
</tr>
</tbody>
</table>

**Journey Time Improvement Opportunities**

As part of early work carried out to inform heavy rail options for electrification of the Valley Lines, analysis has been undertaken to assess locations where line speed improvements could provide journey time reductions. The rolling stock modelled for this analysis assumed use of existing diesel multiple units as well as a range of electric multiple units and utilised existing station stopping patterns. These journey time savings are set out in Table 7.19 with the greater journey time savings being achieved as a result of electrification of the routes and deployment of high performing electric multiple unit rolling stock.

This analysis is being used to help inform decisions as to how the Valley Lines Network will be modernised.
7.2.5 Newport to Crewe (via Shrewsbury)

7.2.5.1 Newport Maindee Junctions – Shrewsbury Abbey Foregate Junction

Overview

This route provides a mixture of local and long distance passenger traffic and heavy freight traffic.

In the longer-term, the 2043 ITSS and 2043 freight growth forecast require the current number of passenger and freight services to increase. This is reflected in Figure 7.13.

Since the publication of the Welsh Route Study Draft for Consultation, further analysis has been undertaken to assess the impact of one additional passenger service in each hour (by 2043) on the route between Newport (Maindee West Junction) and Crewe, via Hereford and Shrewsbury.

This service was originally identified to accommodate delivery of a number of longer term Conditional Outputs (in the Long Distance Market Study) for improving connectivity between Cardiff and Manchester, the wider Bristol area and Manchester. As such for planning purposes, this service had been routed via the Severn Tunnel, Bristol Parkway and Cheltenham Spa, and the Western Route Study assessed the interventions required to accommodate this service alongside all the other requirements identified in the longer term to 2043 on this part of the network. Chapter 5 of the Western Route Study sets out the longer term challenge of accommodating all Conditional Outputs on the route between Westerleigh Junction and Birmingham and identifies that the full set of interventions necessary to accommodate the 2043 Indicative Train Service Specification on this part of the network is likely to be unaffordable and represent poor value for money. A trade-off therefore has been to consider how this service might be accommodated elsewhere on the network, and this Route Study therefore looks at how this service might be accommodated on the route from Newport to Crewe via Shrewsbury.

Constraints in 2043

The timings of trains onto and off this part of the route are heavily dictated by constraints at other major network nodes, such as Newport on the South Wales Main Line, Crewe and Birmingham New Street.

Additionally, the route has some significant gradients that severely restrict the maximum speed of freight services compared to passenger services, which has an impact on overall route capacity.

Other route constraints include long signalling sections that limit available capacity and freight loops of limited lengths at key locations.

It is not possible to accommodate the 2043 ITSS and 2043 freight forecast, because of these constraints, without either considering a trade-off in future service specification or investment in additional infrastructure. The following sections consider these in more detail.

Making best use of current infrastructure, up to 2043 specification

In practice, the constraints identified on other parts of the network prohibit the accommodation of the 2043 ITSS on this route.
Therefore, while there may be the capability for shorter distance passenger services to utilise parts of the line—for instance at the north and south ends, and around Hereford—it is unlikely that today’s number of long distance freight and passenger paths can be substantially increased.

Therefore the ability to operate increased levels of service, both passenger and freight, should be considered in the light of future changes to service specifications both on this route, and on other routes that interact closely with this part of the network.

Interventions for 2043

In order to deliver the 2043 ITSS and projected freight growth to 2043, this Route Study has undertaken further analysis and modelled a number of different service specification scenarios.

The revised 2043 ITSS now provides for three passenger services per hour between Newport (Maindee West Junction) and Shrewsbury. Two of those passenger services are then routed via Crewe to Manchester, with the third passenger service routed to Chester via Gobowen. In addition to these passenger services, a 2400 tonne freight train is assumed to operate between Newport (Maindee West Junction) and Shrewsbury.

Three service specification scenarios were assessed as follows:

1. The two South Wales - Manchester services are flighted close together calling at main stations only. The South Wales – Chester service (extending from / to Liverpool/Holyhead) would operate in the opposite half hour calling all stations (Table 7.20).

2. The two South Wales – Manchester operate half an hour apart calling at main stations only. The South Wales – Chester service (extending from / to Liverpool/Holyhead) would depart closely behind one of these services calling all stations (Table 7.21).

3. As per scenario 2 above but all services calling at most stations or with similar station calling patterns (Table 7.22).

In all three scenarios, a 2400 tonne freight train operates in each (off-peak) hour between Newport (Maindee West Junction) and Shrewsbury.

The analysis undertaken highlights a number of constraining factors when considering future service specification on this route.
The route is steeply graded particularly between Abergavenny and Hereford, which further impacts the speed differential between light passenger trains and heavy freight trains. As a result, faster passenger services, quickly catch slower moving freight services which would then require looping, involving significantly longer journey times with associated increase in operating cost.

Additionally services on this route tend to have fairly fixed timings at or through other busy network nodes such as Birmingham, Crewe, Manchester and Cardiff, which has an impact on how the timetable for the Marches route can be constructed.

The interventions considered are likely to be significant in terms of capital cost, with significant risk associated with additional land requirements, structural and civil engineering works and disruption. In view of the outputs that the interventions would deliver, it is unlikely that these would offer good value for money.

Therefore, when assessing the future requirements for the route in the longer term to 2043, there are a number of other strategic choices that should be considered:

- Improved signalling headways – although because the main constraint is the speed differential between freight and passenger trains, the overall impact of this might be limited. Locations which would benefit from improved headways are identified in Table 7.21 above, although it should be recognised that the future specification of services along this route, and how they might be accommodated in the most effective and efficient manner, will to an extent drive the optimum interventions required. Therefore longer term development and application of European Train Control System (ETCS) on this part of the network will provide the opportunity to increase network capacity at a more affordable cost with less disruption.

- Increasing freight speeds – this could be achieved by reducing train length, although this would likely require additional freight paths on the network so realistically is not an option for all freight services. Providing more powerful traction would require new more powerful locomotives or double heading of trains which would entail significant capital cost investment and/or increased operating costs for freight operators, which would potentially impact the commercial viability of rail freight significantly.

- Reducing passenger specification – the drivers of change in the longer terms are driven by the role that rail can play in improving connectivity between national and regional centres. Passenger capacity along the Marches route is not a significant issue in the longer term and Section 6.1.7 sets out the case for selective train lengthening as a choice for funders in Control Period 6 (CP6). Therefore longer term options do exist for providing passenger services that could split/adjoin during the course of a journey. Potentially therefore services between South Wales and Manchester, and South Wales and locations beyond Chester (such as Holyhead or Liverpool), could run as one train portion as far as Shrewsbury, with the train then splitting with one portion travelling to Manchester, and the other portion travelling to Chester and beyond. In the reverse direction the two train portions would join together at Shrewsbury to travel south to South Wales. This would reduce the number of train paths required along the Marches.

Section 2.3 identifies the opportunity to deliver a turnback platform facility at Abergavenny. This facility would allow additional services to operate between Cardiff Central and Abergavenny which aligns with emerging aspirations of the Cardiff Capital City Region Metro (see Table 7.23).

### Journey Time Improvement Opportunities

As part of this Route Study, a desktop review has taken place based on rolling stock and stopping patterns currently used on the route, to identify potential opportunities to reduce journey time between Newport and Shrewsbury.

These journey time savings are limited up to approximately one minute per journey. This is driven primarily by the stopping patterns on the route. These savings could be achieved with improvements to track condition, track geometry and gauge clearance works at various locations including north of Leominster, south of Hereford, north of Abergavenny Station and at Pontypool and New Inn Station. It should be noted that any improvement in journey time for passenger services will be greater than what can be achieved for freight services given the performance differential between light passenger and heavy freight trains.

There may be opportunity to carry out these enhancements alongside the resignalling of the route currently planned for CP5; and also during CP6 and beyond alongside track renewals that will be planned in these timescales.
Shrewsbury acts as an important hub station at the centre of routes radiating in five directions. This location and function, and the number of different but interlinked flows which pass through and/or start/terminate at the station, act as a constraint on capacity availability.

In the longer term, the 2043 ITSS and 2043 freight forecast require the current number of passenger and freight services to increase. This is reflected in Figure 7.14.

Constraints in 2043

As on other parts of the route between Newport and Crewe, the timings of trains through Shrewsbury will generally be dictated by constraints at other network nodes, such as at Birmingham New Street, Crewe and Chester, and the single line sections on the Cambrian Lines. Consequently, it is likely that many services will require longer-than-average stops at Shrewsbury, in order to meet their timings at these other key constrained points elsewhere on the network.

Additionally, the routeing of future services contained within the 2043 ITSS through Shrewsbury is significant in that it features a number of passenger trains which, from the same point of origin, serve different destinations across alternate hours. The consequence of this routeing is that most passenger services are affected by multiple network constraints, posing a risk to performance, and due to these constraints, are generally likely to arrive at Shrewsbury at a similar point in the hour.

As a result, Shrewsbury is unlikely to have the required amount of platform space to accommodate the full 2043 ITSS. It will, therefore, probably require a trade-off in service structure, and/or infrastructure investment.

Making best use of current infrastructure, up to 2043

This will be dictated by constraints at other network nodes. Currently, these mean that many of today’s passenger services arrive in succession, with limited platform availability in times of perturbation. It is likely that only a limited number of additional services could be timetabled through Shrewsbury.
A number of services, since they serve different routes across alternate hours, have constrained timings due to multiple constraints on different parts of the network. A service trade-off might be to reduce the number of these variable routes, thereby reducing the number of constraints which these services must respect. This could add the flexibility to better stagger arrivals and departures at Shrewsbury.

However, there is still likely to be a requirement to timetable certain services at close intervals, in order to maximise journey opportunities and limit generalised journey times. This would limit the possible performance benefits of this strategy. Additionally, it could increase the number of services requiring to turn back at Shrewsbury, itself limiting platform capacity.

In seeking to deliver the optimum service choices in the future, trade-offs between through services off routes such as the Cambrian Main line should be considered where these might reasonably use scarce capacity for other longer distance services.

In seeking to provide additional services on a north-south axis in the longer term, the use of Shrewsbury station as a hub station should be considered with the ability to regularly connect into other services, improving overall generalised journey times.

### Interventions for 2043

In order to deliver the 2043 ITSS and projected freight growth to 2043, this Route Study has identified a series of interventions that are described in Tables 7.24 and 7.25.

In assessing options for widening Platform 3, it is acknowledged that the access to this platform would remain unchanged. This arrangement is not ideal as it is outside of the barrier line and reached by either lift or steps from the front of the station. Given the design of the station, it is difficult to see how this issue could immediately be overcome without significant alterations to the Grade 2 listed station structure and relocation of station facilities such as the booking office, in one it quite a constrained area. This is an area or work that could be considered in the longer term in conjunction with the options set out in this section.

#### Table 7.24. Assessment of Option A: Extension of Platform 3

<table>
<thead>
<tr>
<th>Summary of intervention:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform 3 will increasingly be used to accommodate the full range and number of anticipated services. Extending it out to the through lines will facilitate access to the Crewe lines.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform 3 is required to accommodate the 2043 ITSS, holding the majority of northbound Wrexham traffic as well as some services turning round. Extending it out to the current through lines, which are lightly used, would permit access to the Crewe lines, potentially permitting the direction of traffic through all platforms to be standardised in normal operation, and leaving one of the existing platforms free to permit turnrounds from the north.</td>
</tr>
</tbody>
</table>

Feasibility work has been undertaken to assess these requirements which has identified that the same length of platform can be accommodated as is currently provided by the existing platform 3 (263m). Additionally some track and signalling works work be required to accommodate the required layout changes driven by the platform widening.

See Figure 7.15.

**Indicative costs**

Indicative costs for these works have been assessed in conjunction with Option B (Table 7.25) and are in the price range £5m - £15m.

#### Table 7.25. Assessment of Option B: Additional bay or through platform

<table>
<thead>
<tr>
<th>Summary of intervention:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A north-facing bay, or additional through platform, is likely to be required if long distance high speed services from London are turned back at Shrewsbury.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>If long distance high speed services are turned round at Shrewsbury, rather than extended to Wrexham (where infrastructure work would also be needed), the time required to turn round such services is likely to drive the need for an additional platform. Possible space has been identified on the north-east side of the station.</td>
</tr>
</tbody>
</table>

Feasibility work has identified that it would be easier to construct and deliver a through platform than a bay platform and this provides better operational flexibility to deliver the 2043 ITSS. The biggest challenge is how to best provide access to the new platform. Assessment undertaken suggests that extending the existing subway would require extensive disruptive works which would significantly increase the cost. An alternative option is to install a new Equalities Act 2010 compliant footbridge to a Network Rail standard design. The existing footbridge does not serve the island platform and does not serve Platform 3 or the proposed Platform 8 directly. In addition it is considered likely that the ramps up to this footbridge would be too steep to be compliant. A new footbridge would therefore serve all the platforms directly and the existing footbridge could be left in place to allow the non-station users to cross from one side of the station to the other.

**Indicative costs**

Indicative costs for these works have been assessed in conjunction with Option A (Table 7.24) and are in the price range £5m - £15m.
7.2.5.3 Shrewsbury Crewe Junction – Crewe Gresty Lane Junction

Overview

This route provides a mixture of local and long distance passenger traffic and heavy freight traffic.

This is reflected in Figure 7.16.

Constraints in 2043

Timings on this route are entirely dictated by the timings at other constrained network locations, and the routes that they serve.

Making best use of current infrastructure, up to 2043

Theoretically, the 2043 ITSS and 2043 freight forecast could be run over this route. This includes the additional one passenger train per hour in each direction assessed in Section 7.2.5.1. However, accommodation of the 2043 ITSS will be heavily dependant on constraints elsewhere on the network.

Interventions for 2043

Given the committed 2019 base infrastructure, it is likely that no interventions will be required to deliver the 2043 ITSS, and projected freight growth to 2043.

Journey Time Improvement Opportunities

As part of this Route Study, a desktop review has taken place based on rolling stock and stopping patterns currently used on the route, to identify potential opportunities to reduce journey time between Shrewsbury and Crewe.

These savings range between half and three minutes per journey.

The maximum journey time saving potential that could be achieved is by use of the most modern high performing rolling stock used on this corridor, together with limited station calls.

These savings could be achieved with improvements to track condition, track geometry and gauge clearance works at various locations specifically between Nantwich and south of Yorton, which would enable a maximum linespeed of 100mph on parts of the route, which has been afforded by recent resignalling of the route during CP4.

Opportunity is likely to exist during CP6 and beyond to incrementally assess these options as part of planned track renewals as the future track renewals work bank matures.
## 7.2.6 Shrewsbury to Chester

### 7.2.6.1 Shrewsbury Crewe Junction – Wrexham General station

**Overview**

This route accommodates a mixture of long distance passenger traffic and freight traffic.

**Constraints in 2043**

The timings of trains onto and off this part of this route are heavily dictated by constraints at other major network nodes, such as Newport on the South Wales Main Line, and Birmingham New Street.

In the longer term, the 2043 ITSS and 2043 freight growth forecast require the current number of passenger and freight services to increase.

**Making best use of current infrastructure, up to 2043**

In order to maintain an acceptable performance buffer, the line could accommodate up to two passenger trains per hour in each direction, or one passenger train alongside one heavy freight service. However, practical delivery of these is dependent on the wider network constraints described above.

The scale of the infrastructure enhancement required is driven by the number of services timetabled. If there were an opportunity to reduce these services, for instance by terminating the long distance high speed service from London Euston at Shrewsbury, or by redirecting certain services to run between Chester and Shrewsbury via Crewe, the scale of enhancement required would be reduced. However, this may reduce the journey options available at Wrexham.

**Interventions for 2043**

In order to deliver the 2043 ITSS and projected freight growth to 2043, this Route Study has identified that additional intermediate signals will be required as detailed in Table 7.26.

The introduction of ETCS will provide capacity and performance benefits on this route.
7.2.7 Cambrian Lines

7.2.7.1 Shrewsbury (Sutton Bridge Junction) – Aberystwyth

Overview

This route accommodates passenger services between Shrewsbury and Aberystwyth that operate at two-hourly intervals with services generally originating from and terminating at Birmingham International. The Welsh Government has recently confirmed that additional morning and evening peak services will operate from May 2015 for a trial period of three years. No freight services currently operate along this route.

In the longer term, the 2043 ITSS predicts an increase in the frequency of passenger services. This is reflected in Figure 7.18.

