

Church Fenton to Newcastle Strategic Advice

What is required to make the rail network between Church Fenton and Newcastle ready for the 2030s and beyond?

Continuous Modular Strategic Planning

April 2020



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Part A Executive Summary

What is required to make the rail network between Church Fenton and Newcastle ready for the 2030s and beyond?

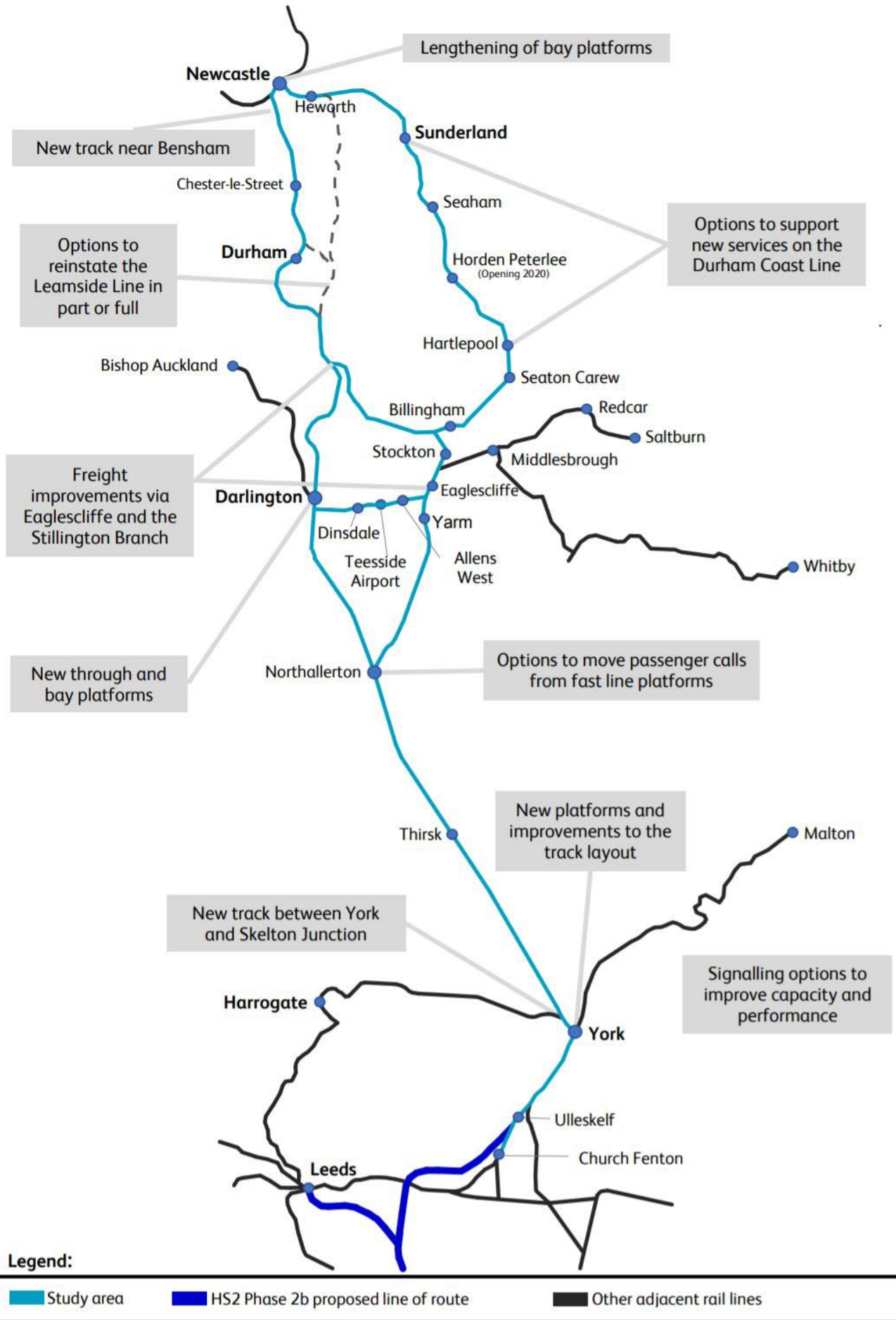
The Church Fenton to Newcastle strategic question provides a set of recommendations to make sure that the rail network meets the demands of passengers and freight-users for decades to come. CMSP (Continuous Modular Strategic Planning – see Part B) considers the needs of the network in a holistic manner, with experts from across the rail industry working with Network Rail to provide inputs. The recommendations made here are evidence-based and impartial, produced using industry-recognised demand forecasts and analysis methodologies. Because of this, CMSP is a vehicle through which funders including the Department for Transport (DfT) and Transport for the North (TfN) can make informed investment decisions and understand the complex interdependencies between train service and infrastructure proposals.

