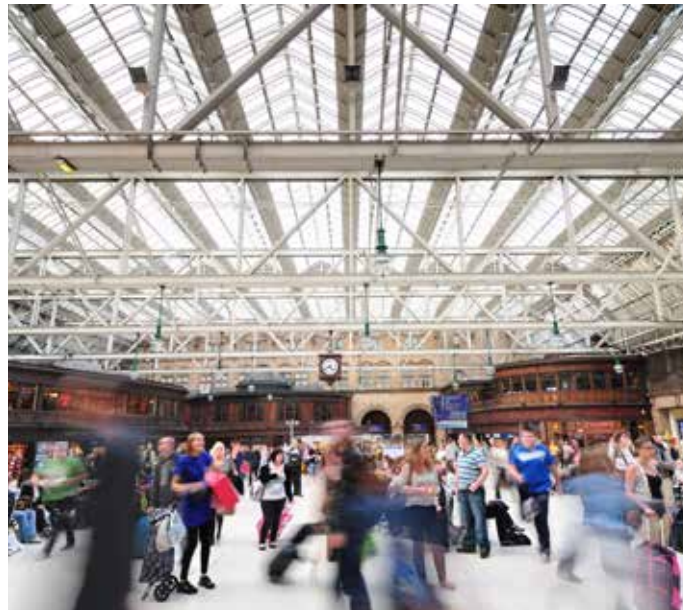


Scotland Route Study

July 2016





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Welcome to the Scotland Route Study, an important milestone in the development of Scotland's railways. We are delighted to be able to present this work, the result of much collaboration across the industry. The railway in Scotland plays a vital role in the country's economy, providing links between communities and employment, industries and markets, and access to our cultural heritage from the Borders to the Highlands.

The success of the rail industry over the last 20 years, during which it has delivered greater capacity, performance and safety, at the same time as improved efficiency and value, is notable. However, sustaining this growth and progress to meet forecast demand for the next 30 years will present significant challenges, and these are explored and addressed in this Scotland Route Study document.

The purpose of the Route Study is to provide an evidence base that will inform funders in Scotland when considering rail industry investment choices for Control Periods 6 and 7 between 2019 and 2029. It is one of a new generation of Studies across Great Britain which will also set out how forecast growth could be met through to 2043. This longer term planning horizon is deliberate: it enables a broad range of options to be considered that take account of developments such as High Speed 2 and technological advancements, with a view to creating a prioritised set of choices for the next 10 years and beyond.

This Route Study also contains a Market Study which forecasts demand for passenger journeys undertaken wholly within Scotland. It has been combined with the Market Studies for Long Distance (Anglo Scottish) Passenger and Freight flows, to provide a strong basis for developing options for the future.

The choices for funders included in this Route Study have been developed through a strategy of focussing on making the best use of the existing network wherever possible before proposing infrastructure enhancement. Where the outputs required cannot be delivered within the constraints of the current network, trade-offs between outputs and options to enhance the network have been considered and developed.

We would like to thank everyone who provided responses during the three month consultation process, where appropriate, this final Route Study document has been updated accordingly.

Network Rail has led the development of this Route Study using a collaborative approach with input from the rail industry, Transport Scotland and Regional Transport Partnerships. We would like to take this opportunity to thank all these stakeholders for their contributions to the work.



Jo Kaye

Director, Network Strategy and Capacity Planning



Phil Verster

Managing Director, Network Rail Scotland, and Managing Director, ScotRail Alliance

The Scotland Route Study is a key part of the rail industry’s Long Term Planning Process. The proposals and choices presented are fundamental to informing investment decisions for the next ten years and beyond.

Rail travel in Scotland has grown significantly over the past two decades. The number of passengers travelling by rail in Scotland has seen sustained growth since 1995/96, increasing by 96 per cent to 96.1 million journeys in 2014/15. Whilst there are challenges across the freight industry, in particular relating to coal, however there continues to be strong growth in all other freight commodities.

The Scotland Route Study takes into account forecast passenger flows within Scotland, developed as part of the Scotland Market Study; and outputs from the Long Distance Market Study and Freight Market Study, both of which were published in 2013. It is important to note that all these outputs are conditional on a business case being developed that demonstrates they are both affordable and value for money. Equally, they will need to be deliverable technologically, operationally and physically.

The rail industry has developed an aspirational train service for 2043. This Indicative Train Service Specification (ITSS) reflects the opportunities which could be achieved if the Conditional Outputs from the Market Studies are met within Scotland.

This process identified seven areas of the Scottish network where changes would be required to support the delivery of the 2043 ITSS:

- Edinburgh Waverley and Haymarket to Glasgow Queen Street (High Level) and Fife
- Edinburgh Waverley and Anglo Scottish Routes from Slateford to Berwick-upon-Tweed
- Glasgow Central (High Level) and associated lines, including the West Coast Main Line to Carlisle and Carstairs to Haymarket
- Glasgow Queen Street (High Level) to Aberdeen and Inverness
- Strathclyde suburban network
- Aberdeen to Inverness
- The Far North Line.

In developing the investment choices for funders, the Scotland Route Study has taken into account a number of key issues that are likely to shape the way the Great Britain railway will develop in the coming years. These relate to: safety, performance, resilience, construction of High Speed 2 (HS2) as currently consulted and the move towards a Digital Railway.

Funding choices for the 10 years from 2019 have then been identified, based on the rail network anticipated after the delivery of committed investments for Control Period 5, and prioritised on the following criteria:

- To meet forecast demand
- Funder priorities
- Linked to asset renewals
- Enable future aspirations
- Access to the HS2 network
- Reduce industry cost.

These funding choices can take two forms; those that can be put in place without significant changes to the existing infrastructure (i.e. train lengthening schemes, providing additional trains, stopping pattern variations) and infrastructure enhancements (i.e. changes to the physical network to enable conditional outputs to be accommodated).

The first steps towards the 2043 railway could include such proposals as:

Train lengthening on various corridors to meet 2023/24 demand

East Coast Main Line - Extra capacity required if demand is to be met for local, long distance and freight services.

Edinburgh Waverley - Extra capacity required both within the station and on its east and west approaches to meet demand to 2023/24.

Edinburgh Suburban Enhancement Programme - Upgrade the capacity and capability to provide a key electrified freight link between East Coast Main Line and West Coast Main Line, empty coaching stock moves to Millerhill Depot and an electrified

Prospering in Global Stability Scenario

| Market | Growth factor 2012-23 | Compound Annual Growth Rate 2012-23 | Growth factor 2012-43 | Compound Annual Growth Rate 2023-43 |
|----------------------------|-----------------------|-------------------------------------|-----------------------|-------------------------------------|
| Edinburgh Morning Commuter | 51% | 3.8% | 115% | 1.8% |
| Glasgow Morning Commuter | 39% | 3.0% | 128% | 2.5% |
| Aberdeen Morning Commuter | 54% | 4.0% | 226% | 3.8% |
| Interurban | 49% | 3.7% | 197% | 3.5% |
| Rural | 61% | 4.4% | 158% | 2.4% |

Unconstrained freight traffic, in terms of tonne kilometres moved in Great Britain, is forecast in the Freight Market Study to increase at an average of 2.9 per cent per annum, implying that the size of the market more than doubles over the next 30 years.

diversionary route for Anglo Scottish passenger services.

West Coast Main Line - Carstairs Junction Remodel (linked to asset renewals), freight gauge enhancement and a High Speed Enabling Projects

Glasgow Central - Extra capacity required both within the station and on its approaches to meet demand.

Rolling programme of electrification - Maximising the benefits of electrification by efficient sequencing and early delivery of key enablers at a corridor level.

Central Belt to Inverness - Incremental outputs to improve capacity and journey time, working towards the 2043 aspirations.

Central Belt to Aberdeen - Incremental outputs to improve capacity and journey time, working towards the 2043 aspirations.

Aberdeen to Inverness - Incremental outputs to improve capacity and journey time, working towards the 2043 aspirations.

The Far North Line - Options to meet connectivity conditional outputs.

The table below summarises the rationale and typical interventions proposed to enable the rail network for 2043:

The Scotland Route Study has been developed collaboratively with the rail industry, funders and Regional Transport Partnerships.

A Draft for Consultation document was published in December 2015 with a three month consultation period which closed in March 2016.

This document has been refreshed taking account of consultation responses as well as further timetable and technical work that has been undertaken since December 2015.

Network Rail would like to take the opportunity to thank all those involved in the process of creating this Route Study and looks forward to continuing collaboration to develop and deliver the choices for funders and industry going forward.

| 2043 Drivers of change | Typical interventions |
|---|--|
| <ul style="list-style-type: none"> • Growth in passenger numbers – ‘high growth’ demand scenarios forecast passenger numbers to double on many busier routes, and at major terminal stations in Scotland | <ul style="list-style-type: none"> • Longer trains – platform lengthening and station capacity • Network capacity – delivering more frequent services • Additional passenger and circulating capacity at stations |
| <ul style="list-style-type: none"> • Scottish Government aspirations for faster journey times, electrification and improved connectivity | <ul style="list-style-type: none"> • Network capacity – more frequent services and optimised timetabling of intercity limited stop services versus local stopping services • Linespeed improvements |
| <ul style="list-style-type: none"> • Long Distance Market Study findings – more cross-border passenger services, HS2, longer trains and faster journey times | <ul style="list-style-type: none"> • Network capacity – more frequent services • Linespeed improvements • Longer trains – with implications for major stations |
| <ul style="list-style-type: none"> • Freight Market Study findings – more cross-border intermodal services, longer and larger gauge trains | <ul style="list-style-type: none"> • Network capacity • Electrification |

Overview

The Scotland Route Study presents a vision of the railway in 2043, and sets out a strategy for realising this vision in ways that are deliverable and likely to provide value-for-money for passengers and funders. A key aspect of the Route Study programme is that evidence is presented as a series of choices for funders and not as recommendations for investment

The Scotland Route Study has been developed with stakeholders from across the rail industry and the broader transport industry in Scotland, including Regional Transport Partnerships and Transport Scotland. The documentation and analysis that supports the study has been produced by Network Rail on behalf of the Route Study Board, a body set up as a steering group to support the delivery of the Scotland Route Study.

This final document replaces and updates the Draft for Consultation document which was published in December 2015. The consultation document provided organisations and the people of Scotland with an opportunity to participate in this element of the planning process to help shape the strategic direction of Scotland's railway in the decades to come. There were numerous responses to the consultation from a wide range of interested parties. All responses have been considered and informed the final document, where appropriate.

The starting point for the Scotland Route Study is the railway system as it is anticipated to be after delivery of committed investments for Control Period 5 (CP5) which is between April 2014 and March 2019. Details of this baseline position, including the changes to current services which will result from this investment, are presented in Chapter 2.

In developing the investment choices for funders detailed in Chapters 4 and 5, the Scotland Route Study has taken into account a number of key issues that are likely to shape the way the GB railway will develop in the coming years. These relate to: safety, performance, resilience, the construction of High Speed 2 (HS2) as currently consulted, and moving towards the Digital Railway.

The Scotland Route Study incorporates the Conditional Outputs identified by the Long Distance Market Study and the Freight Market Study, both of which were published in 2013.

It also contains Conditional Outputs for flows wholly within Scotland which were developed as part of the Scotland Market Study. Details on what Conditional Outputs are and how they drive the strategy of the Scotland Route Study and the

Methodology used to develop them are contained in the Scotland Market Study in Chapter 3.

Key Themes of the Scotland Route Study

The overarching theme running through the Scotland Route Study is that through improving transport connectivity - both within Scotland and between Scotland and the rest of Great Britain - the economic and social aspirations of the Scottish people will be supported.

Rail is well-placed to provide improved and additional connectivity in many - but not necessarily all - transport markets. The rail network enables large volumes of people to be transported quickly into and between key urban centres in an environmentally sustainable way that benefits passengers and the wider public. It does so by enabling people to access employment, leisure and services in a way that is affordable for both passengers and funders. In markets such as these, rail is well-placed to become the mode of choice for many people.

In rural markets, where populations are smaller and more dispersed, rail can provide an important lifeline to the populations it serves. Rail services provide access to local services such as schools and hospitals, and often forms the core service that underpins the existence of a coherent public transport system in rural areas, which is key in terms of social inclusion.

Transporting freight by rail not only supports sustainable economic growth, it is safer and greener than road transport.

Improving rail connectivity generally involves **improving journey times** and/or **improving train service frequencies** for passengers and freight. Connectivity can also be improved in other ways. Firstly, it can be improved by **increasing the capacity of existing trains** where on-train crowding exists. This ensures that the benefits of improved connectivity are enjoyed by as many people as possible rather than moving them onto other modes of transport. Secondly, **improving the travelling environment** improves the quality of the travelling experience and the overall value-for-money of the railway. Finally, **improving the affordability** of rail services enables more people to benefit from the connectivity that these services provide.

The ability to run more and faster trains depends on the track and signalling capacity of the network and on the volume and type of services that already operate. The requirement for sufficient

spacing between trains to ensure that **safety** and **reliability** are maintained is one constraint on capacity. Another is the degree to which traffic is mixed: where there are significant differences in the speeds among trains sharing the same route (for instance between fast, long distance services and slower, stopping passenger services or freight services) the overall service frequency that can be provided will generally be lower than when traffic operates at a uniform speed and to a uniform stopping pattern.

Therefore, in many instances where there are aspirations to improve services, **trade-offs** exist between the number of services that can be accommodated on the network, the **mix of traffic** that can be operated safely on the network and the **quality of service** that can be enjoyed for a given level of infrastructure capability (and therefore cost).

The purpose of this Route Study is to consider the evidence on the nature of trade-offs, and analyse how they affect our ability as an industry to improve rail connectivity in Scotland in a way that is affordable and that delivers good value for money. It is then for funders to make choices about how to prioritise the outputs they require from the railway, in part informed by this Route Study.

Other key strategic themes of the Scotland Route Study are as follows:

- defining what capacity is available, based on current and future expectations of what passengers and freight customers are likely to require
 - optimising timetables to make the most of the network as it is today
 - enhancing train lengths as a first step to meeting capacity requirements where possible
 - segregating different types of traffic where possible to remove capacity constraints
 - taking advantage of planned renewals to ensure that the enhancements that are required deliver maximum value for money
 - taking a whole-life, whole-industry view of the enhancements
- taking an overall corridor view to ensure that individual enhancements deliver outputs in a way that delivers benefits as early as possible, given the requirement to deliver good value for money.

The Long Term Planning Process

The Scotland Route Study is a key output of the rail industry’s Long Term Planning Process (LTPP). Developed following the success of an earlier strategic review – the Route Utilisation Strategy programme – the LTPP is designed to consider the role of the railway in supporting the UK economy over the next 30 years. It comprises a set of activities and documents that:

- address the demands that are likely to be placed on Great Britain’s rail network over the next 30 years
- capture stakeholder aspirations to develop new train services in the light of continuing rail investments
- present investment choices for funders to accommodate demand and future aspirations

Structure of the Long Term Planning Process

The LTPP, shown in Figure 1.1, consists of a number of different elements which seek to define the future capability of the rail network.

Market Studies, which forecast future rail demand, and develop Conditional Outputs for future rail services. These outputs are based on stakeholders’ views of how rail services can support the delivery of the industry’s strategic goals. Four of these market studies were completed in 2013, of which two – the Long Distance and Freight market studies – apply to Scotland. A fifth market study – the Scotland Market Study, which covers the market for rail on flows wholly within Scotland - has been produced as part of the Scotland Route Study and is summarised in Chapter 3.

Route Studies, develop options for future services and for investment for each of Network Rail’s devolved Routes.

Options are based on the Conditional Outputs and demand forecasts generated by the Market Studies, and are assessed against industry appraisal criteria to provide choices for funders.

Cross-Boundary Analysis complements the analysis produced by the Market Study programme. It considers options for services that run across multiple routes, and enables consistent assumptions to be made about the specification of these services.

In addition to these studies, Network Rail facilitates the production of Network Studies. These studies look at network-wide issues and address the future capacity and technology-related issues for the railway.

Further details of the Long Term Planning Process are contained within Appendix 1.

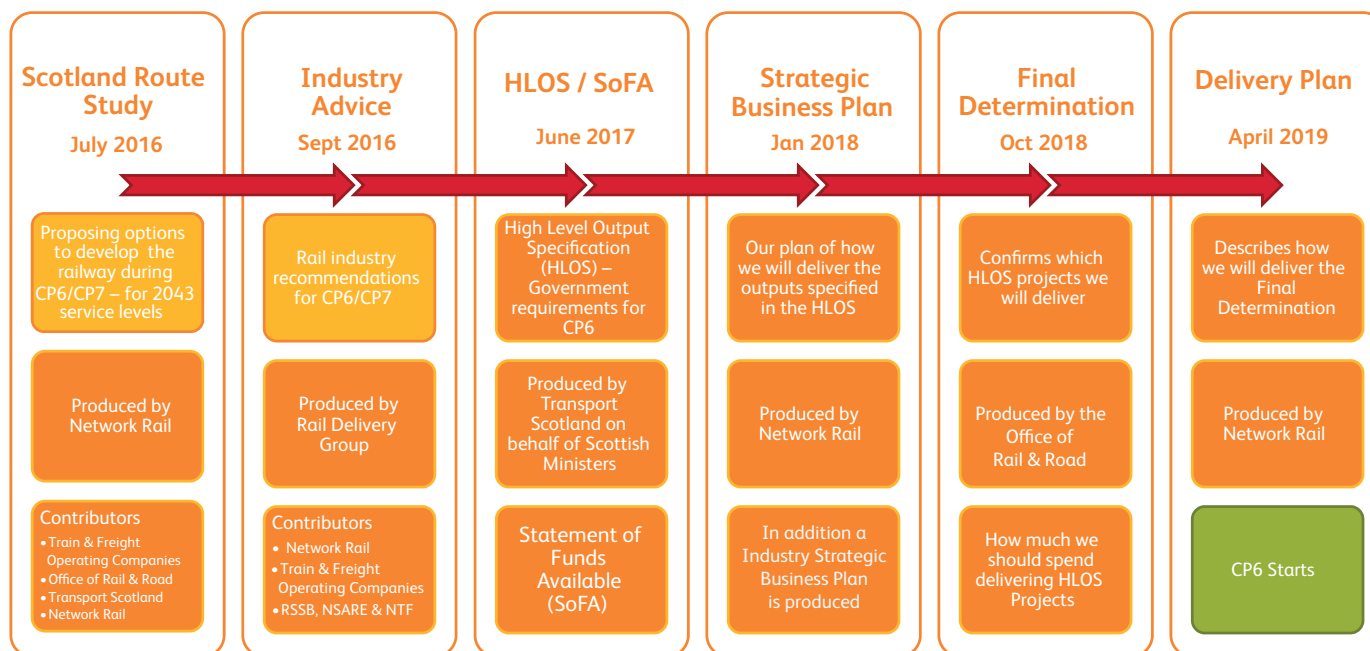


Fig 1.1: The Long Term Planning Process

Background

At this point it is useful to set out the assumptions on which the Scotland Route Study has been developed. Network Rail is a regulated body, and as such is required to comply with the terms of its Operating Licence.

This section sets out in more detail the working assumptions that have been followed in developing the strategy that underpins the Scotland Route Study.

Network Rail's Licence requires it to plan the network in a way that will deliver a safe railway for passengers and for the people who work on the railway. It requires Network Rail to provide a railway that delivers a reliable timetable in the face of short-term and long-term risks, including the uncertainties created by climate change. Finally, it requires Network Rail to adapt to, and take advantage of, technological and market changes such that it provides good value for money for both current and future users and for funders.

Safety, Performance and Resilience

All of the 2043 options for development and the 2019-2029 choices for funders will deliver improved safety, performance and resilience at an individual scheme level and at a strategic network-wide level. In terms of delivering a safe railway, this can include providing safer access to maintain and operate infrastructure or closing level crossings. Consideration has been given to mitigating performance risks wherever possible by reducing the number of junction conflicts and crossing movements, as well as the safety and performance impact of increased passenger flows at stations. Resilience involves making the rail network more resistant to climate change and faster to restore to service following disruption.

Interoperability

Interoperability is an initiative to promote a single market in the rail sector and enable the railway to compete more effectively with other forms of transport, particularly road transport. In the long term it can contribute to reducing costs and provide safe and uninterrupted movement of trains across Europe. Developing a railway that allows for greater interoperability in the future has been considered as part of the 2043 options for development and 2019-2029 Choices for Funders.

High Speed

The HS2 proposals, as set out in the current published business case, will have a significant impact on the Scotland Route Study area from 2026 onwards. The Scotland Route Study is closely aligned with similar studies currently being undertaken by Network Rail's London North Western and London North Eastern Routes, where HS2 proposals also require to be integrated into the rail network.

Impartiality

Network Rail is required to plan the network in a way that does not unduly discriminate between train operators or potential funders of the railway. The proposals contained within the Scotland Route Study therefore represent Network Rail's independent view of the future requirements of the railway up to 2043.

Passenger priorities

The passenger railway in Scotland has been very successful in attracting new passengers over the last 20 years. In order for this growth to continue, the industry needs to understand the factors existing passengers care about the most, as these will most likely be the main obstacles to attracting new users.

Freight priorities

The freight market is very competitive, consequently providing efficiency, sustainability and appropriate connectivity is key to encouraging modal shift to rail.

Technological change: The Digital Railway

The Digital Railway is a rail industry-wide programme designed to benefit the UK economy by accelerating the use of modern technology in several key rail areas. The elements of the Digital Railway that directly relate to the aims of the Scotland Route Study include:

Train operation – improving the on-train environment so that it better reflects the needs of passengers; managing demand better so that better use is made of the capacity that exists outside the peak periods. This element of the Digital Railway is termed the 'Digital Train Operator'.

Capability allocation – the introduction of a traffic management system to ensure that the network responds better to disruption by managing capacity in real-time. This element of the Digital Railway programme is termed the 'Digital System Operator'

Passenger experience – Improving the interface between passengers and operators that will, firstly, enable passengers to plan and purchase their travel in a way that reflects their lifestyles and, secondly, by improving passenger information so that they are

kept aware of actual and potential disruption to their journeys. This element of the Digital Railway programme is termed the ‘Digital Passenger’.

Infrastructure – Network Rail is responsible for managing approximately 1,770 miles of track, over 4,331 bridges and 80 tunnels in Scotland, many of which are over 100 years old and some of which are located in remote areas. Monitoring the condition of these assets so that maintenance can be carried out in an efficient manner is one of the key challenges, and the Digital Asset Manager programme aims to roll out remote monitoring technology that will enable engineers to monitor the condition of assets in real time.

Stations and Interchanges – providing station facilities which better meet the requirements of the travelling public. This could include enhanced retail facilities or improved connections with other forms of transport. This element of the Digital Railway programme is termed the ‘Digital Station’.

Freight – includes such tools as “Connected Driver Advisory Systems”.

In most areas, the work required to deliver these workstreams is already underway. However, as these proposals are still at an early stage of development, for the purposes of the Scotland Route Study, no assumptions have been made on any changes arising from the Digital Railway.

The Scotland Route Study has identified where the Digital Railway is included within a package of works on specific corridors to deliver Conditional Outputs for 2043.

New stations and new railway markets

Many responses to the consultation included significant aspirations for further expansion of the rail network including the opening of new stations on existing lines, conversion of freight routes to support passenger services and the construction of new railway.

Although the Route Study remit and development excluded these aspirations, as it is inappropriate for an industry-led process to determine the appropriate delivery of transport requirements. There will be opportunities for promoters and stakeholders to work with the Scottish Government and the rail industry to develop

options going forward. These will need to be supported by business cases that reflect the Scottish Transport Appraisal Guidance, and take into account deliverability and interaction with the existing and future network.

Should any of these proposals be progressed in the future Network Rail will work with the promoters involved to integrate them into the existing rail network.

Chapter structure

The remainder of this document is structured as follows:

Chapter 2: The Starting Point. This chapter summarises the characteristics of the railway for the Scotland Route Study area following the delivery of the current enhancements plan in CP5.

Chapter 3: The Scotland Market Study. This details future aspirations for the railway and a service specification, presented as Conditional Outputs, which can account for growth to 2043. It also summarises the demand forecasting work that has been undertaken to support the Scotland Route Study.

Chapter 4: A Railway for 2043. This chapter contains the long term development strategy for the railway in Scotland and identifies those locations where enhancements are likely to be required. This strategy builds upon the strategic themes identified in this chapter.

Chapter 5: Choices for Funders. The Route Study outputs are detailed for the next 10 years in terms of options that can be considered as choices for funders.

Chapter 6: Consultation Responses. This explains how responses to the Draft for Consultation have informed the final version of the Scotland Route Study.

In addition the main body of the Scotland Route Study, a series of appendices are included to provide more detail of the work that underpins the document.

This document has been published exclusively on Network Rail’s website. If you would like a paper copy, please email the following address scotlandroutestudy@networkrail.co.uk.

Establishing a baseline

- Geographic scope
- Market characteristics
- Route characteristics.

This chapter provides a summary of the Scottish rail network against which the Conditional Outputs described in Chapter 3 will be compared, and on which the strategy outlined in Chapter 4 will be developed. It sets out current infrastructure capabilities – the characteristics of the railway, and what it can accommodate. The baseline is the point from which future demand is forecast, and from which investment choices – choices that can account for demand growth and support future economic growth – can be developed.

The baseline is formed of the present infrastructure and committed enhancements from the Scottish Government’s CP5 High Level Output Specification (HLOS). These include Borders Railway, Edinburgh to Glasgow Improvements Programme, Aberdeen to Inverness Rail Line Improvements Phase 1, Highland Main Line Rail Improvements Phase 2 and the Rolling Programme of Electrification. The description of the schemes that Network Rail has committed to are detailed in its [Control Period 5 Delivery Plan](#).

Market characteristics

Services which cover the route can be broken down into seven distinct markets as show in figures 2.1 to 2.5 .

Please see the [Network and Route Specifications](#) for further information on the network

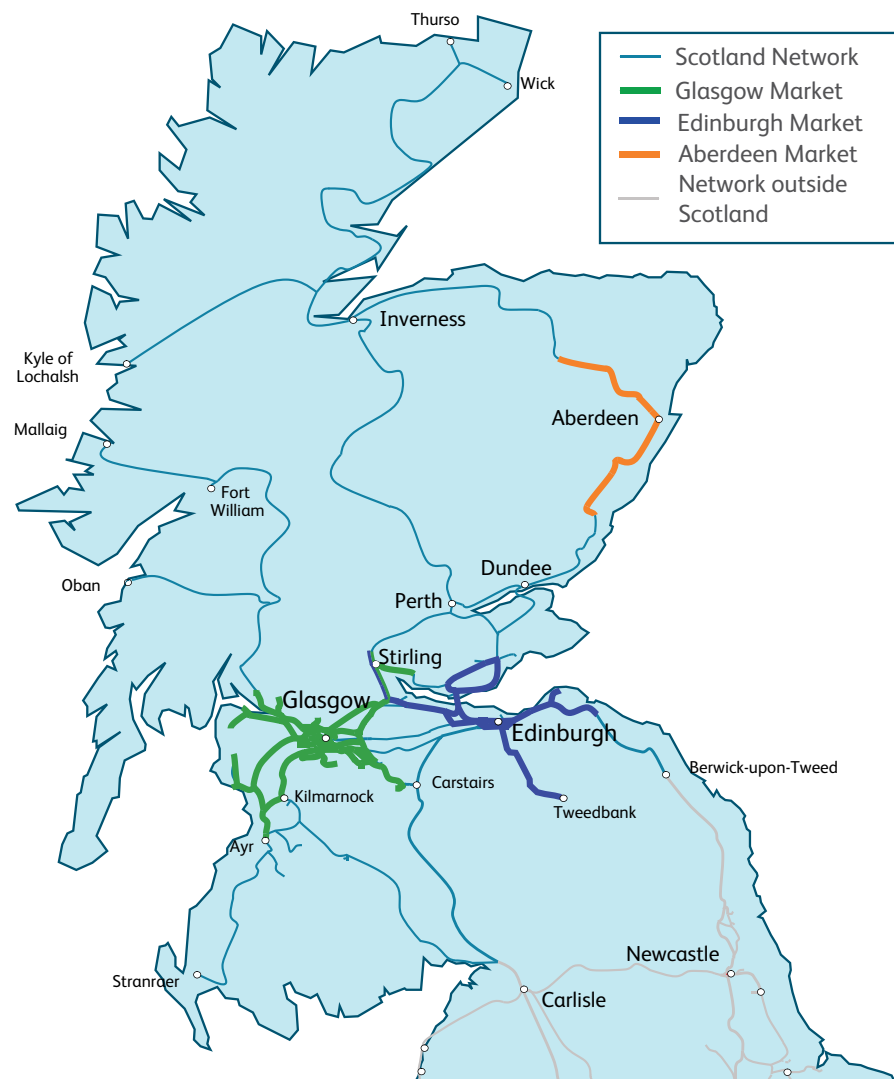


Fig 2.1: The geographical scope of the Scotland Route Study showing urban markets - the Glasgow market covers rail journeys to stations within the greater Glasgow area, the Edinburgh market includes journeys that start and end within the Edinburgh area and the Aberdeen market includes services into and around Aberdeen.

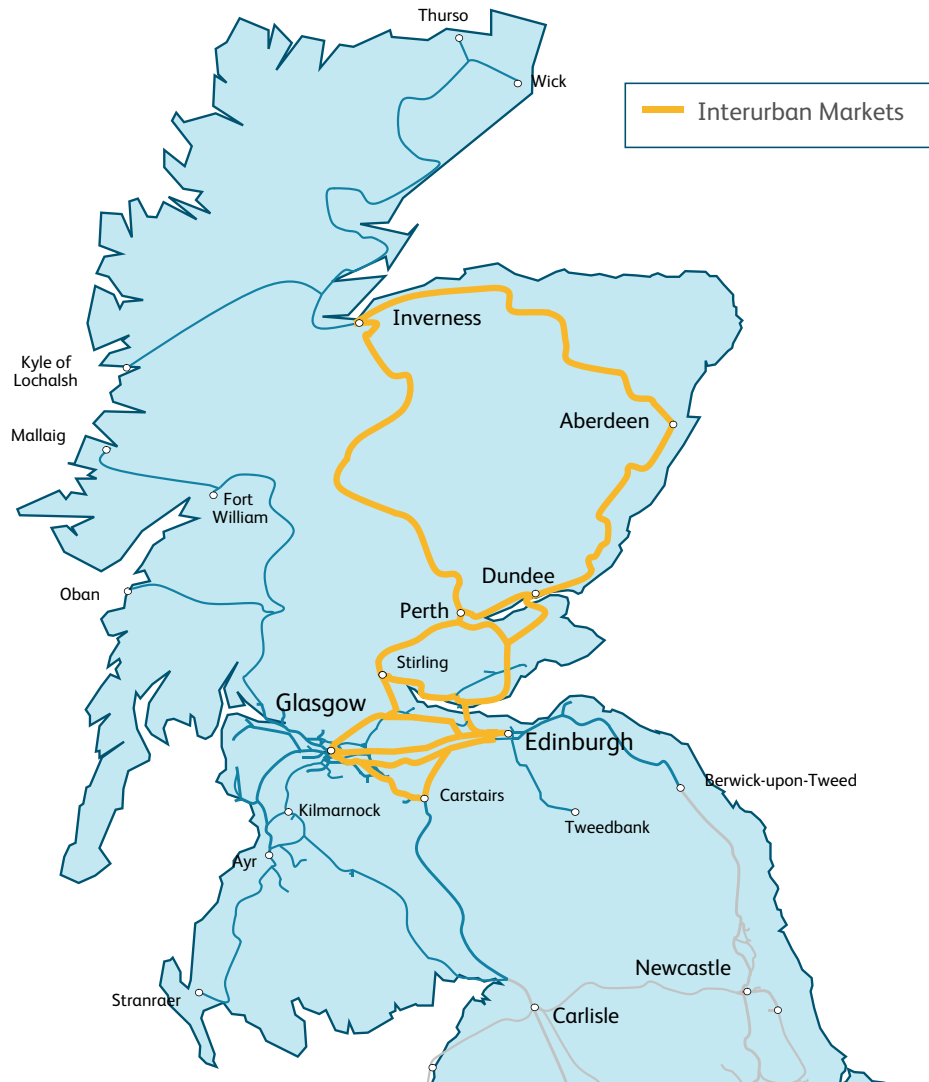


Fig 2.2:- Interurban market including journeys between major cities in Scotland



Fig 2.3:- Rural market including rail journeys that start or end at stations on the rural lines



Fig 2.4:- The long distance market comprising journeys between England and Scotland on the East Coast Main Line and West Coast Main Line as described in the Long Distance Market Study

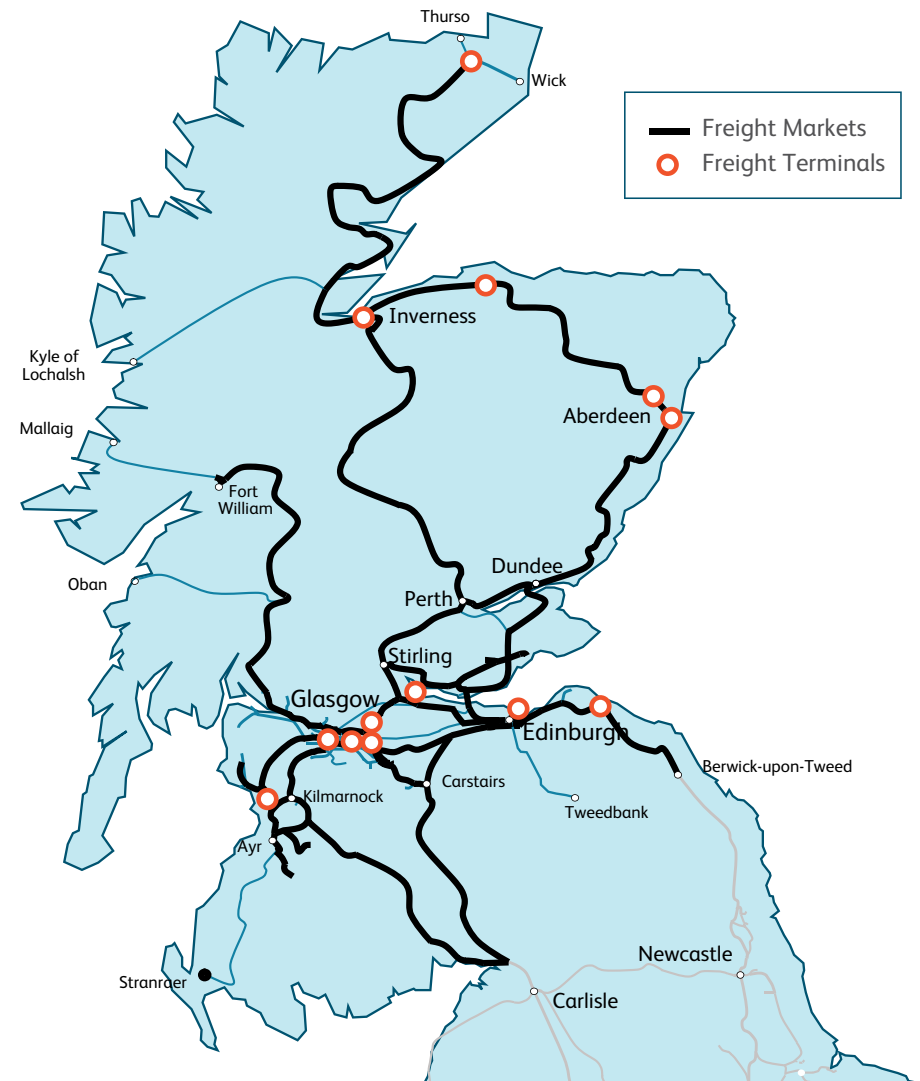


Fig 2.5:- The Freight market in Scotland

Route Characteristics

- Electrification
- Gauge
- Freight characteristics
- Depots and Stabling
- Significant enhanced infrastructure in CP5.

Electrification

Electrification can deliver reduced journey times by improving the rate at which rolling stock is able to reach linespeed. Regenerative braking can deliver environmental benefits by reducing energy cost, while the greater haulage capability of electric traction can reduce journey times for freight traffic, improving overall capacity on key routes. When combined with suitable signalling systems, electrification can often contribute significantly to improving the overall capacity of the network.