This line is notable in that it has been fully converted to ETCS signalling to trial this system for wider application across the rail network.

Constraints in 2043

The Cambrian Main Line from Shrewsbury to Aberystwyth is primarily single track line, with loops provided to enable trains to pass each other. The current infrastructure can accommodate one train an hour in each direction, but the requirement for trains to pass each other at passing loops limits timetable flexibility and presents a performance risk when any train is running late. This can have a knock-on effect on other services from which it is difficult to recover.

It is recognised that there are aspirations for new stations on the Cambrian Main Line. There is significant interest in the provision of a new station at Bow Street (between Aberystwyth and Borth) and Canno (between Machynlleth and Caersws), and Welsh Government has asked Network Rail to advise on the implications on network capacity should either or both stations be promoted, given the recent introduction of enhanced frequency of passenger services along the route.

Making best use of current infrastructure, up to 2043 specification

Network Rail is working with the franchise train operator for Wales and the Borders and the Welsh Government to assess the best ways of accommodating additional station stops and associated service requirements whilst maintaining connectivity for existing customers and ensuring reliable timetables.

Interventions for 2043

In considering the longer term requirement to meet the 2043 Indicative Train Service Specification, planning considerations should include the following:

- The impact of future enhancements to ETCS upon route capacity
- Future franchise specifications which may change service profiles
- Future rolling stock strategy, whereby more modern rolling stock may be better able to exploit prevailing line speed through better acceleration and braking characteristics
- Infrastructure enhancements which could potentially include assessments of line speed increases and/or extensions to loop lengths which would improve network capability and offer timetable flexibility and performance resilience. Such works should also consider closure of crossings where this would also facilitate line speed improvement with added safety benefit to the network.

Journey time improvement opportunities

There are limited opportunities to improve the linespeed between Taldrig and Machynlleth, and west of Dovey Junction, which primarily relate to replacement of old jointed track and upgrade or closure of level crossings.

Opportunity is likely to exist during CP6 and beyond to assess what journey time improvements might be made as the track renewals work bank matures.
7.2.7.2 Dovey Junction – Pwllheli

Overview

This route accommodates passenger services between Dovey Junction and Pwllheli that operate at two-hourly intervals. Most services are a portion of the two-hourly service between Birmingham international and Aberystwyth in each direction that split from and join to this service at Machynlleth. No freight operates along the route. The route is a single line with passing loops.

This part of the Cambrian route has also been fully converted to ETCS signalling to trial this system for wider application across the UK rail network.

Constraints in 2043

Since no service increase is required, there are no constraints to delivery of the 2043 ITSS. In Section 5.4.4, it is recognised that there can be seasonal variations in demand and this is a route where in summer months, passenger demand is higher than during winter months. This demand can generally be accommodated by managing the rolling stock fleet resources.

Making best use of current infrastructure, up to 2043 specification

The current infrastructure delivers the required service.

Interventions for 2043

No interventions are required.

7.2.8 Heart of Wales

Overview

Since publication of the Welsh Route Study Draft for Consultation, and in line with responses received during consultation, the Welsh Route Study Industry Working Group determined that for planning purposes, the minimum passenger service specification on any route in 2043, should be a train every two hours. This has therefore led to some further analysis of the route capability which is described below. No freight currently operates or is forecast to operate on this route in the future.

Making best use of current infrastructure, up to 2043 specification

High level analysis has been undertaken to assess the route capability requirements to deliver a passenger train service every two hours in each direction, along the Heart of Wales route between Shrewsbury and Llanelli. This analysis has involved construction of an indicative timetable for the route between Craven Arms and Llandeilo Junction only, so does not make any assumptions on route capability north of Craven Arms (to Shrewsbury including platforming of additional services at Shrewsbury) or south of Llandeilo Junction. The findings of this work indicate that to operate such a level of service the following would result or would be required:

- Journey times need to be extended for trains in both directions (for the exercise undertaken, ignoring constraints outside the study area, extended dwell times required at Llandrindod (20-25 minutes) and Llandovery (5-10 minutes), although these locations are highly dependent on the timetable independently of the type of rolling stock.

- Alternatively and more preferable, a loop positioned between Llandrindod and Llanwrtyd (around 4-8 miles from Llanwrtyd, although the precise location would be highly dependent on the timetable and constraints at Shrewsbury, Swansea and Carmarthen) would allow a more optimal crossing of trains, with fewer and smaller requirements of journey time extensions.
Additional analysis has also been undertaken to consider what journey time improvements could be made by implementing a revised speed profile of 50-60mph throughout most of the route. As well as improving journey times, such a speed profile would be more efficient in terms of wear and tear on the track and rolling stock, and reduction in the use of fuel used. These improvements could be achieved by improving track condition and either closing or improving level crossings. For the purposes of comparison the analysis compared journey times that could be achieved with Class 150 2-car units, Class 153 1-car units (which are currently used on this route) and Class 158 2-car units. The summary findings of this analysis are indicated below:

- A Class 153 unit could achieve a better northbound journey time of around five minutes and southbound journey time of around seven minutes, compared to a Class 150 unit.
- A Class 158 unit could achieve a better northbound journey time of around eight minutes and southbound journey time of around nine minutes, compared to a Class 150 unit.
- Removal of a number of intermediate stops along the route could enable a Class 153 unit to achieve a better northbound journey time of around 26 minutes and southbound journey time of around 29 minutes, compared to a Class 150 unit.
- Removal of a number of intermediate stops along the route could enable a Class 158 unit to achieve a better northbound journey time of around 28 minutes and southbound journey time of around 29 minutes, compared to a Class 150 unit.

It is important to recognise that the above analysis only provides an indication of how use of the network might be optimised in the future. The use of better performing rolling stock, aligned with potential changes to infrastructure, do present the opportunity to optimise the route capability, and should therefore be considered as part of future re-franchising (rolling stock) and route modernisation (signalling re-control).

It is also important to recognise that the route does serve a number of different passenger markets. Recent timetable changes and additional services funded by Welsh Government (see Section 6.1.6) have enabled better opportunities to commute into main centres at each end of the route. Therefore, in considering how the route capability might be optimised, the Heart of Wales Forum has also proposed a further option whereby a small depot facility is established at Llandovery, which would enable rolling stock to be stabled at this location overnight, reducing the need for inefficient empty passenger rolling stock workings to provide first and last trains along the route. This might also offer the opportunity to recast the timetable along the route to provide more optimum service levels at each end of the route, and along the whole length of the route. Section 6.1.6 describes the work being promoted by the Heart of Wales Forum to develop ‘Hubs’ for the use of communities along the route. A key aim of this is to support growth of the regional economy by encouraging use of the route for both business and tourism. Provision of a small depot and stabling facility at Llandovery would also offer benefits from an economic perspective in that it would create employment opportunities.

The rail industry will continue to support and work with the Heart of Wales Line Forum to consider opportunities for delivering affordable solutions to improve use of this route around the developing strategy outlined above. This should also include consideration of improved Sunday services (currently constrained by the need to maintain the route overnight Saturday into Sunday morning), and improved facilities at the locations at each end of the route (Craven Arms and Llanelli), which may also present suitable interchange opportunities that assist in optimising future enhanced service levels.
7.2.9 Wrexham Central - Bidston

Overview
This route accommodates an hourly local passenger service in each direction between Wrexham Central and Bidston. The route provides interchange facilities for Liverpool at Bidston, North Wales Coast and Chester at Shotton, and services to the West Midlands and South Wales at Wrexham General. Additionally, a number of daily freight services serve the industrial sites at Buckley and Dee Marsh.

In the longer term, the 2043 ITSS and 2043 freight growth forecast predict an increase in both passenger and freight services. This is reflected in Figure 7.19.

Constraints in 2043
The 2043 ITSS published in the Welsh Route Study Draft for Consultation, included an additional passenger service to Hawarden Bridge, and a heavier freight train, cannot be accommodated on the baseline infrastructure, due to the constraints of the current signalling. Hawarden Bridge serves the growing industrial enterprise zone at Deeside so additional services to this station would provide for better rail connectivity to the Deeside Enterprise Zone. However, there is currently no way of turning round passenger services in the platform at Hawarden Bridge station which would currently require services to run empty to Birkenhead sidings, around 2/3 mile further north. In addition, the option to terminate services at Hawarden Bridge will prohibit clock face operation, and is also likely to result in sub-optimal rolling stock utilisation.

It would however be possible, each hour, to extend a second passenger service to Bidston, although this is also constrained by the current signalling on the route. This is now reflected in the final Welsh Route Study 2043 ITSS (see Section 5.5).

Making best use of current infrastructure, up to 2043 specification
Service frequency cannot be improved beyond today’s maximum total level of two trains per hour, consisting of either passenger services between Wrexham Central and Bidston, and/or freight services between Wrexham General and Dee Marsh.

Interventions for 2043
In order to deliver the 2043 ITSS and projected freight growth to 2043, this Route Study has identified the intervention described in Table 7.27.

Since publication of the Welsh Route Study Draft for Consultation, work on a number of network studies has commenced in the North West to inform the North of England Route Study due to be published in 2017. In particular feasibility work is being undertaken to look at a range of infrastructure and rolling stock options for extending passenger services from the electrified (third rail DC) Merseyrail network south of Bidston to Shotton and/or Wrexham. This work supports aspirations of Merseytravel to improve connectivity between Merseyside, Deeside and Wrexham, and also supports a number of responses received during the consultation to this Route Study which also identified the need to improve this connectivity (see Section 3.4.1.2).

This work will also build on a number of other studies that have been conducted in recent years to look at how services on this route may be extended beyond Bidston, to improve connectivity with Liverpool.

In the short to medium term, it is recognised that improving connectivity between Wrexham, and especially Deeside and the communities on the northern part of the Wrexham – Bidston route with Liverpool will grow in importance. The ability to improve frequency, aligned to the high frequency Merseyrail service levels between West Kirby, Bidston and Liverpool, will provide for improved connectivity and journey times.

In the longer term, potential deployment of rolling stock with the ability to operate on battery power for part of their journey may provide the ability in an affordable manner to improve the service offering between the Wrexham – Bidston route and Liverpool.
7.2.10 Chester - Holyhead (including Llandudno and Blaenou Ffestiniog branches)

7.2.10.1 Chester Station

Overview

Chester station acts as a network hub, receiving through and terminating passenger services from six lines, with destinations served across North and South Wales, the Midlands, North West England, and London Euston. Occasional freight services run through, mainly to termini in North Wales. The 2043 ITSS and 2043 freight forecast anticipate a substantial increase in the number of both passenger and freight services calling or terminating at Chester. This is reflected in Figure 7.20

Constraints in 2043

The timings at this station are heavily dictated by constraints at other major network nodes, such as Newport on the South Wales Main Line, Manchester Piccadilly, and Crewe.

Consequently, there are two elements to this station which may prevent delivery of the services required in 2043: the availability of through platforms, and the track layout at Chester East Junction.

- There are only two through platforms generally available, Platforms 3 and 4. The 2043 ITSS can only be accommodated with optimum timings at these platforms, and the requirement to build Chester’s timetable around other constraints on the railway network will make these timings not achievable. Section 6.1.11 identifies the requirement to provide an additional through platform in the shorter term to deliver through services between Liverpool Lime Street and Wrexham via Halton Chord.

- The layout at Chester East Junction includes two points over which there are a high number of moves in different directions (points A and B in Figure 7.21). It is not possible to timetable the 2043 ITSS over this infrastructure.

Making best use of current infrastructure, up to 2043 specification

Best use will be dictated by constraints at other network nodes. Against the base service levels and infrastructure, there is capacity for additional services at Chester, but this is difficult to utilise effectively, due to the fixed timings of services required at other busy major network nodes. However, it is likely that a limited number of additional services could be timetabled through Chester before service trade-offs or additional infrastructure is required.

In seeking to deliver the optimum service choices in the future, trade-offs between running some services as through or terminating should be considered. However, due to a lack of platforms in which to terminate or turn round services at the western end of the station, this strategy may not release significant capacity or timetabling flexibility.

Nonetheless, the development of Chester station as a hub station implies the capability to connect into a range of services, and improvement in overall generalised journey times.

Interventions for 2043

In order to deliver the 2043 ITSS and projected freight growth to 2043, this Route Study has identified the interventions described in Tables 7.28 and 7.29. It is considered that these should be used to inform the resignalling of this part of the network planned in 2025 when future service specification might be considerably different to what operates today.
Figure 7.21: Chester station

Table 7.28 Assessment of Option A: Reconfiguration of Chester East Junction

Summary of intervention:
Chester East Junction currently funnels all traffic, in both directions, over one of two points. The junction should be reconfigured to separate these flows.

Output assessment:
Separation of flows, and therefore an increase in timetabling flexibility and a reduction in performance risk, can be achieved to a significant degree through the layout changes illustrated in Figure 7.21.

This allows arrivals and departures in parallel over each pair of lines, Crewe and Warrington. In addition, it reduces the number and duration of conflicting moves, with only one opposing move at each point.

Affordability assessment
This should be considered in the light of evolving future specification of services and should inform requirements for the planned resignalling of this part of the network in 2025.

Table 7.29 Assessment of Option B: Additional platform at Chester

Summary of intervention:
An additional through platform, Platform 8, may be required in order to provide necessary capacity when other network constraints are considered in a practical timetable.

Output assessment:
An additional platform on the northern side of the station, on the current Goods and Reception loops, would – with the installation of 3rd Rail DC electrification – be able to accommodate the Merseyrail services. This would allow Platform 7 to be used by through services from North Wales, freeing up Platform 4 so that it could be used in both direction, as required to relieve Platforms 3 and 7, or to turn round services from the north. This is likely to provide the necessary platform availability and flexibility to accommodate the 2043 ITSS, but should be considered in the light of timetable development around network constraints elsewhere.

Affordability assessment
This should be considered in the light of evolving future specification of services and should inform requirements for the planned resignalling of this part of the network in 2025.
7.2.10.2 Chester to Holyhead

Overview
This Main Line runs along the length of the North Wales coast, serving coastal towns and providing a direct link between ferries to Ireland from Holyhead, and destinations including Manchester, Birmingham and London. The majority of current traffic is passenger services, with occasional freight services to/from industrial destinations along the route. The 2043 ITSS and 2043 freight forecast envisage an increase in passenger services, but with little growth in the number of freight paths required. This is reflected in Figure 7.22.

Constraints in 2043
The timings along this route are dictated by constraints at other major network nodes, such as Newport on the South Wales Main Line, Manchester Piccadilly, and Crewe. Consequently, the timetable for this route in the future will be significantly dictated by the timings of services at the other busy network nodes referred to above.

Even without this limitation, the baseline signalling will prohibit the delivery of the 2043 ITSS. There are two sections of route between Chester and Llandudno – the heaviest utilised part of the route – with long distances between signals. These dictate the whole line timetable. The scheduling of the full ITSS, even if possible given other network constraints, would present a significant performance risk.

Making best use of baseline infrastructure, up to 2043 specification
The maximum service level that could be accommodated on the baseline infrastructure, is four passenger trains per hour. This is an increase of one service per hour over today’s most intensive hours. Practical delivery would be dependent on network constraints elsewhere, since it may prove difficult to find appropriate matching paths east of Chester.

Freight services could not be accommodated alongside this number of passenger services. Therefore in consideration of making best use of the baseline infrastructure, the 2043 ITSS and freight forecasts should continue to be reviewed in the light of continued passenger growth and improved clarity as to future freight volumes on this route. This will enable potential future trade offs in service levels between passenger and freight to be optimised.

As part of this, it is important to recognise that a number of strategic freight sites exist along the route that might drive increased volumes of freight in the future subject to changes in prevailing market conditions. Additionally there are a number of significant infrastructure projects being planned in the region, including Wylfa power station on Anglesey, a biomass station in Holyhead and hydro-electric schemes, that all have the potential to generate rail freight flows.

Interventions for 2043
In order to deliver the 2043 ITSS and projected freight growth to 2043, this Route Study has identified the intervention described in Table 7.30.

The timing of this particular intervention should be considered in the light of the evolving national deployment of ETCS. ETCS will provide a more affordable and efficient solution in maximising the capacity available and delivering performance improvement along this part of the route. This is particularly important to the consideration of potential future freight volumes. Whilst there are currently very low volumes of rail freight operating along the North Wales Coast Main Line, and the business cases associated with any prospective traffic being currently negligible, the future network capability requirements will need to reflect changes in both prevailing freight market conditions, and changes in government policy so that future modal shift options are not frustrated.
Summary of intervention:
Long signalling sections (Absolute Block) restrict the line from accommodating the 2043 freight and passenger service levels. Therefore, the splitting of signalling sections at two locations will be required.