This strategic question analyses the impacts of and synergies between plans for Northern Powerhouse Rail (NPR) and HS2 Phase 2b in order to inform TfN and government. CMSP frames this in the context of a railway which supports all users. As a result, this report is rooted in the role of the network in supporting the economy and society across the entire geography, including railways across North Yorkshire and the north-east in addition to the East Coast Main Line (ECML). Holistic planning necessitates consideration not only of the seats on trains required to meet forecast growth, but also the potential need for upgrades to stations, power supply and the railway's capability to carry freight. All these factors support a safe and reliable railway for the long term, with recommendations mindful of opportunities to improve train punctuality as the key driver of passenger satisfaction.

The combined impact of the many factors listed above is a recommendation for transformational change of the rail network between Church Fenton and Newcastle for the coming decades. CMSP highlights the benefits for both NPR and HS2 Phase 2b in relieving crowding on trains and improving connections, also showing that there is a strong case for investment in the network regardless of delivery of the programmes. There is now a one-off opportunity to maintain alignment of HS2 and NPR plans with an integrated network which puts passengers first, bringing forward benefits in advance of the 2030s where there is evidence to support doing so. CMSP sets out the next steps to making this happen, recommending immediate progress on some 'no regret' interventions (as set out in section G.01) to support a high-performing railway which is ready for the coming decades.

The map overleaf shows the recommendations established through CMSP, with the rationale, challenges and opportunities behind each explained throughout the report. All recommendations are made based on technical analysis to understand the capacity and economic impacts of options. High-level work has also been undertaken to provide an understanding of order of magnitude costs as the business case for options matures.

Figure 1: Map of Recommendations



A.01 Frequently Asked Questions

A.01.01 Does this study support planned delivery of High Speed 2 Phase 2b and Northern Powerhouse Rail?

NPR and HS2 Phase 2b each have their own outputs, objectives and evidence-base. Part D highlights the benefits of both programmes in relieving potential crowding on trains and improving connections across the area. The recommendations throughout this report are therefore based on support for the programmes, with recommendations given on potential opportunities to maximise benefits. In addition, consideration has been given for the railway's future in scenarios where NPR and HS2 are not constructed as planned as a result of delay or change to scope. Scenario planning is an important part of any strategy, so should not be misinterpreted as a suggestion that Network Rail does not support either programme.

A.01.02 How does this CMSP work differ from previously published Network Rail strategic advice, such as the East Coast Main Line Route Study?

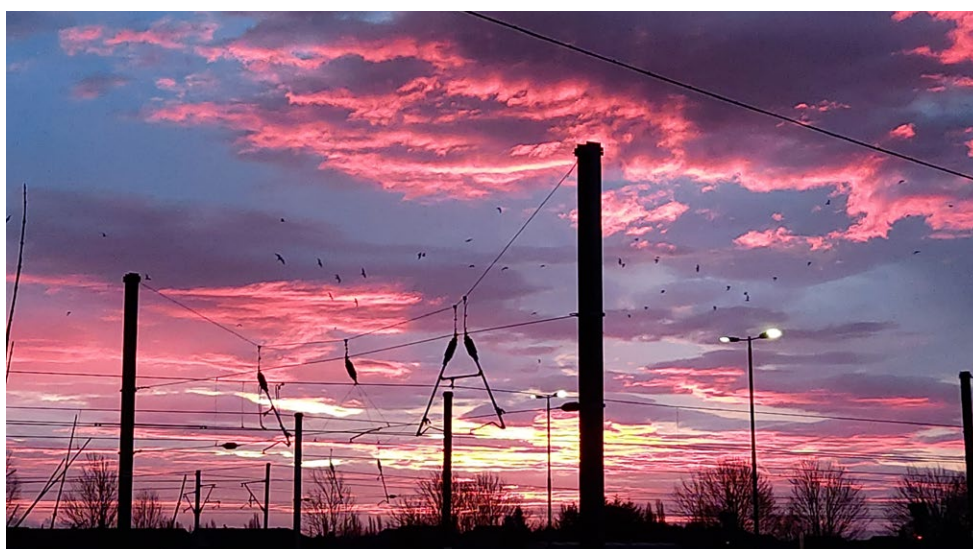
CMSP assesses the entire study area railway geography, including trade-offs between different routes. It therefore builds on the published East Coast Route Study not just through specific consideration of the impacts of HS2 and NPR, but also through inclusion of the wider geography and up to date demand forecasts. Consideration is also given where appropriate to testing the frequency outcomes of TfN's Long Term Rail Strategy, including two trains per hour on corridors such as Harrogate – York and the Durham Coast Line.