Within Scotland, electrification is currently centred on the core Glasgow commuter routes, the West Coast Main Line and the East Coast Main Line south and west of Edinburgh. The electrified network is being significantly expanded during CP5, as a result of the Edinburgh-Glasgow Improvement Project (EGIP) and the Rolling Programme of Electrification. This will mean that all routes between Edinburgh and Glasgow will have been electrified by March 2019 in addition to those to Stirling, Dunblane and Alloa.

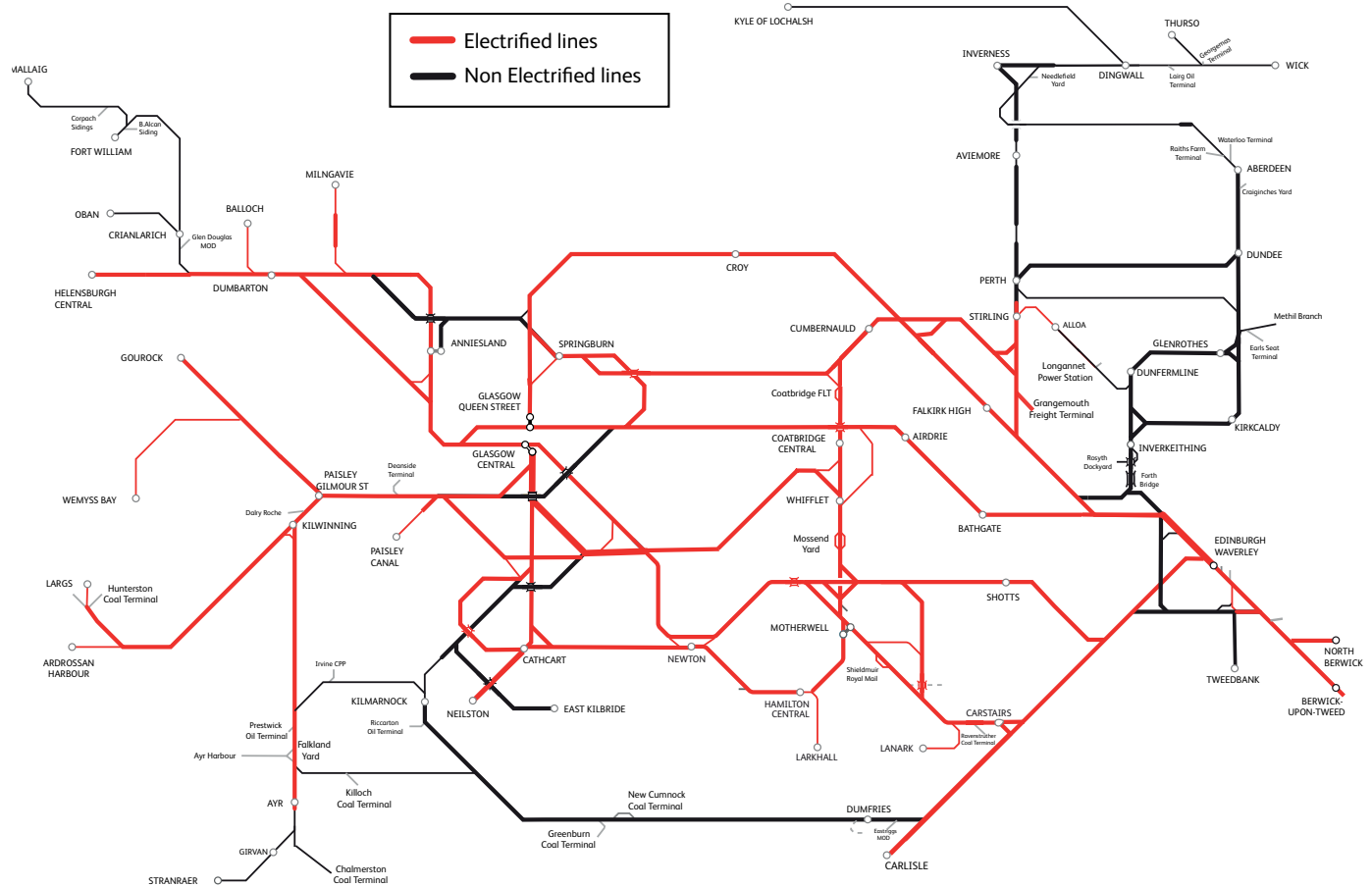


Fig 2.6: Electrification in Scotland by the end of CP5

Gauge

Improving the gauge capability of a route can enable higher volumes of certain types of freight to be transported for a given number of services. Gauge clearance is important for improving the capacity of the network to transport freight. Gauge clearance across the network in Scotland is highly variable: some routes have relatively limited gauge capability, while others – most notably the Anglo Scottish routes - have been partially cleared for W10/W12 gauge, the largest typical freight traffic running on the GB rail network today.

Gauge enhancements delivered in CP5 will for the most part be in tandem with the electrification works during the control period. These include the upgrade of the Shotts route to W10, enabling many container flows from the East Coast Main Line to Central Scotland freight terminals to be diverted away from the West Coast Main Line.

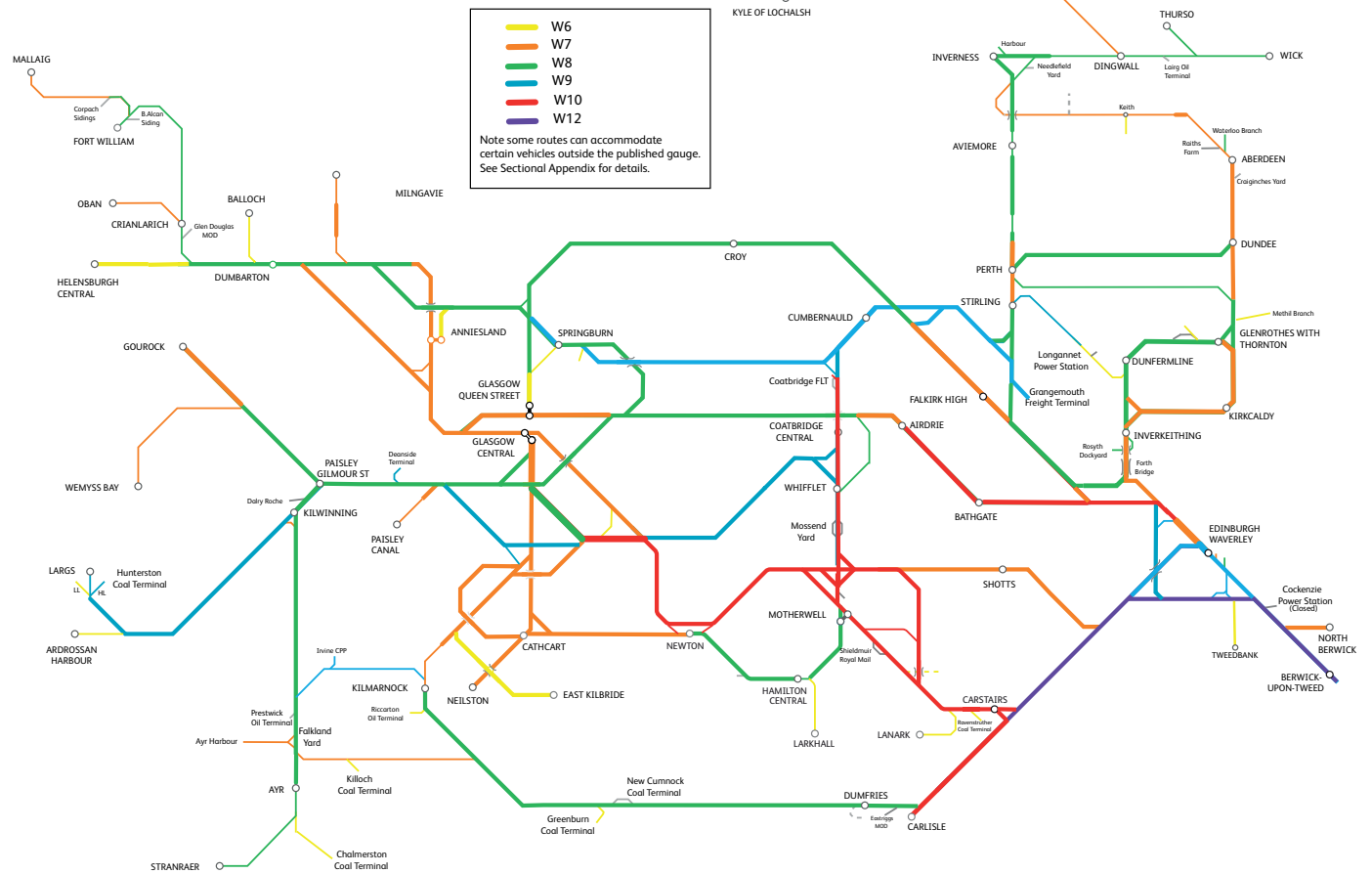


Fig 2.7: Gauge capability in Scotland

Depots and Stabling

The appropriate location of depots and stabling points ensures that services remain robust in the event of disruption and can reduce the interaction between empty coaching stock (ECS) moves and passenger services, before and after the morning and evening peak.

Depots can be used for the stabling, servicing (fuelling/cleaning) and maintenance of trains. They also provide facilities for drivers and other staff.

As the network is progressively electrified, the capability of depots and stabling points needs to reflect the changing balance of electric and diesel rolling stock.

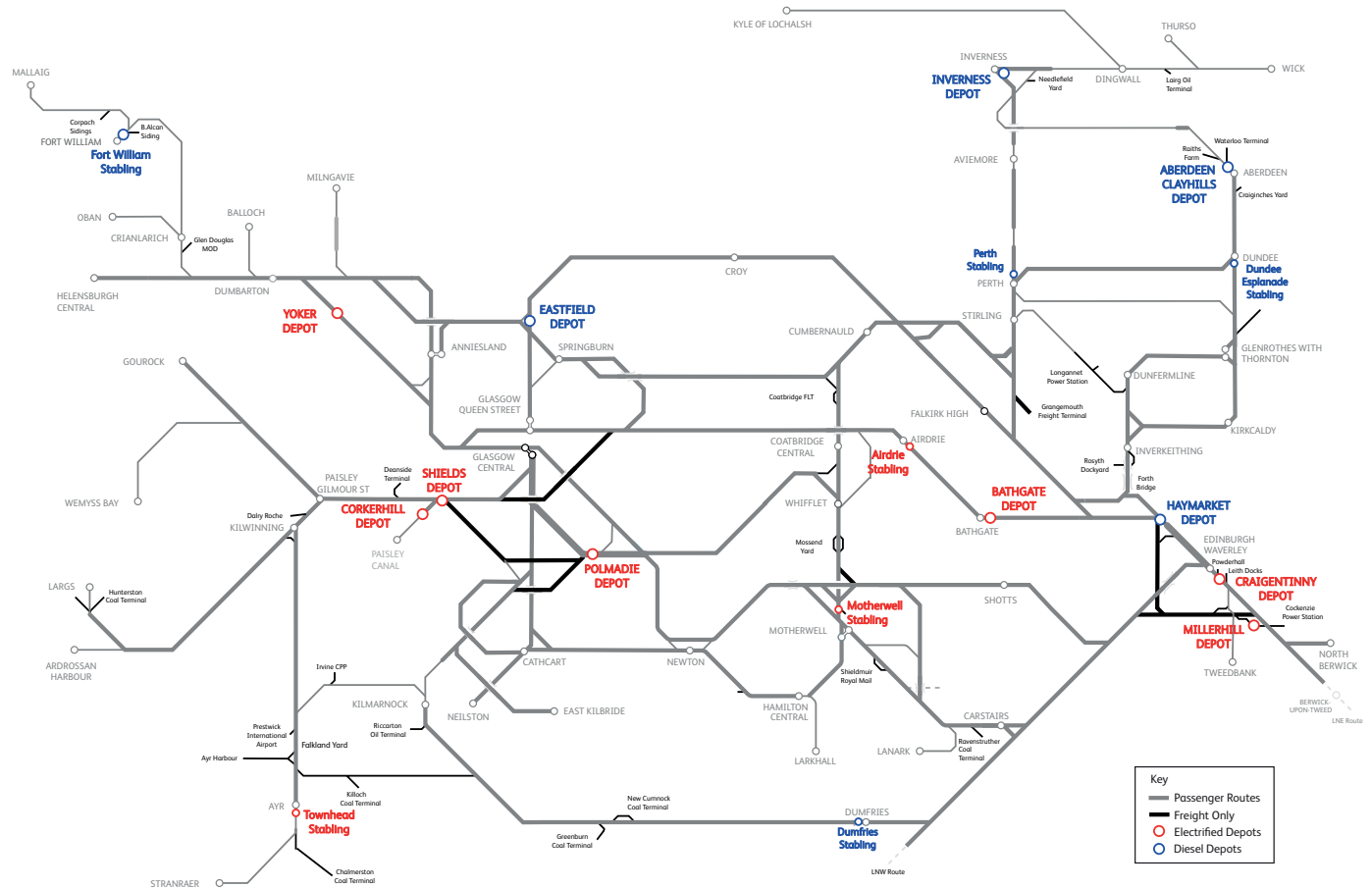


Fig 2.8: Depots and stabling in Scotland

Significant enhanced infrastructure in CP5

The key network enhancements during CP5 are as follows:

- Edinburgh Glasgow Improvement Programme
- Aberdeen to Inverness Phase 1
- Highland Main Line Phase 2
- Borders Railway
- Rolling Programme of Electrification
- East Coast Main Line to West Coast Main Line gauge enhancements.

The outputs of these schemes that Network Rail has committed to are detailed in its [Control Period 5 Delivery Plan](#).

- Key**
- Edinburgh Glasgow Improvement Project
 - Aberdeen to Inverness Phase 1
 - Highland Main Line Phase 2
 - Borders Railway
 - Rolling Programme of Electrification
 - W12 gauge enhancements

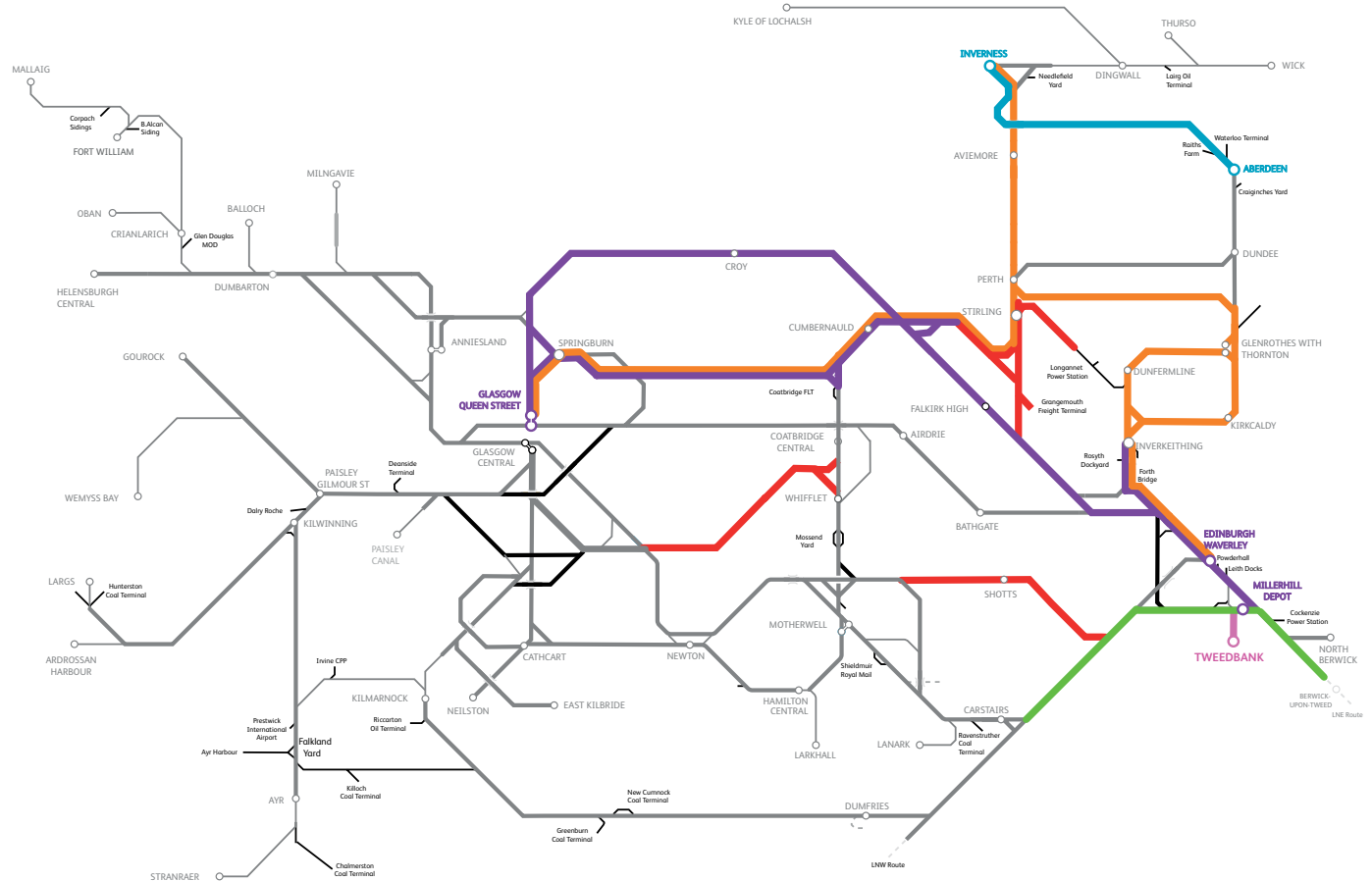


Fig 2.9: Diagram of significant infrastructure enhancements in CP5

03: The Scotland Market Study

Background

In Chapter 1 the Market Studies were discussed in the context of the Long Term Planning Process. The four Market Studies were published in 2013, in collaboration with the rail industry, funders, local authorities and other interested parties.

The purpose of the 2013 Market Studies was to understand, firstly, how the markets served by rail within a 30-year planning window could develop and, secondly, the stakeholder aspirations for connecting communities and economies in Great Britain within these markets.

The initial market study programme consisted of:

- the Long Distance Market Study
- the London and South East Market Study
- the Regional Urban Market Study
- the Freight Market Study.

The Long Distance Market Study and Freight Market Study considered Anglo Scottish flows. The conclusions of these studies – together with the Conditional Outputs and demand forecasts that underpinned them - have been incorporated into the Scotland Route Study.

In terms of the principles it adopts, its structure and its outputs, the Scotland Market Study is largely consistent with the Market Studies published in 2013, and indeed draws upon the evidence base developed for the Market Study programme in several areas. The key principles that it adopts are that:

- it embeds the market for rail travel in the context of a broader market for travel within Scotland
- it draws on a rich body of evidence about where the people of Scotland are likely to work and live in the next 30 years
- it is scenario-based and is consistent with the overall ethos of providing – and testing- choices for funders.

A more detailed overview of all aspects of the Scotland Market Study is contained in Appendix 2.

Structure of the Scotland Market Study

The starting point for the Scotland Market Study involved the setting of broad Scotland-specific strategic objectives, and then translating these into more specific Conditional Outputs which are a critical element of the Route Study concept. They define the strategic direction of the Scotland Route Study.

Conditional Outputs are future service specifications developed to meet stakeholders economic and social aspirations (Connectivity-related Conditional Outputs) supplemented where necessary by the service levels that are required to meet forecast demand (Capacity-related Conditional Outputs).

Both these outputs are conditional on their delivery representing value-for-money, and on them being affordable for potential funders. These Conditional Outputs represent the challenge against which the current network has been tested in the Scotland Route Study.

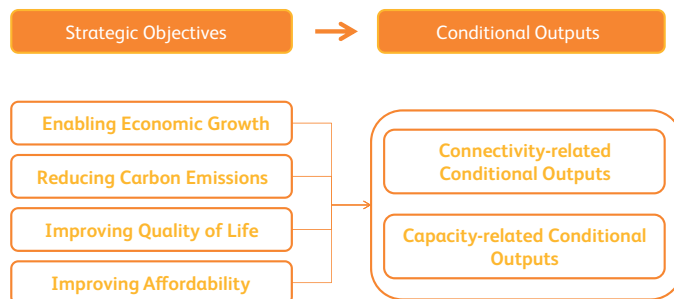


Fig 3.1: Relating Strategic Objectives to Conditional Outputs

Setting Strategic Objectives

The strategic objectives of the Scotland Market Study are described in terms of:

Enabling economic growth by:

- providing sufficient capacity for people travelling to take part in economically productive activities and employers to access the labour pool
- improving business to business connectivity
- improving connectivity to/from the retail, leisure and tourism sectors of the economy
- improving access to workers for businesses.

Reducing carbon and the transport sector's impact on the environment by:

- directly reducing the environmental impact of rail
- reducing less carbon efficient and less sustainable modes of transport.

Improving the quality of life for communities and individuals by:

- providing sufficient capacity for and improving access to employment and training opportunities
- connecting communities
- providing access to social infrastructure such as educational establishments and major leisure venues
- improving integration across the transport network
- reducing safety risks for passengers and the public.

Improving affordability and value for money for funders and customers by:

- directly reducing whole industry subsidy
- meeting outputs in an affordable and value for money way.

These Strategic Objectives were agreed with the Route Study Working Group (a body set up to support the delivery of the Scotland Route Study) following consultation with Transport Scotland. The Strategic Objectives agreed were broadly consistent with Scottish Government aspirations as well as those identified in the Freight Market Study and Long Distance Market Study.

Conditional Outputs

As discussed in Chapter 1, the principal theme running through the Scotland Route Study is that improving overall transport connectivity will support the economic and social aspirations of the Scottish people, and that improving rail connectivity can play an important part in delivering this overall improvement in connectivity. The Conditional Outputs are defined as being either Connectivity-related or Capacity-related

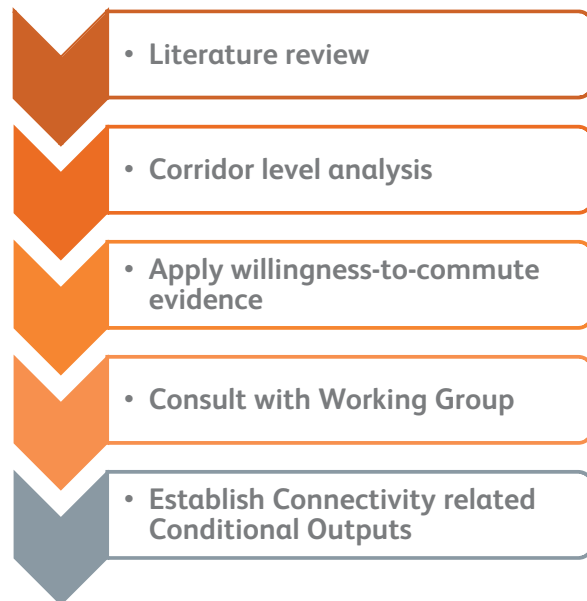


Fig 3.2: Developing connectivity related conditional outputs

The Conditional Outputs developed as part of the Scotland Market Study are based, firstly, on improving levels of connectivity (for instance, by increasing opportunities to travel or reducing journey times between two locations) and, secondly, on ensuring that sufficient capacity exists to enable people to take advantage of the connectivity that already exists (e.g. the aspiration to accommodate forecast passenger demand on services into the key employment centres at peak times). The following section sets out the rationale for setting Conditional Outputs.

Connectivity-related Conditional Outputs

As discussed above, improving rail connectivity for both passengers and freight will improve the ability of the railway to support the development of the Scottish economy and to improve the overall quality of life for people living and working in Scotland. Moreover, delivering improved rail-based connectivity can improve overall transport connectivity in a way that is environmentally friendly and affordable to both rail users and public funds because it enables best use to be made of the overall transport network.

Improving rail-based connectivity can benefit people in a number of ways. It can:

- improve access to employment and services by providing opportunities to travel that fit in better with where they work, where they live and the type of lifestyle they have
- improve people's quality of life by enabling them to visit family and friends or access leisure activities across Scotland and the UK in a flexible and affordable way
- reduce the effective distance between businesses, increasing their geographical reach and improving business-to-business connections
- provide a competitive alternative to the road network for both passenger and freight customers. Where this happens, it will provide benefits for non-rail users by reducing congestion, air pollution and accident risk on Scotland's roads.

Connectivity can be improved by either increasing the number of opportunities to travel (for instance, by increasing service frequency or the quality of interchange between services) or by reducing

journey times.

Capacity-related Conditional Outputs

In some cases, the potential to deliver benefits through improved connectivity can be constrained by the capacity of the rail network to deliver desired levels of connectivity to all those who could reasonably be expected to benefit from it.

Capacity-related Conditional Outputs have been produced for each corridor and are based on the demand forecasts produced for the Scotland Market Study. Capacity can potentially be improved by reconfiguring the internal layout of trains, lengthening trains or, where this is not possible, by introducing additional services.

Developing Conditional Outputs

Both Connectivity-related and Capacity-related Conditional Outputs need to be technologically and operationally deliverable as well as providing value-for-money and being affordable. On this basis, they should also be viewed as aspirations for the future rather than recommendations for future funding. This section sets out the process by which both the Connectivity-related and the Capacity-related Conditional Outputs were developed, and outlines the evidence base that supports them.

Developing Connectivity-related Conditional Outputs

The first stage of the process was to undertake a literature review relating to the aspirations and objectives of rail industry funders, stakeholders and passengers in Scotland. This literature review consisted of mixture of transport and non-transport, national and local evidence sources. The literature review enabled information on the aspirations of different levels of government and data on local housing and services to be collated.

The second stage of the process was to summarise the data collected as part of the literature review at a corridor level. A corridor is defined as a typical operating service, for example all the stations between and including Aberdeen and Inverness. The purpose of the corridor-level analysis was to understand – at a high level – the markets that each station on the network currently serves. It enabled a comparison of similar stations across the network to be undertaken and to understand why some stations serve their markets relatively successfully while others don't. The corridor analysis included quantitative measures such as journeys to and from a station, journey times to key urban employment centres, current population served and service frequency.

Of equal importance, the analysis also contained qualitative data on key local attractors to travel such as education and hospitals, proposed changes to transport provision in the area and significant planned housing developments.

The corridor analysis formed the principal data source on which the Connectivity-related Conditional Outputs were based.

However, they were also informed by the work on the willingness to commute that was undertaken as part of the Regional Urban Market Study (RUMS) to understand the demand drivers within urban commuter markets. It found that most people are willing to commute to their place of employment by rail if the generalised journey time (which comprises the train journey time and an allowance for both frequency of service and whether the journey requires an interchange) is less than 20 minutes, (assuming that the journey times offered by other modes are broadly comparable).

Outside the London conurbation, the RUMS found that very few people are willing to commute into urban centres by rail if the generalised journey time is greater than 60 minutes. One of the conclusions drawn by the RUMS was that improvements to generalised rail journey times within this 20 – 60 minute range will have the largest impact in terms of increasing rail's market share where both the number of people in the population catchment of the origin station and the number of jobs in the catchment of the destination station are high. This evidence, in combination with the other information within the corridor analysis, was used to develop Conditional Outputs for opportunities to travel and journey times

into and between the key locations. These service-level Conditional Outputs on a corridor have also been recommended where the following conditions have been met:

- there is an aspiration for an improved service among stakeholders
- there are reasonable opportunities to improve the service, for instance where renewals are planned.

Developing Capacity-related Conditional Outputs

Capacity-related Conditional Outputs were produced by applying corridor-level demand forecasts to an estimate of the passenger-carrying capabilities of each corridor for a given time period and for a given forecast year.

The first stage of this process was to estimate base year demand, with 2014 selected as the base year. The principal dataset for this part of the process is the LENNON¹ database for 2014, supplemented where required by on-train passenger counts and an allowance for ticket types not captured within LENNON. A description of the analysis carried out to estimate the number of journeys using Strathclyde Partnership for Transport Zoncards and ScotRail Flexipasses is included in Appendix 2. Demand for individual services is summarised at a corridor level.

The second stage of the process was to estimate demand growth at a corridor level to apply to the base demand data.

Estimates of passenger flows at a corridor level were produced by mapping individual origin and destination station pairs to individual corridors. These demand estimates were then compared to anticipated train capacities on these corridors at the end of Control Period 5 (CP5). Where passenger demand was forecast to exceed the anticipated capacity at the end of CP5, the capacity-related Conditional Output was set to deliver the required level.

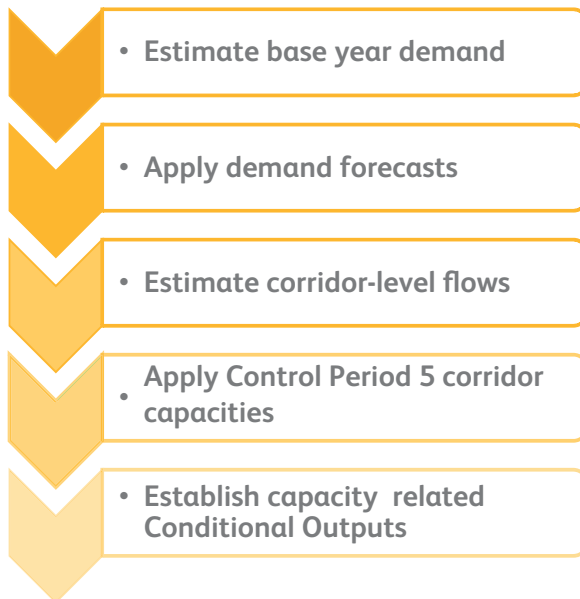


Fig 3.3: Developing capacity related Conditional Outputs

¹ LENNON is the rail industry ticket sales database, which reflects most journeys that are made on the GB rail network.

Case Study

Glasgow to Edinburgh via Bathgate

Current service levels

This electrified service runs from Edinburgh west through Bathgate and Airdrie to Glasgow Queen Street Low Level station and then to the north-west of Glasgow. Current service frequency is four trains per hour in each direction, with two per hour each terminating at Helensburgh and Milngavie. Services to Helensburgh stop at all stations between Glasgow and Edinburgh while services to Milngavie provide a faster limited stop service. The route serves a large population, and provides access to key employment locations in central Glasgow and Edinburgh. In 2015, this employment amounted to over 400,000 jobs.

Attractors to travel

Due to this geography and service the route serves a number of rail markets in both the Glasgow and Edinburgh areas, these include:

- Interurban peak commuting between Edinburgh and Glasgow
- Interurban off-peak connectivity between Edinburgh and Glasgow for leisure, tourism, higher education and social infrastructure
- Peak commuting from West Lothian and North Lanarkshire to Edinburgh and Glasgow
- Peak commuting from north-west Glasgow to Glasgow city centre
- Local connectivity along the route both peak and off-peak for leisure, tourism, and social infrastructure.

It is therefore important to consider all these markets when developing Connectivity Conditional Outputs. City centre commuting to both Edinburgh and Glasgow are key markets; road congestion and constrained parking in both Edinburgh and Glasgow city centres combined with frequent services make rail an attractive travel option. However analysis of current demand also highlights significant flows to key employment centres to the west of Edinburgh at Edinburgh Park and Haymarket. The service also presents an attractive option for commuting and connectivity from west of Glasgow to Edinburgh, the longer journey time being counterbalanced by the direct service for some passengers.

Connectivity Conditional Outputs

Given the current level of service, the analysis of the markets and all the other available evidence, the Connectivity Conditional Outputs for 2043 (see Appendix 2) is:

- Up to 6 opportunities to travel per hour between Edinburgh and Glasgow (via Bathgate) with a 60 minute journey time on fast services

One way this could be achieved is:

- 4 limited stop services per hour between Edinburgh and Glasgow to provide improved journey times to encourage modal shift in local and end to end commuting
- 2 all stop services per hour serving all stations between Edinburgh/Bathgate and Glasgow/Bathgate providing connectivity
- Analysis indicates that service frequency between Helensburgh / Milngavie and Glasgow city centre is appropriate.

Developing Demand Forecasts

Understanding why, where and how people are likely to travel in the future is a key input to the development of the Conditional Outputs to support the strategy contained within the Route Study. Demand forecasts enable an assessment to be made of when and where capacity on the network is likely to become constrained. They also provide part of the evidence base that informs funders' choices on how and where to prioritise investment on the network.

The demand forecasting element of the Scotland Market Study builds upon the scenario-based demand forecasting approaches developed for the RUMS and the Long Distance Market Study (LDMS). These approaches involve:

- estimating the total size of each market for travel for each forecast year
- estimating rail's share of that market for each forecast year
- applying these growth forecasts to MOIRA¹ demand data for 2013/14 to develop forecasts for each corridor.

The forecasts produced for the Scotland Market Study provide a corridor-level picture of demand for 2023/24 and 2043.

Applying forecasts at a corridor level represents a slightly different approach to the RUMS and LDMS, which forecast demand at a city-region level. The approach taken in the Scotland Market Study has been made possible by the volume and quality of the data available (much of which was provided by Transport Scotland) and represents a significant step forward in the understanding of rail demand within Scotland.

As with the modelling that supported both the RUMS and the LDMS, the demand forecasts produced for the Scotland Market Study are scenario-based. Four scenarios have been developed to cover a range of potential 'futures' for the key demand drivers. The network has been tested against the highest growth scenario for each market, but the socio-economic scheme appraisals draw on the range of scenarios.

Defining the Market for Travel

The railway in Scotland serves a number of travel markets. In the biggest cities in Scotland, the urban commuting market is the principal source of rail demand, and has historically tended to drive the transport network capacity required to support the economies of these cities.

The Morning Peak Commuter Market has therefore been defined as the market for travel into Glasgow, Edinburgh and Aberdeen in a weekday morning peak between 0700 and 1000.

The Interurban Market consists of the market for travel between the seven cities of Scotland in the inter-peak period between 1000 and 1600. The Interurban Market tends to be characterised by leisure and business travel, although commuting may also be significant on the shoulders of the morning and evening peaks.

Rural Markets are defined as existing on the following routes:

- The Far North and Kyle lines
- Oban, Fort William and Mallaig lines
- The (Glasgow and South Western) route between Glasgow and Carlisle via Dumfries
- The Stranraer line between Ayr and Stranraer.

These market definitions were agreed with the Route Study Working Group.

High Level Forecasting Methodology

Breaking down the overall market for travel in Scotland into the markets described above is necessary because each of these markets has its own specific characteristics that need to be accounted for in order to develop robust forecasts of rail demand. The methodology underpinning the extensive demand forecasting work completed for the Scotland Market Study is contained in Appendix 2. It includes details on:

- establishing baseline demand
- modelling methodology
- scenario development
- comparison of corridor demand and capacity.

¹ MOIRA is an industry demand forecasting tool which applies LENNON base data to individual train services.

Scenario Development

The world in 2043 is likely to be very different to the world today in ways that cannot be fully anticipated. Forecasting over this timeframe is therefore inherently uncertain, which when combined with the overall ethos of the Scotland Route Study of providing and testing choices for funders, is why a scenario-based approach has been adopted for the forecasts.

The scenarios are intended to broadly identify the circumstances where the network will be most strenuously tested and under which options have been developed to accommodate the Conditional Outputs will cease to be robust. It is this focus on robustly testing the network and providing meaningful choices for funders that has driven the forecasting methodology rather than developing a predictive central case forecast.

The scenarios developed for the Scotland Market Study have been evolved from the scenarios developed for the original 2013 Market Study programme, and in doing so draw upon a significant amount of analysis carried out specifically for the Scotland Market Study. A starting point for the scenarios was a review of economic and social data stretching back in some cases for almost 40 years, complemented by assumptions derived from both the Scottish Transport Appraisal Guidance (STAG) and from stakeholders.

The aim of the scenarios is, firstly, to reflect long term economic and social trends in Scotland, the UK and the world to develop a series of possible economic and social futures and secondly, adjust these to reflect the stated public policy objectives of the Scottish Government, the UK Government and Scottish local authorities. Where appropriate, account has been taken of potential trade-offs between these two objectives.

In line with the original Market Studies, four core scenarios have been developed (described in detail in Appendix 2).

They are:

- Prospering in Global Stability (PGS)
- Struggling in Global Turmoil (SGT)
- Prospering in Isolation (PI)

- Struggling in Isolation (SI).

It is worth noting at this point that although the highest growth scenario (mostly PGS) was used to inform the capacity-related Conditional Outputs, the appraisal of schemes takes account of the full range of scenarios.

The RUMS identified changes in city centre employment as being the primary driver of growth in the morning peak commuter markets. On the basis of this, scenarios were employed to develop:

- long-term employment growth scenarios for Glasgow, Edinburgh and Aberdeen
- long-term car, rail and bus cost growth factors for 2023/24 and 2043.