Output assessment:
Splitting of the following block sections will be necessary:
- Saltney Junction - Flint, around Shotton (both directions)
- Tyn-y-Morfa - Rhyl, around Prestatyn (both directions)
This is likely to permit the timetabling of all required services. Other network constraints may necessitate further signalling improvements, as would a requirement to timetable new freight services alongside the full passenger specification.

Indicative cost:
£5-£15 million

Future roll out and deployment of ETCS will offer a solution to enhancing network capacity in this area. This will be assessed as part of the emerging deployment planning for ETCS as future capacity enhancement requirements become more certain in the longer term.
7.2.10.3 Shotton Station Interchange

Section 6.1.10 identifies a choice for funders in CP6 to improve access to Deeside, which could include undertaking development and planning work to improve the station environment at Shotton to enable this station to act as an effective interchange location in the longer term given potential future enhanced level of passenger service frequency specification on the North Wales Coast Main Line and Wrexham to Bidston route.

7.2.10.4 Llandudno Junction-Llandudno station Overview

This is a three mile double track branch line, connecting Llandudno Junction with Llandudno station, with one intermediate station. It is used exclusively by passenger services.

Constraints in 2043

Due to the short length of this line, and the requirement to accommodate a maximum of three passenger trains in an hour, there are no constraints along this line.

Making best use of baseline infrastructure, up to 2043 specification

The 2043 ITSS can be accommodated on this line.

Interventions for 2043

No interventions are required.

7.2.10.5 Llandudno Junction-Blaenau Ffestiniog Overview

Since publication of the Welsh Route Study Draft for Consultation, and in line with responses received during consultation, the Welsh Route Study Industry Working Group determined that for planning purposes, the minimum passenger service specification on any route in 2043 should be a train every two hours. This has therefore led to some further analysis of the route capability which is described below. Additionally, this further analysis has taken a high level view of the impact of running a two hourly service along the line, should the currently mothballed line beyond Blaenau Ffestiniog to Transwynedd be re-instated for passenger.

Welsh Government has advised that they would wish to see this route retained as part of the network in the longer term as this would provide potential to serve the Snowdonia Enterprise Zone. This is a single track branch line with passing loops, connecting Llandudno Junction and Blaenau Ffestiniog. There are a number of small local stations along its route. It is used exclusively by passenger traffic; the 2043 ITSS does not envisage any increased service levels in the future.

Constraints in 2043, making best use of baseline infrastructure, up to 2043 specification and Interventions for 2043

A two hourly passenger service between Llandudno Junction (extended to from Llandudno) and Blaenau Ffestiniog could be accommodated on the existing infrastructure, although this would require an extra train set. Turn round times at Blaenau Ffestiniog would be short which could potentially impact on route performance and the ability to recover from perturbed operation. Therefore any options to improve journey times as a result of line speed improvements or improved rolling stock operating characteristics should be considered in the longer term.

Should the line be extended to Transwynedd, it has been assessed that a more optimum level of passenger service along the line of two trains every three hours could be accommodated with one additional trainset. This would require an additional passing loop to be provided and options exist for optimising the location of this loop in relation to the preferred timetable service specification. Turn round times at either end of the route would be short which could potentially impact on route performance and the ability to recover from perturbed operation. Again any options to improve journey times as a result of line speed improvements or improved rolling stock operating characteristics should be considered in the longer term.
Appendix A: Appraisal Results

The choices identified for the next Control Period (CP6, commencing April 2019) have been categorised from a financial and socio-economic perspective.

In the context of the financial perspective, CP6 choices have been categorised into either of the following:

- (a) choices which worsen the rail industry’s net operating position (in other words, the additional operating costs exceed the value of revenue generated); or
- (b) choices which improve the rail industry’s net operating position. For these schemes, this Route Study also indicates the extent to which this improvement is able to cover the capital cost of the initial investment.

The choices have also been appraised from a wider ‘socio-economic’ perspective, which compares the value of benefits to users and non-users to the net financial cost to funders. The appraisals have been conducted in line with funders’ guidelines, in particular WelTAG, the Welsh transport planning and appraisal guidance and WebTAG, the Department for Transport’s appraisal guidelines.
**Option 3A: Upgrade of Relief Lines line speed between Severn Tunnel Junction and Cardiff Central**

| Conditional Output | This option will enable Conditional Outputs CO10-15, CO30 & CO35 to be accommodated on the network. These Conditional Outputs all relate to connectivity requirements (service frequency and journey time for services that will operate along the route between Cardiff Central and Severn Tunnel Junction. |
| Timeframe | CP6. It has been identified that the anticipated 2023 passenger service levels on the South Wales Main Line between Cardiff Central and Severn Tunnel Junction will require some services to be operated along the slower Relief Lines as capacity will be reached on the Fast Lines. These services would suffer journey time detriment if the relief Lines are not upgraded. |
| Objectives | To accommodate anticipated growth in passenger services levels by the end of 2023. |
| Description | Upgrade of track condition to optimise maximum line speeds afforded by recent resignalling of the route. |
| Infrastructure requirement | Upgrade of track equipment and closure of Bishton Level Crossing. |
| Operational requirement | None. |
| Passenger impact | Improved journey time. |
| Freight impact | Ability for freight services to operate at higher line speed. Assessment of freight facility connections to Relief Lines should also be assessed as part of development of this scheme. |
| Relates to other options | Section 6.1.4: Cardiff Central Station Modernisation |
| Socio-economic Value for money categorisation | High |
| Rail Industry financial categorisation | NA |
| Note | Details of how the business case has been constructed is set out in Section 6.1.3. |
### Appendix A: Appraisal Results

**Option 3A Financial and socio-economic categorisation**

<table>
<thead>
<tr>
<th>Rail industry financial impact (Categorisation of Revenue, Operating costs &amp; Capital costs over appraisal period)</th>
<th>Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheme increases operating subsidies (i.e. $R - O &lt; 0$)</td>
<td>High</td>
</tr>
<tr>
<td>Scheme decreases operating subsidies (i.e. $R - O &gt; 0$)</td>
<td></td>
</tr>
<tr>
<td>Low capital cost coverage (i.e. $(R - O) / C &lt; 33%$)</td>
<td></td>
</tr>
<tr>
<td>Medium capital cost coverage (33-66%)</td>
<td></td>
</tr>
<tr>
<td>High capital cost coverage (66-100%)</td>
<td>✓</td>
</tr>
<tr>
<td>Positive financial case (&gt; 100%)</td>
<td></td>
</tr>
</tbody>
</table>

**Option 3A Summary TEE (Transport Economic Efficiency) table**

<table>
<thead>
<tr>
<th>30 year appraisal</th>
<th>£m (2010 PV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs (Present Value)</td>
<td></td>
</tr>
<tr>
<td>Investment Cost</td>
<td>37.2</td>
</tr>
<tr>
<td>Operating Cost</td>
<td>0.0</td>
</tr>
<tr>
<td>Revenue</td>
<td>-27.3</td>
</tr>
<tr>
<td>Other Government Impacts (road infrastructure costs)</td>
<td>-0.1</td>
</tr>
<tr>
<td>Total costs</td>
<td>9.8</td>
</tr>
<tr>
<td>Benefits (Present Value)</td>
<td></td>
</tr>
<tr>
<td>Rail user benefits</td>
<td>36.6</td>
</tr>
<tr>
<td>Non user benefits</td>
<td>4.6</td>
</tr>
<tr>
<td>Rail user &amp; non user disruption disbenefits</td>
<td>-2.8</td>
</tr>
<tr>
<td>Current TOCs revenue</td>
<td>0.0</td>
</tr>
<tr>
<td>Current TOCs/ NR opex</td>
<td>0.0</td>
</tr>
<tr>
<td>Other Government Impacts (indirect taxation)</td>
<td>-5.5</td>
</tr>
<tr>
<td>Total Quantified Benefits</td>
<td>32.8</td>
</tr>
<tr>
<td>NPV</td>
<td>23.0</td>
</tr>
<tr>
<td>Quantified BCR</td>
<td>3.35</td>
</tr>
</tbody>
</table>
**Option 3B: Incremental upgrade over Option A to maximise the capability provided by the recent re-signalling and achieve a maximum speed capability of 100 mph on all four lines between Cardiff Central and Severn Tunnel Junction.**

<table>
<thead>
<tr>
<th>Conditional Output</th>
<th>This option (which is incremental to Option 3A) also enables Conditional Outputs CO10-15, CO30 &amp; CO35 to be accommodated on the network. These Conditional Outputs all relate to connectivity requirements (service frequency and journey time for services that will operate along the route between Cardiff Central and Severn Tunnel Junction.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeframe</td>
<td>CP6. It has been identified that the anticipated 2023 passenger service levels on the South Wales Main Line between Cardiff Central and Severn Tunnel Junction will require use of both the existing ‘fast’ and ‘relief’ lines.</td>
</tr>
<tr>
<td>Objectives</td>
<td>This incremental option delivers improved journey times along the South Wales Main Line.</td>
</tr>
<tr>
<td>Description</td>
<td>Upgrade of track condition to optimise maximum line speeds afforded by recent ressignalling of the route.</td>
</tr>
<tr>
<td>Infrastructure requirement</td>
<td>Upgrade of track equipment and closure of Bishton Level Crossing.</td>
</tr>
<tr>
<td>Operational requirement</td>
<td>None.</td>
</tr>
<tr>
<td>Passenger impact</td>
<td>Improved journey time.</td>
</tr>
<tr>
<td>Freight impact</td>
<td>Ability for freight services to operate at higher line speed. Assessment of freight facility connections to Relief Lines should also be assessed as part of development of this scheme.</td>
</tr>
<tr>
<td>Relates to other options</td>
<td>Section 6.1.4: Cardiff Central Station Modernisation.</td>
</tr>
<tr>
<td>Socio-economic Value for money categorisation</td>
<td>Low</td>
</tr>
<tr>
<td>Rail Industry financial categorisation</td>
<td>NA</td>
</tr>
<tr>
<td>Note</td>
<td>Details of how the business case has been constructed is set out in Section 6.1.3.</td>
</tr>
</tbody>
</table>
### Option 3B Financial and socio-economic categorisation

<table>
<thead>
<tr>
<th>Rail industry financial impact (Categorisation of Revenue, Operating costs &amp; Capital costs over appraisal period)</th>
<th>Socio-economic impact (WebTAG VfM category; see summary TEE table for further details)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheme increases operating subsidies (i.e. ( R - O &lt; 0 ))</td>
<td>Low</td>
</tr>
<tr>
<td>Scheme decreases operating subsidies (i.e. ( R - O &gt; 0 ))</td>
<td>Low capital cost coverage (i.e. ( (R - O) / C &lt; 33% ))</td>
</tr>
<tr>
<td></td>
<td>Medium capital cost coverage (33-66%)</td>
</tr>
<tr>
<td></td>
<td>High capital cost coverage (66-100%)</td>
</tr>
<tr>
<td></td>
<td>Positive financial case (&gt; 100%)</td>
</tr>
</tbody>
</table>

### Option 3B Summary TEE (Transport Economic Efficiency) table

<table>
<thead>
<tr>
<th>30 year appraisal</th>
<th>£m (2010 PV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs (Present Value)</td>
<td></td>
</tr>
<tr>
<td>Investment Cost</td>
<td>9.2</td>
</tr>
<tr>
<td>Operating Cost</td>
<td>0.0</td>
</tr>
<tr>
<td>Revenue</td>
<td>-4.9</td>
</tr>
<tr>
<td>Other Government Impacts (road infrastructure costs)</td>
<td>0.0</td>
</tr>
<tr>
<td>Total costs</td>
<td>4.2</td>
</tr>
<tr>
<td>Benefits (Present Value)</td>
<td></td>
</tr>
<tr>
<td>Rail user benefits</td>
<td>5.4</td>
</tr>
<tr>
<td>Non user benefits</td>
<td>0.7</td>
</tr>
<tr>
<td>Rail user &amp; non user disruption disbenefits</td>
<td>-0.7</td>
</tr>
<tr>
<td>Current TOCs revenue</td>
<td>0.0</td>
</tr>
<tr>
<td>Current TOCs/ NR opex</td>
<td>0.0</td>
</tr>
<tr>
<td>Other Government Impacts (indirect taxation)</td>
<td>-0.9</td>
</tr>
<tr>
<td>Total Quantified Benefits</td>
<td>4.5</td>
</tr>
<tr>
<td>NPV</td>
<td>0.3</td>
</tr>
<tr>
<td>Quantified BCR</td>
<td>1.06</td>
</tr>
<tr>
<td>Option 7A: Train lengthening for services between Cardiff and Manchester (Five vehicle option)</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Conditional Output</strong></td>
<td>COS and CO6 - to provide sufficient capacity for passengers travelling on services between Cardiff and Manchester via the Marches, taking into account anticipated growth.</td>
</tr>
<tr>
<td><strong>Timeframe</strong></td>
<td>CP6 (specifically 2023).</td>
</tr>
<tr>
<td><strong>Objectives</strong></td>
<td>To accommodate forecasted demand and reduce on-train crowding on long distance services between Cardiff and Manchester. These services are also used by passengers travelling between local stations on the Marches line.</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>Additional vehicle(s) for services require extra capacity to meet anticipated demand growth by 2023 between Cardiff and Manchester during the day.</td>
</tr>
<tr>
<td><strong>Infrastructure requirement</strong></td>
<td>No infrastructure work required within the Welsh Route Study area. None expected outside Welsh Route Study area - subject to confirmation from other Route Studies.</td>
</tr>
<tr>
<td><strong>Operational requirement</strong></td>
<td>Most of the two or three car sets to be lengthened with one additional vehicle, with two services lengthened with two additional vehicles.</td>
</tr>
<tr>
<td><strong>Passenger impact</strong></td>
<td>Provide sufficient capacity to meet the anticipated demand growth to 2023.</td>
</tr>
<tr>
<td><strong>Freight impact</strong></td>
<td>None.</td>
</tr>
<tr>
<td><strong>Relates to other options</strong></td>
<td>Option 7B: only lengthen services that have a value for money categorisation at medium or higher.</td>
</tr>
<tr>
<td><strong>Socio-economic Value for money categorisation</strong></td>
<td>Low.</td>
</tr>
<tr>
<td><strong>Rail Industry financial categorisation</strong></td>
<td>Increases operating subsidies.</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>The operating costs are estimated from a high level diagramming assumption and subject to further assessment. The value for money case is likely to improve if the diagramming and formation are not constrained.</td>
</tr>
</tbody>
</table>
### Option 7A: Financial and socio-economic categorisation

#### Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)

| Scheme increases operating subsidies (i.e. \( R - O < 0 \)) | ✔️ |
| Scheme decreases operating subsidies (i.e. \( R - O > 0 \)) | ✔️ |
| Low capital cost coverage (i.e. \( (R - O) / C < 33\% \)) | N/A |
| Medium capital cost coverage (33-66%) | N/A |
| High capital cost coverage (66-100%) | N/A |
| Positive financial case (> 100%) | N/A |

#### Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)

- Low
- Medium capital cost coverage (33 - 66%)
- High capital cost coverage (66-100%)
- Positive financial case (> 100%)

### Option 7A Summary TEE (Transport Economic Efficiency) table

<table>
<thead>
<tr>
<th>30 year appraisal</th>
<th>£m (2010 PV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs (Present Value)</td>
<td>0.00</td>
</tr>
<tr>
<td>Investment Cost</td>
<td>0.00</td>
</tr>
<tr>
<td>Operating Cost</td>
<td>27.33</td>
</tr>
<tr>
<td>Revenue</td>
<td>-15.39</td>
</tr>
<tr>
<td>Other Government Impacts (road infrastructure costs)</td>
<td>-0.04</td>
</tr>
<tr>
<td><strong>Total costs</strong></td>
<td><strong>11.91</strong></td>
</tr>
<tr>
<td>Benefits (Present Value)</td>
<td>16.49</td>
</tr>
<tr>
<td>Rail user benefits</td>
<td>18.58</td>
</tr>
<tr>
<td>Non user benefits</td>
<td>0.30</td>
</tr>
<tr>
<td>Rail user &amp; non user disruption disbenefits</td>
<td>0.00</td>
</tr>
<tr>
<td>Current TOCs revenue</td>
<td>0.00</td>
</tr>
<tr>
<td>Current TOCs/ NR opex</td>
<td>0.00</td>
</tr>
<tr>
<td>Other Government Impacts (indirect taxation)</td>
<td>-2.39</td>
</tr>
<tr>
<td><strong>Total Quantified Benefits</strong></td>
<td><strong>16.49</strong></td>
</tr>
<tr>
<td>NPV</td>
<td>4.59</td>
</tr>
<tr>
<td>Quantified BCR</td>
<td>1.39</td>
</tr>
</tbody>
</table>
### Option 7B: Train lengthening for services between Cardiff and Manchester (Two vehicle option)