A.01.03 This report doesn't mention my organisation's aspirations. Will Network Rail support our plans?

CMSP focusses its recommendations to paint a clear picture of what is required for the railway. This means that not all known aspirations are referenced. Network Rail welcomes discussions with interested parties on improvements to the railway, whether these are specifically recommended by this report or not. A proposal is of course more likely to be supported if it complements railway investment plans. Further, Network Rail welcomes working with interested parties to assess the relationship between rail and land-use planning more broadly, including how the railway can effectively support housing, employment and economic growth.

A.01.04 What are the impacts of COVID-19 on rail investment planning?

The majority of the forecasts and analysis upon which the recommendations of this report are based took place prior to the COVID-19 pandemic. At the time of publication, the long-term impacts of COVID-19 on rail demand are not known. The rail industry continually reviews and updates strategic advice, and Network Rail will work with funders to make sure the rail network continues to support society and the economy in the long-term.



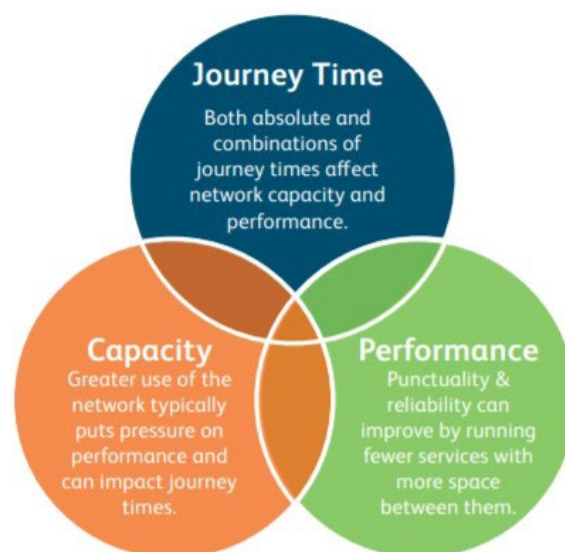


Part B Continuous Modular Strategic Planning

Continuous Modular Strategic Planning (CMSP) provides a rolling programme of recommendations, answering specific strategic questions defined by the rail industry. CMSP is the mechanism which provides funders with an impartial, evidenced-based strategy for the long-term future of the railway. In doing so, it puts the priorities of passengers and freight-users first by identifying opportunities for rail investment to stimulate economic growth as part of the wider transport system. As a collaborative approach to strategic planning, service specifiers, train operators and local and sub-national transport bodies work with Network Rail to develop these investment recommendations.

As the railway becomes increasingly busy, making the best use of train, track and station capacity is a key challenge. It is important to understand how service patterns, journey times and train performance impact on the capacity and capability of the rail network. The CMSP process is led by Network Rail's System Operator function to balance these factors. Furthermore, in an environment in which land-use and transport powers are increasingly devolved to local and regional decision-makers, CMSP recommendations are rooted in the whole-system impacts of planned major investments, including NPR and HS2 Phase 2b. As such, organisations like TfN work closely with Network Rail throughout the CMSP process. All CMSP work is supported by a governance structure, including the Working Group, whose members contribute local knowledge and evidence throughout the process.