Costs and total transport demand for 2012 and 2018 were derived from Central Scotland Transport Model¹ (CSTM) morning peak dataset for Glasgow and Edinburgh; costs and total transport demand for Aberdeen were taken from the Transport Model for Scotland² (TMfS) morning peak dataset. The Glasgow/Edinburgh model was calibrated to CSTM rail demand for 2012 and 2018, while the Aberdeen model was calibrated to TMfS forecast rail demand forecasts – also for 2012 and 2018.

The high-growth (PGS for Glasgow and Aberdeen, PI for Edinburgh) scenarios have been employed to test whether the network has sufficient capability to deliver the Conditional Outputs. The full range of scenarios has been employed to test the economic case for options developed to address network capability shortfalls.

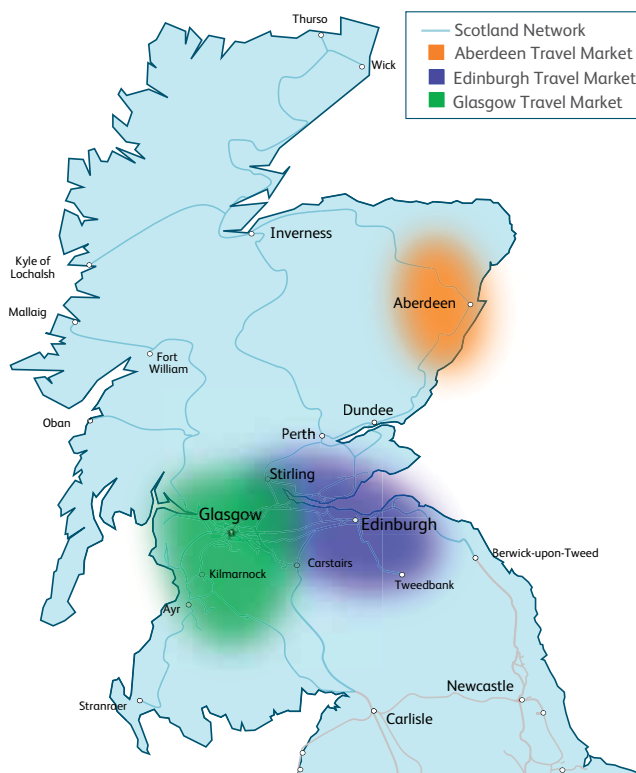


Fig 3.4: Geographical reach of travel markets in Scotland

1 CSTM is a multimodal transport model covering the Central Belt of Scotland

2 TMfS is a multimodal transport model covering most of Scotland

Key findings of the Scotland Market Study¹

Glasgow Morning Peak Commuter Market

| Scenario | Growth factor 2012-23 | Compound Annual Growth Rate 2012-23 | Growth factor 2012-43 | Compound Annual Growth Rate 2023-43 |
|--------------------------------|-----------------------|-------------------------------------|-----------------------|-------------------------------------|
| Prospering in Global Stability | 39% | 3.0% | 128% | 2.5% |
| Prospering in Isolation | 26% | 2.1% | 74% | 1.6% |
| Struggling in Global Turmoil | 21% | 1.8% | 28% | 0.3% |
| Struggling in Isolation | 15% | 1.2% | -4% | -0.9% |

Fig 3.5 High-level summary of Scotland Market Study results for Glasgow Morning Peak Commuter Market

¹ Demand forecasts disaggregated to a corridor level are contained in Appendix 2 for all markets

Glasgow Morning Peak Commuter Market

Glasgow has a mature commuter market served by a well-developed rail network and as a consequence rail already has a relatively high market share on many routes into the city centre. This is because most major residential areas already have access to relatively high frequency rail services and journey times by rail are relatively competitive compared to the private car or bus.

The principal enhancement to the network in and around Glasgow in the current funding cycle is the Edinburgh to Glasgow Improvements Programme (EGIP). This scheme has been developed to reduce end-to-end journey times and to increase capacity per train rather than to expand the network or to increase service frequency.

Compared to those enhancements in recent years where the network has expanded (such as Airdrie-Bathgate or Borders), EGIP represents an incremental (albeit significant) improvement to the rail 'offer' on the core Edinburgh-Glasgow route rather than opening up an entirely new market to rail.

Given that the planned improvements to the M8 east of Glasgow will improve competitiveness of car on some rail corridors to the east of the city, the relative stability of the rail 'offer' means that demand growth in the morning peak up to 2023/24 is likely to be driven more by a growth in the overall size of the market for travel (i.e. a growth in city centre employment) than by a significant increase in rail's share of that market.

The high-growth 'Prospering in Global Stability' (PGS) scenario represents a view of the future consistent with significant growth in city centre employment in Glasgow, subject to equity and environmental constraints, and assumes that this growth is explicitly promoted by governments.

Following the publication of the draft for consultation Scotland Route Study, the high growth employment scenario was revised downwards for the period between 2018 and 2023/24.

The reason for this downwards revision is that more detailed evidence on the industrial composition of the city centre economy in Glasgow became available. Scenarios could therefore be applied at an industry level instead of an economy level (i.e. applying

headline scenarios to the TELMoS¹ estimate). This means that the narrative linking current employment levels and scenario employment levels are more credible.

Beyond 2023/24, growth is less dependent on city centre employment growth than it was in the Draft for Consultation figures. Road congestion in particular is envisaged to become a more significant problem in the high growth scenarios, and it is these factors in combination which are driving overall annual demand growth rates up from the 1.8% published in the draft to 2.5%.

Under the other scenarios, employment and congestion effects are assumed to be much weaker. Under these scenarios demand growth remains positive overall up to 2023/24, falling thereafter in the weakest "Struggling in Isolation" scenario.

It should be noted that the results presented here are aggregate findings: these mask sometimes significant differences between corridors within the overall Glasgow commuter market. On some corridors (for example, the Inverclyde, Ayrshire and Argyle Lines) demand significantly exceeds the overall market growth rates whilst in others (for instance the Anniesland to Glasgow Queen Street via Maryhill corridor) demand growth is far less than the market-level forecast.

¹ TELMoS (Transport and Economic Land-use Model of Scotland), provides independent demographic planning and economic forecasts which form the basis for future travel demands. It underpins many of the assumptions on which both CSTM and TMfS are based.

Edinburgh Morning Peak Commuter Market

The rail commuter market into Edinburgh is less mature than it is in Glasgow. The inner suburban market in Edinburgh is dominated by bus (and more recently tram); the commuter rail market into the city is much more focussed on connecting outer suburbs with both the city centre and with major employment centres to the west of Edinburgh.

Recent extensions to the rail network serving Edinburgh have opened up significant new markets to the west and the south of the city. The Airdrie-Bathgate line opened in 2010, significantly increasing service frequencies into Edinburgh from West Lothian and beyond, whilst the recent reopening of the Borders Railway enables access to the city from the south of the city.

A key aspect of using scenarios is that they enable different types of growth to be modelled. This is particularly useful when contemplating the long term challenges to the rail network as circumstances that may be conducive to strong rail demand growth in Glasgow may not be conducive to driving similar levels of growth in the Edinburgh, and vice versa.

The different constraints on the economies of Scotland's key cities are borne out when comparing the results for Edinburgh under the PGS and PI scenarios.

In Edinburgh, a key factor constraining future rail demand growth in the morning peak is the shortage of development land in central and western Edinburgh, with most potential sites within walking distance of the key railway stations likely to have been developed by 2018 or shortly thereafter.

Given the balance assumed in the PGS scenario between economic growth, equality and environmental considerations, this constrains the potential for employment to grow significantly in those parts of the city centre that are already accessible by rail even allowing for some market-led redevelopment responses to demand in Edinburgh by recycling existing employment locations.

Under PGS, growth into Edinburgh in the morning peak is forecast to be 3.8% pa up to 2023/24 and 1.8% pa thereafter.

By contrast, the environmental constraints that are a pronounced

feature of the PGS scenario are assumed not to be so rigidly applied in the PI scenario as they are in the PGS scenario.

Because of this, the PI scenario is the highest growth scenario between 2023/24 and 2043. Under this scenario, attitudes towards the environment are assumed to be more relaxed, enabling redevelopment of rail-accessible areas of the city centre to take place.

Secondly, the scenario assumes that economic development is less government-led and that Edinburgh's comparative advantage in finance and professional services become more pronounced than they are in the PGS scenario, whilst market share factors (congestion and parking costs) continue to work in rail's favour as in the PGS scenario. Under the PI scenario, rail demand growth in Edinburgh is forecast to grow by 3.7% pa up to 2023/24 and 2.3% pa thereafter.

A key feature of the results in both the high growth scenarios is the role that road congestion and parking are likely to have on the demand for rail into Edinburgh: It the first of these factors in particular that have driven growth post-2023/24 compared to the Draft for Consultation.

Finally, it worth noting how robust they remain in the low-growth scenarios: this reflects two factors: firstly, the economy strikes a balance between diversity and high-value industries. Secondly, the geography of the city prevents car-based commuting from achieving high market shares into many of the key employment areas.

Edinburgh Morning Peak Commuter Market

| Scenario | Growth factor 2012-23 | Compound Annual Growth Rate 2012-23 | Growth factor 2012-43 | Compound Annual Growth Rate 2023-43 |
|--------------------------------|-----------------------|-------------------------------------|-----------------------|-------------------------------------|
| Prospering in Global Stability | 51% | 3.8% | 115% | 1.8% |
| Prospering in Isolation | 49% | 3.7% | 135% | 2.3% |
| Struggling in Global Turmoil | 40% | 3.1% | 52% | 0.4% |
| Struggling in Isolation | 32% | 2.6% | 12% | -0.8% |

Fig 3.6 High-level summary of Scotland Market Study results for Edinburgh Morning Peak Commuter Market

Aberdeen Morning Peak Commuter Market

Aberdeen is a significantly smaller city than either Glasgow or Edinburgh. However, like Edinburgh, Aberdeen has a well-developed, rail connected employment zone outside the city centre (in Aberdeen's case, Dyce). In addition the market for rail during the morning peak is still maturing with significant growth (regularly exceeding 10%) being experienced throughout the last decade, as the impacts of a less restricted housing supply and new transport infrastructure continue to be realised.

The city has only one rail corridor running through the city, and to the south of the city the railway line follows the coast. This geographically constrains the market rail, and the size of the TMFS zones mean that relatively small changes in travel costs into Aberdeen can have disproportionate impacts on forecast demand compared to models for Edinburgh and Glasgow.

This is complicated by the scale of the road and rail infrastructure investment close to Aberdeen planned for delivery by 2018/19. Road connectivity around Aberdeen is due to improve significantly as a result of Aberdeen Western Peripheral Road (AWPR), while improvements to both the A90 and A96 are also likely to adversely affect rail demand.

However, the rail offer from the north west of the city is also due to improve during CP5 as service frequencies increase. Road improvements are unlikely to greatly improve journey times to the city centre and Dyce/Aberdeen Airport for those commuting in from Inverurie. It is the inclusion (on the basis of a desktop review of recent rail demand in this area) that drove the inclusion of zones around Dyce and Aberdeen Airport in the modelling: these zones are a major destination for inbound commuting, and are less constrained in terms of land than Aberdeen City Centre.

Consequently, under the highest growth scenario, demand is forecast to increase at a rate of 4.0% up to 2023/24 and 3.8% between 2023/24 and 2043.

A key finding of the modelling that has been carried out to support the Scotland Market Study is that rail demand into Aberdeen in the morning peak is likely to be less sensitive to employment growth than had been previously thought.

This is particularly worthy of note, because the employment market in Aberdeen is far less diverse than both Edinburgh and Glasgow (although more focussed on high-value occupations than Glasgow) and therefore potentially more susceptible to extreme employment outcomes across the four scenarios.

Under the lowest growth “Struggling in Isolation” (SI) scenario, growth up to 2023/24 is forecast to be 1.7% pa and growth between 2023/24 and 2043 to be -0.8% pa. The reason for this is that under low growth scenarios, rail becomes more competitive as the costs of motoring increase at a higher rate even where the overall market for travel declines.

Aberdeen Morning Peak Commuter Market

| Scenario | Growth factor 2012-23 | Compound Annual Growth Rate 2012-23 | Growth factor 2012-43 | Compound Annual Growth Rate 2023-43 |
|--------------------------------|-----------------------|-------------------------------------|-----------------------|-------------------------------------|
| Prospering in Global Stability | 54% | 4.0% | 226% | 3.8% |
| Prospering in Isolation | 47% | 3.5% | 163% | 3.0% |
| Struggling in Global Turmoil | 24% | 1.9% | 21% | -0.1% |
| Struggling in Isolation | 20% | 1.7% | 3% | -0.8% |

Fig 3.7 High-level summary of Scotland Market Study results for Aberdeen Morning Peak Commuter Market

Key findings of the Scotland Market Study

Interurban Markets

| Scenario | Growth factor 2012-23 | Compound Annual Growth Rate 2012-23 | Growth factor 2012-43 | Compound Annual Growth Rate 2023-43 |
|--------------------------------|-----------------------|-------------------------------------|-----------------------|-------------------------------------|
| Prospering in Global Stability | 49% | 3.7% | 197% | 3.5% |
| Prospering in Isolation | 43% | 3.3% | 111% | 2.0% |
| Struggling in Global Turmoil | 39% | 3.1% | 57% | 0.6% |
| Struggling in Isolation | 38% | 2.9% | 30% | -0.3% |

Fig 3.8 High-level summary of Scotland Market Study results for Interurban markets.

Interurban Markets

In the interurban model, residential population is the principal driver of the size of the overall travel market.

Forecasts from the model have been produced for corridors into the following destinations:

- Glasgow
- Edinburgh
- Aberdeen
- Inverness.

Dundee, Stirling and Perth are located within these corridors and demand growth into these key locations is factored into the forecasts.

Interurban demand has been forecast using inter-peak cost, distance and journey time assumptions from TMfS, and reflect Transport Scotland's policy (as expressed in the ScotRail franchise agreement) of applying an RPI-1% uplift to off-peak ticket prices over the course of the current ScotRail franchise up to 2024.

Since the publication of the Draft for Consultation Scotland Route Study, the market size assumptions have been significantly revised. The main areas of revision relate to population growth and on addressing weaknesses in some of the principal market share assumptions.

In the Draft for Consultation document, population growth was applied at a uniform rate across Scotland. This assumption has been updated to reflect the likelihood that population growth will be highest where economy (and therefore employment growth) is likely to be the most buoyant. In addition, increases in travel times are likely to be most acute in-and-around the largest urban areas.

The highest growth scenario is Prospering in Global Stability (PGS). Under this scenario, high economic (and therefore population) growth is combined with government policies intended to achieve modal shift away from road and onto rail.

So, despite significant investment in roads up to 2018/19 (e.g. Queensferry Crossing, M8 upgrade and A90/A96/AWPR), city

centre-to-city centre journey times by road are assumed to increase over time as a result of increased congestion, and fuel prices are assumed to increase relative to rail ticket prices.

When these factors are combined, the overall result in the highest growth (PGS) scenario is that the high growth previously forecast up to 2023/24 has now been pushed back resulting in much stronger growth post-2023/24.

The RPI-1% fares assumption is common to all scenarios up to 2023/24. Following on from that point, many of the factors that drive the PGS are common to the PI scenarios, albeit that population growth in the west of Scotland (where 40% of Scotland's population currently resides) and assumed congestion are lower in the PI scenario than they are in the PGS scenario.

Under the lower two scenarios, the interesting point to note is that not all low growth assumptions lead to low rail market low rail demand growth: relatively high fuel and non-fuel costs lead to relatively high rail market shares in the lowest growth SI scenario even where the overall market for travel is somewhat depressed.

Key findings of the Scotland Market Study

Rural Markets

| Scenario | Growth factor 2012-23 | Compound Annual Growth Rate 2012-23 | Growth factor 2012-43 | Compound Annual Growth Rate 2023-43 |
|--------------------------------|-----------------------|-------------------------------------|-----------------------|-------------------------------------|
| Prospering in Global Stability | 61% | 4.4% | 158% | 2.4% |
| Prospering in Isolation | 61% | 4.4% | 137% | 2.0% |
| Struggling in Global Turmoil | 61% | 4.4% | 97% | 1.0% |
| Struggling in Isolation | 61% | 4.4% | 72% | 0.3% |

Fig 3.9 High-level summary of Scotland Market Study results for Rural markets.

Rural Markets

Rural Market forecasts were based mainly on the forecast passenger outputs from Abellio's successful bid for the ScotRail franchise. The markets considered were:

- West Highland & Oban
- Kyle & the Far North
- Glasgow & South West
- Stranraer.

The model reflects Transport Scotland's policy that ScotRail should seek to fill spare capacity on rural routes throughout the period of the franchise. Unlike the morning peak commuter and the interurban forecasts (which are based on mode-choice models), the model developed by ScotRail is elasticity-based up to 2026/27 with allowances made for population growth, GDP growth and 'soft' factors. For this reason, forecast growth is identical in all four scenarios up to 2023/24. Post-franchise growth is based on the market size population scenarios.

Applying post-franchise growth to a franchise forecast which is largely policy-led (i.e. the RPI-1% fares policy) risks overstating the growth that is likely to occur in practice. This is because the objective of the franchise is to generate demand to fill spare capacity. In line with the interurban forecasts, the rural forecast results are presented with this caveat.

Demand is likely to vary significantly on rural routes depending on the size and make-up of the populations served and the extent to which the rail service is integrated with locally significant demand drivers such as schools and hospitals. Over the last few years, the number of services on certain rural corridors has grown. During 2014, the number of weekday services between Oban and Glasgow doubled, and additional Sunday services were provided. During 2015 the services to Stranraer were also strengthened.

Demand may also vary depending on the extent to which demand reflects a seasonal tourist market. Analysis has been undertaken to determine how seasonal demand for each rural market is distributed across the year, compared to the available capacity. Consequently demand is forecast to vary significantly between

routes, but may also vary significantly within routes depending on the season or the time of day. Further details are available in Appendix 2.

2043 Indicative Train Service Specification

Analysing the Connectivity Conditional Outputs

The Connectivity Conditional Outputs which have been developed are represented in the 2043 Indicative Train Service Specification (ITSS). This is one way in which the Connectivity Conditional Outputs could be delivered and it is the method with which the current network is tested.

In the west of Scotland, the service frequency of the suburban commuter market is relatively high already; therefore the Connectivity Conditional Outputs do not provide a step change in connectivity. However, even a small increase on a number of corridors into Glasgow Central can have a significant impact on the capacity of the terminal station.

In contrast, the 2043 ITSS proposes a step change in connectivity on the interurban market in Scotland East.

Figure 3.10 is an extract of the ITSS for the Aberdeen area. Each line represents a service an hour, and shows an increase in connectivity into Aberdeen from Dundee and Inverurie/Keith/Inverness. This provides not only increased commuting opportunities but also greater connectivity with key cities such as Inverness and Dundee.

A full list of Connectivity Conditional Outputs and the full 2043 ITSS can be found in Appendix 2.

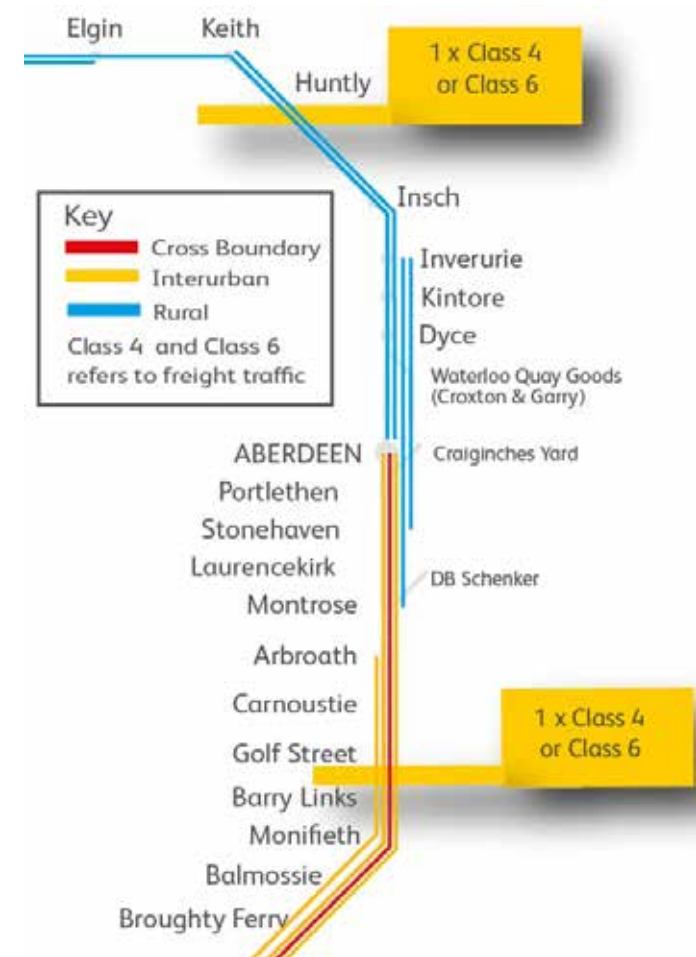


Fig 3.10: Detail of 2043 Indicative Train Service Specification – potential services around Aberdeen

Comparing forecast demand to network capacity

The estimated growth rates for passenger demand in each corridor are key inputs into the scheme appraisals, enabling future socio-economic benefit streams to be estimated and compared to costs. For producing capacity-related Conditional Outputs, however, it is necessary to compare forecast passenger numbers with the train service and rolling stock assumptions for the end of CP5 and identify where the train capacity proposed for the end of Control Period 5 will be insufficient to meet the demand forecast for 2023/24 and 2043. In some cases, the Connectivity-related Conditional Outputs will be sufficient to meet any excess demand.

As an example, figure 3.11 illustrates the impact forecast passenger growth up to 2043 would have on part of the Morning Commuter Market in Glasgow should no infrastructure or service enhancements be undertaken. Similar issues will be seen across the Scottish network.

A list of the demand forecast results is included in Appendix 2.

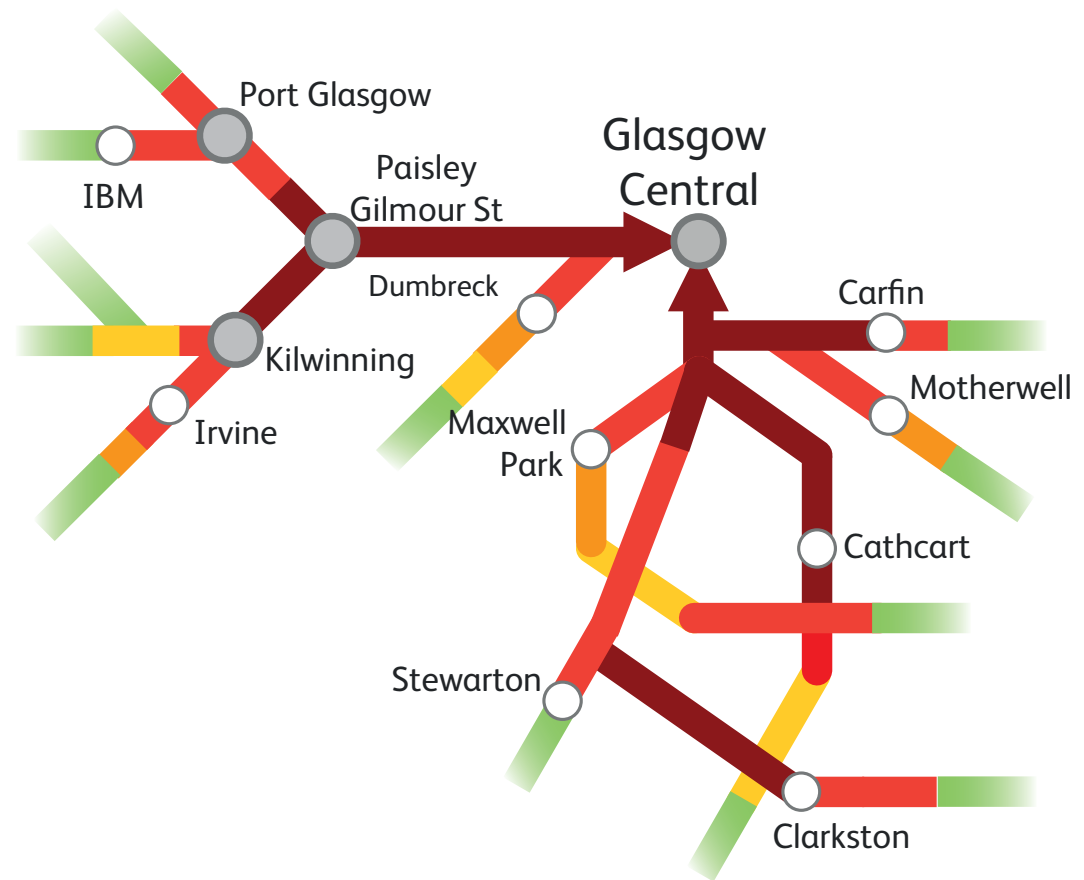
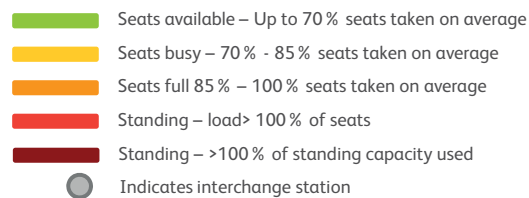


Fig 3.11: Forecast passenger demand in 2043 compared to baseline capacity without infrastructure or service enhancements at Glasgow Central High Level Station (08:00 – 09:00)

Introduction

This chapter contains the long term development strategy for the railway in Scotland and identifies where and when key decisions are likely to be required.

The rail industry developed the 2043 Indicative Train Service Specification (ITSS) in the context of the conditional outputs identified in the GB-wide Market Studies and the Scotland Market Study. The next step was to determine whether the baseline infrastructure was capable of delivering the 2043 ITSS: if the ITSS service level exceeded the infrastructure capability, the Route Study Technical Working Group identified the gap and potential options to address it.

A prioritisation process was then consistently applied to the initial list of potential options, utilising demand forecasts, timetable development and a view of deliverability, cost and outputs it delivered. This created the 2043 options identified in Appendix 6.

The seven groupings of Scotland routes where changes will be required to support the delivery of Conditional Outputs are:

- Edinburgh Waverley and Haymarket to Glasgow Queen Street (High Level) and Fife
- Edinburgh Waverley and Anglo Scottish Routes from Slateford to Berwick-upon-Tweed

- Glasgow Central High Level and associated lines, including the West Coast Main Line to Carlisle and from Carstairs to Haymarket
- Glasgow Queen Street High Level to Aberdeen / Inverness
- Strathclyde commuter network
- Aberdeen to Inverness
- The Far North Line.

All other routes are deemed to be capable of delivering the 2043 ITSS.

There are a number of projects that are being developed by external organisations that may, depending on the outcome of the necessary development appraisal work, have the potential to interface with the existing rail network in Scotland. Whilst Network Rail continues to work with relevant project proposers, no specific schemes have been included within this Route Study resulting from such activity. Any projects to extend the network need to take account of upgrades to the existing infrastructure required as a consequence of those projects.

| Drivers of change | Typical interventions |
|---|--|
| <ul style="list-style-type: none"> • Growth in passenger numbers – ‘high growth’ demand scenarios forecast passenger numbers to double on many busier routes, and at major terminal stations in Scotland | <ul style="list-style-type: none"> • Longer trains – platform lengthening and station capacity • Network capacity – delivering more frequent services • Additional passenger and circulating capacity at stations |
| <ul style="list-style-type: none"> • Scottish Government aspirations for faster journey times, electrification and improved connectivity | <ul style="list-style-type: none"> • Network capacity – more frequent services and optimised timetabling of intercity limited stop services versus local stopping services • Linespeed improvements |
| <ul style="list-style-type: none"> • Long Distance Market Study findings – more cross-border passenger services, HS2, longer trains and faster journey times | <ul style="list-style-type: none"> • Network capacity – more frequent services • Linespeed improvements • Longer trains – with implications for major stations |
| <ul style="list-style-type: none"> • Freight Market Study findings – more cross-border intermodal services, longer and larger gauge trains | <ul style="list-style-type: none"> • Network capacity • Electrification |

Edinburgh Waverley to Glasgow Queen Street (High Level) and Fife

Strategic context

- Accommodating forecast demand – more services and/or longer trains
- Further electrification of Scottish routes.

The rail network linking Edinburgh to Glasgow, Perth and Dundee is a core component of the Scottish network. It delivers fast journey times between cities, freight capacity and local connectivity for commuting, business and leisure markets.

To meet all the forecast demand and connectivity conditional outputs, the network may require some significant and large-scale interventions. To deliver best value there are likely to be choices around changes to train service design, and ensuring that the infrastructure capability is optimised to deliver multiple beneficial outcomes. The strategies chosen to provide additional capacity will be critical in determining the design and timing of future interventions.

Providing a more flexible and resilient network that meets the requirements of fast passenger services, local stopping services and freight services is key. Addressing major capacity constraints such as; Newbridge Junction; between Haymarket West Junction and Inverkeithing; and Ladybank to Hilton single-track section, will increase capacity and flexibility, improve timetabling and achieve strategic outcomes of better connectivity and reduced journey times.

In the context of wider network development, to reduce the impact on passengers and freight users and to minimise costs, there is an opportunity to address these underlying capacity issues before electrifying the network through Fife (as set out in the Scottish Government's Strategic Transport Projects Review). This will result in the maximum benefits being realised when the routes are electrified.

Strategic discussion

The route between Haymarket West and Haymarket East Junctions is a busy four-track railway, comprising the North Lines (from Fife) and the South Lines (carrying Edinburgh / Glasgow and Airdrie-Bathgate services).

The routing of trains approaching Haymarket West Junction is not well balanced, and some trains have to cross from the South to the North Lines before they reach Haymarket Station. This constrains capacity on the South Lines for traffic to and from Carstairs and the West Coast Main Line. Further crossing moves are often required in Princes Street Gardens to allow trains to access platforms at Edinburgh Waverley, a situation complicated further by Empty Coaching Stock (ECS) moves to/from Haymarket Depot at certain times of day.

The Scotland Route Study has concluded that the key to running more trains to and from Edinburgh Waverley, from the West and North, is to optimise the flow of trains approaching Haymarket and minimise the number of crossing moves. Running longer trains to and from Edinburgh Waverley as part of the output specification will help minimise the need for further infrastructure interventions in the Haymarket area or Princes Street Gardens.

Given the number of platforms at Edinburgh Waverley, the importance of the timing and sequencing of future electrification of routes to Fife, Aberdeen and Inverness is less prescriptive than at Glasgow Queen Street (High Level). Using more interchangeable rolling stock across electrified routes will assist in minimising platform occupancy times as, for example, an incoming train from Glasgow Queen Street could depart as a service to Glasgow Central or Perth.

This, in the context of the projected increase in cross-border services (including HS2), needs to be factored into optimising the number of “through” and “bay” platforms, and the mix of platform lengths to minimise the cost and extent of interventions within the confines of Edinburgh Waverley.

Maintaining sufficient space to enable passengers to safely and easily move around Edinburgh Waverley is a major consideration, as additional “through” platforms would create multiple island platforms which may be challenging for passengers to access at peak times.

The section of route between Inverkeithing and Haymarket is already congested, and the 2043 Conditional Outputs indicate that additional services will be required to meet forecast demand and provide improved connectivity. Scottish Government aspirations are

for faster train services between Edinburgh and Aberdeen/ Inverness. Providing an additional route through Fife would create the opportunity to timetable the freight and stopping passenger trains on different lines from limited stop passenger trains, thereby creating additional capacity and offering the ability to reduce journey times by approximately 5-10 minutes (depending on stopping patterns).

Sequencing infrastructure enhancements to minimise disruption to customers and reduce overall costs should be considered at a corridor level. This will also contribute to optimal phasing of interim benefits throughout the process of delivering the overall outputs.

The Strategic Transport Projects Review, published by Scottish Ministers' in 2008 identifies their aspiration to electrify the rail network in Scotland. By the end of CP5, the railway between Edinburgh and Glasgow (via Falkirk High and Falkirk Grahamston and including the Grangemouth Branch), between Glasgow Queen Street and Stirling / Dunblane / Alloa, and the Shotts Line between Holytown and Midcalder Junction, will have been electrified. In order to minimise the overall cost and disruption associated with future electrification and to maximise the benefits gained from capital investment there are a number of key enablers that should be delivered in advance of future electrification. Renewing and upgrading the signalling (in preparation for the Digital Railway) to provide greater capacity, will avoid significant consequential signalling immunisation costs. Altering the gauge clearance of crucial structures and remodelling strategic junctions in advance of electrification will enable the junctions (and related track alignments) to be electrified in a layout appropriate for future network requirements.

Enabling works for the electrification of the network north of Haymarket such as Forth Bridge, North Queensferry Tunnel, Kinghorn Tunnel, enhancement of Ladybank to Hilton single line and strengthening of the Tay Bridge should also be considered, at least five years in advance of overhead lines being installed.

The tables that follow outline examples of the strategic interventions identified in the Route Study, including key enabling and linked enhancements that will contribute to delivering the network capabilities proposed for 2043.