<table>
<thead>
<tr>
<th><strong>Conditional Output</strong></th>
<th>COS and CO6 - to provide sufficient capacity for passengers travelling on services between Cardiff and Manchester via the Marches, taking into account anticipated growth.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timeframe</strong></td>
<td>CP6 (specifically 2023).</td>
</tr>
<tr>
<td><strong>Objectives</strong></td>
<td>To accommodate forecasted demand and reduce on-train crowding on long distance services between Cardiff and Manchester, these services are also used by passengers travelling between local stations on the Marches line.</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>Additional vehicle for selected services between Cardiff and Manchester during the day, only lengthening the services with a value for money categorisation at medium or higher.</td>
</tr>
<tr>
<td><strong>Infrastructure requirement</strong></td>
<td>No infrastructure work required within the Welsh Route Study area. None expected outside Welsh Route Study area - subject to confirmation from other Route Studies.</td>
</tr>
<tr>
<td><strong>Operational requirement</strong></td>
<td>Two-car sets to be lengthened with one additional vehicle.</td>
</tr>
<tr>
<td><strong>Passenger impact</strong></td>
<td>Provide sufficient capacity to meet the anticipated demand growth to 2023.</td>
</tr>
<tr>
<td><strong>Freight impact</strong></td>
<td>None.</td>
</tr>
<tr>
<td><strong>Relates to other options</strong></td>
<td>Option 7A: lengthen all services require extra capacity to meet anticipated demand by 2023, including services that have a poor or low value for money categorisation.</td>
</tr>
<tr>
<td><strong>Socio-economic Value for money categorisation</strong></td>
<td>Financially positive, equivalent to a very high value for money categorisation. This option is financially positive as the net costs to government are negative. The revenue to government exceeds the operating costs to government over the appraisal period.</td>
</tr>
<tr>
<td><strong>Rail Industry financial categorisation</strong></td>
<td>Decreases operating subsidies.</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>The operating costs are estimated from a high level diagramming assumption and subject to further assessment.</td>
</tr>
</tbody>
</table>
### Appendix A: Appraisal Results

#### Option 7B: Financial and socio-economic categorisation

**Rail industry financial impact**  
(Categorisation of Revenue, Operating costs & Capital costs over appraisal period)

| Description                        | Socio-economic impact  
|------------------------------------|------------------------
| Scheme increases operating subsidies (i.e. R – O < 0) | N/A                    |
| Scheme decreases operating subsidies (i.e. R – O > 0) | Low capital cost coverage (i.e. (R – O) / C <33%) |
|                                    | Medium capital cost coverage (33-66%) |
|                                    | High capital cost coverage (66-100%) |
|                                    | Positive financial case (> 100%) |

#### Option 7B Summary TEE (Transport Economic Efficiency) table

<table>
<thead>
<tr>
<th>30 year appraisal</th>
<th>£m (2010 PV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs (Present Value)</td>
<td></td>
</tr>
<tr>
<td>Investment Cost</td>
<td>0.00</td>
</tr>
<tr>
<td>Operating Cost</td>
<td>10.05</td>
</tr>
<tr>
<td>Revenue</td>
<td>-12.16</td>
</tr>
<tr>
<td>Other Government Impacts (road infrastructure costs)</td>
<td>-0.03</td>
</tr>
<tr>
<td>Total costs</td>
<td>-2.13</td>
</tr>
<tr>
<td>Benefits (Present Value)</td>
<td></td>
</tr>
<tr>
<td>Rail user benefits</td>
<td>14.15</td>
</tr>
<tr>
<td>Non user benefits</td>
<td>1.33</td>
</tr>
<tr>
<td>Rail user &amp; non user disruption disbenefits</td>
<td>0.00</td>
</tr>
<tr>
<td>Current TOCs revenue</td>
<td>0.00</td>
</tr>
<tr>
<td>Current TOCs/ NR opex</td>
<td>0.00</td>
</tr>
<tr>
<td>Other Government Impacts (indirect taxation)</td>
<td>-2.44</td>
</tr>
<tr>
<td>Total Quantified Benefits</td>
<td>13.05</td>
</tr>
<tr>
<td>NPV</td>
<td>15.18</td>
</tr>
<tr>
<td>Quantified BCR</td>
<td>-6.13</td>
</tr>
</tbody>
</table>
### Option 8A Provision of 25kV electrification from Crewe/Warrington and Llandudno/Holyhead via Chester (include committed train services only)

<table>
<thead>
<tr>
<th>Conditional Output</th>
<th>CO21 to CO24 - to achieve improved connectivity between North Wales Coast and London, Manchester, Liverpool, and Chester.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeframe</td>
<td>CP6 (specifically 2024).</td>
</tr>
<tr>
<td>Objectives</td>
<td>To increase end to end journey speed for the long distance services to/from North Wales Coast by switching to electric operation.</td>
</tr>
<tr>
<td>Description</td>
<td>Services to/from the North Wales Coast convert to electric traction, include 25kV overhead electrification of the following section:</td>
</tr>
<tr>
<td></td>
<td>- Crewe to Holyhead via Chester; and</td>
</tr>
<tr>
<td></td>
<td>- Acton Grange Junction to Chester.</td>
</tr>
<tr>
<td>Infrastructure requirement</td>
<td>Infrastructure work required to modify a high number of civil engineering structures along the route to enable gauge clearance for 25kV electrification and requirements to provide new bulk electricity supply points along the route. Requirements of depot and stabling facilities and platform extension for electric passenger rolling have not been assessed.</td>
</tr>
<tr>
<td>Operational requirement</td>
<td>The electrified infrastructure allows trains to run at a higher speed and provides savings on operating costs compared to diesel operation. The train services to be converted to electric traction include (as in today’s timetable):</td>
</tr>
<tr>
<td></td>
<td>- London to North Wales</td>
</tr>
<tr>
<td></td>
<td>- Manchester to North Wales</td>
</tr>
<tr>
<td></td>
<td>- Crewe to Chester.</td>
</tr>
<tr>
<td>Passenger impact</td>
<td>Improve end to end journey speed for long distance services with a reduced journey time.</td>
</tr>
<tr>
<td>Freight impact</td>
<td>Improve end to end journey speed for freight trains operate on the North Wales Coast.</td>
</tr>
<tr>
<td>Relates to other options</td>
<td>Option 9A: North Wales Coast journey time improvement (include enhanced level of uncommitted train services), where additional uncommitted future services are considered.</td>
</tr>
<tr>
<td>Socio-economic Value for money categorisation</td>
<td>Poor.</td>
</tr>
<tr>
<td>Rail Industry financial categorisation</td>
<td>Decreases operating subsidies.</td>
</tr>
<tr>
<td>Note</td>
<td>This assessment does not include any “wider economic benefits” to the region.</td>
</tr>
</tbody>
</table>
## Appendix A: Appraisal Results

### Option 8A Financial and socio-economic categorisation

<table>
<thead>
<tr>
<th>Rail industry financial impact (Categorisation of Revenue, Operating costs &amp; Capital costs over appraisal period)</th>
<th>Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheme increases operating subsidies (i.e. R – O &lt; 0)</td>
<td>Poor</td>
</tr>
<tr>
<td>Scheme decreases operating subsidies (i.e. R – O &gt; 0)</td>
<td>Low capital cost coverage (i.e. (R – O) / C &lt;33%)</td>
</tr>
<tr>
<td></td>
<td>Medium capital cost coverage (33-66%) N/A</td>
</tr>
<tr>
<td></td>
<td>High capital cost coverage (66-100%) N/A</td>
</tr>
<tr>
<td></td>
<td>Positive financial case (&gt; 100%)</td>
</tr>
</tbody>
</table>

### Option 8A Summary TEE (Transport Economic Efficiency) table

<table>
<thead>
<tr>
<th>60 year appraisal</th>
<th>£m (2010 PV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs (Present Value)</td>
<td></td>
</tr>
<tr>
<td>Investment Cost</td>
<td>764.5</td>
</tr>
<tr>
<td>Operating Cost</td>
<td>-178.1</td>
</tr>
<tr>
<td>Revenue</td>
<td>-66.1</td>
</tr>
<tr>
<td>Other Government Impacts (road infrastructure costs)</td>
<td>-0.2</td>
</tr>
<tr>
<td>Total costs</td>
<td>520.1</td>
</tr>
<tr>
<td>Benefits (Present Value)</td>
<td></td>
</tr>
<tr>
<td>Rail user benefits</td>
<td>142.4</td>
</tr>
<tr>
<td>Non user benefits</td>
<td>143</td>
</tr>
<tr>
<td>Rail user &amp; non user disruption disbenefits</td>
<td>-54.1</td>
</tr>
<tr>
<td>Current TOCs revenue</td>
<td>0.0</td>
</tr>
<tr>
<td>Current TOCs/ NR opex</td>
<td>0.0</td>
</tr>
<tr>
<td>Other Government Impacts (indirect taxation)</td>
<td>-48.9</td>
</tr>
<tr>
<td>Total Quantified Benefits</td>
<td>182.4</td>
</tr>
<tr>
<td>NPV</td>
<td>-337.6</td>
</tr>
<tr>
<td>Quantified BCR</td>
<td>0.35</td>
</tr>
</tbody>
</table>
Appendix A: Appraisal Results

Option 8B Provision of 25kV electrification from Crewe/Warrington and Llandudno/Holyhead via Chester (include enhanced level of uncommitted train services)

<table>
<thead>
<tr>
<th>Conditional Output</th>
<th>CO21 to CO24 - to achieve improved connectivity between North Wales Coast and London, Manchester, Liverpool, and Chester.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeframe</td>
<td>CP6 (specifically 2024).</td>
</tr>
<tr>
<td>Objectives</td>
<td>To increase end to end journey speed for the long distance services to / from North Wales Coast by switching to electric operation.</td>
</tr>
</tbody>
</table>
| Description        | Services to / from the North Wales Coast convert to electric traction, include 25kV overhead electrification of the following section:  
|                    | • Crewe to Holyhead via Chester;  
|                    | • Acton Grange Junction to Chester  
|                    | • Halton Chord*.                                                                                                     |
| Infrastructure requirement | Infrastructure work required to modify a high number of civil engineering structures along the route to enable gauge clearance for 25kV electrification and requirements to provide new bulk electricity supply points along the route. Requirements of depot and stabling facilities and platform extension for electric passenger rolling have not been assessed. |
| Operational requirement | The electrified infrastructure allows trains to run at a higher speed and provides savings on operating costs compared to diesel operation. The enhanced level of train services to be converted to electric traction include:  
|                    | • London to Holyhead (1tph)  
|                    | • Manchester to Llandudno (2tph)  
|                    | • Liverpool to Holyhead (1tph)  
|                    | • Crewe to Chester (1tph).                                                                                           |
| Passenger impact   | Improve end to end journey speed for long distance services with an reduced journey time.                           |
| Freight impact     | Improve end to end journey speed for freight running through Chester and the North Wales Coast.                       |
| Relates to other options | Option 9A: North Wales Coast journey time improvement (include committed services only).                             |
| Socio-economic Value for money categorisation | Poor.                                                                                                                   |
| Rail Industry financial categorisation | Decreases operating subsidies.                                                                                       |
| Note               | The appraisal includes future services in the indicative timetable specification and assumed these will convert to electric traction. The services reflected in the indicative timetable specification are not committed and only assumed to be operational and deliverable for the purpose of this Route Study. Further assessment would be required to validate this timetable option. This should be noted when comparing to other electrification schemes. This assessment does not include any “wider economic benefits” to the region.  
|                    | * The cost of works necessary to deliver track, signalling and electrification works at Halton Chord necessary to enable electric passenger services between Chester and Liverpool in both directions are not included. |
### Option 8B: Financial and socio-economic categorisation

**Rail industry financial impact**
(Categorisation of Revenue, Operating costs & Capital costs over appraisal period)

<table>
<thead>
<tr>
<th>Scheme increases operating subsidies (i.e. R – O &lt; 0)</th>
<th>Socio-economic impact (WebTAG VfM category; see summary TEE table for further details)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low capital cost coverage (i.e. (R – O) / C &lt;33%)</td>
<td>Poor</td>
</tr>
<tr>
<td>Medium capital cost coverage (33 - 66%)</td>
<td>N/A</td>
</tr>
<tr>
<td>High capital cost coverage (66-100%)</td>
<td>N/A</td>
</tr>
<tr>
<td>Positive financial case (&gt; 100%)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Scheme decreases operating subsidies**
(i.e. R – O > 0)

<table>
<thead>
<tr>
<th>Scheme decreases operating subsidies (i.e. R – O &gt; 0)</th>
<th>Socio-economic impact (WebTAG VfM category; see summary TEE table for further details)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td></td>
</tr>
</tbody>
</table>

### Option 8B Summary TEE (Transport Economic Efficiency) table

<table>
<thead>
<tr>
<th>30 year appraisal</th>
<th>£m (2010 PV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs (Present Value)</td>
<td></td>
</tr>
<tr>
<td>Investment Cost</td>
<td>764.5</td>
</tr>
<tr>
<td>Operating Cost</td>
<td>-186.2</td>
</tr>
<tr>
<td>Revenue</td>
<td>-105.7</td>
</tr>
<tr>
<td>Other Government Impacts (road infrastructure costs)</td>
<td>-0.3</td>
</tr>
<tr>
<td>Total costs</td>
<td>472.3</td>
</tr>
<tr>
<td>Benefits (Present Value)</td>
<td></td>
</tr>
<tr>
<td>Rail user benefits</td>
<td>197.5</td>
</tr>
<tr>
<td>Non user benefits</td>
<td>194.5</td>
</tr>
<tr>
<td>Rail user &amp; non user disruption disbenefits</td>
<td>-54.1</td>
</tr>
<tr>
<td>Current TOCs revenue</td>
<td>0.0</td>
</tr>
<tr>
<td>Current TOCs/ NR apex</td>
<td>0.0</td>
</tr>
<tr>
<td>Other Government Impacts (indirect taxation)</td>
<td>-66</td>
</tr>
<tr>
<td>Total Quantified Benefits</td>
<td>271.8</td>
</tr>
<tr>
<td>NPV</td>
<td>-200.5</td>
</tr>
<tr>
<td>Quantified BCR</td>
<td>0.58</td>
</tr>
</tbody>
</table>
Option 9A Improved linespeeds along North Wales Coast between Chester and Llandudno/Holyhead

<table>
<thead>
<tr>
<th>Conditional Output</th>
<th>CO21 to CO24 - to achieve improved connectivity between North Wales Coast and London, Manchester, Liverpool, and Chester.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeframe</td>
<td>CP6 (specifically 2019).</td>
</tr>
<tr>
<td>Objectives</td>
<td>To increase end to end journey speed for services to/from North Wales Coast by improving journey time between Chester and destinations on the North Wales Coast.</td>
</tr>
<tr>
<td>Description</td>
<td>Increase linespeeds for section between Chester and destinations on the North Wales Coast to maximise capability provided by the signalling upgrade, to a maximum of 100mph where conditions allow.</td>
</tr>
<tr>
<td>Infrastructure requirement</td>
<td>Infrastructure work relating to track geometry and gauge clearance to maximise speed on the line.</td>
</tr>
<tr>
<td>Operational requirement</td>
<td>Trains to run at a higher speed and reduce overall journey time to/from the North Wales Coast. Depending upon stopping patterns of trains, journey time savings vary between one to eight minutes.</td>
</tr>
<tr>
<td>Passenger impact</td>
<td>Improve end to end journey speed for long distance services with an reduced journey time.</td>
</tr>
<tr>
<td>Freight impact</td>
<td>Improves end to end journey speed for freight running through Chester and the North Wales Coast.</td>
</tr>
<tr>
<td>Relates to other options</td>
<td>Option 8A and 8B: The North Wales Coast electrification aims to improve journey speed on the North Wales Coast by switching service operation from diesel to electric.</td>
</tr>
<tr>
<td>Socio-economic Value for money categorisation</td>
<td>Financially positive, equivalent to a very high value for money categorisation.</td>
</tr>
<tr>
<td>Rail Industry financial categorisation</td>
<td>Decreases operating subsidies.</td>
</tr>
<tr>
<td>Note</td>
<td>None.</td>
</tr>
</tbody>
</table>
### Option 9A: Financial and socio-economic categorisation