Figure 2: Some factors considered by CMSP

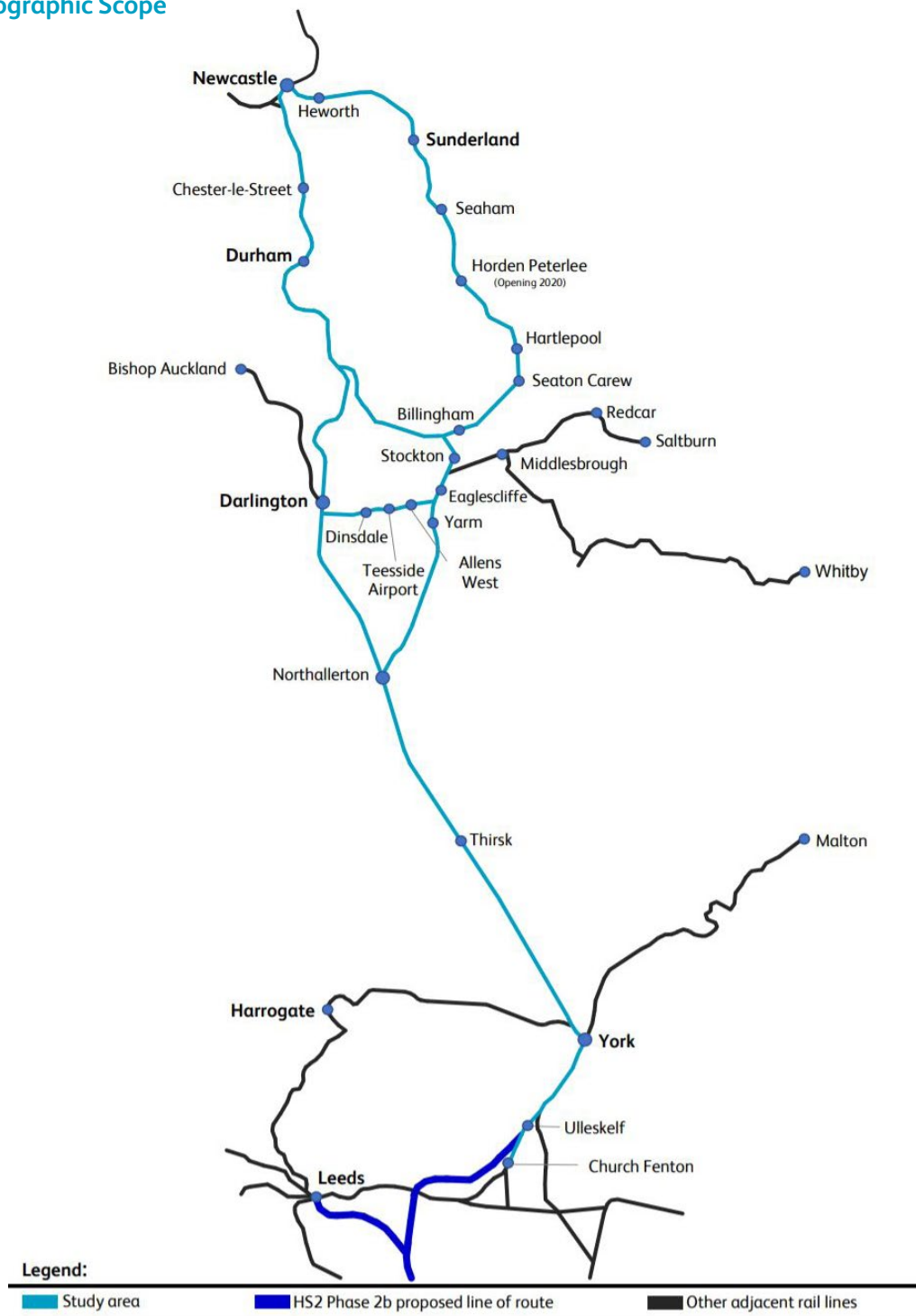


Part C Church Fenton to Newcastle Strategic Context

Figure 3 shows the area considered by CMSP, bounded by Church Fenton to the south in order to consider the planned impacts of HS2 trains joining the conventional rail network in the Ulleskelf area, and by Newcastle to the north.

The railway is hugely important to the economy of the UK, including the north-east, the Tees Valley, North Yorkshire and York. Efficiently providing capacity for forecast volumes of freight and passengers throughout the region is a key objective of the rail industry.

Figure 3: Geographic Scope



This means not only making sure that the ECML provides a reliable service for all users, but also that best use of capacity is identified alongside other routes including the Durham Coast Line and the railway between Northallerton and Teesside. Over the coming years, multiple increases in train services are proposed, with changes in development from train and freight operators, TfN, Nexus, Tees Valley Combined Authority (TVCA) and others. Throughout the process, impacts beyond the Church Fenton to Newcastle geography and alignment with rail plans outside the study area has been considered, including testing the CMSP train service plan at Middlesbrough to make sure shorter-term plans are consistent with study recommendations.