Edinburgh Waverley to Glasgow Queen Street (High Level) and Fife

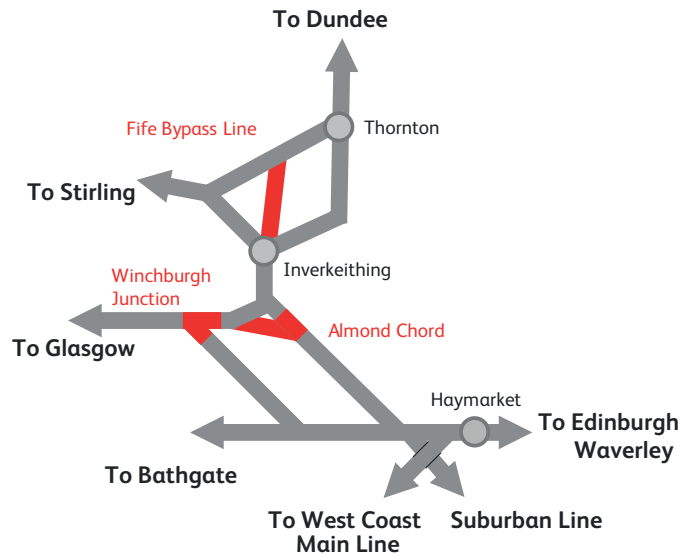


Fig 4.1:- Edinburgh Waverley to Glasgow / Fife proposals

| Fife bypass line | |
|------------------|--|
| Summary | This intervention proposes construction of a new section of railway, running close to the M90 for approximately five miles. New junctions will be required, one between Inverkeithing and Dalgety Bay, and another in the vicinity of Halbeath. Related works are likely to be required in the Cowdenbeath area for higher linespeeds and an upgrade of Thornton North Junction to accommodate the revised routing of the interurban traffic. |
| Benefits | Scottish Government aspirations are for faster train services between Edinburgh and Aberdeen / Inverness. Providing an additional route through Fife will create the opportunity to timetable the stopping/freight and limited stop services on separate lines, thereby creating additional capacity and offering the ability to reduce journey times by approximately 5-10 minutes (depending on stopping patterns). |
| Outputs | Contributes towards EC06, IC06, IC07, IC08, IC09 and 1 class 4 or 1 class 6 freight path per hour. |

| Winchburgh Junction grade separation + Almond Junction | |
|--|---|
| Summary | This option proposes the grade separation of Winchburgh Junction and the creation of a chord line and grade separated junction at Almond to connect the main Edinburgh –Glasgow and Fife lines running to/from Edinburgh. The new junctions and section of line between Winchburgh and Haymarket would be electrified. |
| Benefits | This intervention would enable some Edinburgh/Glasgow and Edinburgh/Dunblane services to run to/from Edinburgh without crossing between the North and South Lines in the Haymarket or Princes Street Gardens areas. This would improve the interface with West Coast Main Line services on the approaches to Edinburgh Waverley and the capacity for Empty Coaching Stock to/from Haymarket Depot, allowing more passenger services to run to/from Edinburgh. It provides an alternative route avoiding Newbridge Junction, minimising the timetable impact of a potential new station at Winchburgh, and offers the opportunity for selected Edinburgh/Glasgow services to call at Edinburgh Gateway. This intervention helps avoid the need for large scale interventions to improve capacity and infrastructure flexibility between Newbridge Junction and Haymarket, and limits the scope of platform reconfiguration/lengthening works at Edinburgh Waverley and enhancements in Princes Street Gardens. It would also provide an enhanced gauge route for freight (avoiding Winchburgh Tunnel). |
| Outputs | Contributes towards CC01, CC06, EC05, EC06, IC10, IC11, IC12 and IC13. |

Edinburgh Waverley to Glasgow Queen Street (High Level) and Fife

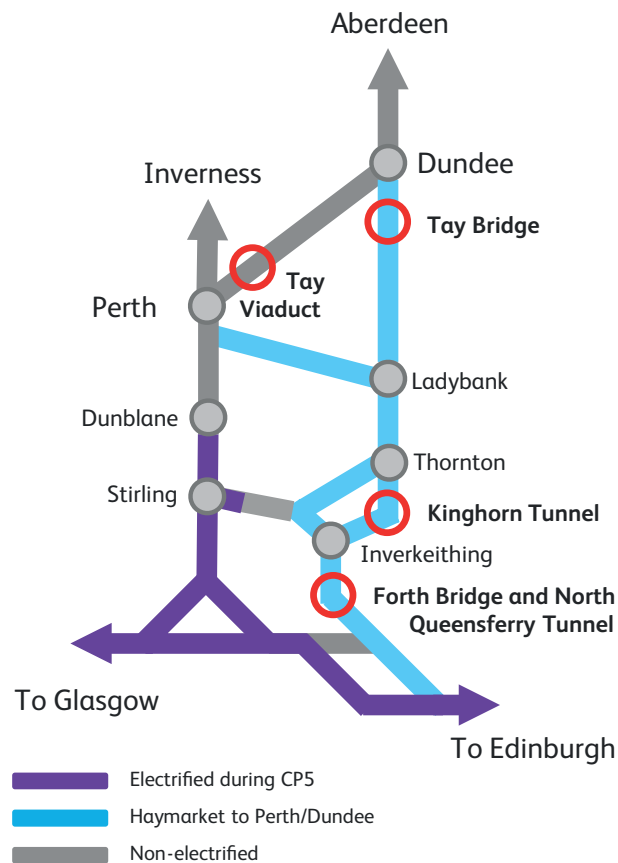


Fig 4.2:- Electrification staging to Perth/Dundee

| Electrification | |
|--------------------------------|---|
| Summary | Electrification of the network between Edinburgh and Perth/Dundee, including challenging structures such as the Forth Bridge, North Queensferry Tunnel, Kinghorn Tunnel and the Tay Bridge. Independently Powered Electric Multiple Unit (IPEMU) / bi-mode could be considered once further development work has been undertaken, as an option to reduce the scope and cost of route clearance works. |
| Benefits | <p>This intervention is proposed, in conjunction with other infrastructure enhancements, to increase the capacity on the interurban network to meet forecast demand and connectivity and contribute towards Scottish Government environmental targets for carbon reduction.</p> <p>Linked to electrification of Dunblane to Dundee, and Dundee to Aberdeen and enhancing Tay Viaduct (Perth).</p> <p>Consideration to be given to depot and stabling facilities for electric rolling stock as the proportion of electrified routes in Scotland increases.</p> <p>Additional feeder station capacity is likely to be required to supply power to the newly electrified routes.</p> |
| Outputs | Contributes towards EC05, EC06, IC06, IC07, IC08, IC09, 1 class 4 or 1 class 6 freight path per hour, and future improved freight gauge on these routes. |
| Edinburgh Waverley Enhancement | |
| Summary | <ul style="list-style-type: none"> • Doubling of Calton North Tunnel and remodelling of Waverley East approaches • Longer platforms • Additional “through” platforms • Creation of a mezzanine level in Edinburgh Waverley. |
| Benefits | <p>To facilitate more and longer local and Anglo Scottish services. Creation of a mezzanine level for safe and easy station navigation and relocated retail/passenger facilities to allow more platform capacity for trains.</p> <p>Transformation required, as the existing station layout will become increasingly congested given forecast growth in passenger numbers on Anglo Scottish and Scotland routes by 2043.</p> <p>Enhancement of Winchburgh Junction/Almond Junction and the Edinburgh Suburban Line reduces the quantum and cost of enhancements required at Edinburgh Waverley.</p> |
| Outputs | Contributes towards CC01, CC05, CC06, CC10, EC01, EC02, EC03, EC04, EC05, EC06, EC07, EC08, IC06, IC07, IC08, IC09, IC10, IC11, IC12, IC13, LDC01, LDC03, LDC04, LDC05, LDC06, LDC07, LDC013, LDC014, LDC016, LDC017, LDC018, LDC019, LDC020, LDC026 and LDC027. |

Edinburgh Waverley and Anglo Scottish Routes from Slateford to Berwick-upon-Tweed

Strategic context

- Accommodating growth in long distance passenger and freight traffic as well as demand for local commuter services on the East Coast Main Line (ECML)
- Improving diversionary route capability
- Integration with High Speed 2 (HS2)
- Availability of platforms for terminating and through services
- Improving passenger experience (i.e. pedestrian flow/ facilities).

The demand for long distance passenger trains on the ECML is forecast to increase significantly by 2043, as is demand for commuter and regional services from East Lothian and the Borders. Anglo Scottish freight demand is also predicted to increase. Improved capacity on the existing two track ECML will be required to accommodate the additional services while providing acceptable journey times and levels of connectivity on this route that address the conditional outputs.

Providing a flexible and resilient network that can consistently and robustly meet passenger and freight demand is a key consideration for Anglo Scottish connectivity. The capability to provide appropriate diversionary routes (with capacity to keep trains running during planned or unplanned disruption) is also considered in the Scotland Route Study.

HS2 will accommodate a step change in capability for Anglo Scottish routes, but its outputs and timescales are still in development. For the purposes of the Scotland Route Study, assumptions are consistent with the current published business case i.e. that HS2 services from London run via WCML routes to Glasgow/Edinburgh. The Scotland Route Study addresses potential alternative scenarios for HS2 integration with the railway network in Scotland, and the wider implications of these scenarios.

Edinburgh Waverley was used by over 21 million passengers in 2014/15, a figure that is forecast to continue to rise up to 2043, requiring more capacity delivered by a combination of longer and additional.

Extending platforms or creating new ones to meet forecast demand

will reduce the current space available for passenger circulation and facilities in the station. The increase in passenger numbers and potential reduction in concourse space suggests that a major redevelopment of Edinburgh Waverley will be required in the medium to long term (2029-2043).

The optimal configuration of platforms at Edinburgh Waverley will be driven by a number of inter-linked factors, including the number and length of terminating and through services, and which lines they are approaching from. This means that capacity within Edinburgh Waverley is influenced by the network infrastructure design and capability from Newbridge and Inverkeithing from the West, and from Drem in the East.

As a consequence, the capacity and flexibility of the rail infrastructure approaching Edinburgh Waverley has been assessed, in addition to the infrastructure within the station itself, to determine the optimal solution to deliver the 2043 conditional outputs.

Strategic discussion

In order to meet all the 2043 capacity, connectivity and freight Conditional Outputs on the ECML, key junctions are likely to require remodelling, with complementary enhancements to related infrastructure to maximise benefits. Moving a number of intermediate stations on to loops and encouraging more electric-hauled freight will assist in meeting the 2043 Conditional Outputs; however additional infrastructure would be required to accommodate them robustly. Timetable analysis undertaken by Network Rail on behalf of the Office of Rail and Road demonstrated that the existing capacity on the ECML will not meet industry requirements by the end of Control Period 6. Significant growth is forecast for commuter services into Edinburgh Waverley which cannot not be met by 2043 simply through lengthening existing services. Additional local services are likely to be required, and there is insufficient capacity to support delivery without enhancing the existing two track railway north of Berwick to provide opportunities for limited stop cross-border services to overtake freight and local stopping services. Timetable or rolling stock solutions alone do not provide sufficient capacity. The current published HS2 business case assumes HS2 service run via the West Coast Main Line to Edinburgh

and Glasgow. Consequently the 2043 Indicative Train Service Specification only includes three cross-border trains per hour to “non-London” destinations. Should this assumption be amended and cross-border services increase on the ECML, further infrastructure enhancements may be required.

The current published HS2 business case also assumes that from 2026 HS2 trains will be 200 metres in length. From 2033 they will be 400 metres in length and it is proposed to split and join them in the vicinity of Carstairs Junction. This will allow a 200 metre long train to operate to Edinburgh Waverley and a further 200 metre long train to Glasgow Central. If splitting and joining does not take place at Carstairs, or any other location, then Edinburgh Waverley and Glasgow Central would have to accommodate 400 metre long trains. There would be a significant impact on capacity for both stations and would necessitate major investment, with consideration of options including a new station in Glasgow and the implications for redevelopment of Edinburgh Waverley.

Edinburgh Waverley not only serves terminating long distance, interurban and local services, but also “through” services, all of which vary significantly in frequency and length. A combination of longer bay platforms (east and west), additional “through” platforms and optimising the approaches (both from the east and the west to allow the smooth flow of trains into Edinburgh Waverley) will minimise the need for significant enhancements within the station in the short to medium term. An enhancement of Calton North Tunnel and the eastern approach to Edinburgh Waverley would provide more flexible access to east-facing platforms.

Considering network capacity around Edinburgh, the Edinburgh Suburban line is a key strategic route on the Anglo Scottish network, as it currently allows diesel freight to avoid Edinburgh Waverley and provides a diversionary route for diesel passenger trains if access to Edinburgh Waverley is restricted. At present the only electrified route between the ECML and WCML is through Edinburgh Waverley.

The Edinburgh Suburban line does not have the capability to carry the forecast growth in freight or offer a viable diversionary route for cross-border services during planned or unplanned disruption. Building on the gauge enhancement delivered in 2016 to facilitate larger freight wagons, and to minimise costly enhancements within

the confines of Edinburgh Waverley, electrifying and enhancing the route between Portobello Junction and Slateford Junction provides a local and cross-border diversionary route, facilitates growth in electric-hauled freight services on the ECML as well as local and cross-border services to 2043. If freight services running via the Edinburgh Suburban line convert to electric traction this will improve capacity on the WCML between Slateford and Midcalder, a benefit of their superior performance when climbing up towards Midcalder Junction and Carstairs. It will also significantly improve capacity on the ECML as a result of superior rolling stock performance.

The Scotland Route Study has considered the implications of routing additional freight on the ECML from the port of Felixstowe and the South instead of the WCML. It also takes into account potential implications of continual Anglo Scottish passenger demand from London and the South via the ECML. Timetable development studies have determined that significant enhancement of the existing infrastructure would be required to accommodate the 2043 ITSS on both the ECML and WCML therefore there is little benefit from varying the routing of Anglo Scottish freight in isolation.

The tables that follow outline examples of the strategic interventions identified in the Route Study, including key enablers and linked enhancements that will contribute to delivering the network capabilities proposed for 2043.

Edinburgh Waverley and Anglo Scottish Routes from Slateford to Berwick-upon-Tweed

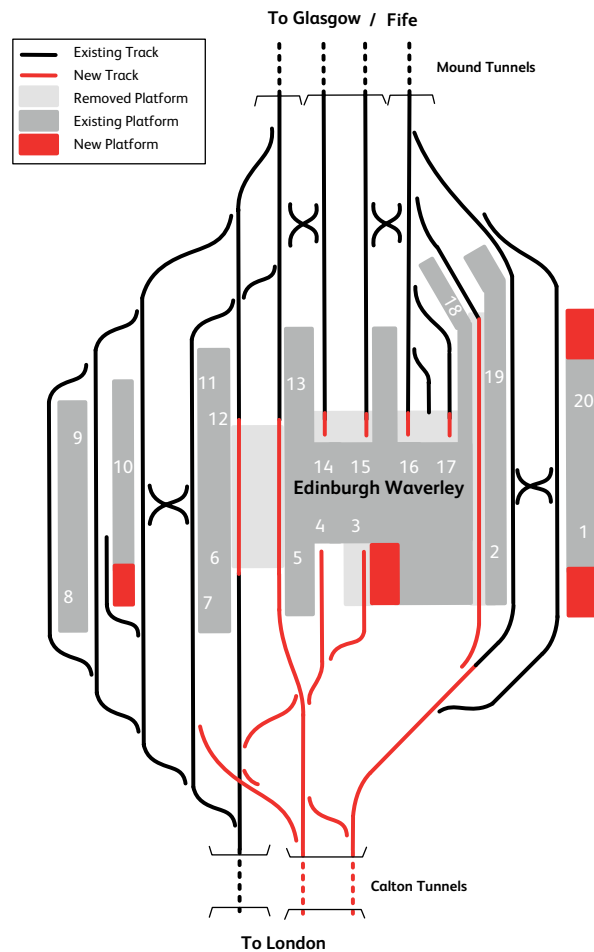
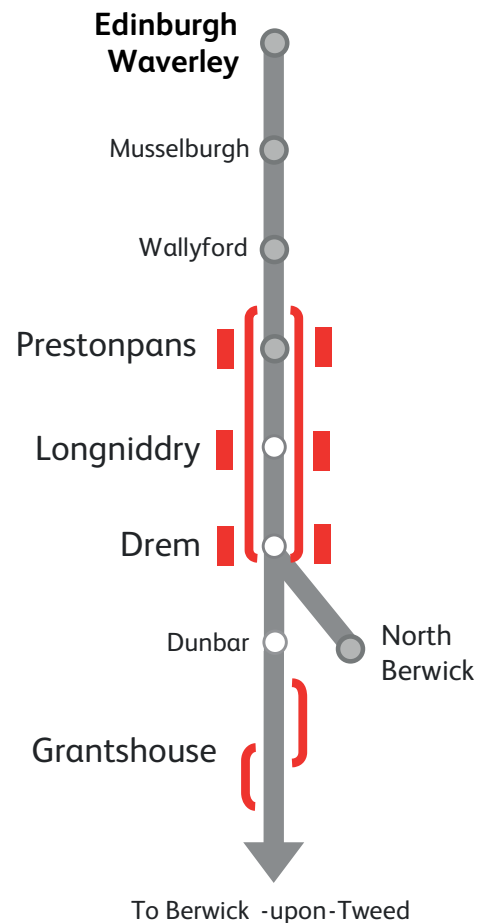


Fig 4.3:- Edinburgh Waverley Enhancement

| Edinburgh Suburban Line Enhancement Programme | |
|---|--|
| Summary | Remodelling of Portobello, Slateford and Niddrie West single lead junctions, upgrade of the signalling capacity, enhancement of the Millerhill through route capabilities (from Monktonhall Junction) in addition to electrification. |
| Benefits | <p>This package of enhancements will provide a robust and fit for purpose link between the East Coast Main Line and the West Coast Main line. It will accommodate forecast electric freight paths (avoiding Edinburgh Waverley), provide appropriate electric diversionary routes for Anglo Scottish and local services (to Dunbar/North Berwick and between Edinburgh and Glasgow via Falkirk High) and provide flexibility on the approaches to Edinburgh Waverley. Electrifying the existing line without further upgrades would provide an electrified link between the ECML and WCML for freight, but not the capacity for it to be used as a diversionary passenger route for ECML and WCML services running to /from Edinburgh Waverley.</p> <p>This builds on the W12 gauge enhancement project and electrification of the Shotts line in CP5 and allows operators to divert electric rolling stock during planned disruption.</p> |
| Outputs | Contributes towards CC01, CC06, EC01, EC02, EC03, EC04, IC010 and 1 class 4 or 1 class 6 freight path per hour |

| Edinburgh Waverley Enhancement | |
|--------------------------------|--|
| Summary | <ul style="list-style-type: none"> • Doubling of Calton North Tunnel and remodelling of Waverley East approaches (as far as Portobello) • Longer platforms • Additional “through” platforms • Creation of a mezzanine level in Edinburgh Waverley to provide sufficient space for passenger circulation and facilities. |
| Benefits | <p>To facilitate more and longer local and Anglo Scottish services. Creation of a mezzanine level for safe and easy station navigation and relocated retail/passenger facilities to allow more platform capacity for trains.</p> <p>A transformation is required, as the existing station layout will become increasingly congested given forecast growth in passenger numbers on Anglo Scottish and Scotland routes by 2043.</p> <p>Enhancement of Winchburgh Junction/Almond Junction and the Edinburgh Suburban Line reduces the quantum and cost of enhancements required at Edinburgh Waverley.</p> |
| Outputs | Contributes towards CC01, CC05, CC06, CC010, EC01, EC02, EC03, EC04, EC05, EC06, EC07, EC08, IC06, IC07, IC08, IC09, IC010, IC011, IC012, IC013, LDC01, LDC03, LDC04, LDC05, LDC06, LDC07, LDC013, LDC014, LDC016, LDC017, LDC018, LDC019, LDC020, LDC026 and LDC027. |

Edinburgh Waverley and Anglo Scottish Routes from Slateford to Berwick-upon-Tweed



| Additional infrastructure on ECML | |
|-----------------------------------|---|
| Summary | <ul style="list-style-type: none"> Capacity enhancement between Abbeyhill Junction and Portobello Junction to enable trains to run closer together (linked to the remodelling of Edinburgh Waverley East throat and Edinburgh Suburban Line Enhancement Programme) 4-tracking between Prestonpans and Drem (including Prestonpans, Longniddry and Drem Stations) Longer loops or dynamic loops in the Grantshouse area (scope dependant on the capacity enhancements achievable at the east end of the corridor). |
| Benefits | <p>Delivered together, these enhancements accommodate more local, Anglo Scottish and freight services in line with 2043 Capacity and Connectivity Conditional Outputs.</p> <p>Taking cognisance of the anticipated population growth in the East Lothian area and the economic benefit of accessing employment and leisure in Edinburgh connectivity would be significantly improved in this area of Scotland.</p> <p>There would be environmental benefits from a freight modal shift from road to rail, in addition to the environmental benefits (and capacity benefits) of electric freight trains in place of diesel trains.</p> |
| Outputs | Contribute towards CC01, CC06, EC01, EC02, EC03, EC04, LDC04, LDC07, LDC012, LDC013, LDC017, LDC026, LDC027 and 1 class 4 or 1 class 6 freight path per hour. |

Fig 4.4:- East Coast Main Line Enhancement

Glasgow Central (High Level) and associated lines, including the West Coast Main Line (WCML) to Carlisle and from Carstairs to Haymarket

Strategic context

- Integration with High Speed 2 (HS2)
- Accommodating growth in long distance passenger and freight traffic as well as more demand for local commuter services that also run on the West Coast Main Line
- Improving diversionary route capability
- Further electrification of Scottish routes
- Accommodating forecast demand into Glasgow Central – more services and/or longer trains.

HS2 will accommodate a step change in capability for Anglo Scottish routes, but its outputs and timescales are still in development. For the purposes of the Scotland Route Study, assumptions are consistent with the current published business case – i.e. that HS2 services run via WCML routes for Glasgow/Edinburgh to London passengers. The Scotland Route Study addresses potential alternative scenarios for HS2 integration with the railway network in Scotland, and the wider implications of these scenarios.

The number of long distance passenger trains on the WCML is forecast to increase by 2043, as is the demand for commuter and regional services. Anglo Scottish freight demand is also expected to increase. Extra capacity on the existing two track rail network will be required to accommodate the additional services, whilst providing acceptable journey times, to accommodate the 2043 Capacity and Connectivity Conditional Outputs.

Providing a flexible and resilient network that can consistently and robustly meet passenger and freight demand is a key consideration for the Anglo Scottish connectivity. Offering diversionary routes with the appropriate capability (i.e. gauge and electrification) and capacity to keep running trains during planned or unplanned disruption is considered in the Scotland Route Study.

Glasgow Central (High Level) was used by approximately 29 million passengers in 2014/15, a figure that is forecast to rise by 2043, requiring more capacity for longer and/or additional trains. One strategy to address this issue is to extend platforms or create new ones to meet forecast demand, though this will reduce the current space available for passenger circulation and facilities in the

station. Expanding the station footprint to extend existing and/or create additional platforms may require the demolition of a number of adjoining buildings, and possibly the reinstatement of the Clyde Bridge (taken out of use in 1967). In light of this, several other options have been developed which would reduce the pressure to expand the existing Glasgow Central (High Level), but some of these alternatives are also likely to be challenging and expensive.

Strategic discussion

The published HS2 business case assumes that from 2026 the HS2 trains will be 200 metres in length. From 2033 they will be 400 metres in length and it is proposed that they will split and join in the vicinity of Carstairs Junction. The existing junction layout cannot currently facilitate these activities in addition to the passenger and freight services forecast to run between Midcalder and Law Junction via Carstairs. Asset condition requires track and signalling renewals to be undertaken throughout the Carstairs area during CP6 and as such it is proposed to remodel Carstairs Junction at that time to reduce journey times, improve freight regulation and reduce asset whole life costs. This proposal does not preclude a future stage that could facilitate improved connections to Edinburgh and potentially the splitting and joining of HS2 services. The industry will continue to work with HS2 Ltd to develop the timetable for their trains and understand how it can be robustly introduced onto the Scottish network. If HS2 services do not split and join, then Edinburgh Waverley and Glasgow Central would need to accommodate 400 metre long trains. This would be a significant change for both stations and would likely require major investment.

There is no timetable solution that can accommodate the 2043 Capacity and Connectivity Conditional Outputs on the current infrastructure. Key junctions would require to be remodelled or grade separated and additional loops and track installed. Moving intermediate stations on to loops and encouraging more electric-hauled freight will assist in providing some additional capacity. However, to deliver the desired quantum of services a significant volume of additional track would be required between the Carlisle and Carstairs.

The Scotland Route Study has reviewed the implications of routing freight on the ECML instead of the WCML from the port of

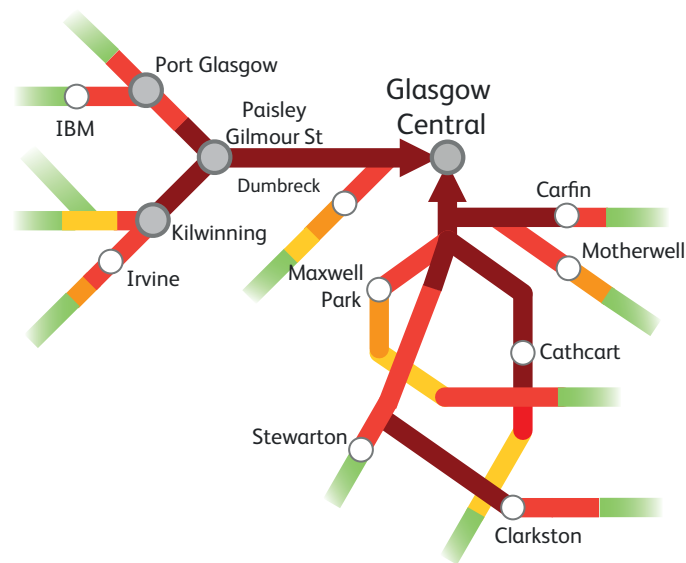
Felixstowe and the south. Additionally, it takes into account potential implications of continued Anglo Scottish demand from the south via the ECML. Changing the routing of two freight services from the WCML to the ECML is not sufficient to remove the requirement to enhance the infrastructure. Similarly, routing two long distance passenger services via the ECML instead of the WCML is also not sufficient to remove the requirement to enhance the infrastructure. It is worth noting that the current ECML cannot accommodate the base 2043 Indicative Train Service Specification.

For Glasgow Central to be able to meet 2043 Conditional Outputs for long distance and commuter services it will need to be adapted to accommodate longer and more frequent trains. Due to changes in the length of modern electric trains, by CP6, a number of the shorter platforms at Glasgow Central will not provide sufficient capacity to meet service requirements and more, longer platforms will be required at the city centre station that is geographically constrained. Enhancements out with the station that allow turnaround times within the station to be reduced should be considered, such as enhancement of corridors to East Kilbride / Barrhead, as minimising platform occupancy times may reduce the requirement for costly enhancements within Glasgow Central. Similarly, reducing the number of splitting and joining moves within Glasgow Central could improve platform utilisation levels and reduce the need for platform extension works in the short to medium term.

Given the range and mix of current train lengths the throat layout is necessarily complex, to provide flexible routing of trains to platforms of the appropriate length. Optimising Glasgow Central capacity and capability is principally focused on providing sufficient platforms to accommodate the trains running on each of the main corridors without having to interact. Consequently the capacity and flexibility of the rail infrastructure approaching Glasgow Central has been assessed as well as the infrastructure within the station confines, in order to determine the optimal solution to deliver the 2043 Conditional Outputs.

The tables that follow outline examples of the strategic interventions identified in the Route Study, including key enabling and linked enhancements that will contribute to delivering the network capabilities proposed for 2043.

Glasgow Central (High Level) and associated lines, including the West Coast Main Line (WCML) to Carlisle and from Carstairs to Haymarket

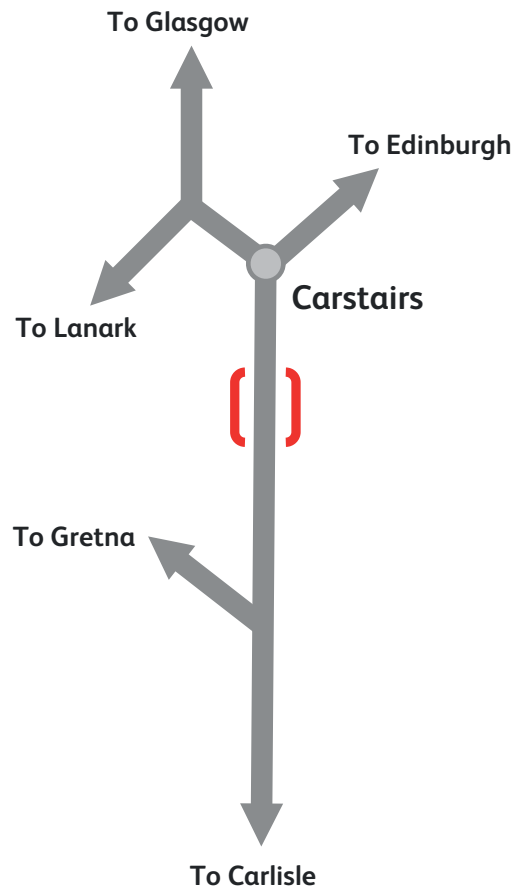


- Seats available – Up to 70 % seats taken on average
- Seats busy – 70 % - 85 % seats taken on average
- Seats full 85 % – 100 % seats taken on average
- Standing – load > 100 % of seats
- Standing – >100 % of standing capacity used
- Indicates interchange station

Fig 4.5:- Forecast demand into Glasgow Central in 2043 during the peak hour (0800 - 0900)

| Glasgow Central (High Level) Capacity Improvements | |
|--|--|
| Summary | <ul style="list-style-type: none"> Extension and remodelling of existing platforms Additional platforms (out with the current footprint) Additional / re-modelled approach lines Consideration of a new Glasgow City Centre Station. <p>Pedestrian flow and retail/passenger facilities within Glasgow Central are a key consideration.</p> |
| Benefits | <p>Passenger demand for Anglo Scottish and local passenger services is forecast to grow substantially in the long term into Glasgow Central High Level. Figure 4.5 shows forecast demand for all corridors into Glasgow Central by 2043 in the peak hour (0800-0900). To accommodate this demand existing services will require to be lengthened in addition to running more trains. This will have a significant effect on the capacity of Glasgow Central High Level.</p> <p>Without investment in this terminal station, trains will not be able to be lengthened (or frequency increased) to accommodate forecast demand with customers being crowded off trains and unable to travel by rail to key employment locations.</p> <p>Enhancements out with the station confines, when combined with timetable solutions, may assist in increasing platform capacity at Glasgow Central. For example enhancing and electrifying the East Kilbride and Barrhead lines, could allow the current extended dwell time at Glasgow Central to be accommodated at East Kilbride/Barrhead, thus reducing the platform occupation time at Glasgow Central. Similarly, reducing the number of splitting and joining moves within Central Station could improve platform utilisation levels and reduce the need for platform extension works in the short to medium term.</p> <p>Diverting Glasgow Central “High Level” services to the “Low Level” is another approach to reducing pressure on the “High Level” station, but due to passenger access considerations this would also incur high costs due to the technical complexity of altering the layout of the “Low Level” station..</p> |
| Outputs | <p>Contribute towards CC02, CC07, IC011, IC012, GC04, GC05, GC06, GC07, GC08, GC09, GC010, GC011, GC012, GC013, GC014, GC015, GC016, GC018, GC022, GC025, GC026, GC027, GC028, GC030, LDC02, LDC08, LDC09, LDC010, LDC011, LDC012, LDC015, LDC021, LDC022, LDC023, LDC024 and LDC025.</p> |

Glasgow Central (High Level) and associated lines, including the West Coast Main Line (WCML) to Carlisle and from Carstairs to Haymarket



| Four tracking options on the West Coast Main Line | |
|---|--|
| Summary | This option considers the requirement to provide additional capacity on key sections of the WCML, south of Carstairs, to accommodate forecast demand and deliver journey time improvements in Scotland. |
| Benefits | <p>The existing two track railway on the WCML is already congested and will not provide sufficient capacity and capability required to support the predicted growth and connectivity for long distance passenger services, local passenger services and freight, as expressed in the 2043 ITSS. Governments have aspirations for more, faster train services between Edinburgh/Glasgow and cities in England and Wales and to accommodate forecast Anglo Scottish freight growth.</p> <p>This option is linked to the long term strategy of the WCML between Glasgow and London, and facilitating forecast growth in Anglo Scottish freight traffic. Further timetable development has been undertaken (in conjunction with London North West Route team) which has determined that to provide a robust timetable, a significant volume of additional track would be required for the WCML. If HS2 services did not split and join at Carstairs and did, for example, at Carlisle, then in addition to enhancing Carlisle Station additional capacity would still be required between Carlisle and Carstairs. A significant number of either freight or passengers services would need to be routed via the already busy ECML (or the G&SW) to negate the enhancement requirement.</p> |
| Outputs | Contributes towards GC029, RC010, GC010, LDC01, LDC02, LDC03, LDC04, LDC05, LDC06, LDC08, LDC09, LDC010, LDC011, LDC012, LDC015, LDC016, LDC018, LDC019, LDC021, LDC022, LDC023, LDC024, LDC025, 4 class 4 and 1 class 6 freight paths per hour. |

| Carstairs Junction remodelling | |
|--------------------------------|--|
| Summary | Asset condition is driving a like-for-like renewal of the junction in CP6, but the current capability of the junction will not facilitate forecast demand (freight and passenger) to 2043. Enhancing this junction will reduce journey times, improve freight regulation and reduce whole life costs. The re-modelled layout proposed for Carstairs has been optimised for linespeeds and flexibility as far as possible within existing railway land, but does not enable HS2 services to split and join at this location on a routine basis though this could be provided in a future phase. Further interventions are likely to be required to increase WCML capacity to meet the 2043 forecast for Anglo Scottish passenger and freight traffic. |
| Benefits | <p>This option is required to increase the linespeed through the junction, reduce journey times for passenger services on the WCML and improve freight regulation.</p> <p>This option is linked to the long term strategy for the WCML between Glasgow and London and facilitating forecast growth in Anglo Scottish freight traffic.</p> |
| Outputs | Contributes towards GC029, RC010, GC010, LDC01, LDC02, LDC03, LDC04, LDC05, LDC06, LDC08, LDC09, LDC010, LDC011, LDC012, LDC015, LDC016, LDC018, LDC019, LDC021, LDC022, LDC023, LDC024, LDC025, 4 class 4 and 1 class 6 freight paths per hour. |

Fig 4.6:- Floriston and Beattock 4 tracking proposal

Glasgow Central (High Level) and associated lines, including the West Coast Main Line (WCML) to Carlisle and Haymarket

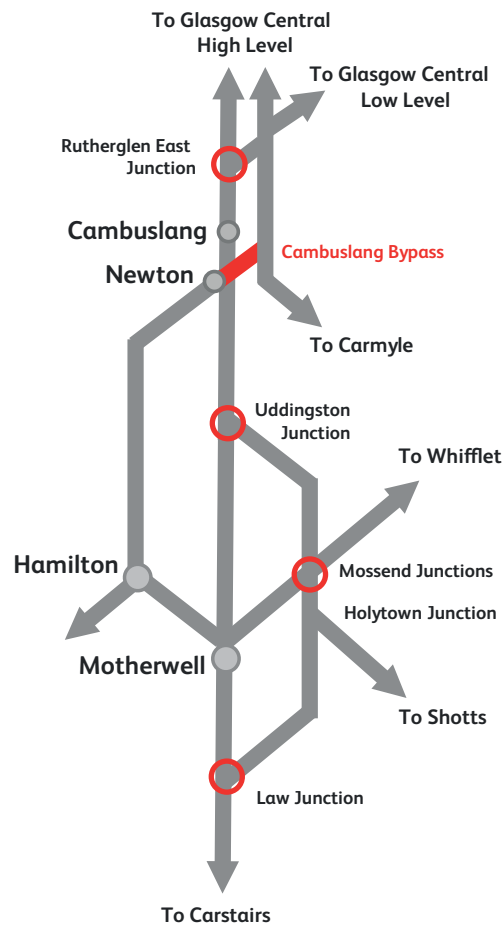


Fig 4.7:- Motherwell to Glasgow Enhancements

| Law Junction and Uddingston Junction Upgrades | |
|---|---|
| Summary | Possible grade separation of Law Junction and Uddingston Junction, and / or relocation of Uddingston Station to minimise timetable constraints from local services stopping at stations on the WCML. Possible faster route for WCML passenger services via Holytown, enabling freight services to run to Mossend via Motherwell, though upgrade costs for the alternative route could be significant. The interventions selected in this area will be driven by changes in service frequencies on the WCML and related routes, and how these flows of traffic can be optimised through the key junctions. |
| Benefits | <ul style="list-style-type: none"> Additional freight paths Additional long distance passenger trains (including HS2) <p>These options are linked to the long term strategy of the WCML between Glasgow and London and facilitating forecast growth in Anglo Scottish freight traffic.</p> |
| Outputs | Contributes towards LDC02, LDFC08, LDC09, LDC 10, LDC011, LDC012, LDC015, LDC 21, LDC 022, LDC 023, LDC 024, LDC 025, 4 class 4 and 1 class 6 freight path per hour. |

| Newton to Rutherglen Grade Separation (Cambuslang bypass) | |
|---|---|
| Summary | This option is linked to reducing the scale and cost of works at Glasgow Central (High Level) relating to platform capacity. However, routing additional local services via the Argyle Line may introduce a requirement to re-model Glasgow Central Low Level with flank platforms to manage the resulting increase in passengers, and also to improve Partick – Hyndland corridor capacity or create a Glasgow North Electrics turnback facility |
| Benefits | <p>Improved pathing / timetable for Anglo Scottish services between Glasgow Central and Cambuslang.</p> <ul style="list-style-type: none"> Additional long distance passenger trains (including HS2) Option to route more local services via the Argyle Lines |
| Outputs | Contributes towards LDC02, LDFC08, LDC09, LDC 10, LDC011, LDC012, LDC015, LDC 21, LDC 022, LDC 023, LDC 024 and LDC 025 |

Glasgow Queen Street High Level to Aberdeen and Inverness

Strategic context

- **Making best use of Glasgow Queen Street capacity**
- **Accommodating forecast demand – more services and/or longer trains**
- **Further electrification of Scottish routes.**

Glasgow Queen Street (High Level) was used by nearly 17 million passengers in 2014/15, a figure that is forecast to rise by 2043, resulting in longer and / or more trains using the station. By the end of CP5 the station will have been remodelled and enhanced as part of the Edinburgh to Glasgow Improvement Programme (EGIP).

To accommodate the forecast demand to 2043, trains will need to be lengthened and or / additional services introduced. Extending existing platforms or creating new ones to meet this demand at an extremely constrained city centre locations, such as Glasgow Queen Street, would be technically challenging and expensive. Consistency of rolling stock performance characteristics and managing train lengths within available platform capacity can assist in making optimal use of Glasgow Queen Street with robust performance and reliability.

The network between Glasgow and Aberdeen/Inverness, which is currently a mix of two-track and single line railway will continue to serve commuter markets, the interurban market, as well as providing local connectivity and capacity for freight. To meet 2043 Conditional Outputs, there would need to be large-scale infrastructure enhancements which would be expensive. To ensure that the most efficient and affordable outcomes are developed, whole-industry solutions, including train lengthening, service specification, rolling stock specification, electrification and timetabling will need to be assessed to determine the optimal configurations to deliver capacity and capability increases.