#### Rail industry financial impact
(Categorisation of Revenue, Operating costs & Capital costs over appraisal period)

<table>
<thead>
<tr>
<th>Scheme increases operating subsidies (i.e. R – O &lt; 0)</th>
<th>Scheme decreases operating subsidies (i.e. R – O &gt; 0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low capital cost coverage (i.e. (R – O) / C &lt; 33%)</td>
<td>N/A</td>
</tr>
<tr>
<td>Medium capital cost coverage (33 - 66%)</td>
<td>N/A</td>
</tr>
<tr>
<td>High capital cost coverage (66-100%)</td>
<td>N/A</td>
</tr>
<tr>
<td>Positive financial case (&gt; 100%)</td>
<td></td>
</tr>
</tbody>
</table>

#### Socio-economic impact
(WebTAG VfM category; see summary TEE table for further details)

- Low capital cost coverage (i.e. (R – O) / C < 33%)
- Medium capital cost coverage (33 - 66%)
- High capital cost coverage (66-100%)
- Positive financial case (> 100%)

### Option 9A Summary TEE (Transport Economic Efficiency) table

<table>
<thead>
<tr>
<th>30 year appraisal</th>
<th>£m (2010 PV)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Costs (Present Value)</strong></td>
<td></td>
</tr>
<tr>
<td>Investment Cost</td>
<td>14.6</td>
</tr>
<tr>
<td>Operating Cost</td>
<td>0.00</td>
</tr>
<tr>
<td>Revenue</td>
<td>-30.2</td>
</tr>
<tr>
<td>Other Government Impacts (road infrastructure costs)</td>
<td>-0.07</td>
</tr>
<tr>
<td><strong>Total costs</strong></td>
<td>-15.7</td>
</tr>
<tr>
<td><strong>Benefits (Present Value)</strong></td>
<td></td>
</tr>
<tr>
<td>Rail user benefits</td>
<td>38.1</td>
</tr>
<tr>
<td>Non user benefits</td>
<td>5.6</td>
</tr>
<tr>
<td>Rail user &amp; non user disruption disbenefits</td>
<td>-1.2</td>
</tr>
<tr>
<td>Current TOCs revenue</td>
<td>0.0</td>
</tr>
<tr>
<td>Current TOCs/ NR opex</td>
<td>0.0</td>
</tr>
<tr>
<td>Other Government Impacts (indirect taxation)</td>
<td>-5.9</td>
</tr>
<tr>
<td><strong>Total Quantified Benefits</strong></td>
<td>36.6</td>
</tr>
<tr>
<td>NPV</td>
<td>52.3</td>
</tr>
<tr>
<td>Quantified BCR</td>
<td>-2.3</td>
</tr>
</tbody>
</table>
## Appendix B: Mapping of Choices for Funders to Conditional Outputs

### South West Wales

**CP6 Choices:**
- Programme of level crossing closures in West Wales.
- Continuation of additional peak services on the Heart of Wales Line, and further improved generalised journey times.

**Longer-term strategy to 2043:**
- Improve connectivity from Fishguard, Pembroke, Milford Haven and Carmarthen to Swansea

### South Wales Main Line

**CP6 Choices:**
- Upgrading Relief Lines between Cardiff and Severn Tunnel Junction to create a 4-track passenger railway.
- Redevelopment of Cardiff Central Station to create a station fit for a capital city.

**Longer-term strategy to 2043:**
- Optimise 4 track railway capability (ETCS, high speed connections / grade separation)
- Grade separation at Maindee West Junction
- Additional platform face(s) at Newport
- Cardiff West Junction remodelling
- Headway improvements
- Additional peak services Cardiff to Abergavenny including provision of a turnback platform at Abergavenny station – to be delivered as part of the resignalling of the route.

### Valley Lines

**CP6 Choices:**
- More passenger capacity on the Valley Lines - operating more frequent trains and/or longer trains.
- Phased programme of enhancements on the Valley Lines - linked to Metro.
- Improved frequency on the Ebbw Vale Line with connectivity to Newport and Abertillery.

**Longer-term strategy to 2043:**
- Consideration of layout improvements to remove capacity and performance constraints at Cardiff Queen Street and Cardiff West/Radyr Branch Junctions – to be assessed in conjunction with emerging Metro considerations.
- Headway improvements.

### Conditional Outputs:

<table>
<thead>
<tr>
<th>Conditional Outputs:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1 Cardiff peak capacity</td>
</tr>
<tr>
<td>CO8 Cardiff Central station capacity</td>
</tr>
<tr>
<td>CO30 South Wales Main Line JTI</td>
</tr>
<tr>
<td>CO32 Valley lines JTI</td>
</tr>
<tr>
<td>CO33 Ebbw Vale – Newport connectivity</td>
</tr>
<tr>
<td>CO37 South West Wales connectivity</td>
</tr>
<tr>
<td>CO38 Improved connectivity to/from Heart of Wales Line</td>
</tr>
</tbody>
</table>

### Longer term strategy to 2043:

| CO2 Swansea peak capacity |
| CO7 Cardiff – Birmingham all day capacity |
| CO9a Providing sufficient growth for freight markets identified in Freight Market Study |
| CO9b Freight capacity for steel traffic between Llanwern and Port Talbot (Margam) |
| CO10 Cardiff – London connectivity |
| CO11 Swansea – London connectivity |
| CO12 Cardiff – Bristol connectivity |
| CO13 Swansea – Bristol connectivity |
| CO14 Cardiff – Birmingham connectivity |
| CO15 Cardiff – Leicester connectivity |
| CO16 Cardiff – Sheffield connectivity |
| CO17 Cardiff – Manchester connectivity |
| CO18 Cardiff – Leeds connectivity |
| CO29 Newport/Severn Tunnel Junction – Bristol/Bath connectivity |
| CO31 Improved service frequency to local stations between Cardiff Central and Swansea. |
| CO33 Ebbw Vale – Newport connectivity |
| CO34 Lydney/Chepstow – Bristol connectivity |
| CO35 Cardiff – Birmingham JTI |
| CO36 North-South Wales connectivity |
| CO41 Airport connectivity |
| CO43 Major ports connectivity |
| CO44 Improving connectivity for leisure markets at weekends |
| CO45 Access to higher education establishments and other social infrastructure |
| CO46 Improved passenger satisfaction |
| CO47 Integrated transport |

<table>
<thead>
<tr>
<th>South Wales Main Line</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CP6 Choices:</strong></td>
</tr>
<tr>
<td>Upgrade Relief Lines between Cardiff and Severn Tunnel Junction to create a 4-track passenger railway.</td>
</tr>
<tr>
<td>Redevelopment of Cardiff Central Station to create a station fit for a capital city.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>South Wales Main Line</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Longer-term strategy to 2043:</strong></td>
</tr>
<tr>
<td>Optimise 4 track railway capability (ETCS, high speed connections / grade separation)</td>
</tr>
<tr>
<td>Grade separation at Maindee West Junction</td>
</tr>
<tr>
<td>Additional platform face(s) at Newport</td>
</tr>
<tr>
<td>Cardiff West Junction remodelling</td>
</tr>
<tr>
<td>Headway improvements</td>
</tr>
<tr>
<td>Additional peak services Cardiff to Abergavenny including provision of a turnback platform at Abergavenny station – to be delivered as part of the resignalling of the route.</td>
</tr>
</tbody>
</table>
Appendix B: Mapping of Choices for Funders to Conditional Outputs

**Network Rail – Welsh Route Study**

**March 2016**

### North-South

**CP6 Choices:**
- Selected train lengthening on Cardiff to Manchester services.

**Longer-term strategy to 2043:**
- Shrewsbury station layout changes and additional platform
- Headway improvements

### Heart of Wales

**CP6 Choices:**
- Continuation of additional peak services on the Heart of Wales Line, and further improved generalised journey times.

### Cambrian Lines

**CP6 Choices:**
- Improved all day frequency on the Cambrian Main Line.

**Longer-term strategy to 2043:**
- Improve connectivity to/from mid Wales by improving frequency and/or journey time.

#### Conditional Outputs:

**CP6 Choices:**
- CO5 Marches line all day capacity
- CO6 Cardiff – Manchester all day capacity
- CO38 Improved connectivity to/from Heart of Wales Line
- CO39 Cambrian Line connectivity and generalised journey time improvements

**Longer-term strategy to 2043:**
- CO4 Shrewsbury peak capacity
- CO9a Providing sufficient growth for freight markets identified in Freight Market Study
- CO9c Freight capacity on the Marches line
- CO17 Cardiff – Manchester connectivity
- CO19 Shrewsbury – London connectivity
- CO20 Shrewsbury – Liverpool connectivity
- CO36 North-South Wales connectivity
- CO39 Cambrian line connectivity
- CO41 Airport connectivity
- CO42 HS2 connectivity
- CO44 Improving connectivity for leisure markets at weekends
- CO45 Access to higher education establishments and other social infrastructure.
- CO46 Improved passenger satisfaction
- CO47 Integrated transport
Appendix B: Mapping of Choices for Funders to Conditional Outputs

**Conditional Outputs:**

**CP6 Choices:**
- CO22 North Wales Coast – Manchester connectivity
- CO23 North Wales Coast – Liverpool connectivity
- CO28 Wrexham – Liverpool connectivity
- CO40 Connectivity to Deeside

**Longer term strategy to 2043:**
- CO3 Chester peak capacity (from North Wales)
- CO9a Providing sufficient growth for freight markets identified in Freight Market Study
- CO21 North Wales Coast – London connectivity
- CO24 North Wales Coast – Chester connectivity
- CO25 Wrexham – London connectivity
- CO26 Wrexham – Shrewsbury connectivity
- CO27 Wrexham – Birmingham connectivity
- CO36 North-South Wales connectivity
- CO41 Airport connectivity
- CO42 HS2 connectivity
- CO43 Major ports connectivity
- CO44 Improving connectivity for leisure markets at weekends
- CO45 Access to higher education establishments and other social infrastructure.
- CO46 Improved passenger satisfaction
- CO47 Integrated transport

**North Wales Coast**

**CP6 Choices:**
- Modernisation of the North Wales Coast Main Line.
- Improved line speeds on the North Wales Coast Main Line.
- Improved connectivity to Deeside.

**Longer-term strategy to 2043:**
- Chester remodelling (as part of Chester area resignalling)

**Wrexham to Bidston**

**CP6 Choices:**
- Improved line speeds between Wrexham and Bidston.

**Longer-term strategy to 2043:**
- Headway improvements
- Frequency enhancement

**Wrexham to Chester**

**CP6 Choices:**
- Further programme of capacity improvements between Chester and Wrexham.

**Longer-term strategy to 2043:**
- Capacity enhancement to deliver anticipated 2043 traffic levels
Appendix C: Stakeholder Aspirations

Key Welsh Route Stakeholders

This appendix sets out the main aspirations of Welsh Government and the regional authorities within Wales and the Borders.

Since publication of the Welsh Route Study Draft for Consultation, this appendix has been updated to reflect the most recently published Local Transport Plans. A number of consultation responses were received which reflected earlier transport planning documents which were produced by the Regional Transport Consortia. Links to these documents have been provided in the relevant sections below.


Up to April 2014, there were four Regional Transport Consortia within Wales, each of which contained representation from the local county authorities within their area of influence and each consortia funded by Welsh Government. These consortia were:

- South East Wales Transport Consortium (SEWTA) – covering South East Wales
- South West Wales Integrated Transport Consortium (SWWITCH) – covering South West Wales
- Trafnidiaeth Canolbarth Cymru (TraCC) – covering mid Wales; and,
- TAIITH – covering North Wales.

All four Transport Consortia published Regional Transport Plans setting out priorities for transport including rail in each of their areas. The Regional Transport Consortia were abolished in April 2014 (although TRACC still remain as an entity supported by the local authorities in mid-Wales), with local transport planning now residing with the local councils, although these have tended to group together within their areas under new umbrella organisations to co-ordinate the planning of transport.

The Local Enterprise Partnership (LEP) for the Marches, has also developed transport plans which include the rail route through the Marches between Newport and Shrewsbury and the route between Shrewsbury and Wolverhampton (which will be considered by the West Midlands & Chiltern Route Study).

Development of this Route Study has also seen engagement with the Passenger Transport Executives for Merseyside (Merseytravel) and Greater Manchester (GMPTE), and the border county authorities in Cheshire (which borders North East Wales), and Gloucestershire County Council (which borders South East Wales) all of which have important economic and cultural links Wales.

It should be noted that this Route Study does not consider new lines or new stations specifically unless a specific Conditional Output has been identified or for which such a requirement might be a funders priority.

Welsh Government

The Welsh Government published the National Transport Finance Plan 2015 in July 2015. It sets out the investment for transport infrastructure and services, with a delivery plan for the five year period 2015-2020 and beyond.

The purpose of the plan is threefold:

- provide the timescale for financing schemes undertaken by the Welsh Government
- provide the timescale for delivering these schemes and detail the estimated expenditure required to deliver the schemes
- identify the likely source of financing to allow delivery to take place.

Welsh Government recognise in the plan that responsibility for rail infrastructure in Wales is non-devolved, and Welsh Government has been responsible for the management of the Wales and Borders franchise since 2006, with agreement in principle being reached on the transfer to Welsh Government responsibility for specifying and awarding the next Wales and Borders franchise.

The schemes relating to rail in the Plan are detailed in Table A.
### Table A: Welsh Government schemes relating to rail

<table>
<thead>
<tr>
<th>Ref</th>
<th>Scheme description</th>
<th>Delivery Period</th>
<th>Welsh Route Study Conditional Outputs relating to scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>Implement the recommendations of the Freight Task &amp; Finish Group, making an annual update to the Assembly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>Keep opportunities to enable uptake of rail freight and short sea shipping under review</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F3</td>
<td>Continue to support Rail Freight infrastructure development through the provision of Freight Facilities Grants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F4</td>
<td>Continue to support Modal Shift (Road to Rail) by providing grant support.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access for All Programme</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R1a</td>
<td>Station accessibility improvements at Radyr, Llandaf, Ystrad Mynach, Machynlleth and Chirk railway stations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Easy access installation programme for small rural stations across Wales to provide wheelchair access by use of on train ramps.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R13</td>
<td>CPS Access for All Programme: Station improvements at Llanelli, Barry, Trefforest, Taffs Well, Cathays and Treherbert.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R14</td>
<td>CPS Access for All Programme: Undertake feasibility studies/delivery options report for improved access at Flint, Pengam and Cadoxton stations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Station Improvement Programme</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R12</td>
<td>Station Improvements Programme (NSIP+): station improvements at Aberystwyth, Rhyl, Ystrad Mynach, Pontypidd, and Port Talbot Parkway; easy access installation programme for small stations across Wales to provide wheelchair access by use of on train ramps.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R19</td>
<td>Cardiff Central Station – develop business case subject to necessary consents. Metro Phase 1 station improvement programme – Line of route: Cardiff to Merthyr Tydfil. Range of station improvements (inc. accessibility) and Park &amp; Ride improvements at all stations on route.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rail Line Improvements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R13</td>
<td>Ebbw Valley Railway Line Improvements: Line extension, line speed improvements and new station to/at Ebbw Vale Town.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Railway Lines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R18</td>
<td>Consider opportunities to bring disused railways back into the transport network subject to viability through feasibility studies and economic appraisal/evaluations on a case by case basis.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Frequency Enhancements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R14</td>
<td>Maesteg Branch Frequency Enhancements including improved service frequency – Develop to GRIP 4 report.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R15</td>
<td>Ebbw Vale Line frequency enhancements (part of Phase 1 Metro). Redoubling 7 miles of track between Cross Keys and Aberbeeg; Line Speed Improvements; New Platforms at Newbridge and Llanhilleth; Signalling and Structure Infrastructure Improvements.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Journey Time/Capacity Improvements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R16</td>
<td>North-South wales journey time / capacity improvements project funded through Welsh Government (includes Broad Oak Level Crossing)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The National Transport Finance Plan (published in 2015) can be found at the following link: [http://gov.wales/topics/transport/planning-strategies/ntp/?lang=en](http://gov.wales/topics/transport/planning-strategies/ntp/?lang=en)