Planning for the network requires a clear understanding of any discrepancy between forecast demand and the capability and capacity of the railway. CMSP is about planning holistically for the future of the whole railway between Church Fenton and Newcastle to facilitate forecast growth and to maximise the benefits of rail investment.

The strategic question answered by CMSP is therefore:

What is required to make the rail network between Church Fenton and Newcastle ready for the 2030s and beyond?

It is important that the recommendations of this report are used by funders as investment plans for NPR and HS2 Phase 2b mature. There are synergies and whole industry cost savings to integrating plans at every stage of the development process. Planning in a joined-up manner for the long-term future of the network will provide a one-off opportunity to support the economy of the north. It should therefore be remembered that the desired outcome of investment recommendations made here is that rail provides socio-economic benefits for passengers, freight-users and the taxpayer across the region.

A high-quality rail network likewise encourages modal shift, reducing road congestion, carbon emissions and improving air quality. The Working Group agreed that there are multiple factors critical to providing recommendations for the 2030s and beyond including, but not limited to:

C.01.01 Passenger capacity and connectivity

In addition to understanding forecast demand between major destinations, CMSP provides a sense-check that local forecast demand is factored into plans. The train services analysed have been assessed to make sure enough passenger calls are made at intermediate stations, for example Thirsk, Northallerton and Chester-Le-Street. In assessing efficient capacity usage between adjacent routes, the implications for local services are always considered. This typically includes

testing the frequency conditional outputs of TfN's Long Term Rail Strategy, two trains per hour in each direction between locations.

C.01.02 Supporting rail freight

It is crucial that the economic benefits of rail freight are considered alongside increasing passenger demand. Rail freight removes lorries from the roads, reducing congestion and facilitating decarbonisation whilst supporting domestic and global industry.

C.01.03 Scenario planning

In order to maximise the benefits of planned investment, scenarios have been tested including where NPR and HS2 Phase 2b do not go ahead. This is essential because no government-funded rail investment project is committed until a Final Investment Decision (see Part G) is made and delivery of infrastructure is committed. This scenario planning should not be misinterpreted as a suggestion that Network Rail does not support either NPR or HS2.

C.01.04 Holistic railway planning

The aim of CMSP is to take a holistic approach, considering all anticipated impacts on the rail network and providing a set of recommendations. Many factors influence the recommendations, including passenger satisfaction, train performance and power supply, as set out in Part F. All factors considered are based on the environmental, safety and technological implications of potential recommendations and the role of rail in the wider economy.

C.02 Existing Train Services

C.02.01 Passenger

The study area is served by a wide range of passenger services including those run by open access operators. Long-distance high-speed trains provide direct links with London for hubs such as Newcastle, Durham, Darlington and York. The ECML also facilitates direct links with many of the UK's core cities, including Edinburgh, Leeds, Sheffield, Manchester, Liverpool and Birmingham.

Within the study area, there are many local and regional services which are hugely important to society and the economy. This includes trains linking York with Leeds, Scarborough, Harrogate, Hull and more. Further north, services towards Teesside leave or join the ECML at Northallerton, serving Redcar Central, Middlesbrough, Sunderland and Hartlepool, amongst others. Trains linking Middlesbrough, Newcastle and further afield serve the Durham Coast Line, in addition to Tyne and Wear Metro services.

Local services linking Bishop Auckland with Saltburn cross the ECML at Darlington, providing connectivity with a key interchange. Newcastle provides a regional transport hub, connecting to Carlisle, Morpeth, Hexham and more places across the north-east.

C.02.02 Freight

Rail freight is responsive to market trends, and although flows are less uniform compared with passenger trains, the area supports a wide range of regular services. Amongst others, this includes regular trains to and from Teesport, the Port of Tyne and Sunderland. Intermodal container freight is moved across the country, including inland to distribution centres and facilities in West and South Yorkshire, with demand growing in recent years. There are also trains carrying biomass to Drax power station and regular flows such as a waste train from Merseyside, engineering trains from Scotland, steel trains across the country and a mail train from Low Fell near Newcastle.