The performance characteristics of passenger rolling stock specified in the ScotRail franchise commencing in 2025 and the size, weight and length of freight trains will heavily influence the location and scale of infrastructure enhancements.

To minimise disruption to passengers and to reduce costs, these strategic constraints should be addressed in the context of electrifying the network to Aberdeen and Inverness (set out in the Scottish Government's Strategic Transport Projects Review). This will result in the maximum benefits being realised from electrifying these routes. For example running electric freight trains from the central belt to Aberdeen and Inverness minimises the speed differentials between the fastest and slowest trains, thus reducing the number and size of enhancements required to deliver the 2043 Conditional Outputs. The range of options identified for enhancements until 2043 aims to address these issues, and therefore the proposals for CP6 represent the starting point for improving Scotland rail network capabilities. Providing a more flexible and resilient network that enables a mix of fast passenger services, local stopping services and freight services.

Strategic discussion

Making best use of Glasgow Queen Street (High Level) capacity

To minimise the need for further infrastructure enhancements at such a constrained city centre location as Glasgow Queen Street; services need to be provided by rolling stock that has consistent operational performance and that makes best use of track and platform capability. Ideally these units would be interchangeable between routes to minimise platform occupancy times e.g. an Edinburgh train could depart as a service to Perth.

Running longer trains in and out of Glasgow Queen Street (High Level), rather than more frequent shorter ones, could also reduce the pressure on capacity through Queen Street Tunnel (which is currently bi-directionally signalled), and reduce the need for additional track for traffic regulation in the Cowliars Junction area.

The timing and sequencing of future electrification of the routes to Aberdeen and Inverness (and of the local route to Anniesland / Westerton) are also relevant to the Glasgow Queen Street (High Level) strategy.

Accommodating forecast demand – more services and/or longer trains

To provide the level of connectivity and journey times proposed in the 2043 Conditional Outputs as affordable as possible, clarity on service specification will be required. Current train services support a number of markets, for example combining commuter and interurban functions, and consequential impacts on both passenger perception through crowding and the cost of service provision. Looking, where possible, to segregate “inner”, “outer” and interurban demand may assist in optimising capacity while delivering better connectivity and reduced journey times.

At present the interurban timetable between the Edinburgh/ Glasgow and Aberdeen/Inverness is largely constrained by the capacity available on the routes closer to Glasgow and Edinburgh i.e. south of Stirling and Inverkeithing. This means that, to a certain extent, enhancing the network at the northern end will have limited benefits if they are not appropriately aligned with the infrastructure in the Central Belt. For example, on the approaches to Glasgow Queen Street, the “flat” junction at Greenhill Upper limits timetable

flexibility and the maximum number of trains that can operate through this location. Similarly in the east, the flat junction at Newbridge and the infrastructure between Haymarket and Inverkeithing limit flexibility and capacity on the routes into Haymarket and Edinburgh Waverley. These also limit the capacity available for Anglo Scottish and internal freight traffic running north of the Central Belt towards Aberdeen and Inverness. Given the aspiration for more passenger trains to run on these routes with shorter journey times, it will be challenging to accommodate additional freight services without making infrastructure interventions to increase the capacity available for all types of traffic.

The Scotland Route Study suggests that future demand for freight services will be best facilitated by providing infrastructure with suitable gauge capability on key freight routes, electrified (as part of the rolling programme of electrification in Scotland), with strategically located loops of suitable length. Not only will this accommodate forecast freight growth and allow more efficient freight operations, but faster electric-hauled freight services will reduce the infrastructure required to support running longer, larger and more frequent freight trains.

Further electrification of Scottish routes

By the end of CP5, the railway to Stirling / Dunblane / Alloa as well as Grangemouth will be electrified. In order to minimise the overall cost and disruption associated with electrification and to maximise the benefits gained by the significant capital investment there are a number of key enablers on these routes that should be delivered in advance of future electrification.

Renewing/upgrading the signalling systems to provide greater capacity (enabling crucial structures and remodelling strategic junctions in advance of electrification) will limit costly signalling immunisation costs for electrification and enable the junctions to be electrified in the optimal layout. This has the additional benefit of facilitating a more straightforward Digital Railway transition including the implementation of the European Rail Train Management System (ERTMS) and European Train Control System (ETCS).

A number of strategic interventions will be delivered more efficiently

if they are undertaken, in conjunction with route clearance works, prior to electrification of the routes to Aberdeen and Inverness. These include:-

- Enhancing signalling headways between Stirling and Perth before Dunblane to Perth electrification to minimise both costs and levels of disruption to customers
- Perth station re-modelling, redevelopment and re-signalling prior to electrification, including freight looping capacity and with improved transport interchange capabilities
- Tay Viaduct to Barnhill doubling, if required for diversionary capacity when Tay Bridge strengthening works take place, should be undertaken prior to Perth to Dundee electrification
- Between Dundee and Aberdeen, consideration should be given to increasing capacity and reducing journey times, building on the recent Aberdeen City Region Deal commitment to examine options to address the Montrose-Usan single line capacity constraint as well as other linespeed / signalling enhancements.

The following tables outline examples of the strategic interventions identified in the Route Study, including key enabling and linked enhancements that will contribute to delivering the network capabilities proposed for 2043.

Glasgow Queen Street High Level to Aberdeen and Inverness

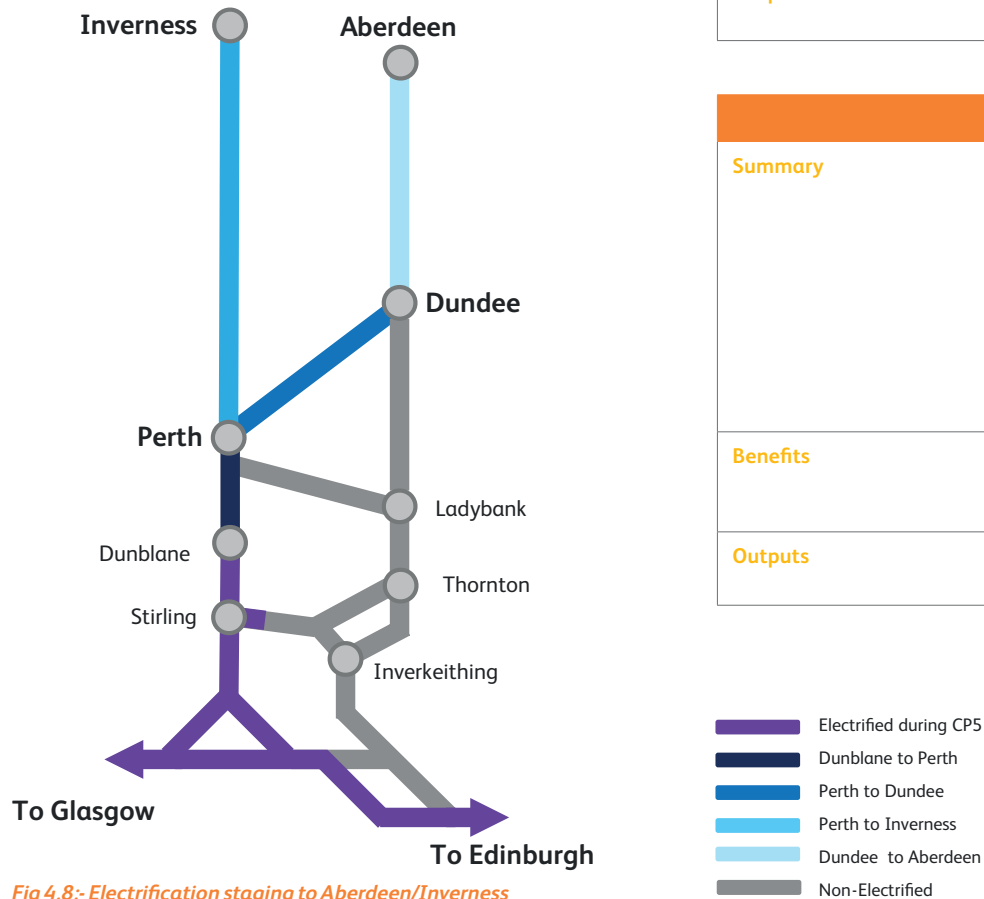


Fig 4.8:- Electrification staging to Aberdeen/Inverness

| Greenhill Upper Junction Grade Separation | |
|---|---|
| Summary | This option provides a grade separated double junction at Greenhill Upper to increase capacity and remove conflicts between Edinburgh to Glasgow and interurban services running to Perth |
| Benefits | This increases Central Scotland network flexibility, thus facilitating the 2043 connectivity Conditional Outputs for both the Glasgow commuter market and the interurban market. This enhancement helps remove timetable constraints between Glasgow Queen Street and Inverness and Aberdeen, reducing the pressure on Glasgow Queen Street platform capacity and contributing to end-to-end journey time improvements for interurban services. |
| Outputs | Contributes towards CC02, CC04, CC05, CC07, CC09, CC10, IC01, IC03, IC04, IC10, RC07, RC08, GC01, GC02, GC03 and 1 class 4 or 1 class 6 freight path per hour. |

| Electrification | |
|-----------------|--|
| Summary | <p>Electrification of the network between Dunblane and Inverness/Aberdeen, including challenging structures such as the Tay Viaduct (Perth), Dundee Dock Street Tunnel, Killiecrankie Tunnel, and numerous Victorian steel and masonry viaducts.</p> <p>Linked to electrification of Haymarket to Perth/Dundee, re-modelling of Perth Station and Tay Viaduct doubling. Additional feeder station capacity is likely to be required to supply power to the newly electrified routes. Independently Powered Electric Multiple Unit (IPEMU) / bi-mode could be considered once further rolling stock development work has been undertaken.</p> <p>Consideration to be given to depot and stabling facilities for electric rolling stock as the proportion of electrified routes in Scotland increases.</p> |
| Benefits | This intervention is proposed to increase the capacity and connectivity for passenger and freight services on the interurban network to meet forecast demand and connectivity. Efficient rolling stock utilisation is a key consideration for the staging of electrification. |
| Outputs | Contributes towards CC02, CC05, CC07, CC10, IC01, IC02, IC03, IC04, IC05, IC10, GC01, GC02, GC03, 1 class 4 or 1 class 6 freight path per hour, and future improved freight gauge on these routes. |

Glasgow Queen Street High Level to Aberdeen and Inverness

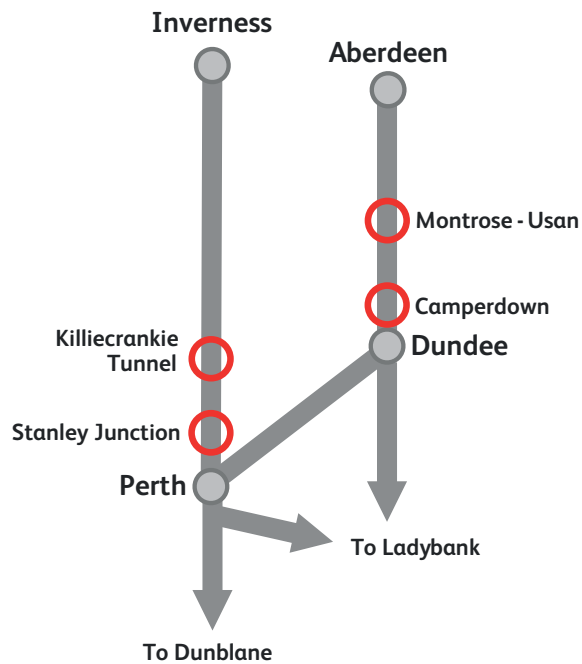


Fig 4.9:- Key constraints to Aberdeen/Inverness

| Key constraints between Dundee and Aberdeen | |
|---|--|
| Summary | Enhancement of infrastructure to deliver journey time reductions and additional services between the Central Belt and Aberdeen, as per the 2043 capacity and Connectivity Conditional Outputs. <ul style="list-style-type: none"> ● Camperdown looping facility ● Montrose-Usan single line section ● Signalling capacity ● Capability and capacity of Aberdeen Station. |
| Benefits | Enhancement of the network, in conjunction with timetabling solutions, to deliver journey time reductions and increased connectivity for passenger and freight services. |
| Outputs | Contributes towards CC03, CC05, CC08, CC010, IC01, IC02, IC03, IC06, IC07, LDC013 and 1 class 4 or 1 class 6 freight path per hour. |

| Key constraints between Perth and Inverness | |
|---|--|
| Summary | Enhancement of infrastructure to deliver journey time reductions and additional services between the Central Belt and Inverness, as per the 2043 capacity and connectivity Conditional Outputs. <ul style="list-style-type: none"> ● Perth Station remodelling ● Stanley Junction remodelling ● Capability of Killiecrankie Tunnel ● Single line sections ● Capability and capacity of Inverness Station. |
| Benefits | Enhancement of the network, in conjunction with timetabling solutions, to deliver journey time reductions and increased connectivity for passenger and freight services. |
| Outputs | Contributes towards CC05, CC010, IC04, IC05, IC08 and 1 class 4 or 1 class 6 path per hour. |

Strathclyde commuter network

Strategic context

- Accommodating forecast demand – more services and/or longer trains
- Making best use of Glasgow Central High Level platform capacity
- Capacity through the Partick – Hyndland corridor

To facilitate forecast growth for services using Glasgow Central High Level station, additional services could be routed to run via the Low Level, in order to minimise the overall cost and disruption of enhancements required in the High Level. There may still be implications for the Low Level station (such as platform extensions/reconfiguration) in order to safely manage pedestrian flows, as well as interventions to address the capacity constrained section between Partick and Hyndland.

From the start of CP6 the two principal Glasgow Low Level stations will have the following configuration:-

- Glasgow Queen Street Platforms 8 + 9 (flank format)
 - 6 car (23.8m carriage length) capacity
- Glasgow Central Platforms 16 + 17 (central island format)
 - 6 car (20m carriage length) capacity

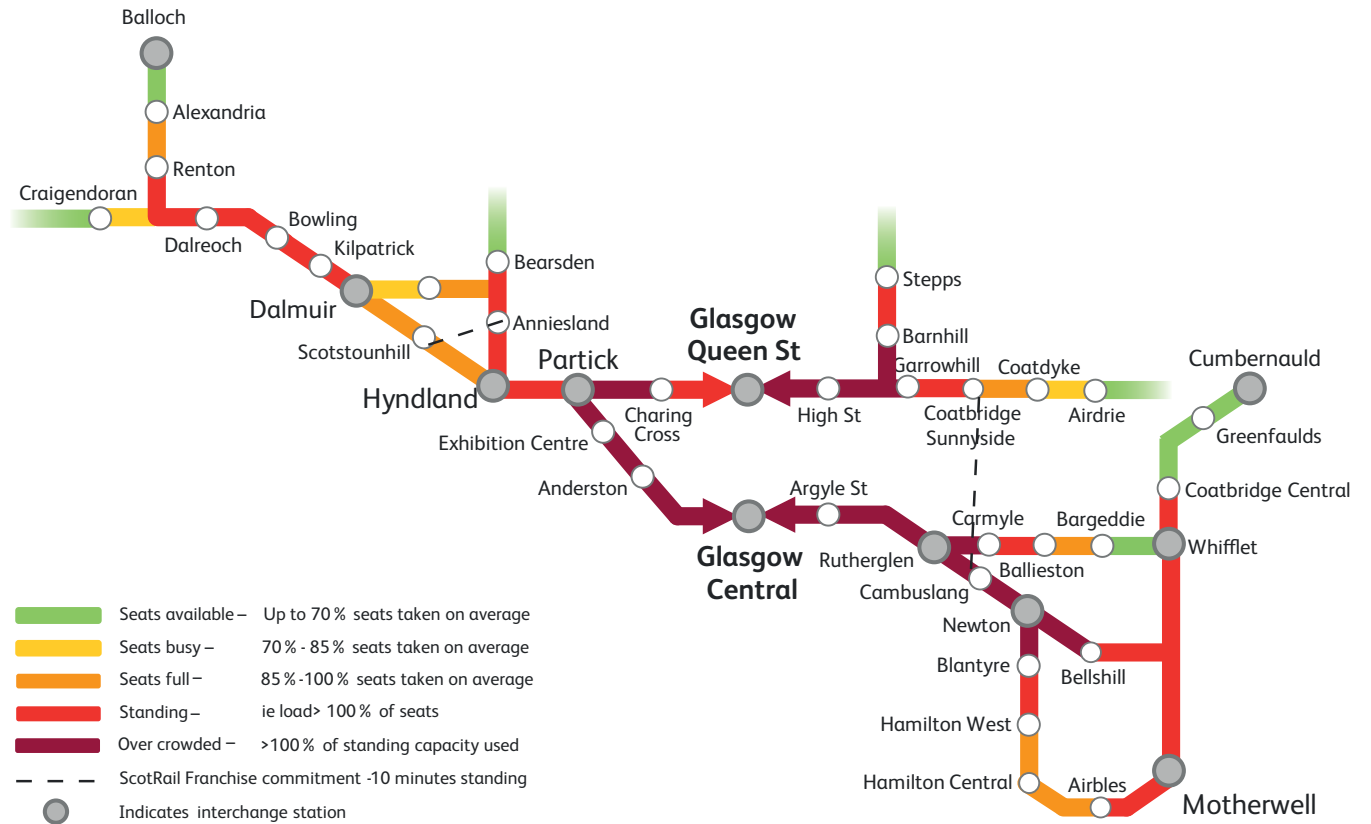


Fig 4.10:- Glasgow Northern Suburban Routes forecast passenger demand into central Glasgow Low Level stations in 2043 (morning peak hour 08:00-09:00)

Strathclyde commuter network

The following tables outline examples of the strategic interventions identified in the Route Study, including key enabling and linked enhancements that will contribute to delivering the network capabilities proposed for 2043.

Strategic discussion

All major stations on Glasgow North and South Electric routes have platforms that are suitable for 6-car electric trains of 20 metre carriage length. Newer electric trains tend to be longer e.g. 23.8 metre carriages rolling stock, therefore running 7 or 8-car trains on certain routes would necessitate platform lengthening at stations where Selective Door Opening is not appropriate. This is a key choice, particularly at the two Low Level stations, where management of pedestrian flows will be an important consideration.

The platform capacity required at Glasgow Central High Level could, if the cost and complexity of works required, determine the extent to which there is a business case for additional services running via Glasgow Central Low Level, and the consequential increase in passengers using the current central island platforms. Reconfiguring the Low Level with flank platforms and modern lifts and escalator access is a major intervention, but would be required to support a significant increase in service frequency.

If more trains are to run on the Glasgow North and South Electric routes the two-track section of route between Partick and Hyndland, already timetabled to deliver 16 trains per hour at peak times, will be of particular concern. Turnback facilities on the Argyle and Airdrie lines to the east of Partick station would assist if capacity can be delivered through some services from the east serving Glasgow Queen Street Low Level and Glasgow Central Low Level and then terminating. In the longer term it may be necessary to enhance the capability of the Hyndland – Partick corridor to run a higher frequency

| Glasgow Central Low Level Enhancement | |
|---------------------------------------|--|
| Summary | Reconfigure the station, and convert the format from a shared central island platform to two wider flank platforms with lifts and escalator access to / from street level and Glasgow Central High Level. |
| Benefits | Passenger accessibility suitable for 2043 proposed service frequency and forecast growth on number of customers using Argyle line trains. This option complements the proposal to divert some High Level services via the Argyle Line, in order that costs and disruption for High Level platform capacity works are minimised. Initial assessment suggests that adding flank platforms at the Low Level and retaining the central island would not be viable, as flank platform widths would be too narrow and short. Acquisition of property may be required to create full width flank platforms. |
| Outputs | Contributes towards GC016, GC018, GC022, GC025, GC026 and GC027. |

| Partick to Hyndland Enhancement | |
|---------------------------------|---|
| Summary | Partick Signalling Upgrade/4-track Hyndland East Junction to Partickhill. Partick to Hyndland would operate more like a 'metro-style' network, with some potential limitation on linespeeds to ensure that trains can routinely meet defined arrival / departure timeslots. |
| Benefits | Capability to handle up to 20 trains per hour in each direction through Partick and Hyndland. |
| Outputs | Contributes towards GC016, GC017, GC018, GC019, GC020, GC021 and GC022. |

Aberdeen to Inverness

Strategic context

By the end of CP5 the infrastructure between Aberdeen and Inverness will have been enhanced to facilitate half hourly services between Aberdeen and Inverurie, additional commuter services between Elgin and Inverness, and new stations at Dalcross (linked to Inverness Airport) and Kintore.

The 2043 Capacity and Connectivity Conditional Outputs propose a step change in connectivity in terms of end to end opportunities, commuting opportunities and journey times.

| Enhancement of the line between Aberdeen and Inverness | |
|--|--|
| Summary | <p>The following interventions are proposed:</p> <ul style="list-style-type: none"> • New dynamic loops/double track at Dalcross and other locations • Extension of existing loops • Signalling enhancements • Linespeed improvements • Structures and earthwork enhancements • Track renewals • Enhancement of Inverness and Aberdeen Stations. <p>The 2043 Connectivity Conditional Outputs link this route with the Far North and south of Aberdeen.</p> |
| Benefits | <p>To meet the forecast 2043 Connectivity and Capacity Conditional Outputs, between Aberdeen and Inverness (and linking to the Far North and south of Aberdeen)</p> <p>These interventions could also improve the resilience and performance of the network.</p> |
| Outputs | Contributes towards CC03, CC05, CC08, CC010, RC04, RC05, RC06 and 1 class 4 or class 6 freight path per hour. |

Strategic discussion

Passenger growth on the commuter market into Aberdeen and the interurban market between the key cities of Aberdeen and Inverness has increased significantly over the past 10 years. The Scotland Market Study forecasts strong growth to 2043 across the Aberdeen commuter market, the interurban market and the rural market. The end to end connectivity (both in terms of opportunities to travel and journey time) are proposed to be enhanced in the 2043 Connectivity Conditional Outputs. They also propose to improve commuting opportunities into Aberdeen and Inverness, taking cognisance that people may choose to commute into the cities from further afield. This would represent a significant increase compared with the current level of service and would require extensive enhancement to the existing infrastructure, in order to provide a resilient network.

The future staging of these outputs should be carefully considered to prevent enhancing infrastructure in one control period that is not beneficial in the medium to long term.

The table above outlines the strategic interventions identified in the Route Study, including key enabling and linked enhancements that will deliver the network capabilities proposed for 2043.

Far North

Strategic context

The rail network north of Inverness serves a rural market between Wick / Thurso / Kyle of Lochalsh, a commuter market into Inverness and a freight market to Georgemas. It provides “lifeline” services to rural communities consequently connectivity and resilience are key.

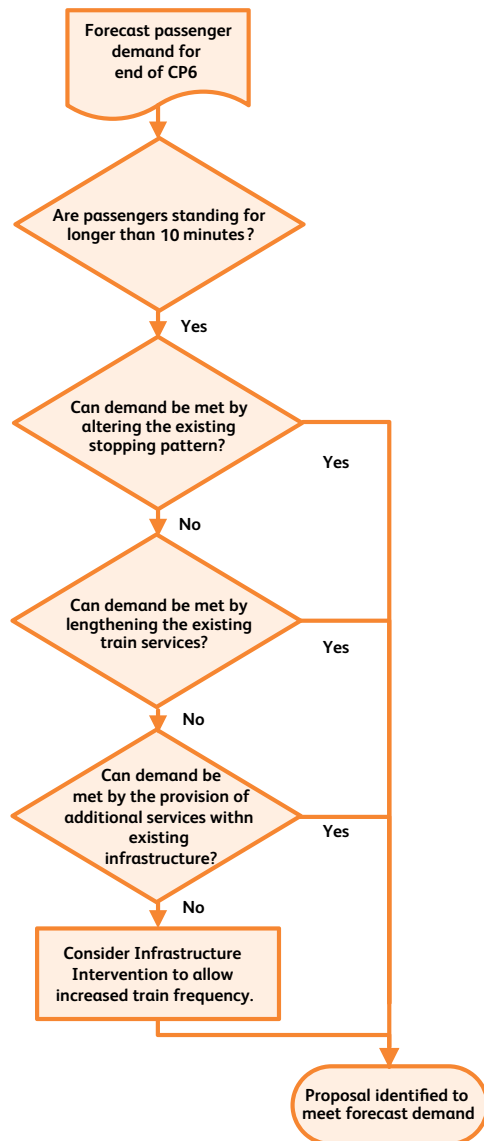
The 2043 Conditional Outputs propose an increase in services on the Far North line to provide greater connectivity and a more robust commuter service into Inverness from Invergordon. Current infrastructure, and associated capacity, could not facilitate this and a substantial upgrade of track and signalling infrastructure would be required.

| Enhancement of the line between Inverness and Wick/Thurso | |
|---|--|
| Summary | <p>The following interventions are proposed:</p> <ul style="list-style-type: none"> ● Inverness to Dingwall - additional loop to provide greater flexibility to pass trains ● Dingwall to Invergordon - additional track to provide greater flexibility to pass trains ● Re-signalling from Inverness to Dingwall - to replace the existing radio based system with a conventional signalling system arrangement ● Georgemas Chord - to create new connection to facilitate a direct service to Thurso without the need to reverse at Georgemas Station. <p>Reconfiguration of Inverness platforms 5-7 may be required to facilitate more frequent services on this section of route. Consideration of these potential changes will need to be factored in to any modifications made to the fuelling facility at Inverness to accommodate new rolling.</p> |
| Benefits | To meet the forecast 2043 Conditional Outputs, between Inverness and Invergordon, and Inverness and Wick/Thurso. These interventions could also improve the resilience and performance of the network. |
| Outputs | Contributes towards CC04, CC09, RC01, RC02, RC03 and 1 class 4 or 1 class 6 freight path per hour. |

Strategic discussion

Current service levels between Inverness and Invergordon are hourly at best during the times of day when commuter demand is highest. Improving service frequency is likely to require looping facilities and installation of conventional signalling on the route between Inverness and Dingwall to facilitate the increased number of trains and passing moves involved in providing a higher intensity passenger service. Improvements in the platform arrangements and track layout at Inverness station may also be required to create the capacity for more frequent train services to and from the Dingwall direction.

The table above outlines the strategic interventions identified in the Route Study, including key enabling and linked enhancements that will deliver the network capabilities proposed for 2043.



Control Period 6 and 7 Choices

This chapter highlights funding choices for the next 10 years, Control Period 6 (CP6) and Control Period 7 (CP7). CP6 starts in April 2019.

These choices can take two forms:

- Making best use of existing rail network – these options do not involve significant changes to the existing infrastructure e.g. train lengthening schemes, providing additional train services and varying stopping patterns
- Increasing the capability of the network - enhancement of the existing infrastructure to enable Conditional Outputs to be accommodated.

The Scottish network baseline position assumes that all Control Period 5 enhancement schemes will be delivered before April 2019.

Chapter 4 sets out the anticipated requirements for 2043 in line with the Conditional Outputs identified by the Market Studies. This stage determines which of these options should be proposed as Choices for Funders for CP6 and CP7.

These choices were developed by evaluating the proposed options against the following criteria:

- to provide sufficient capacity for the anticipated level of passenger and freight services by the end of 2023/24
- investments which deliver funders’ priorities
- ‘once in a generation’ opportunities where Conditional Outputs can be delivered efficiently during 2019-2029 for example, in conjunction with planned renewals
- preparatory works which enable efficient enhancements and reduce disruption to customers in future control periods (such as in advance of electrification)
- investments which enable improved access to the proposed High Speed Rail network
- investments which reduce rail industry costs.

It is helpful to discuss in detail the process of identifying how passenger demand could be met, if appropriate, by the end of 2023/24. Figure 5.1 describes this process.

The first consideration for passenger services is the number of people who would be standing, and from where. Second, it is determined whether timetable changes would accommodate demand. Third, train lengthening is explored and the extent to which it could be delivered with or without platform extensions. There may not always be infrastructure implications (and associated costs) with lengthening trains as selective door opening could be implemented. However there may be rolling stock and train depot considerations. Finally, increasing the frequency of services (and available network capacity) is considered.

As demand for passenger and freight services grows, so too will the pressures on the network. In some circumstances, making best use of the existing network will require informed trade-offs to be made between proposals, and the Route Study highlights where these choices exist.

Further timetable and technical development work is being undertaken, on the interurban corridors between Glasgow/Edinburgh and Inverness/Aberdeen. This analysis will help determine appropriate combinations of timetable, rolling stock and infrastructure solutions to meet forecast demand to 2023/24, and contribute towards delivering the 2043 Connectivity and Capacity Conditional Outputs. Until this work is complete, a definitive choice cannot be provided for the routes north of Perth for 2019-2029.

The tables that follow outline the Choices for Funders for the period between 2019-2029 identified in the Route Study using the criteria previously discussed.

Fig 5.1:- Flowchart for CP6/CP7 passenger demand

Choices for Funders in CP6 and CP7 (2019-2029)

1. East Coast Main Line Enhancement
 - Prestonpans to Drem four-tracking
 - Dynamic Loops south of Drem
2. Edinburgh Waverley Enhancement
 - Edinburgh Waverley platform extensions
 - Edinburgh Waverley Western approach enhancements
 - Edinburgh Waverley Eastern approach enhancements
3. Train Lengthening Fife to Edinburgh Waverley
4. Edinburgh Suburban Enhancement Programme
5. Gauge enhancement
 - West Coast Main Line to Grangemouth
 - Glasgow to Carlisle via Dumfries
6. Carstairs Area Enhancement
7. High Speed Enabling Projects
8. Options for the Greater Glasgow area
 - Electrification of Maryhill Line
 - Timetable amendments Glasgow Queen Street High Level corridors
 - Train lengthening Glasgow Low Level corridors
 - Train lengthening Ayrshire and Inverclyde
 - Electrification and enhancement to East Kilbride/Barrhead
 - Electrification and enhancement to Kilmarnock/Barassie
 - Glasgow Central High Level Station Enhancement
9. Greenhill Junction Grade Separation
10. Dunblane to Perth Corridor Enhancement
11. Central Belt to Inverness Enhancement Options
12. Central Belt to Aberdeen Enhancement Options
13. Aberdeen to Inverness Enhancements
14. Far North Line Enhancements

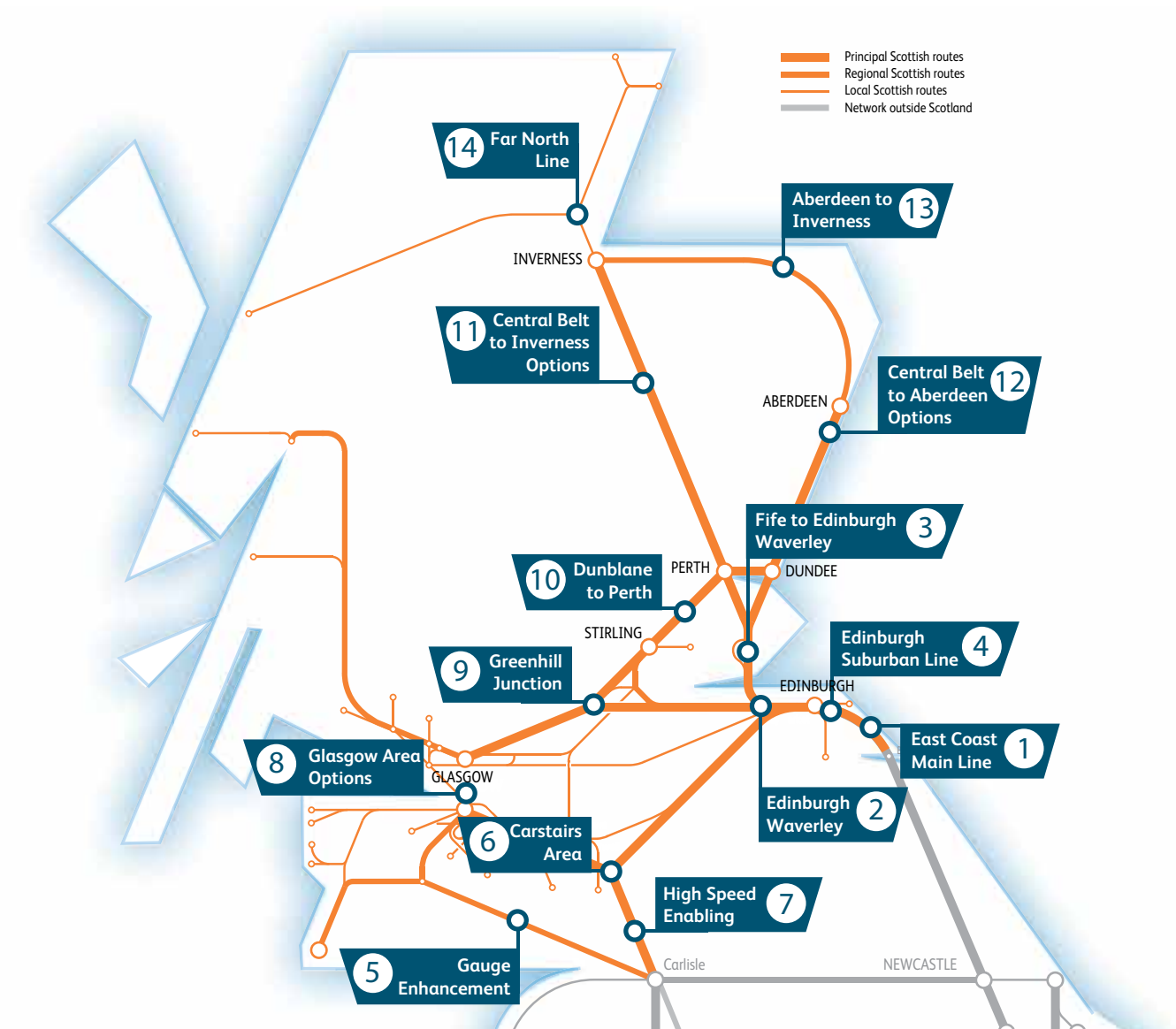
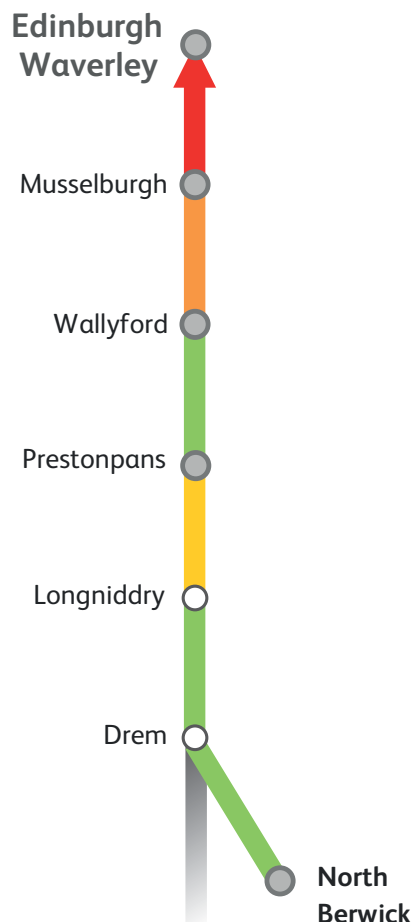


Fig 5.2: The geographic location of the Scotland Route Study CP6/CP7 choices for funders

East Coast Main Line and Edinburgh Waverley 2023/24 Demand

Commuter services are forecast to be over 100 per cent of seating capacity in the morning peak hour approaching Edinburgh Waverley.



The East Coast Main Line (ECML) runs east and south from Edinburgh Waverley, with a number of local stations before Drem Junction and the North Berwick branch. Forecast passenger demand in 2023/24 indicates that ScotRail services will exceed 100 per cent of seating capacity (assumed to be six carriage trains) in the peak hour by the time they reach Edinburgh Waverley. This does not exceed the current ScotRail franchise commitment of passengers standing for more than 10 minutes.

To improve the passenger experience trains could be lengthened to provide additional seats. To facilitate this, a number of small enhancements to stations and rail infrastructure would be required.

The Connectivity Conditional Outputs for 2043 propose an increase in the number of stopping services in the Dunbar/Drem to Edinburgh Waverley corridor. Therefore enhancements to enable train lengthening may only offer short-term benefits, if the additional seating capacity provided by longer trains is then superseded by providing more trains. It may prove better value for money in the longer term to meet the end of CP6 forecast demand through delivery of the interventions detailed on the following pages as they enhance capacity not only for local services, but also for Anglo Scottish passenger and freight services.