In addition the Wales Transport Strategy (published in 2008) which is referenced in the Wales National Transport Finance Plan can be found at the following link: [http://gov.wales/topics/transport/planning-strategies/?lang=en](http://gov.wales/topics/transport/planning-strategies/?lang=en)
### Table A: Welsh Government schemes relating to rail

<table>
<thead>
<tr>
<th>Ref</th>
<th>Scheme description</th>
<th>Delivery Period</th>
<th>Welsh Route Study Conditional Outputs relating to scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>RI7</td>
<td>Contribute to Network Rail's Long Term Planning Process and the development of an ambitious Welsh Route Study.</td>
<td>2015/16</td>
<td></td>
</tr>
<tr>
<td>RI8</td>
<td>Develop assessment criteria and, using those criteria, a prioritised list of station improvement proposals to draw down funding from relevant HLOS specific funds (as rail is non-devolved).</td>
<td>2016/17</td>
<td></td>
</tr>
<tr>
<td>RI10</td>
<td>Develop assessment criteria and, using those criteria, a prioritised list of new station proposals for further consideration (in relation to securing funding from the rail industry). The following stations will be assessed as part of this process: South East Wales – Roath Park/Wedal Road, Crwys Road, Gabalfa, Ely Mill/Victoria Park, Caerleon, Llanwern, Newport West (on Ebbw Line), Crumlin, St Mellons, Newport Road/Rover Way, Brackla, St Fagans, Magor; South West Wales – Templeton, St Clears, Cockett, Landore; Mid Wales – Bow Street, Carno, Howey, Abermule; North Wales – Broughton, North Wrexham, Deeside Industrial Park / Northern Gateway (as alternative to upgraded Hawarden Bridge Station), South Wrexham, Llangefni.</td>
<td>2017/18</td>
<td></td>
</tr>
<tr>
<td>RI11</td>
<td>Identify and prioritise opportunities to improve efficiency or capacity on the rail network and draw down on HLOS specific funds through level crossing closures &amp; line speed improvements.</td>
<td>2018/19</td>
<td></td>
</tr>
<tr>
<td>RI12</td>
<td>Where appropriate, identify other priorities for investment in rail in Wales and bring those priorities to the attention of the UK Government given that rail infrastructure is not devolved.</td>
<td>2019/20</td>
<td></td>
</tr>
<tr>
<td>RI12a</td>
<td>North Wales rail modernisation including electrification – make the case for investment by UK Government during the next Control Period.</td>
<td>2020 and beyond</td>
<td>CO21, CO22, CO23, CO24</td>
</tr>
<tr>
<td>RI12b</td>
<td>Upgrade of the relief lines from Severn Tunnel to mainline standard – make the case for investment by UK Government during the next Control Period</td>
<td>2015/16</td>
<td>CO1, CO9b, CO10, CO11, CO12, CO13, CO14, CO15, CO16, CO17, CO18, CO30</td>
</tr>
<tr>
<td>RI12c</td>
<td>Other priorities to be identified</td>
<td>2016/17</td>
<td></td>
</tr>
<tr>
<td>RI15</td>
<td>Cambrian Line User Worked Crossing closures – close 8 crossings in Talerdig area</td>
<td>2017/18</td>
<td></td>
</tr>
<tr>
<td>RI16</td>
<td>North East Wales railway improvement – investigate potential rail interventions – carry out studies</td>
<td>2018/19</td>
<td>CO25, CO26, CO27, CO28, CO40</td>
</tr>
<tr>
<td>RI17</td>
<td>North East Wales railway improvement – potential delivery based on study outcomes above</td>
<td>2019/20</td>
<td>CO25, CO26, CO27, CO28, CO40</td>
</tr>
<tr>
<td>RS4</td>
<td>Evaluate rail service enhancements identified in Network Rail’s Welsh Route Study 2015 and other Long Term Planning Process studies that may be required in CP6, including: Service frequency enhancement on Marches Line i.e. half hourly to Shrewsbury (hourly Cardiff to Bangor/Holyhead); train lengthening on selected Marches Line services between Cardiff and Manchester; service frequency enhancement Wrexham-Chester following the redoubling, extension of TPE services and/or new services to Liverpool.</td>
<td>2020 and beyond</td>
<td>CO5, CO6, CO25, CO28, CO36</td>
</tr>
<tr>
<td>RS5</td>
<td>Investigate opportunities to modernise rail rolling stock</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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The National Transport Finance Plan (published in 2015) can be found at the following link: [http://gov.wales/topics/transport/planning-strategies/ntp/?lang=en](http://gov.wales/topics/transport/planning-strategies/ntp/?lang=en)

In addition the Wales Transport Strategy (published in 2008) which is referenced in the Wales National Transport Finance Plan can be found at the following link: [http://gov.wales/topics/transport/planning-strategies/?lang=en](http://gov.wales/topics/transport/planning-strategies/?lang=en)
### Table A: Welsh Government schemes relating to rail

<table>
<thead>
<tr>
<th>Ref</th>
<th>Scheme description</th>
<th>Delivery Period</th>
<th>Welsh Route Study Conditional Outputs relating to scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Franchise Management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS1</td>
<td>Manage the current franchise including:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RS1a Ensure the contract is managed effectively</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RS1b Introduction of new services on the Cambrian Main Line and Heart of Wales Line</td>
<td></td>
<td>2015/16 2016/17 2017/18 2018/19 2019/20 and beyond</td>
</tr>
<tr>
<td></td>
<td>RS1c A review of currently proposed service enhancements, including the following rail service improvement commitments in the National Transport Plan 2010 that will roll into the new National Transport Finance Plan period:</td>
<td></td>
<td>CO2, CO4, CO38, CO39</td>
</tr>
<tr>
<td></td>
<td>• Additional carriages to peak time services to Caerphilly following completion of Cardiff Area Signalling Renewal (CASR) in 2016</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Introduce additional services on the lines from Pontypridd and Caerphilly to Cardiff following completion of CASR in 2016</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Introduce additional services on the Vale of Glamorgan line following completion of CASR in 2016</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Extend the half-hourly service from Maesteg to Cardiff and Brackla Station following completion of CASR in 2016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS1d</td>
<td>Engage with rail industry partners, stakeholders, and passengers to help develop and promote rail services including safety and security</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS2</td>
<td>Prepare for the next franchise to be in a position to let the franchise:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RS2a Establish the policy framework within which the franchise will be let</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RS2b Identify appropriate service frequencies and identify any additional services that should be included</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RS2c Develop commercial strategy, informed by modelling work</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RS2d Consider possible role of alliancing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS3</td>
<td>Identify opportunities to develop rail services serving Wales delivered via DfT managed English services and influence the related franchising processes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The National Transport Finance Plan (published in 2015) can be found at the following link: [http://gov.wales/topics/transport/planning-strategies/ntp/?lang=en](http://gov.wales/topics/transport/planning-strategies/ntp/?lang=en)
In addition the Wales Transport Strategy (published in 2008) which is referenced in the Wales National Transport Finance Plan can be found at the following link: [http://gov.wales/topics/transport/planning-strategies/?lang=en](http://gov.wales/topics/transport/planning-strategies/?lang=en)
### Appendix C: Stakeholder Aspirations

#### Table A: Welsh Government schemes relating to rail

<table>
<thead>
<tr>
<th>Ref</th>
<th>Scheme description</th>
<th>Delivery Period</th>
<th>Welsh Route Study Conditional Outputs relating to scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCRM1</td>
<td>Metro Phase 2 – Cardiff and Valleys Lines – Extensions of platforms to 6 car length – feasibility and business development.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRM7</td>
<td>Smart ticketing – implement smart ticketing ‘pay as you go’ product</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRM8</td>
<td>Complete the transport planning work that will confirm the appropriate mix of public transport modes that should be developed for each corridor, enable the development of specific business cases and underpin long term Metro delivery, including consideration of light rail and other options</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRM9</td>
<td>With Network Rail and train operators, further test proposals to remove identified operational constraints and, if they appear feasible and deliver the anticipated benefits, will be subject to business case development. This will include the constraints identified in the August 2014 Metro update report such as capacity through Queen Street and Cardiff Central.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRM10</td>
<td>Metro – Phase 2 – Cardiff &amp; Valley Lines improvements: Investigate improvements to the existing valley rail lines to boost performance. Proposed delivery of recommended solution. Investigations to look at first are:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRM10a</td>
<td>Metro Phase 2 – Rhymney Line – investigations/feasibility studies. Delivery of recommended solution.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRM10b</td>
<td>Metro Phase 2 – Coryton Line investigations/feasibility studies. Delivery of recommended solution.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRM10c</td>
<td>Metro Phase 2 – Bay/City Lines – investigations/feasibility studies. Delivery of recommended solution(s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRM10e</td>
<td>Metro Phase 2 – Treherbert/ Aberdare/ Merthyr Line – investigations/feasibility studies. Delivery of recommended solution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRM10f</td>
<td>Metro Phase 2 – Ebbw Vale Line Frequency (phase 2) – dualling Rogerstone to Pye Corner; new platforms at Rogerstone and Pye Corner; Abertillery spur and station; Crumlin station; Newport West Station. Undertake feasibility studies, development of business case and delivery of recommended solution/option.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRM11</td>
<td>Improving access to non-rail served communities: Investigate options to provide high quality public transport to communities and proposed development areas not currently served by rail, including: East Cardiff and Newport urban areas, Abertillery, Hirwaun and North West Cardiff into Rhondda Cynon Taff (Beddau – Llantrisant – Cardiff)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRM15</td>
<td>Metro Phase 2 – Maesteg Branch Frequency Enhancements – Delivery of passing loop between Tondu and Garth.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRM16</td>
<td>Metro Phase 2 – Enhanced intermodal facilities &amp; associated station improvements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRM17</td>
<td>Metro Phase 3 – City Centre, City Line and Penarth Line improvements and Bay Line extension</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The National Transport Finance Plan (published in 2015) can be found at the following link: [http://gov.wales/topics/transport/planning-strategies/ntp/?lang=en](http://gov.wales/topics/transport/planning-strategies/ntp/?lang=en)

In addition the Wales Transport Strategy (published in 2008) which is referenced in the Wales National Transport Finance Plan can be found at the following link: [http://gov.wales/topics/transport/planning-strategies/?lang=en](http://gov.wales/topics/transport/planning-strategies/?lang=en)
### Rail priorities for South West Wales

There are four Local Authorities in South West Wales:
- Carmarthenshire County Council
- Neath Port Talbot County Borough Council
- Pembrokeshire County Council
- City and County of Swansea

These four authorities previously formed the transport consortium SWWITCH (South West Wales Integrated Transport Consortium), who published the Regional Transport Plan for 2010-2015. This document can be found at: [http://www.pembrokeshire.gov.uk/objview.asp?object_id=5160&language=](http://www.pembrokeshire.gov.uk/objview.asp?object_id=5160&language=).

#### Table B South West Wales Priorities for Rail

<table>
<thead>
<tr>
<th>Timescale</th>
<th>Local Authority</th>
<th>Scheme</th>
<th>Description</th>
<th>Relevant Route Study Conditional Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short term (2015- 2020)</td>
<td>Carmarthenshire County Council</td>
<td>Llanelli Integrated Transport Interchange</td>
<td>A number of studies have been undertaken investigating potential solutions to the issues of interchange, accessibility, safety and security; this scheme would take forward the recommendations arising from these pieces of work.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Neath Port Talbot County Borough Council</td>
<td>Port Talbot Modal Interchange</td>
<td>Provision of new bus and rail interchange facility adjacent to rebuilt train station to provide improved opportunities for integrated journeys.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improvements to the access to Neath Station Forecourt</td>
<td>Improvements to enable better public transport integration and modernise facilities. Complements Neath town centre regeneration.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Port Talbot Parkway – Park and Ride</td>
<td>Completion of parking at Port Talbot Parkway Station to enable full potential of Park and Ride to be realised.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improvements to access and promotion of Baglan and Briton Ferry stations</td>
<td>Interchange and other facilities at Baglan and Briton Ferry stations to promote their use for integrated access to Baglan Energy Park employment site and the new Sandfields school.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Pembrokeshire County Council</td>
<td>Pembroke Dock Public Transport Interchange</td>
<td>Public transport interchange adjacent to Pembroke Dock railway station to include improved pedestrian and shared use links to Pembroke Dock town centre and retail park.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Milford Haven Public Transport Interchange</td>
<td>Improved access to Milford Haven Bus/Rail interchange including improved pedestrian and shared use inks around Havens Head Retail Park.</td>
<td>CO47</td>
</tr>
<tr>
<td>Medium and long term (2020-2030)</td>
<td>City and County of Swansea</td>
<td>Reopen Landore &amp; Cockett Railway Stations</td>
<td>City and Council of Swansea would seek to be joint partner with Network Rail for this scheme if sufficient demand can be identified for both or either station.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Carmarthenshire County Council</td>
<td>St Clears Station</td>
<td>Reopening St Clears railway station in line with the outcome of recent studies which demonstrated a strong supporting business case</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Whitland Station</td>
<td>Station enhancements</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Neath Port Talbot County Borough Council</td>
<td>Freight transfer facilities at local ports</td>
<td>Adequate provision, storage and processing facilities for minerals are required at ports and railheads. They support the local economy and allow goods to be transported by means other than by road which reduces congestion and emissions and therefore should be safeguarded. Neath Port Talbot also has freight lines which provide an important means of bulk transport.</td>
<td>CO47, CO9a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Port Talbot deep water harbour extended use</td>
<td>Development of the TATA deep water harbour for multiple use utilising the OVE rail link to the main line.</td>
<td>CO47, CO9b</td>
</tr>
<tr>
<td></td>
<td>Pembrokeshire County Council</td>
<td>Access improvements to rail stations</td>
<td>Continued progress on walking, cycling and public transport access improvements to the county's rail stations to compliment the increasing patronage.</td>
<td>CO47</td>
</tr>
</tbody>
</table>

The joint City Region Local Transport Plan and accompanying appendix published in 2015 can be found at the following link: [http://www.swansea.gov.uk/localtransportplan](http://www.swansea.gov.uk/localtransportplan).
## Table C South West Wales - Additional priorities for Rail

<table>
<thead>
<tr>
<th>Timescale</th>
<th>Description</th>
<th>Detail</th>
<th>Relevant Route Study Conditional Outputs</th>
</tr>
</thead>
</table>
| **Short term** (2015-2020)  | Improved rail services to and from the region                               | - Electrification of the Great western mainline to Swansea.  
- Increase service levels to the east and west of Swansea City Centre.  
- Identify station improvements for all stations in the region.  
- Improve integration at railway stations through improved bus, cycle, walking, electric vehicle charging and parking facilities. | CO2, CO11, CO30, CO31, CO47                                                             |
| Improved access by rail.    | Support the development of the TEN-T Rail network                           | - Seek to improve quality of carriages on west Wales and Heart of Wales line services and allow for cycle carriage on trains  
- Examine role/impact of additional stations  
- Continue to support additional rail services to Fishguard/Goodwick and the Heart of Wales line  
- Make better use of commuting stations around Swansea  
- Examine the potential for additional hourly services to Cardiff from West Wales via the district line | CO2, CO31, CO37, CO38 |
| Future proofing rail services. |                                                                              | - Examine role of rapid transit corridors to link railheads with communities/strategic development sites.  
- Examine the potential for increased freight levels and freight interchange depots.  
- Examine the potential for increased rail traffic to/from ports. | CO9a, CO9b |
| **Medium and long term** (2020-2030) | Improved rail services to and from the region                              | - Electrification of the GW Mainline to Carmarthen.  
- Increase service levels east of Swansea.  
- Increase service levels west of Swansea.  
- Ensure integration between modes at all stations. | CO2, CO11, CO13, CO30, CO37 |
| Improved access to and from the rail network | Fishguard & Goodwick and improved HOWL services to be part of franchise requirements. | - Additional regular services to and from West Wales via the district line.  
- Investigate the opportunities/develop business cases for new stations. | CO37, CO38 |
| Wider rail connectivity     | Work to secure Western rail access to Heathrow.                             | - Examine the potential for a South Wales HS3 new alignment for high speed rail.  
- Examine new rapid transit corridors utilising freight only corridors. |                                                                                     |

The joint City Region Local Transport Plan and accompanying appendix published in 2015 can be found at the following link: [http://www.swansea.gov.uk/localtransportplan](http://www.swansea.gov.uk/localtransportplan)
Appendix C: Stakeholder Aspirations

Rail Priorities for North Wales

There are six Local Authorities in North Wales:

- Conwy County Borough Council
- Denbighshire County Council
- Flintshire County Council
- Gwynedd Council (excluding Meirionnydd)
- Isle of Anglesey County Council
- Wrexham County Borough Council

These authorities published a joint Local Transport Plan in January 2015 which set out transport priorities for the region for 2015-2020 and in the longer term until 2030. The key priorities relating to rail are set out in the document are shown in Table D.