C.03 Future Train Services

C.03.01 Planned service changes – the CMSP train service baseline

The railway network will see a significant improvement over the coming years. As the industry works to deliver upgrades to the railway, several new services have been tested as part of CMSP over and above the December 2019 timetable:

- Extension of one existing London to/from York service each hour to Newcastle
- Five new trains per day between London and Edinburgh, calling only at Newcastle within the study area
- A train every two hours between Middlesbrough and London
- An additional train each hour between York and Harrogate, extending an existing service which runs between Leeds and Knaresborough
- An additional train each hour between Middlesbrough and Newcastle
- An additional train each hour between York and Scarborough
- An additional Tyne and Wear Metro service each hour between Sunderland and Pelaw Junction.

C.03.02 Transpennine Route Upgrade

Plans are underway over the coming years to create a more reliable railway with more seats, additional trains and faster services between Manchester and York, via Huddersfield and Leeds. There is an indicative completion date in the mid to late 2020s for the programme, which will improve journeys across the Pennines.

C.03.03 Northern Powerhouse Rail and Transport for the North plans

NPR plans to provide transformational changes to journeys across the north of England. TfN are developing the programme, which will make it easier to move between the north's towns and cities through new and significantly upgraded railway lines. Within the study area, emerging plans are being developed in parallel with CMSP, based on speeding up journeys to and from Newcastle. The industry's agreed train service plans for NPR are factored into the relevant scenarios of CMSP, with analysis considering the impacts of planned journey time reductions across the north.

It is important to recognise that CMSP does not present an alternative to NPR, instead providing a complementary suite of recommendations to make sure that benefits are maximised and that investment plans are consistent with forecast demand on all routes. As such, the study is mindful of TfN's wider priorities as set out in the Long Term Rail Strategy, including testing the impacts of two trains per hour on corridors such as Harrogate – York and the Durham Coast Line.

C.03.04 High Speed 2 Phase 2b

Current HS2 Phase 2b plans include a junction for high-speed services to join the conventional rail network in the Ulleskelf area. CMSP analysis assumes that this connection will be a grade-separated junction onto the Leeds lines. As with NPR, CMSP has tested forecast growth scenarios both with and without HS2 Phase 2b in order to provide industry recommendations on the alignment of multiple major programmes in case of changes to delivery timescales or scope change. Delivery of HS2 Phase 2b would enable up to four trains per hour to join the study area in each direction each hour, with one terminating in York and up to three to Newcastle. This would have a transformational impact on journey times between the north-east, Yorkshire, the Midlands and London.



Part D Demand in the 2030s and Beyond

Train service scenarios were produced in order to understand the levels of capacity required to facilitate forecast demand growth. These scenarios, referred to as Indicative Train Service Specifications (ITSSs), were agreed with the Working Group and include, as appropriate:

- Current passenger services
- Freight services as shown in section D.01.02
- Planned future passenger services as listed in section C.03.01

- Agreed NPR and HS2 Phase 2b services, with some substitutions for current passenger services agreed with the Working Group
- Some additional passenger services agreed with the Working Group, such as passenger trains between Ashington and Newcastle and options for the planned additional Middlesbrough to Newcastle train to run each hour via the Durham Coast Line

This gives the scenario matrix shown below:

Figure 4: ITSS scenarios

A (services agreed by the Working Group, plus HS2 Phase 2b and NPR trains)	B (services agreed by the Working Group, plus HS2 Phase 2b trains)	C (services agreed by the Working Group, no HS2 or NPR)
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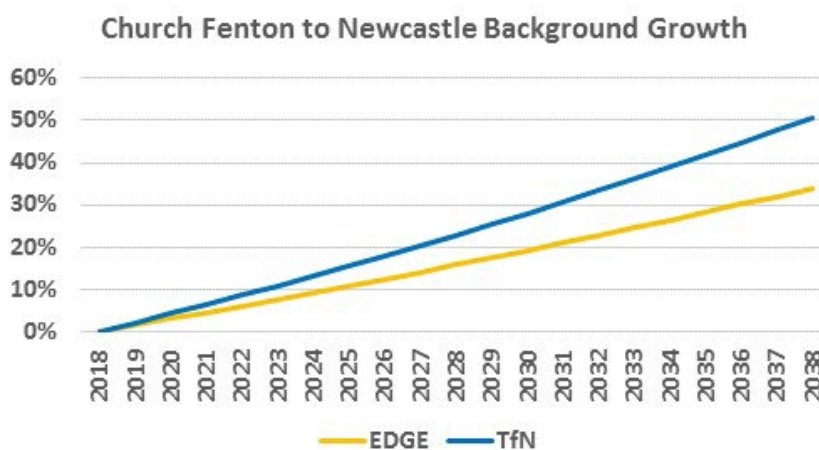
D.01 Economic Analysis

D.01.01 Passenger demand

Each of the scenarios listed was tested against EDGE demand forecasts endorsed by the Department for Transport for the years 2037, 2043 and 2050. Testing these years provides a broad understanding of future demand, though each ITSS could theoretically be delivered sooner if capacity were to be made available. The NPR scenario was additionally tested against TfN's growth forecasts on the same timescales.