- Seats available – Up to 70 % seats taken on average
- Seats busy – 70 % - 85 % seats taken on average
- Seats full 85 % - 100 % seats taken on average
- Standing ie load > 100 % of seats
- ScotRail Franchise commitment - 10 minutes standing
- Indicates a location where some or all services stop in the baseline. Stopping patterns may change in the future

Fig 5.3:- East Coast Main Line forecast demand into Edinburgh Waverley (morning peak hour 08:00-09:00)

Prestonpans to Drem Four Tracking - Key Points

Commuting services are forecast to exceed 100 per cent of seating capacity in the peak hour in 2023/24 by the time they reach Edinburgh Waverley. Additional local services west of Drem require the existing network to be enhanced. This enhancement option also contributes towards accommodating the 2043 Capacity and Connectivity Conditional Outputs.

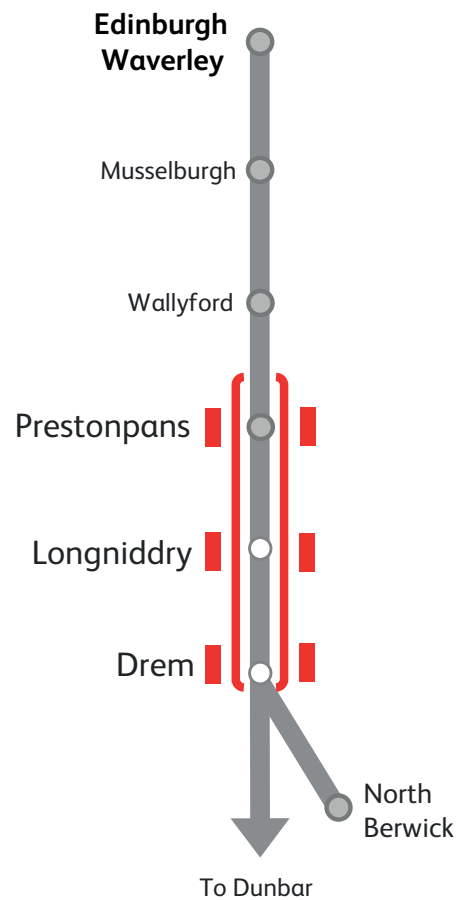


Fig 5.4 – ECML with proposed Prestonpans to Drem Four Tracking

| Prestonpans to Drem Four tracking | | | | | |
|-----------------------------------|---|-------------|------------------|-----------------------|-------------|
| Purpose | To allow local passenger and freight services to utilise new track between Prestonpans and Drem in order that long distance non-stopping services can overtake slower trains on this section of the ECML. This intervention will substantially increase timetable flexibility and contributes towards additional services, as well as providing regulating capacity for freight services between Drem Junction and Millerhill. | | | | |
| Technical Description | This option consists of the provision of two new tracks to form passing loops via new flat junctions between Prestonpans and Drem stations. Prestonpans, Longniddry and Drem stations would be relocated on the new loops. | | | | |
| Indicative Costs | £125m - £300m | | | | |
| Strategic Links | Dynamic Loops south of Drem and Edinburgh Waverley Eastern Approach Enhancements | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | ↑ | → | ↑ | ↑ |
| Long Distance | | ↑ | → | → | ↑ |
| Local | | ↑ | → | → | ↑ |
| Prioritisation assessment | This scheme could be delivered as the first of several interventions required on the East Coast Main Line to achieve the 2043 Capacity and Connectivity Conditional Outputs. In conjunction with a change to the timetable, this enhancement provides the opportunity to run additional local services and the capability for non-stopping passenger services to overtake freight trains. This choice will form part of an appraisal for enhancement options on the East Coast Main Line between Edinburgh Waverley and London Kings Cross, once the London North East Route Study is published later in 2016. | | | | |
| Outputs | Contribute towards CC01, CC06, EC01, EC02, EC03, EC04, LDC04, LDC07, LDC012, LDC013, LDC017, LDC026, LDC027 and 1 class 4 or 1 class 6 freight path. | | | | |
| Notes | The standalone option of moving one or both of the platforms at Drem onto loops has been discounted due to further timetable work demonstrating that on its own, it does not provide the ability to run more trains. The option to four track between Wallyford and Prestonpans has been revised to four track between Prestonpans and Drem due to the results of further timetable work. It demonstrated that the additional track between Wallyford and Prestonpans are located too close to Edinburgh and are not long enough to provide the opportunity for fast cross-border services to easily overtake freight or local stopping services. | | | | |

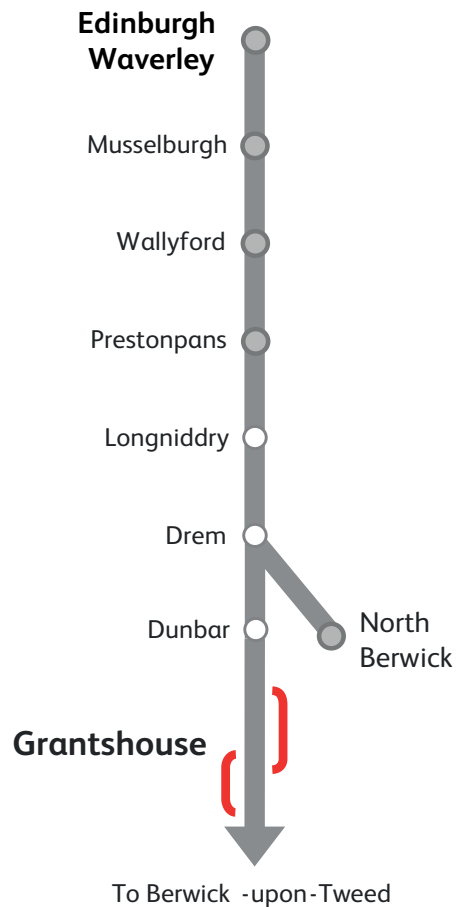


Fig 5.5 – ECML with proposed dynamic loops south of Drem

Dynamic Loops south of Drem - Key Points

There are currently no looping facilities on the East Coast Main Line (ECML) in Scotland which can accommodate 775 metre freight services. This limits the capacity for freight services, Anglo Scottish services and local stopping services.

This option contributes towards accommodating the 2043 Capacity and Connectivity Conditional Outputs.

| Dynamic loops south of Drem | | | | | |
|----------------------------------|--|-------------|------------------|-----------------------|-------------|
| Purpose | This intervention provides a key regulating facility strategically located south of Drem, to create the capacity required for the number of ECML services identified in the 2043 Conditional Outputs. | | | | |
| Technical Description | These options are heavily dependent upon the timetable structure, the rolling stock utilised by freight (diesel or electric) and the capacity enhancements that are delivered at the west end of the corridor (Edinburgh Waverley Eastern Approach Enhancements). The options are: <ul style="list-style-type: none"> • a dynamic loop between Oxwellmains and Grantshouse on the Up line • a dynamic loop at Reston on the Up line • a dynamic loop between Reston and Grantshouse on the Down line. | | | | |
| Indicative Costs | £150m - £375m | | | | |
| Strategic Links | Prestonpans to Drem Four tracking and Edinburgh Waverley Eastern Approach Enhancements | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| | Freight | ↑ | → | ↑ | ↑ |
| | Long Distance | ↑ | → | → | ↑ |
| | Local | ↑ | → | → | ↑ |
| Prioritisation assessment | This scheme is one of several interventions required to achieve the 2043 Capacity and Connectivity Conditional Outputs. It is proposed to be delivered after the Prestonpans to Drem Four Tracking to optimise the benefits of phasing the combined ECML works. This would provide another high quality looping capacity between Drem and Berwick-upon-Tweed for freight and local services, thereby improving capacity for all types of service to/from and within Scotland. This choice will form part of an appraisal for enhancement options on the East Coast Main Line between Edinburgh Waverley and London Kings Cross, once the London North East Route Study is published later in 2016. | | | | |
| Outputs | Contribute towards CC01, CC06, EC01, EC02, LDC04, LDC07, LDC012, LDC013, LDC017, LDC026, LDC027 and 1 class 4 or 1 class 6 freight path | | | | |
| Notes | The option for dynamics loops on both the Up and Down lines has been revised in light of further timetable development which demonstrated how interdependent the enhancement proposals are across the various sections of the ECML. | | | | |

Edinburgh Waverley Platform Enhancements - Key Points

Platforms 5, 6 and 12 will be extended by the end of March 2019. Edinburgh Waverley continues to experience significant levels of growth for Anglo Scottish, interurban and local services, and will need to accommodate more and longer trains by the end of CP6.

This enhancement option contributes towards accommodating the 2043 Capacity and Connectivity Conditional Outputs..

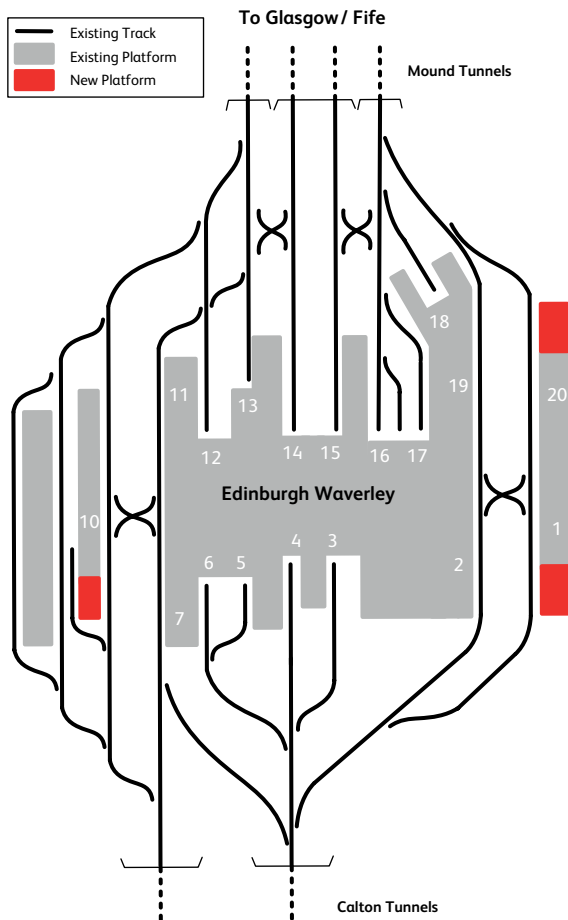


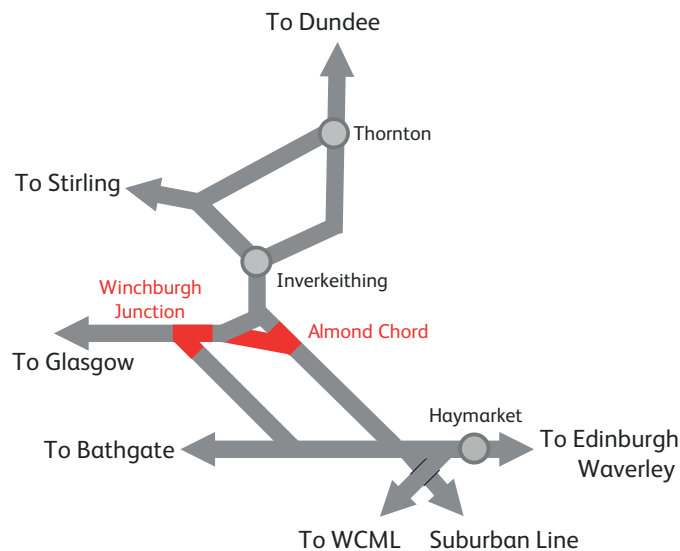
Fig 5.6 – Edinburgh Waverley

| Edinburgh Waverley Platform Enhancements | | | | | |
|--|---|-------------|------------------|-----------------------|-------------|
| Purpose | This intervention is to accommodate more and longer services required to accommodate forecast demand at Edinburgh Waverley. | | | | |
| Technical Description | This option proposes the extension of platforms 1 to 8-car length, platform 20 to 10-car length and platform 10 to 11-car length. This requires civil engineering works, alterations to the signalling system and the customer information system. | | | | |
| Indicative Costs | £7m - £17.5m | | | | |
| Strategic Links | <p>The interventions proposed for the Edinburgh Waverley to Haymarket corridor to meet forecast demand for passenger and freight services have been minimised through the lower cost enhancements proposed for the Edinburgh Suburban line and at Winchburgh Junction/Almond Chord.</p> <p>The Edinburgh Suburban Electrification and related enhancements provide a viable route for electric freight services (currently required to go through Edinburgh Waverley) between the ECML and Central Scotland. This contributes to improving capacity for long distance and local passenger services through Edinburgh Waverley.</p> <p>The interventions at Winchburgh Junction and Almond Chord allow Edinburgh/Glasgow services to cross to the Fife lines at Almond Junction so that they do not have to cross at Haymarket Junction. This reduces the requirement for large scale interventions in the Haymarket or Edinburgh Waverley area to improve flexibility and/or capacity. Further enhancements may be required to support passenger demand beyond CP7.</p> | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | 🟡 | 🟡 | 🟡 | 🟡 |
| Long Distance | | 🟢 | 🟡 | 🟢 | 🟡 |
| Local | | 🟢 | 🟡 | 🟢 | 🟡 |
| Prioritisation assessment | This scheme is proposed to meet forecast passenger demand to the end of CP6. | | | | |
| Outputs | Contribute towards CC01, CC05, CC06, CC010, EC01, EC02, EC03, EC04, EC05, EC06, EC07, EC08, IC06, IC07, IC08, IC09, LCD01, LDC03, LDC04, LDC05, LDC06, LDC07, LDC013, LDC014, LDC016, LDC017, LDC018, LDC019, LDC020, LDC026 and LDC027. | | | | |

Edinburgh Waverley Western Approach Enhancements - Key Points

Edinburgh Waverley is forecast to experience significant levels of growth for Anglo Scottish, interurban and local services, and will need to accommodate additional trains. The western approaches to Edinburgh Waverley are currently inflexible and provide limited routes to west facing platforms.

This enhancement option contributes towards accommodating the 2043 Capacity and Connectivity Conditional Outputs.



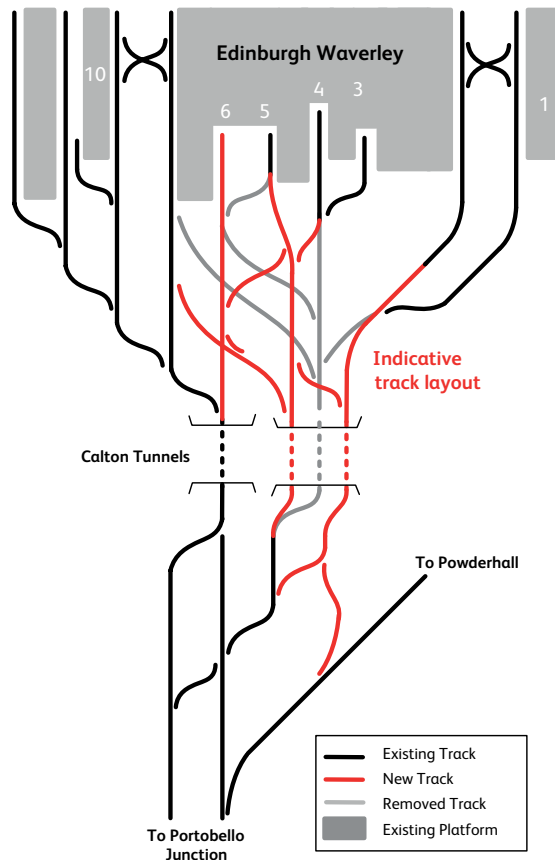
| Edinburgh Waverley Western Approach Enhancements | | | | | |
|--|---|-------------|------------------|-----------------------|-------------|
| Purpose | This intervention facilitates Edinburgh/Glasgow services crossing to the Fife lines at Almond Junction so that they do not have to transfer from the South lines to the North lines at Haymarket Central Junction. | | | | |
| Technical Description | This option proposes the grade separation of Winchburgh Junction and the creation of a chord line and grade separated junction at Almond to connect with the Winchburgh and Fife line towards Edinburgh. The new junctions and section of line between Winchburgh and Haymarket would be electrified and could accommodate larger gauge freight traffic. | | | | |
| Indicative Costs | £150m - £250m | | | | |
| Strategic Links | <p>This intervention helps avoid the need for larger scale interventions to improve capacity and infrastructure flexibility between Newbridge Junction and Haymarket (such as grade separating Newbridge Junction), and limits the scope of platform reconfiguration and lengthening works at Edinburgh Waverley.</p> <p>It would enable some Edinburgh/Glasgow services to run to/from Edinburgh without crossing between the North and South Lines in the Haymarket or Princes Street Gardens areas, which will improve the interface with West Coast Main Line services on the approaches to Edinburgh Waverley and capacity for Empty Coaching Stock to/from Haymarket.</p> <p>It provides an alternative route avoiding Newbridge Junction, minimises the timetable impact of a potential new station at Winchburgh, and offers the opportunity for selected Edinburgh/Glasgow services to call at Edinburgh Gateway.</p> <p>It would also provide an enhanced gauge route for Anglo Scottish freight running to and from Scottish Central Belt freight terminals (bypassing Winchburgh Tunnel).</p> | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | | | | |
| Long Distance | | | | | |
| Local | | | | | |
| Prioritisation assessment | This scheme is proposed to meet passenger demand to the end of CP6. | | | | |
| Outputs | Contributes towards CC01, CC06, EC05, EC06, IC10, IC11, IC12 and IC13 | | | | |

Fig 5.7 – Edinburgh Waverley Western Approach Enhancements

Edinburgh Waverley Eastern Approach Enhancements - Key Points

Edinburgh Waverley is forecast to experience significant levels of growth for Anglo Scottish, interurban and local services, and will need to accommodate additional services. The eastern approaches to Edinburgh Waverley are currently complex, inflexible and provide limited routes to east facing platforms.

This enhancement option contributes towards accommodating the 2043 Capacity and Connectivity Conditional Outputs..



| Edinburgh Waverley Eastern Approach Enhancements | | | | | |
|--|--|-------------|------------------|-----------------------|-------------|
| Purpose | To create a more flexible network in order to accommodate more cross-border services, local services and freight on the East Coast into Edinburgh Waverley and make best use of the existing platforms. | | | | |
| Technical Description | This option consists of: <ul style="list-style-type: none"> remodelling of track layout at the eastern approaches re-doubling of Calton North Tunnel enhancing capacity between Abbeyhill and Portobello to complement enhancements east of Drem. | | | | |
| Indicative Costs | £150m - £375m | | | | |
| Strategic Links | Edinburgh Waverley Platform Enhancements, Prestonpans to Drem four-tracking and dynamic loops south of Drem | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | 🟡 | 🟡 | 🟡 | 🟡 |
| Long Distance | | 🟢 | 🟡 | 🟡 | 🟢 |
| Local | | 🟢 | 🟡 | 🟡 | 🟢 |
| Prioritisation assessment | This scheme is one of several interventions required to achieve the 2043 Capacity and Connectivity Conditional Outputs. It is proposed to be delivered after the Edinburgh Suburban Enhancements Programme in order that ECML services can be re-routed via Haymarket while eastern approach enhancements are undertaken. This choice will form part of an appraisal for enhancement options on the East Coast Main Line between Edinburgh Waverley and London Kings Cross, once the London North East Route Study is published later in 2016. | | | | |
| Outputs | Contribute towards CC01, CC06, EC01, EC02, EC03, EC04, LDC04, LDC07, LDC012, LDC013, LDC017, LDC026, LDC027 and 1 class 4 or 1 class 6 freight path | | | | |
| Notes | Calton North Tunnel was originally double track but the line was singled during the rationalisation works from the 1960s to the 1980s. | | | | |

Fig 5.8 – Edinburgh Waverley Eastern Approach Enhancements

Fife to Edinburgh Waverley 2023/24 Forecast Demand

Demand forecasting for 2023/24 (based on the highest forecast growth scenario “Prospering in Isolation”) indicates significant crowding on services from the north into Edinburgh Waverley in the morning peak. This is also the case for the “Prospering in Global Stability” scenario.

Some customers may be standing in excess of the ScotRail franchise commitment of not more than 10 minutes.

Lengthening trains from the existing three vehicles to six vehicles could alleviate some peak crowding. This proposal would have a Benefit Cost Ratio of 0.6; however passengers on certain trains may still be standing for more than 10 minutes. Finding the right balance of stopping patterns between interurban and local commuter services would help to relieve this crowding. This option is being progressed by Transport Scotland through the ScotRail franchise for delivery in December 2018.

Longer trains would have implications on the provision of rolling stock. It would not require infrastructure enhancements to intermediate stations, but would contribute to enhancement requirements at Edinburgh Waverley.

- Seats available – Up to 70% seats taken on average
- Seats busy – 70% - 85% seats taken on average
- Seats full 85% - 100% seats taken on average
- Standing ie load > 100% of seats
- ScotRail Franchise commitment - 10 minutes standing
- Indicates interchange station

From stations in Fife to Edinburgh Waverley

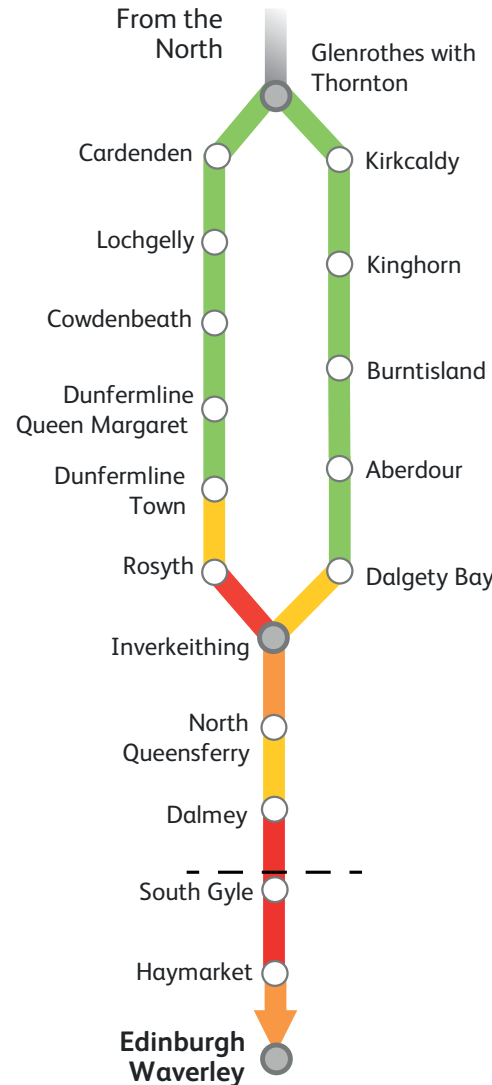


Fig 5.9:- Passenger numbers 2023/24 into Edinburgh Waverley in the morning peak (08:00 – 09:00)

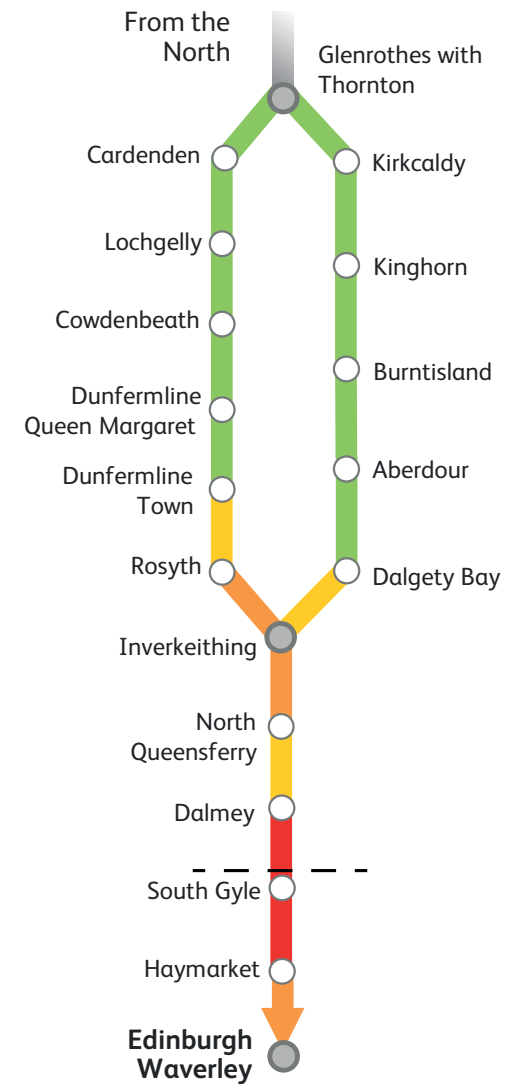


Fig 5.10:- Passenger numbers 2023/24 into Edinburgh Waverley in the morning peak (08:00 – 09:00) with lengthened trains

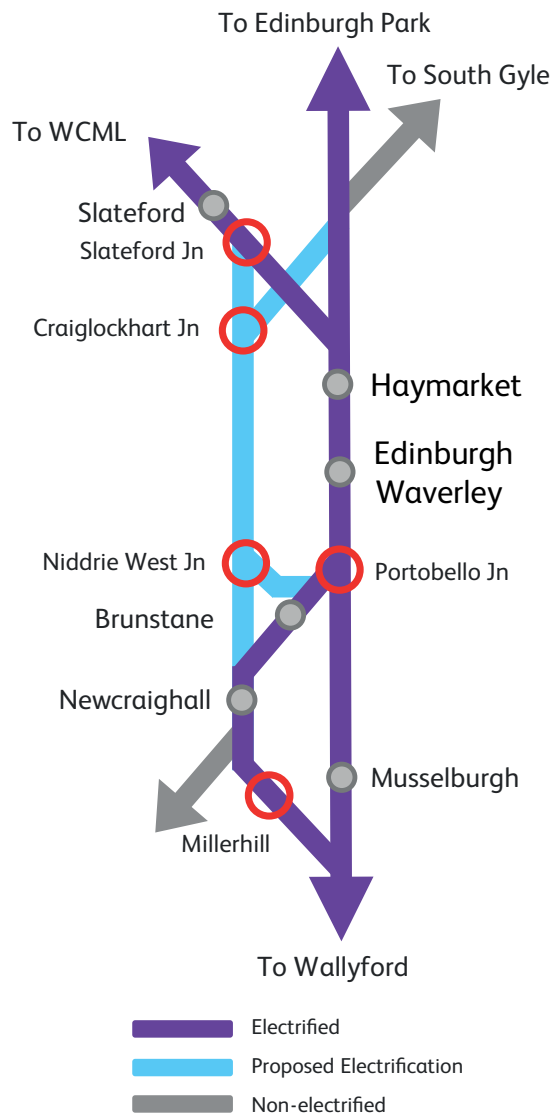


Fig 5.11 – Edinburgh Suburban Enhancement Programme

Edinburgh Suburban Enhancement Programme - Key Points

This route provides a strategic link between the East Coast Main Line (ECML) and West Coast Main Line (WCML) for freight, long distance passenger and engineering haulage services. This proposal aligns closely with the CP5 schemes to electrify the Shotts line and enhance ECML to WCML freight gauge. Modelling of power supply requirements indicates that a new feeder station will be required to support more electric services, likely to be located near Curriehill.

This option supports 2043 Conditional Outputs for Connectivity and Capacity.

The Edinburgh Suburban Line requires a number of infrastructure enhancements prior to electrification to provide sufficient capacity for diverted East Coast and West Coast services.

| Edinburgh Suburban Enhancement Programme | | | | | |
|--|--|-------------|------------------|-----------------------|-------------|
| Purpose | The proposal provides capacity for electric freight services from the ECML to Central Scotland (currently running through Edinburgh Waverley) to run via a less congested route, which releases Edinburgh Waverley capacity for use by long distance and local passenger services. It also creates a viable diversionary electrified route for freight, local services (from the train depot at Millerhill), and diverted long distance ECML and WCML passenger services to/from Edinburgh Waverley. This package of enhancements improves capacity at Portobello Junction, which is a low speed (15mph) single lead junction on a 90mph section of the ECML. It also reduces performance risks at this key location on the Scottish network where the two trains per hour Borders service integrates with ECML services. Enhancements of other junctions and signalling on the route contribute to a significant capacity upgrade prior to electrification. | | | | |
| Technical Description | This option proposes the electrification of the Edinburgh Suburban line to the electrified fringes at Millerhill, Portobello Junction on the ECML, Slateford Junction on the Midcalder lines and Haymarket junctions on the Edinburgh to Glasgow lines. It also proposes the redoubling of Portobello Junction and the remodelling of Niddrie West, Slateford and Craiglockhart junctions in conjunction with re-signalling the route and higher linespeeds. In addition the capability and capacity at Millerhill through the provision of a new signalling system and optimised track layout between Monktonhall Junction and Niddrie South Junction are proposed. | | | | |
| Indicative Costs | £211m - £330m | | | | |
| Strategic Links | To minimise cost and disruption to customers, the signalling and junction enhancements should be delivered in advance of electrification. To deliver sufficient capacity for a robust diversionary route for all services both the infrastructure enhancements and the electrification are required. | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | ↑ | ↑ | ▢ | ↑ |
| Long Distance | | ↑ | ▢ | ▢ | ▢ |
| Local | | ↑ | ▢ | ▢ | ▢ |

Edinburgh Suburban Enhancement Programme - Key Points

This route provides a strategic link between the East Coast Main Line (ECML) and West Coast Main Line (WCML) for freight, long distance passenger and engineering haulage services. This proposal aligns closely with the CP5 schemes to electrify the Shotts line and enhance ECML to WCML freight gauge. Modelling of power supply requirements indicates that a new feeder station will be required to support more electric services, likely to be located near Curriehill.

This option supports 2043 Conditional Outputs for Connectivity and Capacity.

The Edinburgh Suburban Line requires a number of infrastructure enhancements prior to electrification to provide sufficient capacity for diverted East Coast and West Coast services.

| Edinburgh Suburban Enhancement Programme (continued) | |
|--|--|
| Prioritisation assessment | <p>To meet current electric freight demand this is a better value for money option than undertaking a major intervention to create more capacity for freight through the Edinburgh Waverley to Haymarket corridor.</p> <p>This establishes a more resilient network for the Edinburgh area, providing the capability to divert services in the event of planning or unplanned disruption.</p> <p>The electrification of Edinburgh Suburban line during CP6, in addition to the electrified Grangemouth Branch (delivered in CP5) and W12 Gauge Enhancements significantly enhances the strategic freight network between ECML/WCML and across Central Scotland.</p> <p>This choice will form part of an appraisal for enhancement options on the East Coast Main Line, once the London North Eastern Route Study is published later in 2016.</p> |
| Outputs | Contributes towards 1 class 4 or 1 class 6 freight path per hour. |
| Notes | Further work is required to determine whether any enhancements to the connection into the new Millerhill Depot are required to support the late night and early morning movement of empty coaching stock in conjunction with increased freight traffic and engineering haulage through this corridor. |

W12 Gauge Enhancements from West Coast Main Line to Grangemouth - Key Points

The key strategic corridor for Anglo Scottish freight traffic to Central Scotland terminals.

This proposal builds on gauge enhancement and electrification work undertaken between the East Coast and West Coast Main Lines in CP5 at Carstairs and Midcalder Junction to Holytown Junction providing enhanced gauge to Central Scotland.

This option supports 2043 Conditional Outputs for freight.

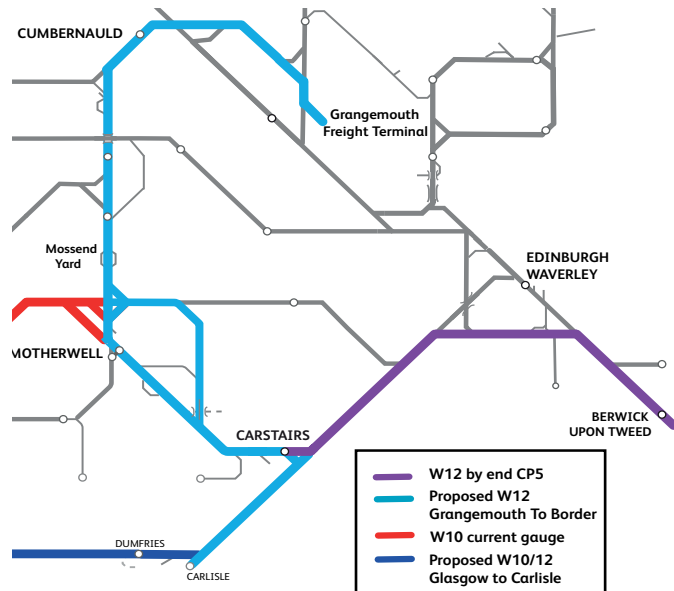


Fig 5.12 – Gauge Enhancement from WCML to Grangemouth

| W12 Gauge Enhancements from West Coast Main Line to Grangemouth | | | | | |
|---|--|-------------|------------------|-----------------------|-------------|
| Purpose | The gauge capability of a corridor defines the maximum size of freight wagons the infrastructure can accommodate. Building on the ECML to WCML W12 gauge enhancement project delivered in CP5 this proposal extends W12 gauge clearance on the route from the border through Carstairs to Grangemouth. This offers the opportunity for more efficient freight operations between ECML and WCML terminals at Mossend, Coatbridge and Grangemouth, and enables operators to better meet freight demand at the end of CP5 while minimising the requirement to increase the frequency or length of freight services to carry the equivalent volume of goods. | | | | |
| Technical Description | This option focuses on increasing the gauge clearance to W12 on the WCML from Carstairs to Grangemouth. It includes the route through Law, via Holytown and Mossend junctions and the route through Motherwell via Lesmahagow junction and Mossend. The interventions may include the reconstruction of bridges, track level alterations and drainage works. | | | | |
| Indicative Costs | £15m - £50m | | | | |
| Strategic Links | Enhancement and electrification of the Edinburgh Suburban line builds on the electrified Grangemouth Branch and ECML to WCML W12 Gauge Enhancements (both delivered in CP5) and contributes to a Strategic Freight Network between ECML/WCML and Central Scotland. It also aligns with the England and Wales Strategic Freight Network. The Winchburgh/Almond enhancement would provide an alternative W12 route to the Central Belt freight terminals if the route via Law Junction is unavailable. | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | ↑ | □ | ↑ | □ |
| Long Distance | | □ | □ | □ | □ |
| Local | | □ | □ | □ | □ |
| Prioritisation assessment | This scheme is proposed to increase freight efficiency by the end of CP6. This choice will form part of an appraisal for enhancement options on the West Coast Main Line once the London North Western "Capacity Plus" Study is published later in 2016. | | | | |
| Outputs | Contributes towards accommodating four Class 4 and one Class 6 freight paths per hour | | | | |

W10/W12 Gauge Enhancements on the G&SW - Key Points

A strategic diversionary freight corridor between the West Coast Main Line at Gretna Junction through South-West Scotland to the Central Belt. This proposal aligns with CP5 gauge enhancement and electrification works which will be undertaken between the East Coast and West Coast Main Lines, and provides enhanced gauge through South-West Scotland.

This option supports 2043 Conditional Outputs for freight.