Previous to this, relevant publications relating to rail in North Wales included the North Wales Regional Transport Plan produced by Taith in 2009, and the North East Wales Integrated Task Force Report for the Welsh Minister for Economy, Science and Transport produced in 2013. These can be found at the following links:

http://www.taith.gov.uk/publications/

Table D: North Wales schemes relating to rail - priorities for 2015-2020

<table>
<thead>
<tr>
<th>Local Authority</th>
<th>Scheme Name</th>
<th>Description</th>
<th>Relevant Route Study Conditional Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>All authorities</td>
<td>Integrated Ticketing.</td>
<td>Development and roll-out of integrated ticketing schemes to facilitate the seamless transfer between passenger transport modes and services.</td>
<td></td>
</tr>
<tr>
<td>Conwy</td>
<td>Abergele Park &amp; Ride (Abergele Station).</td>
<td>Provision of a park and ride facility at Abergele rail station with good connections to the A55 to encourage transfer from road to rail for longer distance work trips, such as Wylfa nuclear new build.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Colwyn Bay Station interchange improvements.</td>
<td>Proposed improvements to provide an overall more accessible station with better passenger facilities, including improved car parking and improved cyclist provision. This will reinforce regeneration initiatives in the Colwyn Bay area.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Llandudno Junction Station</td>
<td>Proposed improvements to provide an overall more accessible station with better passenger facilities, including improved car parking, cyclist provision and extended footbridge from station to create a new link to employment and leisure sites to the south of the station.</td>
<td>CO47</td>
</tr>
<tr>
<td>Flintshire</td>
<td>Connections to Wrexham to Liverpool &amp; Borderlands rail line.</td>
<td>Providing improvements to all interconnecting sustainable modes of transport for the Wrexham, Bidston to Liverpool/Borderlands Line.</td>
<td>CO28, CO40, CO47</td>
</tr>
<tr>
<td>Wrexham</td>
<td>Wrexham North New Strategic Transport Hub.</td>
<td>Development of a new strategic transport hub to the north of Wrexham to provide an additional point of access to the strategic rail/road network to cater for forecast increase in demands generated by significant new development opportunities to the north and east of Wrexham including the new prison located on Wrexham Industrial Estate.</td>
<td></td>
</tr>
</tbody>
</table>
|                 | Improved access to Ruabon Train Station | A package of measures aimed at improving accessibility to rail services to cater for both existing and forecast demands for rail travel from this strategically placed location. Measures include:  
  - Additional car parking capacity.  
  - Improved bus passenger interchange facilities.  
  - Improved disabled access to north/south bound platforms. | CO47 |
|                 | Improved access to Gwersyllt Train Station | A package of measures aimed at improving safe access to Gwersyllt train station. Measures include:  
  - Traffic management and pedestrian safety scheme.  
  - Infrastructure improvement to improve pedestrian and disabled access to north/south bound platforms. | |

The North Wales Joint Local Transport Plan published in 2015 can be found at the following link: http://www.taith.gov.uk/publications/
## Rail Priorities for Mid Wales

There are three Local Authorities in Mid Wales:

- Ceredigion County Council
- Gwynedd Council (Meirionnydd only)
- Powys County Council

These three authorities produced a joint Mid Wales Local Transport Plan, the Draft for Consultation of which has been published.

The priorities for rail for the period 2015-2020 are set out in Table E.

Previous to this the regional transport consortium TraCC published a Regional Rail Strategy and Actions in 2013. This can be found at the following link:

http://www.tracc.gov.uk/index.php?id=114&L=0

### Table E: Mid Wales schemes relating to rail - priorities for 2015-2020

<table>
<thead>
<tr>
<th>Local Authority</th>
<th>Scheme Name</th>
<th>Description</th>
<th>Relevant Route Study Conditional Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceredigion</td>
<td>Central Wales Sustainable Distribution Project</td>
<td>Project to bring together potential partners from the public and private sectors to identify opportunities to develop one or more multi-modal freight transport facilities to enable the transfer of goods from road to rail and to enable more environmentally sustainable local goods distribution and to conduct a study into current distribution patterns. The council is seeking to encourage rail freight as a means of reducing heavy goods vehicle movements on the regional road network.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Access improvements to the rail network</td>
<td>The scheme package will seek to provide a local authority capital funding contribution towards improving access to existing rail services and infrastructure. This will include working with the rail industry, Welsh Government, rail user groups and local communities to identify potential schemes and to progress development and funding of these schemes.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Bow Street Railway Station</td>
<td>This scheme will complement the proposal to construct a Park &amp; Ride car park at Bow Street and is a second phase to an overall integrated public transport scheme in Bow Street. Initially there is a need to update the business case provided as part of the WelTAG Transport Appraisal, funded by the Welsh Government and published by TraCC in 2011. The business case will focus on Bow Street only and will need to take account of more recent developments that will strengthen the Business Cost Ratio (BCR) for constructing a new station — in particular, the development plans for Aberystwyth University’s IBERIS site at nearby Gogerddan.</td>
<td></td>
</tr>
</tbody>
</table>
| Powys           | Rail hub improvements | The scheme comprises four improvements to access to rail stations:
- Scheme A – Machynlleth Railway Station Interchange: rail/bus interchange and enhanced car park;
- Scheme B – Welshpool Railway Station additional car parking;
- Scheme C – Caersws Railway Station Interchange: rail/bus interchange and car park;
- Scheme D – Llandrindod Railway Station Interchange: rail/bus interchange and enhanced car park. Interchange on private land immediately to north east of railway station. | CO47 |

The Mid Wales Local Transport Plan published in 2015 can be found at the following link: http://www.tracc.gov.uk/index.php?id=114&L=0
Rail Priorities for South East Wales

SEWTA’s Rail Strategy published in March 2013 provided the short, medium and long term priorities for the South East Wales authorities, namely:

- Blaenau Gwent
- Bridgend
- Caerphilly
- City and Council of Cardiff
- Merthyr Tydfil
- Monmouthshire
- Newport
- Rhondda Cynon Taff
- Torfaen
- Vale of Glamorgan

Their aspirations include improvements to current timetable, service frequency improvements, new stations and new lines/line extensions. The specific detail for these are listed in Table F.

More recently, each local authority produced local transport plans in January 2015. These are set out in Table G and Table H.

Note that the South East Wales Valleys Local Transport Plan was jointly produced by Blaenau Gwent, Caerphilly, Merthyr Tydfil, Rhondda Cynon Taff and Torfaen County Borough Councils.
### Table G: South East Wales short term rail aspirations 2015-2020

<table>
<thead>
<tr>
<th>Local authority</th>
<th>Scheme name</th>
<th>Description</th>
<th>Relevant Route Study Conditional Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merthyr Tydfil</td>
<td>Pentrebach park and ride</td>
<td>Provide car park at Pentrebach railway station and encourage extra usage of the railway network.</td>
<td>CO47</td>
</tr>
<tr>
<td>Rhondda Cynon Taff</td>
<td>Trefforest Estate Station Park and Ride</td>
<td>Provision of a new park and ride facility which would serve a wide catchment area including Tonteg and Church Village.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Taifs Well Park and Ride</td>
<td>Installation of decking at rail station to increase capacity of site.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Expansion of park and ride / park and share at Aberdare</td>
<td>Provide an increase in capacity at a key existing site in the Cynon Valley (Robertstown) that serves Aberdare rail station.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Pontyclun park and ride</td>
<td>Expansion of existing park and ride / park and share facilities at rail station in order to provide an increase in capacity and accommodate growing demand.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Porth interchange park and ride / park and share</td>
<td>Construction of a park and ride / park and share facility at Porth station. Sites alongside the northbound and southbound platforms have been identified. Full development is subject to completion of Valley Lines electrification and relocation of ticket office.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Trefforest rail station park and ride</td>
<td>Expansion of existing park and ride / park and share facilities at rail station in order to provide an increase in capacity and accommodate growing demand.</td>
<td>CO47</td>
</tr>
<tr>
<td>Torfaen</td>
<td>Pontypool &amp; New Inn park and ride</td>
<td>Improvements to the existing station access, increased car park spaces, DDA compliance and facilities, and a park and ride are predicted to generate an additional 9,000 trips per annum.</td>
<td>CO47</td>
</tr>
<tr>
<td>Monmouthshire County Council</td>
<td>Severn Tunnel Junction access &amp; interchange improvements</td>
<td>The council believes rail journey times and frequency enhancements, as set out in the South East Wales Integrated Transport Task Force report and in line with draft NTP (3.23.8 and interventions IT6, RS2, CCRM10 and CCRM13) is required to achieved the wider economic, social and environmental priorities of the LTP and LTP guidance. The proposals includes improved bus, cycle and pedestrian access to station, information provision and signage, cycle storage, expansion of park &amp; ride site, construction of new link from B4245 to expanded park &amp; ride site. Full benefit will be achieved if constructed in conjunction with M48/B4245 link road.</td>
<td>CO47</td>
</tr>
<tr>
<td>Cardiff Council</td>
<td>Improving access to local stations Danescourt, Waun-Gron Park and Fairwater</td>
<td>Improvements to access, signage and information at the station.</td>
<td>CO47</td>
</tr>
<tr>
<td>Cardiff Council</td>
<td>Improving access to local stations Radyr, Ty Glas and Birchgrove</td>
<td>Improvements to access, signage and information at the station.</td>
<td>CO47</td>
</tr>
<tr>
<td>Cardiff Council</td>
<td>Improving access to local stations Heath High Level, Rhwibina, Coryton and Whitchurch</td>
<td>Improvements to access, signage and information at the station.</td>
<td>CO47</td>
</tr>
<tr>
<td>Cardiff Council</td>
<td>Improving access to local stations Llanishen, Lisvane and Thornhill and Llandaff</td>
<td>Improvements to access, signage and information at the station.</td>
<td>CO47</td>
</tr>
<tr>
<td>Cardiff Council</td>
<td>Improving access to local stations Grangetown &amp; Cardiff Bay</td>
<td>Improvements to access, signage and information at the station.</td>
<td>CO47</td>
</tr>
<tr>
<td>Cardiff Council</td>
<td>City Centre to Cardiff Bay</td>
<td>Phase 1 – conversion of existing single track to tram. Phase 2 – twin track and link via Collaghan Square to Central Station. Phase 3 – Remove Herbert Street bridge and realign tracks to be at grade.</td>
<td>CO1</td>
</tr>
</tbody>
</table>
### Appendix C: Stakeholder Aspirations

#### Table H: South East Wales medium and long term rail aspirations to 2030

<table>
<thead>
<tr>
<th>Local authority</th>
<th>Scheme name</th>
<th>Description</th>
<th>Relevant Route Study Conditional Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caerphilly CBC</td>
<td>Llanbradach park and ride</td>
<td>The scheme would provide a significant new rail park and ride facility to provide approximately 500 new spaces and encourage increased rail use for those in the mid valleys area. Due to the location of the proposed facility the scheme would require relocation of Llanbradach rail station.</td>
<td>CO47</td>
</tr>
<tr>
<td>Rhondda Cynon Taff</td>
<td>Abercynon park and ride / park and share land south of Ty Trevithick adjacent to A470</td>
<td>A new facility that will provide opportunities for people to meet and continue their journey in a single car or by bus for the remainder of their journey, thereby helping to reduce congestion and pollution.</td>
<td>CO47</td>
</tr>
<tr>
<td>Vale of Glamorgan</td>
<td>Barry Dock Station Bus Interchange</td>
<td>New bus interchange with rail.</td>
<td>CO47</td>
</tr>
<tr>
<td>Bridgend County Borough Council</td>
<td>Park and ride at Wildmill station</td>
<td>Provision of a Park &amp; Ride facility with associated active travel links at Wildmill railway station.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Maesteg rail/bus interchange</td>
<td>Improved connectivity between Maesteg rail and bus stations.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Park and ride at Pyle Station</td>
<td>Proposal to extend the existing park and ride facility from 25 bays (inc. 2 disabled) by a minimum of 32 spaces.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Park and Ride at Ewenny Road, Maesteg</td>
<td>Proposal to provide park and ride facilities at Ewenny Road stop in Maesteg.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Bridgend interchange</td>
<td>Improved connectivity to Bridgend railway station.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>P&amp;R at Brackla</td>
<td>Provision of a Park &amp; Ride facility at the proposed Brackla Station site.</td>
<td>CO47</td>
</tr>
<tr>
<td>Cardiff Council</td>
<td>Cardiff Capital Region Metro programme</td>
<td>Delivery in line with WG Strategic Metro programme.</td>
<td>CO47</td>
</tr>
<tr>
<td></td>
<td>Park and ride</td>
<td>Identify and progress potential rail and bus park and ride schemes.</td>
<td>CO47</td>
</tr>
</tbody>
</table>
Appendix C: Stakeholder Aspirations

Merseytravel
A part of the development of this Route Study, Network Rail has engaged with Merseytravel, the passenger transport executive responsible for the coordination of public transport in the Liverpool City Region. Merseytravel are keen to see the introduction of direct services between Liverpool and North Wales via an enhanced Halton Chord (for which the UK Government recently announced the funding of the capital costs associated with the enhancement of this rail link), and have been working closely with Welsh Government to develop options for services that would provide direct links between these regions.

Merseytravel also supports aspirations to improve connectivity from Merseyside south to Deeside and Wrexham (see sections 6.1.10 and 7.2.9) and is working closely with the rail industry to develop future options which will inform future franchise specification.

This will help support the economies of Merseyside and North East Wales whose economies work closely together.

Heart of Wales Line Forum
The Heart of Wales Line Forum published a report in December 2014 to the Welsh Minister for Economy, Science and Transport, entitled ‘Unlocking Mid Wales’, and funded by Welsh Government. It considered how to make better use of the line in order to help the regeneration of the communities in mid Wales and the rural economy.

The key priorities identified for the Heart of Wales Line in the report are as follows:

- A standard pattern timetable with a regular two hourly service, including on Sundays.
- Later trains from each end of the route.
- Improved rolling stock which is readily accessible for all users and caters for cyclists.
- A Llandovery operating base.
- Support for the development of business regeneration initiatives to be delivered via a rail based Community Business Unit, taking the form of a Social Enterprise Company.

Marches Local Enterprise Partnership (LEP)
A part of the development of this Route Study, Network Rail has engaged with the Marches Local Enterprise Partnership, which has undertaken some work to assess capacity on the rail network on the Marches Line. This Route Study has assessed future passenger growth and proposed interventions in Section 6.1.7.

Community Rail Partnerships (CRPs)
Network Rail will continue to engage and support the work of CRPs in Wales and the border counties in identifying where improvements can be made to the rail network which will promote and support greater use of rail services on CRP routes.

Herefordshire County Council
Herefordshire County Council are developing proposals for a short rail link south of Hereford to Rotherwas. Network Rail has provided indicative costs for this rail link and London Midland Train Operating company has provided details of how their services from Birmingham might be extended to Rotherwas. Currently this proposal has no committed funding.