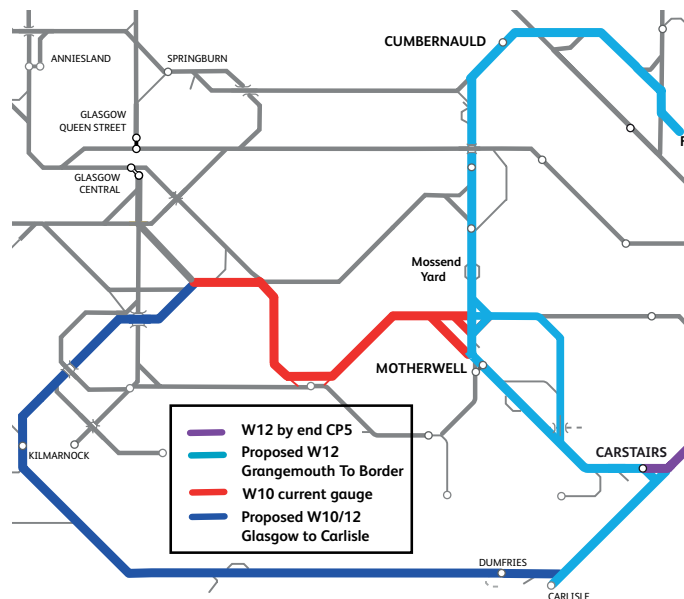


Fig 5.13 – Gauge Enhancement from Gretna Junction to Glasgow via Dumfries and Kilmarnock

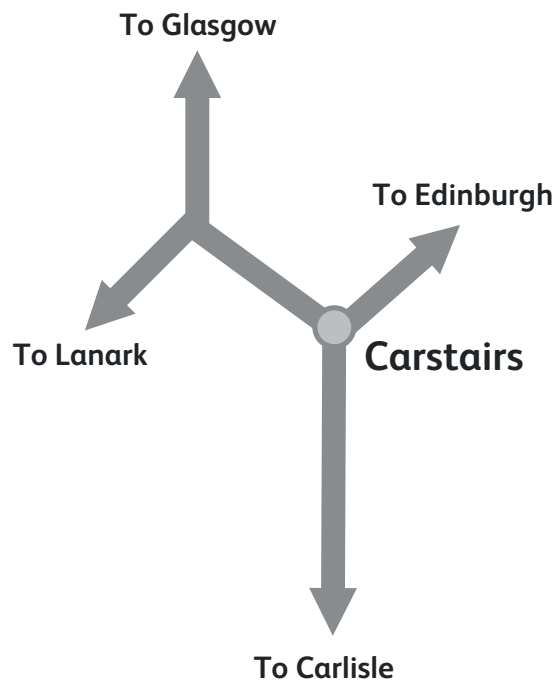
| W10/W12 Gauge Enhancements on G&SW | | | | | |
|------------------------------------|--|-------------|------------------|-----------------------|-------------|
| Purpose | This intervention enhances the capability of the Anglo Scottish diversionary freight route to W10 gauge clearance, with the aim, over time, to clear the route to W12 gauge and electrification. During times of unplanned disruption the gauge enhanced G&SW route could provide a viable alternative route for long distance freight and passenger services. | | | | |
| Technical Description | This option consists of increasing the gauge clearance to W10 (W12 where the work scope can be increased at marginal cost) on the route from Gretna Junction to Glasgow via Dumfries and Kilmarnock. The interventions required include the reconstruction of bridges, track level alterations and associated drainage works. | | | | |
| Indicative Costs | £66m - £150m | | | | |
| Strategic Links | Provides a key diversionary route to the main strategic freight network to Central Scotland and aligns with the W12 Gauge Enhancements from the WCML to Grangemouth. | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | ↑ | □ | ↑ | □ |
| Long Distance | | □ | □ | □ | □ |
| Local | | □ | □ | □ | □ |
| Prioritisation assessment | This scheme increases the resilience of the strategic freight network by providing diversionary routes of sufficient capability to run more trains when network capacity is reduced due to planned or unplanned disruption. | | | | |
| Outputs | Contributes towards accommodating four Class 4 and one Class 6 freight paths per hour. | | | | |

Carstairs Area Enhancement - Key Points

Carstairs is a complex strategic junction on the WCML which regulates a range of Anglo Scottish passenger and freight traffic, local stopping services. It also facilitates the splitting and joining of night-time Sleeper services.

The current layout is fit for an era when flexibility for shunting moves was a fundamental requirement, whereas the priorities for CP6 and beyond focus on higher linespeeds for shorter journey times, and additional capacity for all passenger and freight services in advance of the planned introduction of HS2.

This option supports 2043 Conditional Outputs for Capacity and Connectivity.



| Carstairs Area Enhancement | | | | | |
|----------------------------------|--|-------------|------------------|-----------------------|-------------|
| Purpose | Asset condition is driving the like-for-like renewal of the junction in CP6, but the current capability of the junction will not facilitate forecast demand (freight and passenger) to 2043. Enhancing this junction will improve performance and freight regulation, reduce journey times and whole life costs. | | | | |
| Technical Description | <p>This option rationalises and remodels the junction, providing higher linespeeds for long distance passenger services and improves freight regulation and network performance.</p> <p>It will require the renewal of all track, signalling and overhead line assets in the Carstairs Junction area. Works will involve substantial re-alignment of the track, larger junctions for higher speeds, new drainage, and temporary running lines to minimise overall levels of disruption to customers.</p> <p>The enhanced layout will retain the facility to split and join sleeper services, but not 400 metre HS2 trains. A much larger enhancement would be required at Carstairs to facilitate HS2 splitting and joining moves.</p> | | | | |
| Indicative Costs | £125m - £250m | | | | |
| Strategic Links | Planned asset condition driven renewals in CP6 (including works deferred from CP5). G&SW W10/12 gauge enhancements. Edinburgh Suburban Enhancement Programme. | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | ↑ | ↑ | ↑ | ↑ |
| Long Distance | | ↑ | ↑ | □ | □ |
| Local | | □ | □ | □ | □ |
| Prioritisation assessment | Track asset condition is such that renewal of Carstairs Junction must be undertaken in CP6. This is the opportunity to provide a value for money enhancement of this junction. | | | | |

Fig 5.14 – Carstairs Junction on West Coast Main Line

Carstairs Area Enhancement - Key Points

Carstairs is a complex strategic junction on the WCML which regulates a range of Anglo Scottish passenger and freight traffic, local stopping services. It also facilitates the splitting and joining of night-time Sleeper services.

The current layout is fit for an era when flexibility for shunting moves was a fundamental requirement, whereas the priorities for CP6 and beyond focus on higher linespeeds for shorter journey times, and additional capacity for all passenger and freight services in advance of the planned introduction of HS2.

This option supports 2043 Conditional Outputs for Capacity and Connectivity.

| Carstairs Area Enhancement (continued) | |
|--|--|
| Outputs | <p>Higher linespeeds, for example 105-125mph on the WCML; 35-50mph on the other through lines (which are currently 15mph).</p> <p>1-2 minute journey time improvements on all through routes.</p> <p>Freight regulating capacity - 1.6km Down Loop; 775m standage in the Up direction.</p> <p>The Benefit Cost Ratio is 1.07 based on the Prospering in Global Stability scenario and will be further updated as the option is developed.</p> |
| Notes | <p>Advanced works at Carstairs should be undertaken in CP5, in order that the track, signalling and overhead line enhancements can be delivered early in CP6.</p> <p>The proposed new layout of Carstairs Junction maximises linespeeds and capacity as far as possible on currently available railway land.</p> <p>CP5 enhancements enable diversions for Carstairs traffic e.g. Midcalder to Holytown junctions and EGIP electrification. Other CP6 projects and WCML renewals will be phased to align with Carstairs to minimise customer disruption.</p> |

High Speed Enabling Projects – Key Points

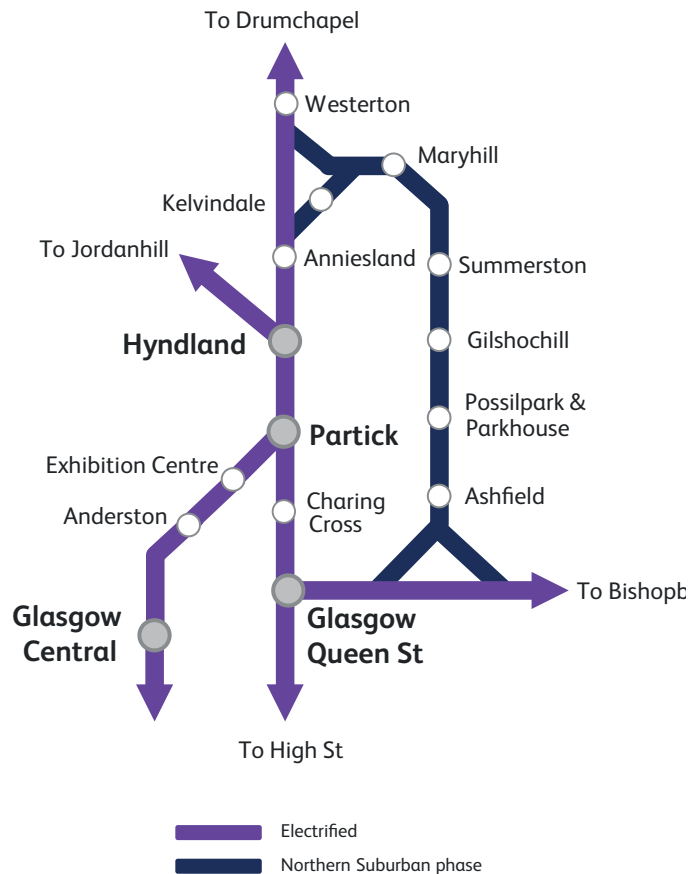
From 2026, 200 metre High Speed 2 trains will be running on the Scottish rail network, and from as early as 2033, 400 metre High Speed 2 train could be introduced. High Speed Rail options are being developed to reduce journey times between the Central Belt of Scotland and London to less than three hours.

| High Speed Enabling Projects | | | | | |
|----------------------------------|--|-------------|------------------|-----------------------|-------------|
| Purpose | This proposal is to provide funding to undertake development work to determine how High Speed 2 (HS2) and High Speed Rail Scotland (HSRS) can be efficiently integrated into the existing rail network in Scotland. This work will build on the Scotland Route Study outputs for Anglo Scottish routes (WCML/ECML/G&SW) to identify enhancement options that deliver the 2043 Conditional Outputs for all types of services on these routes. | | | | |
| Technical Description | As the development of HS2 and HSRS progresses and timetabling evolves, technical feasibility work would be undertaken to ensure that high speed services can be successfully introduced onto Scotland's rail network. | | | | |
| Indicative Costs | £5m - £10m | | | | |
| Strategic Links | Carstairs Area Enhancement, Edinburgh Waverley Enhancements, Glasgow Central Enhancements, East Coast Main Line Enhancements and Four tracking options on the West Coast Main Line. | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| | Freight | | | | |
| | Long Distance | | | | |
| | Local | | | | |
| Prioritisation assessment | Feasibility and development works should be undertaken during CP6 to allow sufficient time for successful delivery of enabling works in advance of the introduction of high speed services. | | | | |

Electrification of Maryhill Line - Key Points

By the end of CP5, the Maryhill line will be the only remaining diesel line in the Glasgow northern suburban network and was included in the Strategic Transport Projects Review (further electrification of the strategic rail network).

This option supports 2043 Conditional Outputs for Capacity.



| Electrification of Maryhill Line | | | | | |
|----------------------------------|---|-------------|------------------|-----------------------|-------------|
| Purpose | To allow trains operating on Maryhill line from Queen Street High Level to have comparable performance characteristics and consistent train formations with other services using this terminal station. This offers opportunities to construct a more efficient timetable to further optimise platform occupancy, improve rolling stock utilisation and provide more resilient performance. It also provides an electrified diversionary route for Glasgow Queen Street services to the low level platforms via Partick and Springburn. | | | | |
| Technical Description | This option proposes approximately five miles of electrification of the Maryhill line from Cowlaers Junctions to Westerton Junction including the Anniesland single line. | | | | |
| Indicative Costs | £60m - £100m | | | | |
| Strategic Links | This option contributes to making best use of Queen Street High Level Station, minimising the scope and costs of future work to improve Queen Street tunnel capacity and the number / length of platforms in the station. | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | 🟡 | 🟡 | 🟡 | 🟡 |
| Long Distance | | 🟡 | 🟡 | 🟡 | 🟡 |
| Local | | 🟢↑ | 🟢↑ | 🟡 | 🟡 |
| Prioritisation assessment | Funder aspiration as part of the Strategic Transport Projects Review Rolling Programme of Electrification. | | | | |
| Outputs | Funder aspiration as part of the Strategic Transport Projects Review Rolling Programme of Electrification. | | | | |

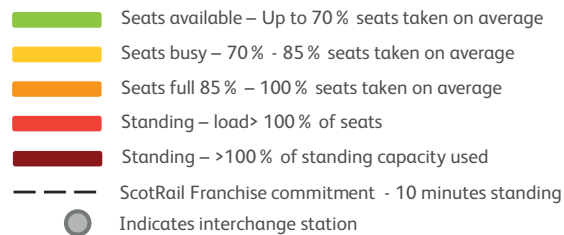
Fig 5.15 – Electrification of Maryhill Line

Glasgow Queen Street High Level Routes 2023/24 Forecast Demand

These routes run to the North, with services from the East (Edinburgh) joining the route in the Greater Glasgow area

Passenger numbers forecast for 2023/24 indicates significant crowding on services from the north in the Greater Glasgow area (see Fig 5.16).

A combination of timetabling and changes to stopping patterns could better distribute these passengers across all available services in the morning peak hour following the completion of the Edinburgh Glasgow Improvement Project (EGIP) in 2019 when there will be more seats available from the east into this area. (see Fig 5.17). This option is being progressed by Transport Scotland through the ScotRail franchise for delivery in December 2018.



From Aberdeen/Inverness to Glasgow Queen Street High Level

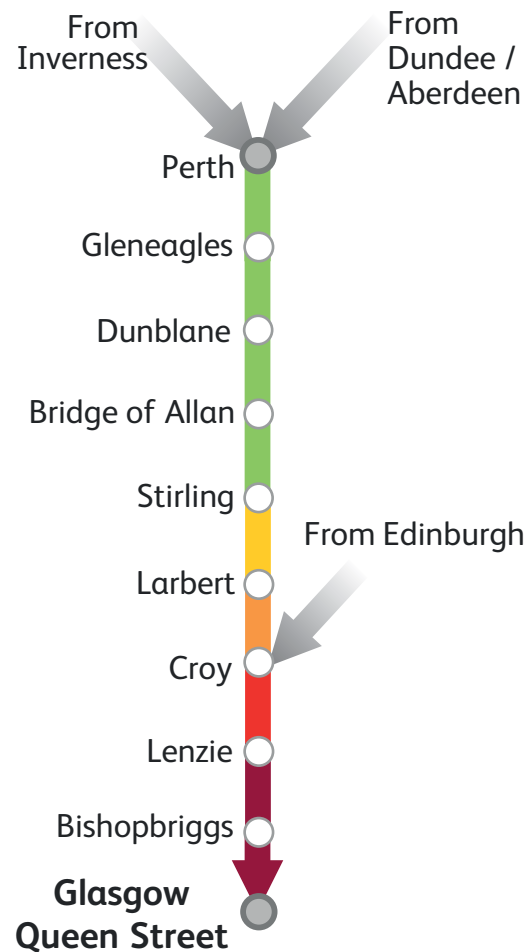


Fig 5.16:- Passenger numbers in 2023/24 into Glasgow Queen Street in the morning peak (08:00 – 09:00) – Aberdeen/Inverness trains only

From all corridors to Glasgow Queen Street High Level

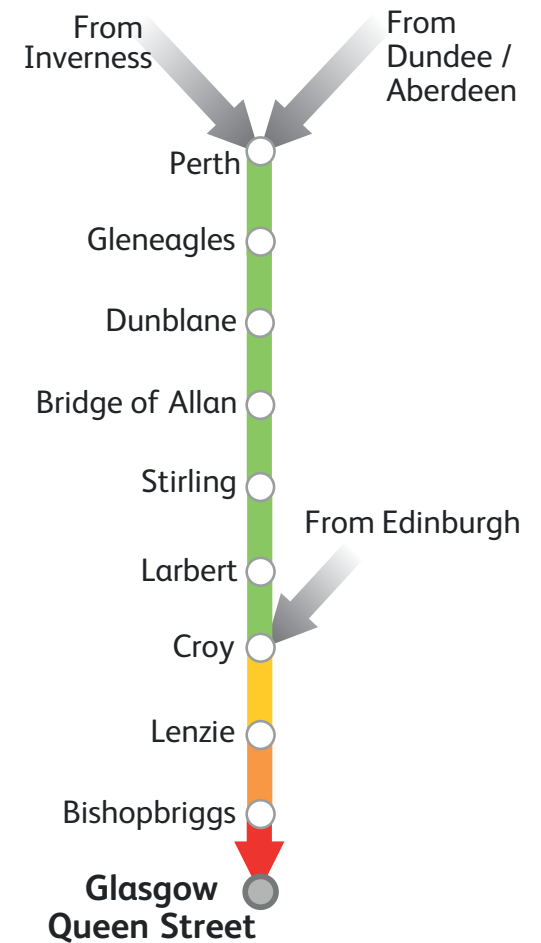


Fig 5.17:- Passenger numbers in 2023/24 into Glasgow Queen Street in the morning peak (08:00 – 09:00) – All services

Glasgow Central High Level Ayrshire and Inverclyde Routes 2023/24 forecast demand

Passenger forecasts for 2023/24 indicate that some services may exceed 100 per cent seating capacity into Glasgow Central and Glasgow Queen Street low level stations

These electrified routes run from Helensburgh, Milngavie and Balloch in the north-west through interchange stations at Hyndland and Partick to Glasgow Central and Glasgow Queen Street Low Level stations to Whifflet, Cumbernauld, Airdrie, Edinburgh, Motherwell and Larkhall in the east. These routes are intensively used by commuters into Glasgow city centre and services are very frequent with up to 16 trains per hour each way serving the busiest stations.

In certain areas forecast demand exceeds the current ScotRail Franchise commitment of no more than 10 minutes standing time for passengers such as from Balloch and from Motherwell/Larkhall via Hamilton.

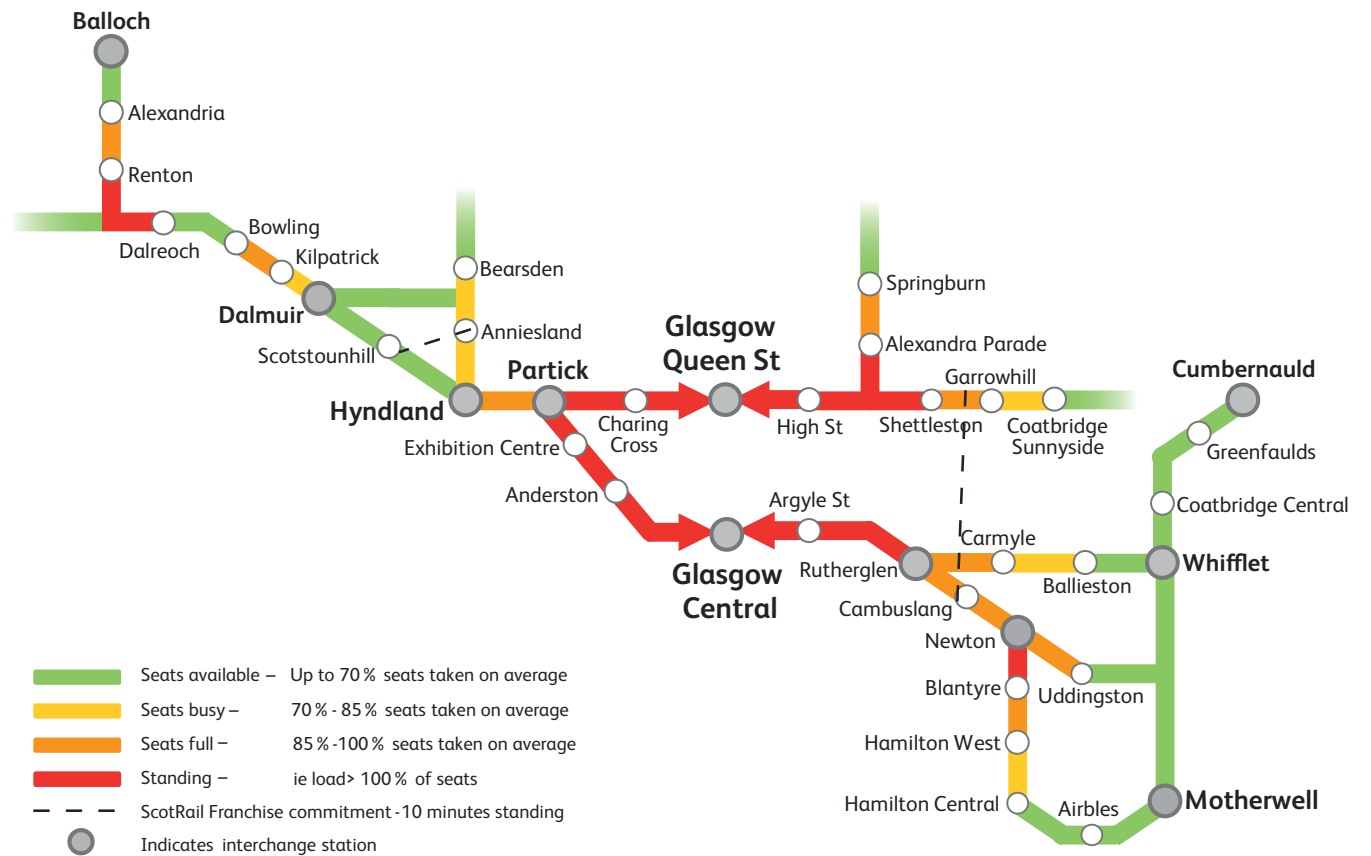


Fig 5.18:- Glasgow Northern Suburban Routes forecast demand into central Glasgow 2023/24 (morning peak hour 08:00-09:00)

Services currently run as a combination of three and six car trains. Strengthening peak services to all six car trains would reduce congestion on services from the west and from the east. This would have implications on the provision of rolling stock however would not require infrastructure enhancements to intermediate stations. Selective train lengthening on busy services would be the first proposed step in alleviating crowding to 2023/24. Based on the two strong growth scenarios, there is a positive business case for lengthening the Balloch to Airdrie services in the peak (Prospering in Global Stability scenario has a Benefit Cost Ratio of 1.7). Based on the two strong growth scenarios, there is also a positive business case for lengthening the Motherwell services in the peak (Prospering in Global Stability scenario has a Benefit Cost Ratio of 2.8).

Post 2023/24 passenger numbers are predicted to continue to grow and lengthening all trains on this network would provide more seats (see figure 5.19) although services continue to exceed 100 per cent capacity westbound. Towards 2043, capacity improvement projects could be considered to address this issue, including turnback options at Exhibition Centre, Charing Cross and/or Hyndland.

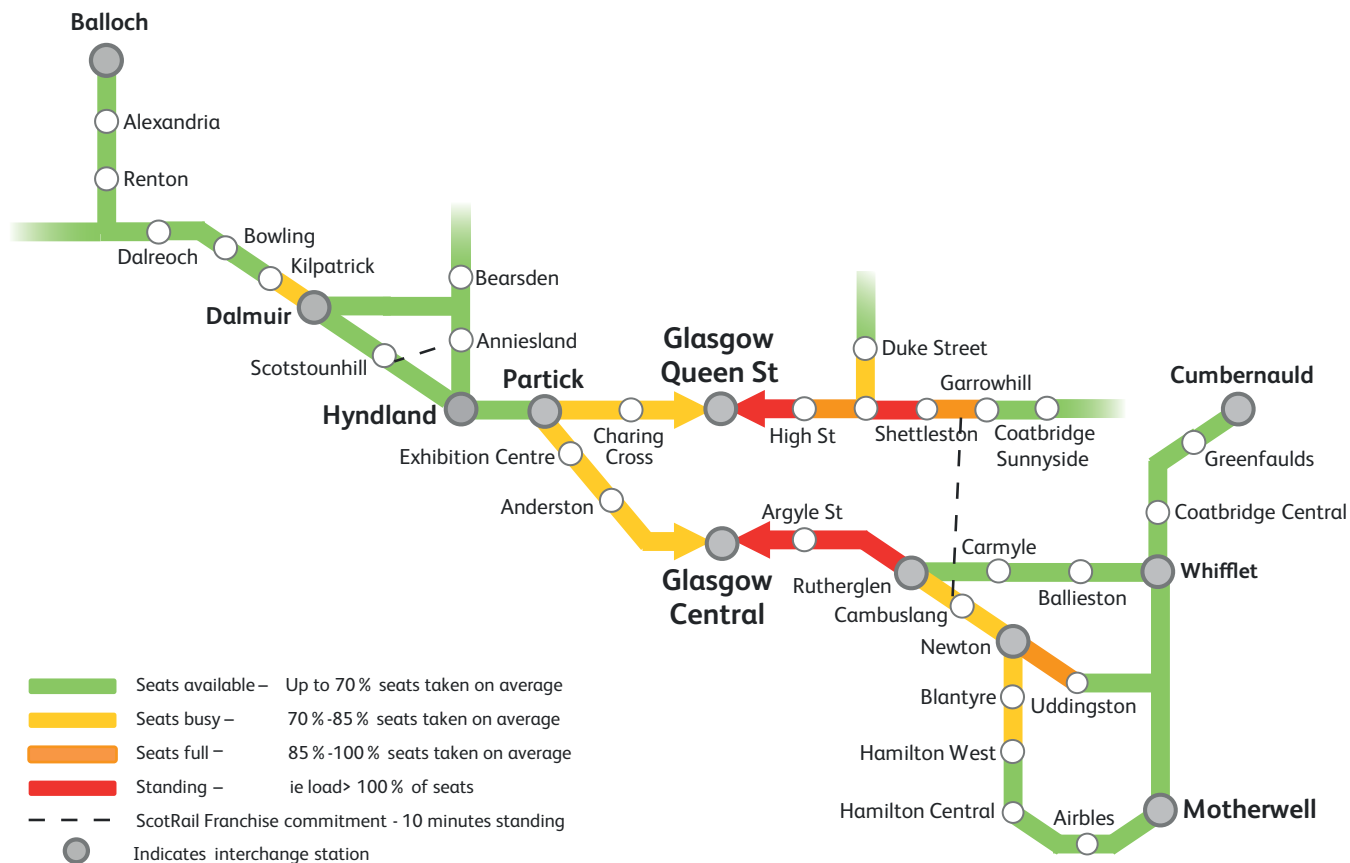


Fig 5.19:- Glasgow Northern Suburban Routes forecast demand into Central Glasgow 2023/24 - lengthened to all 6 car trains (morning peak hour 08:00-09:00)

Train lengthening Ayrshire and Inverclyde Routes 2023/24

Demand forecasts indicate that by 2023/24 services may exceed 100 per cent seating capacity into Glasgow Central in the peak hour.

These routes are intensively used by commuters into Glasgow city centre and services are frequent with up to 14 trains per hour approaching Glasgow Central.

Lengthening trains from Gourock would reduce congestion on services from the west in the morning



Fig 5.20:- Ayrshire & Inverclyde lines forecast demand into Glasgow Central (08:00-09:00)

peak hour. This would have implications on the provision of rolling stock and impact on the required enhancements at Glasgow Central. Lengthening Gourock services has a positive business case in the highest growth scenario (Prospering in Global Stability scenario has a Benefit Cost Ratio of 1.1).

Lengthening Ayr services from 7 to 8 car trains has a positive business case in all the scenarios, with Prospering in Global Stability providing a Benefit Cost Ratio of 2.9). Selective door opening would be required for intermediate stations and there would be an impact on platform capacity at Glasgow Central.



Fig 5.21:- Ayrshire & Inverclyde lines forecast demand into Glasgow Central -Train Lengthening (morning peak hour 08:00-09:00)

Electrification and enhancement of the East Kilbride and Barrhead Lines - Key Points

Enhancement of the East Kilbride and Barrhead corridors to accommodate forecast passenger numbers by the end of CP6 and to minimise the scale of enhancement required at Glasgow Central High Level station.

This option supports 2043 Conditional Outputs for Connectivity and Capacity.

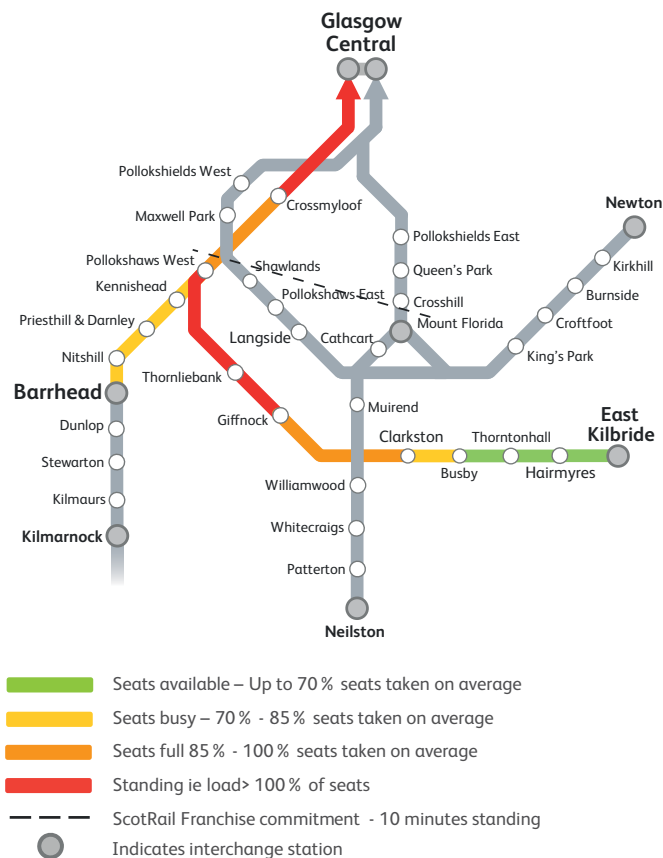
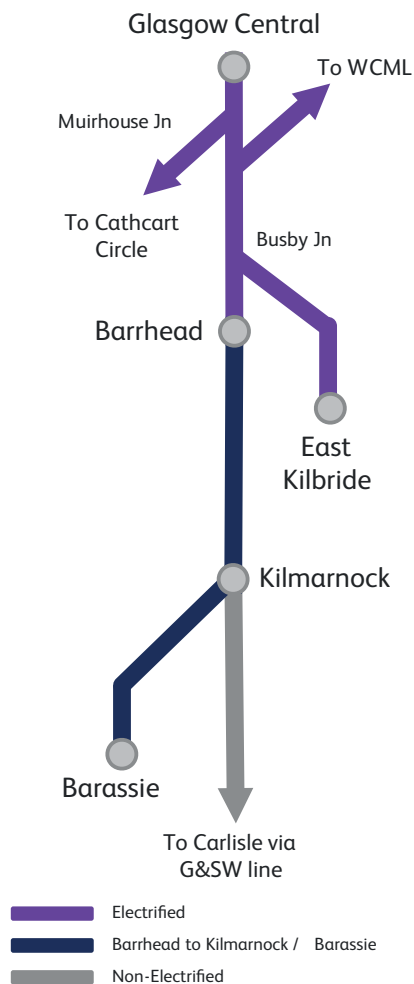


Fig 5.22 – East Kilbride line 2023/24 forecast passenger numbers into Glasgow Central (08:00-09:00)

| Electrification and enhancement of the East Kilbride and Barrhead lines | | | | | |
|---|--|-------------|------------------|-----------------------|-------------|
| Purpose | To accommodate forecast passenger numbers and to maximise the benefits of the electrification to East Kilbride and Barrhead the corridor could be enhanced to permit an increased frequency of trains and reduce the platform occupancy requirements at Glasgow Central High Level station. | | | | |
| Technical Description | The 14 miles of electrification to East Kilbride and Barrhead requires the replacement of several bridges to create sufficient clearance; this will include footbridges in station areas. A second platform at East Kilbride station, and sections of double track or loops between Hairmyres and Busby stations could facilitate more trains to East Kilbride. | | | | |
| Indicative Costs | £150m - £300m | | | | |
| Strategic Links | Glasgow Central High Level Station enhancements and Strategic Transport Projects Review - Rolling Programme of Electrification. | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | 🟡 | 🟡 | 🟡 | 🟡 |
| Long Distance | | 🟡 | 🟡 | 🟡 | 🟡 |
| Local | | 🟢 | 🟢 | 🟢 | 🟢 |
| Prioritisation assessment | Accommodating forecast passenger demand for the end of CP6. To minimise costs and disruption to passengers enhancing the infrastructure in advance of electrification is advisable. In this corridor the signalling and track enhancements could be delivered (providing an increase in the number of trains and reducing capacity requirements in Glasgow Central) prior to electrification. Due to the different rolling stock performance characteristics between diesel trains and electric trains further infrastructure alterations may be required. An appraisal will be progressed once further timetable and technical development works is undertaken. | | | | |
| Outputs | Contributes towards CC02, CC07, GC09, GC011, a reduction in journey times and a reduction in platform occupancy at Glasgow Central. | | | | |
| Notes | Consideration to be given to depot and stabling facilities for electric rolling stock as the proportion of electrified lines in Scotland increases. Additional feeder station capacity is likely to be required to supply power to the newly electrified routes. | | | | |



Electrification and enhancement to Kilmarnock/Barassie - Key Points

Following the enhancements and electrification of the East Kilbride and Barrhead lines, the route from Barrhead to Barassie via Kilmarnock could be electrified and enhanced to improve the efficiency of rolling stock utilisation and reduce platform occupation at Glasgow Central High Level Station and provide an additional opportunity to travel between Glasgow Central and Kilmarnock.

This option supports 2043 Conditional Outputs for Capacity and Connectivity.

| Electrification and enhancement to Kilmarnock/Barassie | | | | | |
|--|--|-------------|------------------|-----------------------|-------------|
| Purpose | To maximise the benefits of the electrification to Kilmarnock/Barrassie the corridor could be enhanced to permit an increased frequency of services and reduce the platform occupancy requirements at Glasgow Central High Level station. It would also make optimum use of the available electric rolling stock fleet. | | | | |
| Technical Description | The 25 miles of electrification to Kilmarnock and Barassie requires the replacement of several bridges to create sufficient gauge clearance; this will include footbridges in station areas and the upgrade of power supplies. An increase in the signalling capacity between Barrhead and Kilmarnock should be considered to allow multiple trains to operate through the single line section. | | | | |
| Indicative Costs | £80m - £200m | | | | |
| Strategic Links | Glasgow Central High Level Station enhancements and Strategic Transport Projects Review - Rolling Programme of Electrification | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | 🟡 | 🟡 | 🟡 | 🟡 |
| Long Distance | | 🟢 | 🟡 | 🟡 | 🟡 |
| Local | | 🟢 | 🟢 | 🟡 | 🟢 |
| Prioritisation assessment | Funder aspiration and capacity at Glasgow Central High Level Station. | | | | |
| Outputs | Contributes towards CC02, CC05, CC07, CC010 and GC010 | | | | |
| Notes | This option is the next key step in upgrading the G&SW route for Anglo Scottish services with sufficient capacity and gauge clearance. Consideration to be given to depot and stabling facilities for electric rolling stock as the proportion of electrified routes in Scotland increases. Additional feeder station capacity is likely to be required to supply power to the newly electrified routes. | | | | |

Fig 5.23– Electrification and enhancement to Kilmarnock/Barassie

Glasgow Central High Level Enhancements - Key Points

Glasgow Central continues to experience significant levels of growth for Anglo Scottish, interurban and local services, and will need to accommodate more and longer trains by the end of CP6.

This option supports 2043 Conditional Outputs for Connectivity and Capacity.

| Glasgow Central Station enhancements | | | | | |
|--------------------------------------|---|-------------|------------------|-----------------------|-------------|
| Purpose | To accommodate forecast demand on key corridors into Glasgow Central High Level choices for funders have been provided to lengthen trains and/or increase service frequency. Depending on which of these choices are progressed by funders, platform capacity at Glasgow Central will require to be enhanced to differing levels to continue to deliver a robust timetable. | | | | |
| Technical Description | A number of options exist to minimise capacity requirements at Glasgow Central High Level Station: <ul style="list-style-type: none"> ● Timetable amendments to maximise interworking between services with the same rolling stock (i.e. Inverclyde and Ayrshire), and minimise splitting and joining moves to reduce average platform dwell times at Glasgow Central ● Enhancement of East Kilbride/Barrhead lines to reduce platform occupation at Glasgow Central ● Remodelling and lengthening of existing platforms in line with train lengthening and service frequency changes. | | | | |
| Indicative Costs | Further technical development work will be undertaken once funders have chosen which options to progress. | | | | |
| Strategic Links | Enhancement and electrification to East Kilbride/Barrhead and all train lengthening options could impact on the capacity available at Glasgow Central High Level. | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | 🟡 | 🟡 | 🟡 | 🟡 |
| Long Distance | | 🟢 | 🟡 | 🟢 | 🟢 |
| Local | | 🟢 | 🟡 | 🟢 | 🟢 |
| Prioritisation assessment | Due to forecast demand by the end of CP6 the shorter platforms at Glasgow Central High Level will no longer be fit for purpose as they will be too short to accommodate modern rolling stock. Further enhancements may be required to support passenger demand beyond CP7. | | | | |
| Outputs | Contributes towards CC02, CC05, CC07, CC010, IC011, IC012, GC04, GC05, GC06, GC07, GC08, GC09, GC10, GC011, GC012, GC013, GC014, GC015, GC016, GC018, GC022, GC025, GC026, GC027, GC028, GC030, LDC02, LDC08, LDC09, LDC010, LDC011, LDC012, LDC015, LDC021, LDC022, LDC023, LDC024 and LDC025. | | | | |

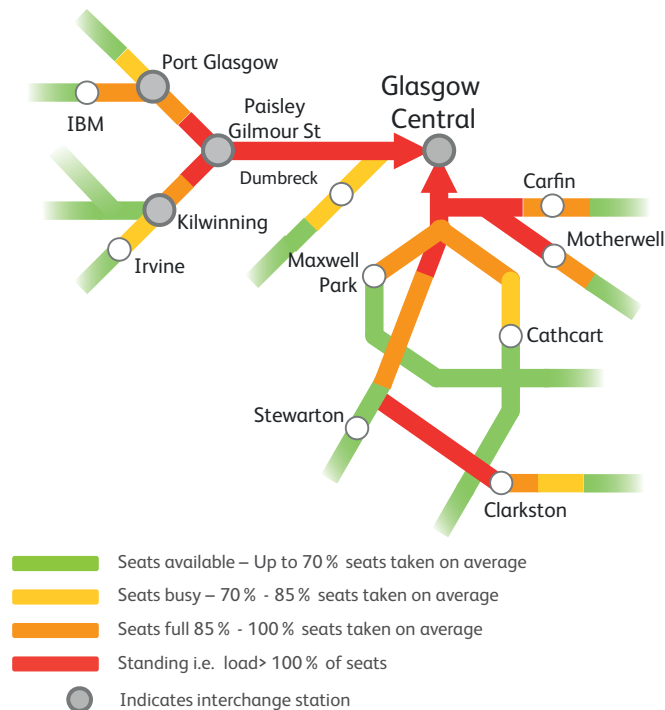
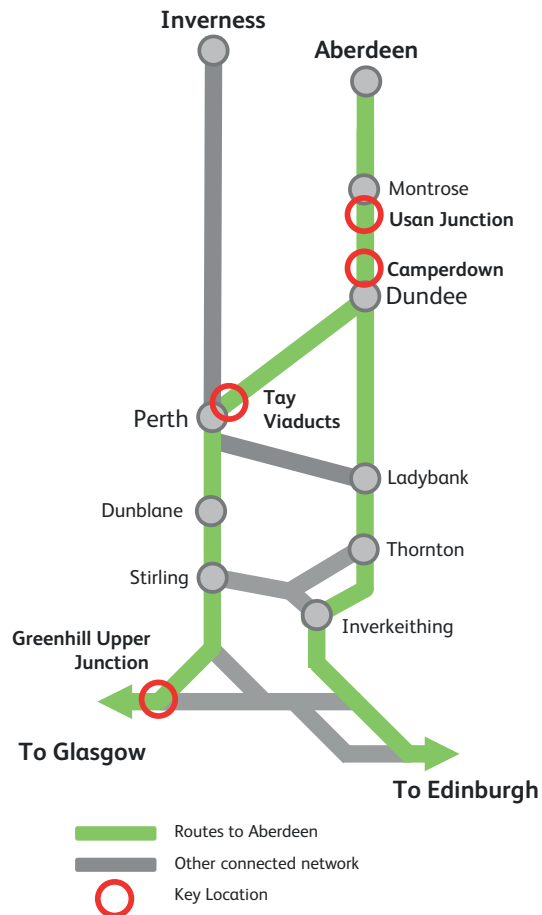


Fig 5.24 – Passenger numbers in 2023/24 into Glasgow Central High Level in the morning peak hour (08:00 – 09:00)

Central Belt to Aberdeen Enhancement - Overview

Initial timetable development work identified key network constraints to delivering the 2043 Conditional Outputs. Technical development work was undertaken on these constraints. The cost and level of disruption to customers of the technical options is significant and highly influenced by rolling stock characteristics, particularly north of Perth. Further timetable development work is underway, but not yet complete. Consequently, enhancement options for these routes will be provided to funders as part of the ongoing Long Term Planning Process

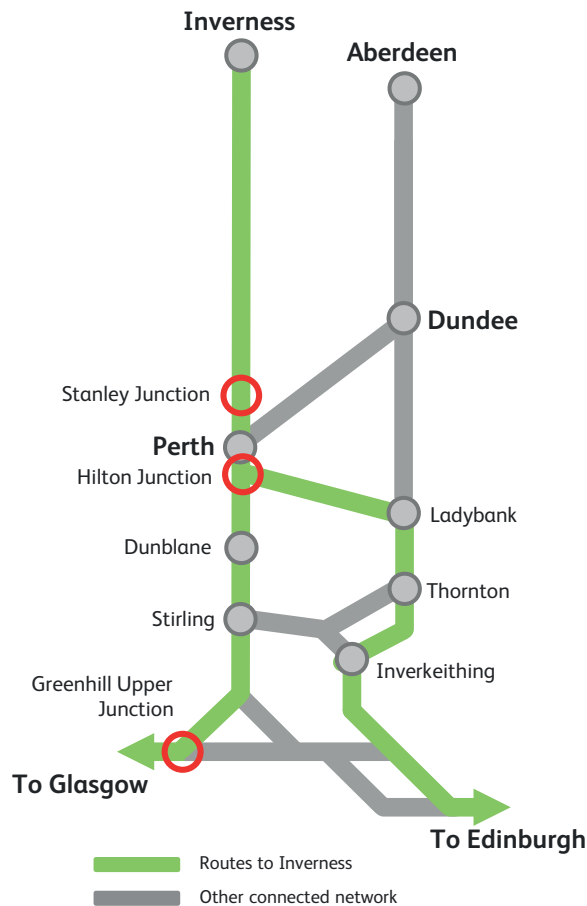


| Central Belt to Aberdeen Enhancement (including electrification) | |
|--|--|
| Purpose | To provide packages of timetable and infrastructure enhancement options (including electrification) to deliver incremental outputs, such as journey time reduction and improved connectivity, at a corridor level, working towards the 2043 Conditional Outputs |
| Technical Description | <p>The following interventions should be considered:</p> <ul style="list-style-type: none"> Greenhill Upper Junction Grade Separation to increase the flexibility of the timetable by removing the conflict between Edinburgh/Glasgow and interurban services Dunblane to Dundee corridor enhancements to improve capacity and journey times Camperdown freight loop and bi-directional working to Dock Street Tunnel to provide a freight regulating facility to assist the provision of hourly Aberdeen and the Central Belt freight paths Double tracking between Usan Junction and South Esk Viaduct at Montrose on a new shorter alignment to reduce journey times and improve freight regulation Enhancing the section of line between Perth and Barnhill Junction by doubling the Princes Street Viaduct Arches and Tay Viaduct in advance of electrification to create sufficient capacity to act as a diversionary route for Fife traffic Fife Enhancements including a Dunfermline Bypass, Cowdenbeath to Thornton Line Improvements and pre-works for Electrification to improve capacity and journey times through Fife. |
| Strategic Links | Central Belt to Inverness Enhancement and Aberdeen to Inverness Enhancement. |
| Notes | <p>Electrification to Aberdeen will enable electric freight to run, reducing the speed differential between the fastest and slowest trains, thus minimising the extent and cost of additional infrastructure interventions required to meet the forecast demand for all services.</p> <p>The approximate electrification required per phase in terms of single track kilometres (stk) is as follows:</p> <ul style="list-style-type: none"> From Dunblane to Perth – 100stk From Perth to Dundee – 70stk From Haymarket to Hilton/Dundee – 400stk From Dundee to Aberdeen – 250stk. |

Fig 5.25:- Central Belt to Aberdeen enhancement options

Central Belt to Inverness Enhancement - Overview

Initial timetable development work identified key network constraints to delivering the 2043 Conditional Outputs for connectivity, capacity and freight. Technical development work was undertaken on these constraints. The cost and level of disruption to customers of the technical options is significant and highly influenced by rolling stock characteristics, particularly north of Perth. Further timetable development work is underway, but not yet complete. Consequently enhancement options for these routes will be provided to funders as part of the ongoing Long Term Planning Process.



| Central Belt to Inverness Enhancement | |
|---------------------------------------|---|
| Purpose | To provide packages of timetable and infrastructure enhancement options to deliver incremental outputs, including journey time reduction and improved connectivity, at a corridor level, working towards the 2043 Conditional Outputs. |
| Technical Description | <p>The following interventions should be considered:</p> <ul style="list-style-type: none"> ● Greenhill Upper Junction Grade Separation to increase the flexibility of the timetable by removing the conflict between Edinburgh/Glasgow and interurban services ● Fife Enhancements including a Dunfermline Bypass, Cowdenbeath to Thornton Line Improvements and pre-works for electrification to improve capacity and journey times through Fife. ● Ladybank to Hilton enhancement to improve capacity and journey times ● Dunblane to Perth Capacity Enhancement to improve capacity and journey times ● Stanley Junction relocation on to straight track for a higher linespeed ● Signalling enhancements to allow simultaneous acceptance of trains into both platforms at Highland Main Line stations ● Inverness layout flexibility revisions to the existing track and platform layout to improve operational efficiency and flexibility, including introduction of new rolling stock. |
| Strategic Links | Central Belt to Aberdeen Enhancement and Aberdeen to Inverness Enhancement. |
| Notes | Electrification to Inverness will enable electric freight to run, reducing the speed differential between the fastest and slowest trains thus minimising the extent and cost of additional infrastructure required to meet the forecast demand for all services. |

Fig 5.26:- Central Belt to Inverness Enhancement options

Greenhill Junction Grade Separation - Key Points

Key flat junctions, such as Greenhill, currently constrain the interurban and commuter timetables. Removing this bottleneck to create a more flexible network will enable the full benefits of linked enhancements to be realised, and deliver shorter interurban journeys without reducing local connectivity.

This option supports 2043 Conditional Outputs for Capacity and Connectivity.

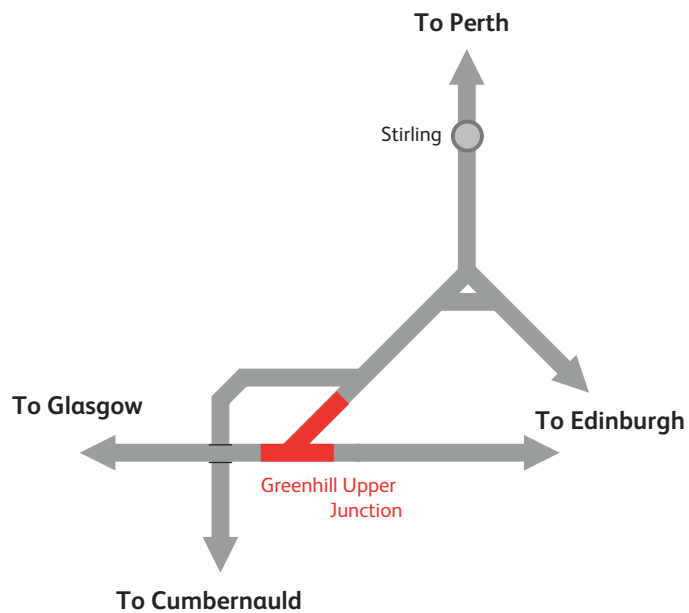


Fig 5.27:- Grade separated Greenhill Upper Junction

| Greenhill Junction Grade Separation | | | | |
|-------------------------------------|--|------------------|-----------------------|-------------|
| Purpose | This intervention permits trains running from Larbert towards Glasgow Queen Street to do so without conflicting with Edinburgh to Glasgow via Falkirk High services when crossing the line towards Glasgow. This will offer potential timetable, journey time and performance benefits to services running between Glasgow and Aberdeen/Inverness. | | | |
| Technical Description | Replacement of the flat junction layout at Greenhill Upper with a grade separated arrangement, enabling Larbert to Glasgow Queen Street services to join the line to Glasgow without crossing the line to Edinburgh. | | | |
| Indicative Costs | £90m - £150m | | | |
| Strategic Links | Central Belt to Aberdeen Enhancement, Central Belt to Inverness Enhancement, Edinburgh Waverley Western Approaches Enhancement and Electrification of Maryhill Line. | | | |
| Customer Outcomes | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | | | |
| Long Distance | | | | |
| Local | | | | |
| Prioritisation assessment | This scheme complements other Aberdeen and Inverness to Central Belt enhancement proposals. | | | |
| Notes | Contributes towards CC02, CC05, CC07, CC010, IC01, IC03, IC04, IC010, GC01, GC03 and 1 class 4 or 1 class 6 freight path per hour. | | | |

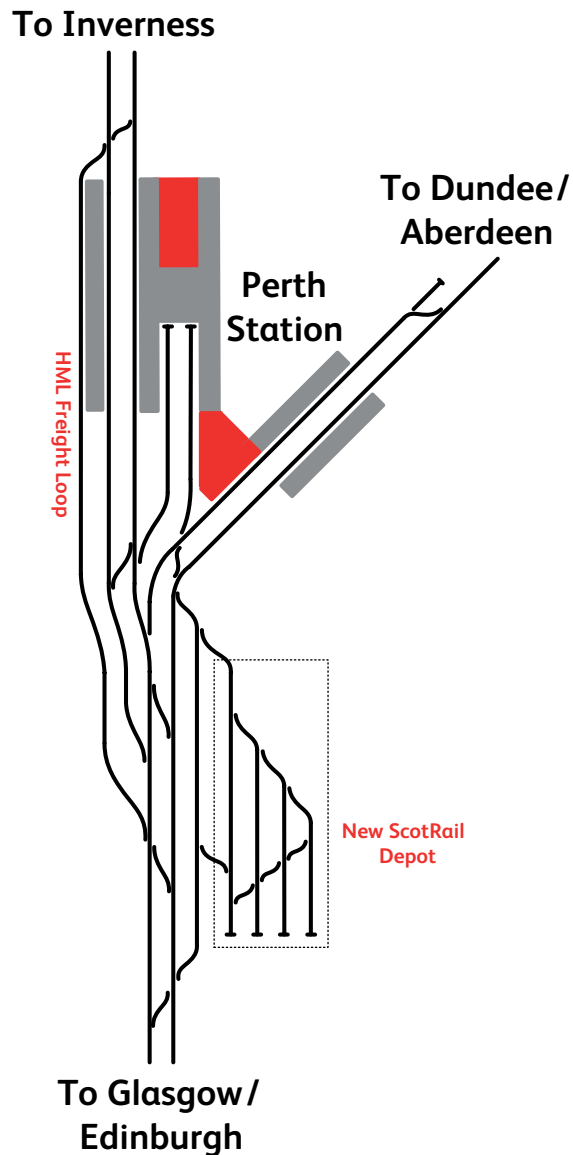


Fig 5.28:- Outline proposals for remodelled Perth Station

Dunblane to Perth Corridor Enhancement - Key Points

This section of the Scottish Central Line requires modernisation prior to being electrified, including the removal of manual signal boxes at Auchterarder, Blackford and Greenloaning, and the re-control and re-signalling of Perth station.

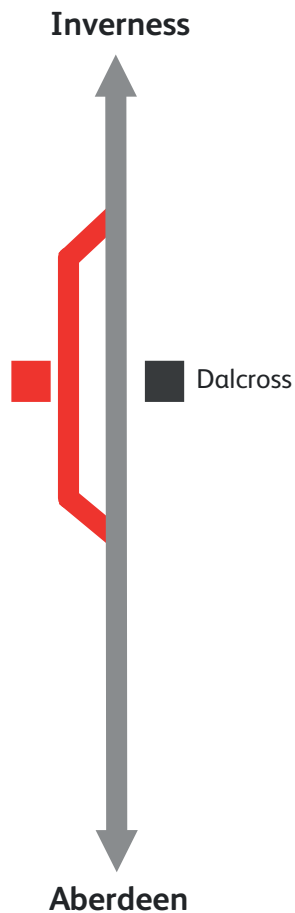
Preparations for electrification of the route would involve work at structures, tunnels and stations to achieve the requisite clearance for the overhead wires. This provides a one-off opportunity, particularly in the Perth station area, for enhancement of the track layout and linespeed improvements to improve network flexibility and performance.

Perth Station is a key interchange for local, interurban and freight services on the Scottish Central Main Line. In its current form will not be able to accommodate the increase in passenger and freight forecast demand to 2043.

| Dunblane to Perth Corridor Enhancement | | | | | |
|--|--|-------------|------------------|-----------------------|-------------|
| Purpose | This proposal is for a comprehensive upgrade of the Dunblane – Perth railway corridor, including re-signalling, station re-modelling, linespeed increases and electrification. This will improve the timetable, journey times and capacity for passenger and freight services. | | | | |
| Technical Description | <p>Re-signalling and re-control of this section of route in advance of electrification to enable potential linespeed increases for improved journey times.</p> <p>Timetable analysis has identified that improving Greenloaning – Kinbuck area signal headways will increase capacity on this section and ease operating constraints south of Stirling.</p> <p>Advance route clearance works to the south of Perth station to enable track realignment and layout re-modelling for higher linespeeds between Hilton Junction and Perth.</p> <p>This option proposes the removal of platforms 3 & 4 to open up access to the front of the station and the creation of a new platform 8 and adjacent long loop for Highland Main Line services to allow better regulation/timetabling of through services.</p> | | | | |
| Indicative Costs | £295m - £600m | | | | |
| Strategic Links | Central Belt to Aberdeen Enhancement, Central Belt to Inverness Enhancement and Greenhill Upper Grade Separation. | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | ↑ | → | ↑ | ↑ |
| Long Distance | | → | ↑ | → | → |
| Local | | ↑ | ↑ | → | → |
| Prioritisation assessment | Enhancements between Dunblane and Perth should be undertaken prior to electrification to minimise disruption to customers and provide better value for money. | | | | |

Aberdeen to Inverness Enhancement - Key Points

These options build on the outputs delivered in CP5 as part of Aberdeen to Inverness Phase 1 (half hourly service between Aberdeen and Inverurie, additional commuter services between Elgin and Inverness and new stations at Kintore and Dalcross). This option supports 2043 Conditional Outputs for Capacity and Connectivity.



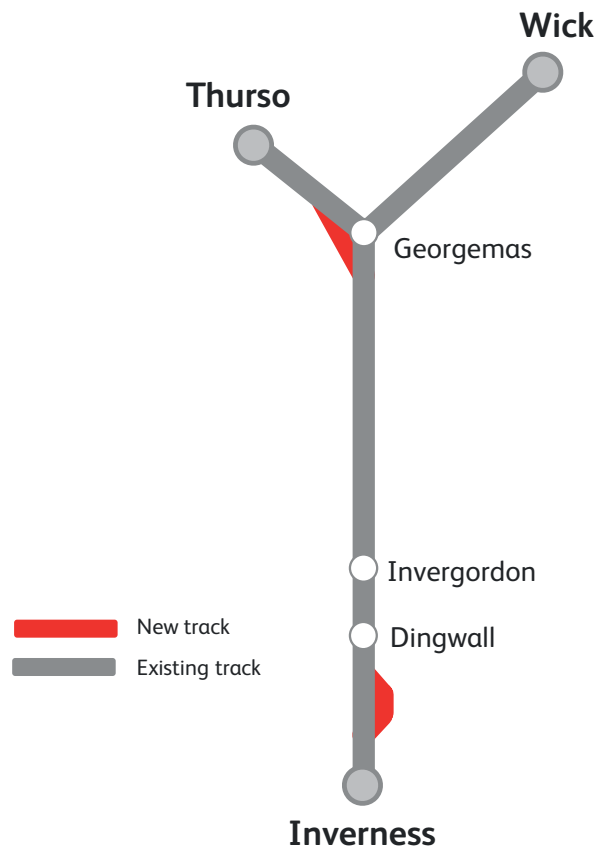
| Aberdeen to Inverness Enhancement | | | | | |
|-----------------------------------|--|-------------|------------------|-----------------------|-------------|
| Purpose | To provide packages of timetable and infrastructure enhancement options to deliver incremental outputs, such as improved connectivity and journey time reduction, at a corridor level, working towards the 2043 Conditional Outputs. | | | | |
| Technical Description | To provide a robust step change in connectivity on a corridor with a significant proportion of single line track the following interventions could be considered: <ul style="list-style-type: none"> • New dynamic loop at Dalcross, including second platform at Dalcross Station • Extension of some existing loops • Signalling enhancements • Track enhancements • Civils enhancements. | | | | |
| Indicative Costs | Half-hourly opportunities to travel between Inverness and Elgin: £36m - £90m Hourly opportunities to travel between Inverness and Aberdeen: £78m - £190m | | | | |
| Strategic Links | Central Belt to Aberdeen Enhancement, Central Belt to Inverness Enhancement and Far North Enhancements. | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | | | | |
| Long Distance | | | | | |
| Local | | | | | |
| Prioritisation assessment | Hourly opportunities to travel between Aberdeen and Inverness to meet forecast interurban demand by the end of CP6. Half-hourly opportunity to travel between Inverness and Elgin is a funder aspiration (RC05). | | | | |
| Outputs | Contributes towards RC04, RC05, RC06 and 1 class 4 or 1 class 6 freight path per hour. | | | | |
| Notes | For a corridor such as this, with significant single line sections, combining timetabling with infrastructure enhancements is key. It should also be highlighted that different outputs require different infrastructure enhancements, consequently outputs should be phased to avoid enhancing an asset in one control period that is not required in future control periods. This project should be integrated with the Transport Scotland project to dual the A96. Special consideration should be given to the transport corridor approaching Inverness from the South and East. | | | | |

Fig 5.29:- Aberdeen to Inverness Enhancement

Far North Enhancement - Key Points

A key rural route in the North of Scotland for passenger and freight services, which is currently constrained and therefore difficult to reinstate normal services in the event of disruption to the timetable.

These options support the 2043 Conditional Outputs for Connectivity.



| Far North Enhancement | | | | | |
|----------------------------------|--|-------------|------------------|-----------------------|-------------|
| Purpose | To meet the forecast 2043 connectivity Conditional Outputs, between Inverness and Invergordon. These interventions could also improve the resilience and performance of the network. | | | | |
| Technical Description | The following interventions are proposed: <ul style="list-style-type: none"> • Inverness to Dingwall additional loop to provide greater flexibility to pass trains • Dingwall to Invergordon additional infrastructure to provide greater flexibility to pass trains • Installation of conventional signalling between Inverness and Dingwall to replace current token exchange arrangements • Georgemas Chord to create new connection to facilitate a direct service to Thurso without the need to reverse at Georgemas. | | | | |
| Indicative Costs | £30m - £75m | | | | |
| Strategic Links | Links to Central Belt to Inverness Enhancements and Aberdeen to Inverness Enhancements | | | | |
| Customer Outcomes | | Punctuality | Quicker Journeys | More seats / Capacity | More trains |
| Freight | | ↑ | ▢ | ▢ | ▢ |
| Long Distance | | ▢ | ▢ | ▢ | ▢ |
| Local | | ↑ | ↑ | ▢ | ↑ |
| Prioritisation assessment | Funder aspiration. | | | | |
| Notes | Replacing the existing radio based system (RETB) with a conventional signalling system arrangement between Inverness to Dingwall, could contribute towards performance and journey time improvements. Bunchrew level crossing is due for renewal during CP6, which could align with introducing conventional signalling and higher linespeeds. | | | | |

Fig 5.30:- Far North Enhancement

06: Consultation Responses

This chapter describes:

- How stakeholders have been consulted to develop the Scotland Route Study through the draft for consultation to final stage
- The key themes identified within consultation responses

Management and consultation process

Network Rail has taken a collaborative approach to the development of the Long Term Planning Process. Development of the Route Studies follows publication of four Market Studies at the end of 2013 which set out the direction of travel for demand on the rail network in Great Britain over the next 30 years. The Route Studies are a key next step in the process to develop the case for investment in the rail network for 2019-2029 and beyond.

The Scotland Route Study has been developed with the close involvement of a wide range of stakeholders. This has ensured that the process, evidence gathering and options have been challenged by an informed audience of key stakeholders.

Stakeholder groups

The Scotland Route Study is managed by the groups set out in Appendix 1. These groups have been complemented by one to one

meetings to discuss specific issues raised by stakeholders.

Consultation Process

The Scotland Route Study Draft for Consultation was published on 10th December 2015 on the Network Rail website, for a consultation period which ended on 10th March 2016. Prior to and during the consultation period stakeholders were briefed on the findings of the draft for consultation study. In addition these groups have been complemented by wider stakeholder events, including “drop-in” sessions with Members of Parliament and Scottish Members of Parliament.

Consultation Responses

The consultation received a total of 136 responses from a wide range of interested parties which are shown in figure 6.1 below. Consultation responses are published on the Network Rail website alongside this study.

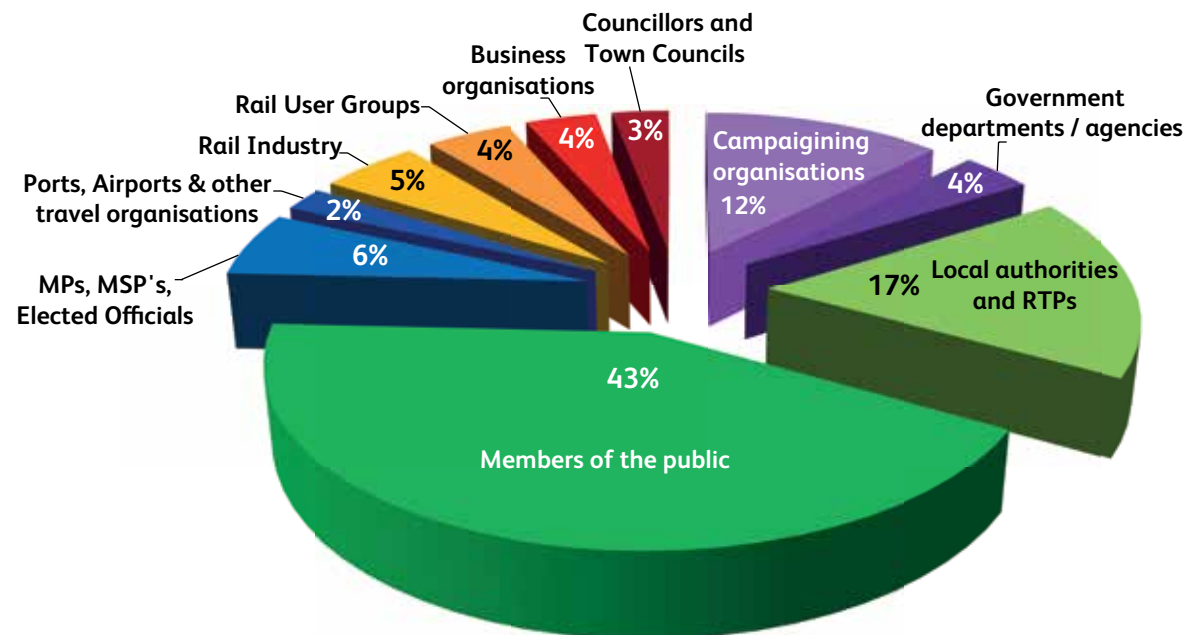


Figure 6.1 Summary of responses by stakeholder type

Key Themes

The responses Network Rail received were well considered and, in many cases, comprehensive. As a result it is difficult to provide a summary of, and response to all points raised within this document. Inevitably in a consultation process, it can be the case that individual suggestions are potentially helpful but also contradict other responses.

Key themes are summarised in figure 6.2 below.

In general, the responses to the content of the Route Study was positive, welcoming a strategy which focused on the Scottish rail network and considered the long term future of rail in Scotland.

The framework of the Long Term Planning Process (see Appendix 1) results in a number of responses being outside the remit of the Route Study.

New lines and new stations

Of the small number of negative responses received the majority expressed disappointment that the Scotland Route Study did not recommend the opening of new lines and new stations. Collectively 24% of responses requested new railway lines, the reopening of previously closed lines and the opening of new stations on both new and existing lines.

The Scotland Route Study remit excludes these aspirations. It would be inappropriate for a rail industry process to assume that the solution to a local transport need is either a new/re-opened railway station or a new/re-opened railway line.

Going forward, there will be opportunities for promoters and stakeholders to work with the Scottish Government and the rail industry to develop options. These would need to be supported by business cases that reflect the Scottish Transport Appraisal Guidance, and take into account deliverability and interaction with the existing and future rail network.

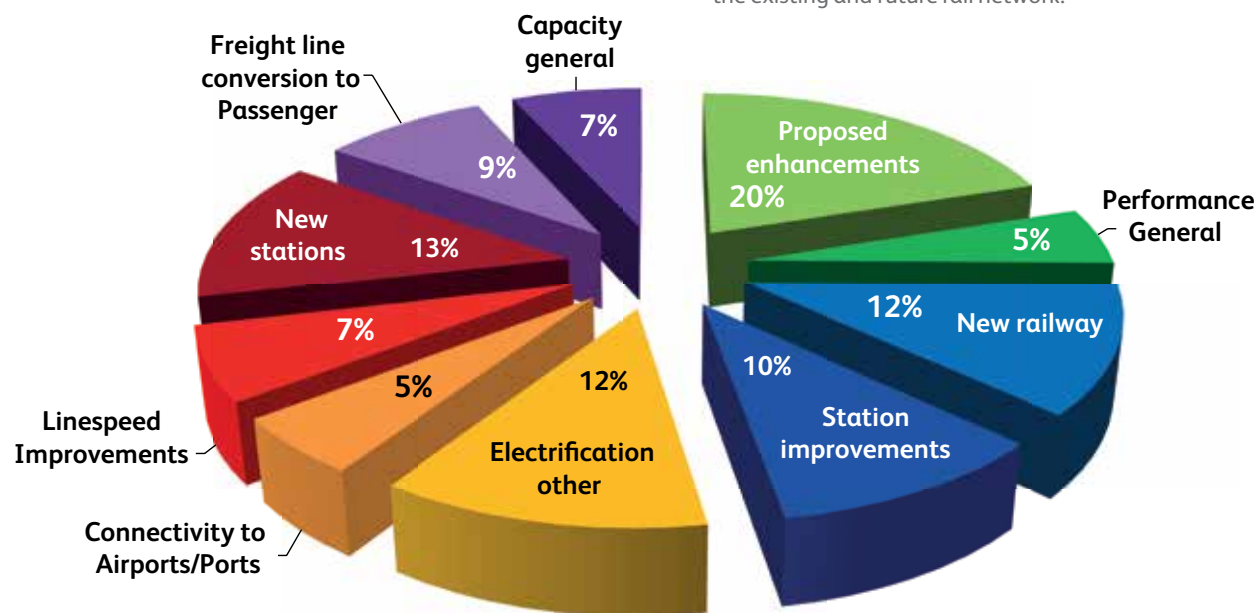


Figure 6.2 Top 10 key themes raised by consultation respondents

Draft Choices for Funders

Feedback on both the vision for the railway in 2043 and the choices for funders over the next 10 years were positively received. In a number of cases respondents expressed aspirations to increase and extend schemes.

North of Scotland

Choices proposed for the Far North Line were appreciated as respondents anticipate that they will address performance issues. Additional capability for freight is a key aspiration with suggestions of additional freight facilities.

Proposed choices between Inverness and Aberdeen were also welcomed. A number of respondents would like to build on these choices by increasing linespeed, doubling the whole line and introducing additional services in order that rail maintain modal share once the dualling of the A96 project is complete. Concerns were also raised that electrification of the line had not been included. The current proposed timetable for electrification anticipates that this line would not be electrified until after 2043.

Aberdeen and Inverness to Central Belt

Reduction of journey times from the North of Scotland to the central belt is a key aspiration for respondents, particularly those within the business community and proposed choices which might facilitate this have been strongly supported. Respondents identified double tracking and electrification as key to help achieve this and there was also support for junction remodel choices such as Greenhill Upper grade separation which would facilitate timetable improvements.

The option to remodel Perth Station was positively supported as key to facilitating faster and more frequent services. Choices for improvements around Dundee were also welcomed, particularly those which would offer resilience to future climate change.

Concern was expressed by a number of respondents that the timetable for electrification would not reach Fife until 2039. The proposed electrification schedule is subject to change and will continue to be reviewed on an ongoing basis. However a number of large structural changes would be required before electrification

could take place and the current proposed schedule anticipates these works. The proposed timings of electrification have also been a matter of concern for a number of respondents in relation to rolling stock between Inverness, Aberdeen and the central belt.

Responses received indicate that there is some confusion regarding the inclusion of the Fife Bypass. This is in regards to how it would benefit the local and long distance markets in the Fife. It was also queried why this new rail option has been suggested when the scope of the Scotland Route Study has not included other new rail aspirations. This option has been included as a way to meet connectivity Conditional Outputs ICO6 and ICO7 (See Appendix 3).

A number of respondents have referenced the funding for rail improvements which has been announced in conjunction with the Aberdeen City Deal. Network Rail will work with the Scottish Government and other funders, including those promoting both the Aberdeen and other City Region Deals, to support the development of choices which fall both within and out-with the scope of the Scotland Route Study.

The Greater Glasgow Area

Station capacity at Glasgow Central was highlighted as a key concern by respondents and the choices which would address this within the station and around Glasgow were positively received. A variety of suggestions have also been received for schemes to route Glasgow suburban services away from Central High Level station and into the Low Level platforms and on to Glasgow Queen Street creating cross-Glasgow services.

A number of respondents also expressed concern that the Scotland Route Study had not taken into account increased train frequency into the station which may result from Glasgow City Deal aspirations. Network Rail will continue to work with funders in development of these aspirations.

Options to electrify lines to East Kilbride and Kilmarnock have also gained support, however respondents proposed electrification beyond this throughout the Glasgow and South Western (G&SW) line to Dumfries and Carlisle. Disruption on the West Coast Main Line during the consultation period has highlighted the importance of this line as an alternative route for cross-border trains. In

response to consultation feedback and stakeholder discussions the option to enhance gauge to W12 between Carstairs and Grangemouth has now been expanded to encompass the G&SW line and the West Coast Main Line south to Carlisle. (see Chapter 5).

Cross-Border Routes

The proposed choice to enhance the Carstairs Junction area on the West Coast Main Line has also been supported although some respondents expressed concern that the current proposals did not fully consider the introduction of High Speed 2 (HS2) train services. The Scotland Route Study has taken into account the implications of HS2 as currently consulted and further information will be considered as part of the ongoing development of choices as it becomes available.

Respondents and stakeholders support proposed choices on the East Coast Main Line (ECML) which could enhance the capacity for freight and passenger cross-border services, as well as local services. These choices have been further developed in line with ongoing timetable works.

The Greater Edinburgh Area

Many respondents and stakeholders support the choice to enhance and electrify the Edinburgh Suburban. There were also aspirations to develop the line for local passenger services. A number of respondents also highlighted aspirations to develop stations east of Edinburgh Waverley and freight enhancements to branch lines. Several pointed out that one choice to provide a freight link between Musselburgh and Niddrie West was not practicable as housing developments had been built on the proposed line. This choice has been withdrawn.

Proposed choices in and around Edinburgh Waverley were commended although some respondents were concerned that these may restrict pedestrian flow within the station. There were also aspirations to double not just the Calton North Tunnel but the South Tunnel as well. The Winchburgh Junction and Almond Chord grade separation choice was also supported by respondents as a way to regulate traffic from the north and west into Edinburgh Waverley.

Fife was the area of Scotland most commented on in consultation

(mentioned by 18% respondents). This was in part due to responses on proposed schemes and in part due to aspirations for new rail services and new stations.

It was highlighted that on the newly re-opened Borders line Connectivity Conditional Output ECO1 proposes up to four opportunities to travel per hour by 2043 (see Appendix 3). However, current infrastructure would not support this frequency of service. No options were identified in the draft Route Study which would allow this increased level of service to run. These have now been identified to support this Conditional Output. Aspirations were also received for an extension of the Borders railway beyond Tweedbank.

Rural Areas

Respondents identified line speed improvements and enhanced freight capability as key aspirations for lines serving rural areas particularly the West Highland Line and Stranraer Line. Some respondents were disappointed that options were not identified specifically for these lines.

Publication of Responses

Except where respondents have specifically requested otherwise, all responses to the consultation have been published on Network Rail's website.

To comply with the requirements of the Data Protection Act, Network Rail holds (where supplied) the name, email, telephone, organisation and postal address information of respondents for the purpose of strategic route planning. This includes the Long Term Planning Process including the Market, Route and Route Utilisation Study projects, as well as ongoing route planning purposes. This information will not be used for any other purpose by Network Rail.

The Scotland Route Study Working Group wished to offer thanks to those individuals and organisations that have taken the time to read the Draft for Consultation Scotland Route Study and provided considered responses.