Traws link Cymru
Traws Link Cymru has aspirations to re-open the rail route between Aberystwyth and Carmarthen. This route was closed during 1964/65. Welsh Government has funded an initial feasibility study into the reopening of this former route.
### Rolling Stock Assumptions

<table>
<thead>
<tr>
<th>Class</th>
<th>Type</th>
<th>Assumed Capacity</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>67</td>
<td>Loco + 4 Mk3 Carriages</td>
<td>Seats: 210 Seats + Standing: 315</td>
<td>North Wales Coast to Manchester Piccadilly and Cardiff Central</td>
</tr>
<tr>
<td>142</td>
<td>2-car DMU</td>
<td>Seats: 138 Seats + Standing: 198</td>
<td>Valley Line Services</td>
</tr>
<tr>
<td>143</td>
<td>2-car DMU</td>
<td>Seats: 138 Seats + Standing: 198</td>
<td>Valley Line Services</td>
</tr>
<tr>
<td>150</td>
<td>2-car DMU</td>
<td>Seats: 149 Seats + Standing: 204</td>
<td>Valley Lines and local services across Wales</td>
</tr>
<tr>
<td>153</td>
<td>1-car DMU</td>
<td>Seats: 75 Seats + Standing: 107</td>
<td>Local services across Wales</td>
</tr>
<tr>
<td>158</td>
<td>2-car DMU</td>
<td>Seats: 139 Seats + Standing: 203</td>
<td>Local and regional urban services across Wales and the Borders. Inter Regional services to Cardiff from Penzance/Plymouth</td>
</tr>
<tr>
<td>165</td>
<td>2/3-car DMU</td>
<td>2-Car - Seats: 188 Seats + Standing: 250 3-car - Seats: 282 Seats + Standing: 375</td>
<td>Regional urban services towards Bristol and the south coast by the end of CP5</td>
</tr>
<tr>
<td>166</td>
<td>3-car DMU</td>
<td>3-car - Seats: 282 Seats + Standing: 375</td>
<td>Regional urban services towards Bristol and the south coast by the end of CP5</td>
</tr>
<tr>
<td>170</td>
<td>2/3-car DMU</td>
<td>2-car - Seats: 135 Seats + Standing: 215 3-car - Seats: 203 Seats + Standing: 323</td>
<td>Regional urban services between Cardiff Central and Nottingham via Chepstow and Lydney</td>
</tr>
<tr>
<td>175</td>
<td>2/3-car DMU</td>
<td>2-car - Seats: 134 Seats + Standing: 224 3-car - Seats: 206 Seats + Standing: 311</td>
<td>Inter-regional services between North Wales/Manchester and South Wales</td>
</tr>
<tr>
<td>220</td>
<td>4-car DMU</td>
<td>Seats: 200 Seats + Standing: 240</td>
<td>Long distance services between Cardiff and the north via Bristol</td>
</tr>
<tr>
<td>221</td>
<td>4/5-car DMU</td>
<td>4-car - Seats: 192 Seats + Standing: 225 5-car - Seats: 254 Seats + Standing: 300</td>
<td>Long distance services between Cardiff and the north via Bristol and between North Wales Coast and London Euston</td>
</tr>
<tr>
<td>800</td>
<td>5-car bi-mode SET</td>
<td>Seats: 315 Seats + Standing: 378</td>
<td>Long distance services between South Wales and London Paddington</td>
</tr>
<tr>
<td>801</td>
<td>9-car SET</td>
<td>Seats: 627 Seats + Standing: 752</td>
<td>Long distance services between South Wales and London Paddington</td>
</tr>
</tbody>
</table>

Note: The information provided above is typical of rolling stock configuration deployed on existing services throughout Wales and the Borders, and those services committed by the Welsh Route Study starting point for 2019.
Appendix E: Interoperability Requirements

1 Background to TEN-T

The trans-European transport network (TEN-T) is comprised of roads, railway lines, inland waterways, inland and maritime ports, airports and rail-road terminals throughout the 28 Member States of the European Union. Building on existing and planned infrastructure the network aims to provide seamless transport chains for passengers and freight. The TEN-T consists of two planning layers: a comprehensive network and a core network.

Comprehensive Network

The comprehensive network is a multi-modal network of relatively high density which provides all European regions (including peripheral and outermost regions) with an accessibility that supports their further economic, social and territorial development as well as the mobility of their citizens. Its planning has been based on a number of common criteria (e.g. volume thresholds for terminals or accessibility needs). There is a legal requirement for Member States to realise the comprehensive rail network’s alignment according to the technical and operational characteristics discussed below by 2050, unless the European Commission accepts that investment in infrastructure cannot be justified in socio-economic terms.

Core Network

The core network is a part of the comprehensive network, distinguished by its strategic importance for major European and global transport flows.

Developed by the European Commission it has been subjected to broad consultation among Member States and other stakeholders. There is a legal requirement for Member States to realise the core network’s alignment according to the technical and operational characteristics described below by 2030, unless the European Commission accepts that investment in infrastructure cannot be justified in socio-economic terms.

Interoperability

The creation of an interoperable European rail network is a long standing EU ambition for which the TEN-T regulations are the latest instrument. By focusing on making the different technical systems on the EU’s railways work together, EU legislation has sought to increase the competitiveness of the European rail system. The primary means of promoting interoperability have been Technical Standards for Interoperability (TSIs) which provide uniform specifications for:

- infrastructure
- energy
- maintenance
- control and command and signalling
- rolling stock
- traffic operation and management
- telematic applications for passenger and freight services.

The Member States are required to draw up implementation plans for compliance with the TSIs. In the UK implementation plans focus on coordination with renewal and enhancement programmes to progressively replace non-compliant infrastructure. Any work on the TEN-T rail network must be delivered according to the requirements of the TSIs and of the Interoperability Directive (2008/57/EC).

The Railways (Interoperability) Regulations 2011 and associated Technical Specifications for Interoperability (TSI) apply to the entire United Kingdom rail network with the exception of the exclusions defined on the DfT website. Network Rail, along with other Infrastructure Managers in the UK, is legally obliged to comply with the Interoperability Regulations when the nature of the works being undertaken so requires.

European and UK legislation defining objectives for Interoperability and the Trans European Transport Network (TEN-T) have been taken into account during the development of this Route Study. Network Rail and the wider rail industry have sound practical experience in applying the respective regulations and associated TSI.
The experience has been used to good effect to:

- demonstrate legal compliance with the requirements and provide feedback to Government and the European Railway Agency on practical issues of application
- leveraging the benefits associated with the Interoperability principles
- developing plans to assess the full potential of an interoperable network, including connectivity with continental Europe.

For works being carried out on TEN-T, European Union funding support might be available for qualifying projects. Network Rail will work with the DfT to ensure that the UK takes maximum benefit from this opportunity.

Within the Welsh Route Study geographic scope, two parts of the network are defined as TEN-T routes. The North Wales Coast Main Line between Crewe and Holyhead is defined as a core passenger network, and the route between Bristol Parkway and Cardiff Central is defined as a core passenger network, and a core freight network between Bristol Parkway and Milford Haven.

2 Electrification

TEN-T requirements

The TEN-T network requirement is that the entirety of the Passenger and Freight Core Networks should be electrified by 2030.

Baseline

Just over 40% of the rail network in Great Britain is currently electrified. The Government has previously announced the development of a series of electrification projects in this control period (up to 2019). These schemes are set out in Network Rail’s Strategic Business Plan published in January 2013 and have subsequently been reported in Sir Peter Hendy’s review of enhancement projects in 2015. The completion of these electrification schemes will leave approximately 50% of the network electrified. This forms the baseline for assessment of TEN-T network compliance.

Gaps to TEN-T requirements

The following sections of the Core Networks within Wales are not at present electrified or funded for electrification by committed schemes:

- Crewe – Holyhead
- Swansea – Milford Haven

Network Rail is currently developing an updated Electrification RUS which will examine the priorities for further electrification in CP6 and beyond, to be published during 2016.
Appendix E: Interoperability Requirements

3 Route Availability

**TEN-T requirement**
The TEN-T network requirement is that the entirety of the Core Freight Network be able to accommodate 22.5 tonne axle loads at 100kph by 2030.

**Baseline**
The ability to accommodate a 22.5 tonne axle load is the equivalent of the UK’s RA8 standard. This statement has assessed compliance with RA8 on all areas of the Core Freight Network and found the current infrastructure to be almost entirely compliant.

**Gaps to TEN-T requirements**
The current infrastructure in Wales is currently incompliant with the TEN-T requirement in the following area:
- Swansea – Llanelli

There is not currently any funded schemes to upgrade the Route Availability on this line.

4 Train Length Availability

**TEN-T requirement**
The TEN-T network requirement is that the entirety of the Core Freight Network be able to accommodate 740m trains by 2030.

**Baseline**
Only short sections of the network in the Swansea area meet the requirements.

**Gaps to TEN-T requirements**
The UK rail network is largely non-compliant with the train length requirements of the TEN-T Core Freight Network, even following the implementation of funded schemes in CPS.

5 ERTMS

**TEN-T requirement**
The TEN-T network requirement is that the entirety of both the Core Passenger and Freight networks should have ERTMS installed and operational by 2030.

The European Rail Traffic Management System is being developed to become the universal train control system throughout Europe. It has two basic components: ETCS, the European Train Control System, is an automatic train protection system while GSM-R is a radio system for providing voice and data communication between the track and the train. The ERTMS is being developed as a world leading train control system which will bring considerable benefits in eventually replacing the various non-interoperable systems currently in use across Europe.

**Baseline**
The UK rail network currently has only one section of ERTMS controlled route: a pilot scheme running between Shrewsbury, Aberystwyth and Pwllheli in Wales. However, Network Rail has a long term plan to 2060 for the rollout of ERTMS across the network. The extent of ERTMS shown as implemented by 2030 in this plan forms the baseline for assessment of TEN-T compliance.

**Gaps to TEN-T requirement**
The ERTMS implementation programme has not been developed with the aim of meeting the TEN-T requirements and while use of ERTMS on the UK rail network would be fairly extensive by 2030, it would not cover all of the Core Networks in GB. However, Network Rail’s current plan for deployment of ERTMS is under review and compliance will require reassessment against the revised programme.
6 Road map for developing strategy

This analysis has shown that the baseline GB rail network would be non-compliant with the requirements of the TEN-T Core Networks in 2030 in a number of areas without further investment. By 2030 GB rail must either have upgraded the network to be compliant in these areas or the UK Government must have successfully sought deregation from the requirements by demonstrating that investment in infrastructure cannot be justified in socio-economic benefit terms.

Further assessment of the gaps identified and compliance with the TEN-T requirements will need to be undertaken.
<table>
<thead>
<tr>
<th><strong>Term</strong></th>
<th><strong>Meaning</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>ABP</td>
<td>Association of British Ports</td>
</tr>
<tr>
<td>AFC</td>
<td>Anticipated Final Cost. A cost provided in the Route study to allow options to be compared, composed of the Point Estimate plus Risk (also known as a Proposal Estimate).</td>
</tr>
<tr>
<td>Baseline</td>
<td>The baseline year of the study is 2019</td>
</tr>
<tr>
<td>CASR</td>
<td>Cardiff Area Signalling Renewal. A signalling renewal to increase capacity in the Cardiff area.</td>
</tr>
<tr>
<td>CRP</td>
<td>Community Rail Partnerships. The support of local railways by local organisations.</td>
</tr>
<tr>
<td>CP4</td>
<td>Control Period 4. This is the funding period from 2009-2014.</td>
</tr>
<tr>
<td>CPS</td>
<td>Control Period 5. This is the funding period from 2014 - 2019.</td>
</tr>
<tr>
<td>CP6</td>
<td>Control Period 6. This is the funding period from 2019 - 2024.</td>
</tr>
<tr>
<td>DFT</td>
<td>Department for Transport.</td>
</tr>
<tr>
<td>DECC</td>
<td>Department of Energy and Climate Change.</td>
</tr>
<tr>
<td>Dc</td>
<td>Direct Current. Specifically 750 volt 3rd Rail electrification.</td>
</tr>
<tr>
<td>DMU</td>
<td>Diesel Multiple Units. A type of train using internal diesel power source only.</td>
</tr>
<tr>
<td>EMU</td>
<td>Electric Multiple Units. A train using an electrical power source.</td>
</tr>
<tr>
<td>ESI</td>
<td>Electricity Supply Industry.</td>
</tr>
<tr>
<td>ERTMS</td>
<td>European Rail Traffic Management System. A system for managing train movements using ETCS to signal trans and GSMR to communicate with trains.</td>
</tr>
<tr>
<td>ETCS</td>
<td>European Train Control System. A new signalling control and train protection system currently being installed.</td>
</tr>
<tr>
<td>GWRM</td>
<td>Great Western Route Modernisation</td>
</tr>
<tr>
<td>GWML</td>
<td>Great Western Main Line.</td>
</tr>
<tr>
<td>GMPTE</td>
<td>Greater Manchester Passenger Transport Executive.</td>
</tr>
<tr>
<td>GVA</td>
<td>Gross Value Added.</td>
</tr>
<tr>
<td>HLOS</td>
<td>High Level Output Specification.</td>
</tr>
<tr>
<td>HS2</td>
<td>High Speed Two. The planned High speed link between London, Birmingham and the north.</td>
</tr>
<tr>
<td>HST</td>
<td>High Speed Train.</td>
</tr>
<tr>
<td>ITSS</td>
<td>Indicative Train Service Specification. A list of possible or proposed train services including characteristics such as origin, destination and routeing.</td>
</tr>
<tr>
<td>IIP</td>
<td>Initial Industry Plan. A plan to examine the key choices and options facing funders in specifying the future outputs of the railway and the level of funding required.</td>
</tr>
<tr>
<td>IEP</td>
<td>Intercity Express Programme. A series of linked projects to introduce new Super Express Trains (SETs), associated with depots infrastructure on the Western Route and elsewhere.</td>
</tr>
<tr>
<td>LDC</td>
<td>Local Distribution Centre</td>
</tr>
<tr>
<td>LEP</td>
<td>Local Enterprise Partnership. A partnership between local authorities and businesses.</td>
</tr>
<tr>
<td>LTTPP</td>
<td>Long Term Planning Process.</td>
</tr>
<tr>
<td>MoD</td>
<td>Ministry of Defence.</td>
</tr>
<tr>
<td>NSIP</td>
<td>National Station Improvement Programme. A series of projects to improve railway stations.</td>
</tr>
<tr>
<td>NASR</td>
<td>Newport Area Signal Renewal. A signalling renewal to increase capacity in the Newport area.</td>
</tr>
<tr>
<td>Term</td>
<td>Meaning</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>NDS</td>
<td>National Distribution Centre</td>
</tr>
<tr>
<td>NSC</td>
<td>National Supply Chain</td>
</tr>
<tr>
<td>ORR</td>
<td>Office of Rail and Road. The safety and economic regulator for the rail industry in Great Britain.</td>
</tr>
<tr>
<td>PGS</td>
<td>Prospering in Global Stability. High economic growth forecast scenario.</td>
</tr>
<tr>
<td>RUS</td>
<td>Route Utilisation Strategy. A report which considers the future development of the railway in a particular area, or one aspect of its development in depth. This are being phased out by Route studies in the Long Term Planning Process.</td>
</tr>
<tr>
<td>SEWTA</td>
<td>South East Wales Transport Consortia. An alliance of 10 local authorities in South East Wales those were previously involved in the development of regional transport strategy and planning.</td>
</tr>
<tr>
<td>SET</td>
<td>Super Express Trains (see IEP)</td>
</tr>
<tr>
<td>SFN</td>
<td>Strategic Freight Network</td>
</tr>
<tr>
<td>SWML</td>
<td>South Wales Main Line. The railway line running between Severn Tunnel and Swansea.</td>
</tr>
<tr>
<td>SWWITCH</td>
<td>South West Wales Integrated Transport Consortia. An alliance of four local authorities in South West Wales those were previously involved in the development of regional transport strategy and planning.</td>
</tr>
<tr>
<td>SII</td>
<td>Struggling In Isolation. Low economic growth forecast scenario.</td>
</tr>
<tr>
<td>SDL</td>
<td>Swansea District Line. A railway running predominately through Northern Swansea which is mainly used by freight traffic.</td>
</tr>
<tr>
<td>STJ</td>
<td>Severn Tunnel Junction.</td>
</tr>
<tr>
<td>TAITH</td>
<td>An Alliance of six North Wales local authorities which were previously involved in the development of regional transport strategy and planning.</td>
</tr>
<tr>
<td>TEN-T</td>
<td>The Trans-European transport network, comprising of roads, railway lines, inland waterways, inland and maritime ports, airports and rail-road terminals throughout the European Union.</td>
</tr>
<tr>
<td>TraCC</td>
<td>Trafnidiaeth Canolbarth Cymru. An alliance of three Mid Wales local authorities which were previously involved in the development of regional transport strategy and planning.</td>
</tr>
<tr>
<td>Tph</td>
<td>Number of trains per hour.</td>
</tr>
<tr>
<td>VLE</td>
<td>Valley Lines Electrification. The Railways that serve the Welsh Valleys north of Cardiff, Newport and the Vale of Glamorgan.</td>
</tr>
<tr>
<td>WRCCA</td>
<td>Weather Resilience and Climate Change Adaptation.</td>
</tr>
<tr>
<td>WAG</td>
<td>Welsh Assembly Government. This is the devolved Government for Wales.</td>
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</tbody>
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