The growth forecasts are intended to model the impact of conditions determined by wider economic factors rather than induced through train service changes. These exogenous factors include population and employment growth. The TfN growth forecasts were constructed using population, employment and GDP data from TfN's Independent Economic Review. These forecasts assumed high-level improvements to the transport network across both road and rail and so may implicitly include some of the impacts from expected rail service improvements.

Figure 5: indicative comparison of passenger demand growth



D.01.02 Freight demand

As section C.02.02 set out, the freight market is highly responsive to market demands and flows vary daily. Despite this, in order to provide consistency, freight growth has been equally applied to each scenario based on industry agreed forecasts and inputs from the Working Group. The agreed freight demand is measured in paths per hour in both directions, as shown in Figure 6, with each line representing one path in both directions.

The map shows the baseline assumption tested for CMSP, though options such as routing freight via Dinsdale have been explored throughout the process. It should also be noted that the map only shows freight within the study area. It therefore does not show the origins or destinations of freight services, and is neutral to whether, for example, freight through Eaglescliffe has originated from Teesside or elsewhere. Section F.09 gives CMSP’s recommendations for changes to freight routing.



D.02 Capacity – providing for the 2030s and beyond

Each scenario has been assessed against the demand forecasts to assess potential over or under-provision of standard seating capacity with and without HS2 and NPR trains. The purpose of this is to inform CMSPs recommendations of the optimisation of services for the network as a whole.

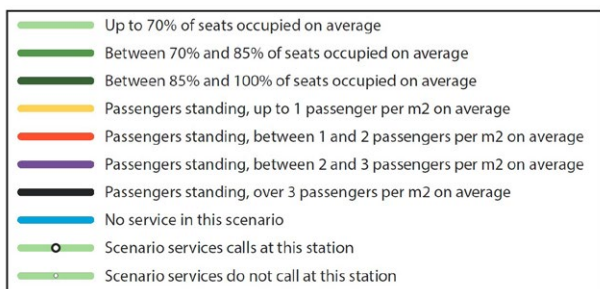
Analysis tested the evening high-peak as the time which sees highest demand across the day for tested services. Localised crowding, including outside of the high-peak hour, is still foreseeable however, and should be mitigated where possible. Detailed analysis of each train service has been undertaken and is summarised in brief here.

Enough capacity is provided to deliver forecast growth on services against DfT-endorsed forecasts except where noted here. This is supported by the ongoing roll-out of new trains with more seats across the network. Across all scenarios, the second Leeds to York (via Harrogate) service provides enough seats to meet forecast demand. As part of separate Leeds Area CMSP analysis, this demand was assumed to be met by extending existing trains, which provides equivalent provision to a second hourly service.

D.02.01 Scenario C: Services agreed by the Working Group, no HS2 or NPR

Recommendation – Tyne Valley: By the 2030s, Tyne Valley services between Newcastle and Carlisle should be operated by at least four-car trains in order to facilitate demand, with up to one passenger per square metre expected to stand between Newcastle and Prudhoe (outside the study area) in the evening otherwise. Crowding is also likely to be significant during the morning peak towards Newcastle.

Figure 7 Scenario B (EDGE growth) 2043 crowding, Northbound CrossCountry services



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The North of England Platform Extension Programme, part of the Great North Rail project, supports introduction of longer services.

Against forecast growth recognised by DfT, crowding on certain trains to and from London results in an indicative vehicle gap¹ of four-cars by the 2037 and seven by 2050, even with the planned introduction of new services to Middlesbrough and Edinburgh. This means that additional seats each hour should be provided by the late 2030s.

For journeys served by Transpennine Express, increased capacity is currently being provided through introduction of new trains. By 2037, forecast crowding on some services leaves an indicative vehicle gap of three vehicles per hour. On CrossCountry services, with peak trains modelled as five-car services, more than one passenger per square metre would be forecast to stand south of York by the 2030s and north of York on northbound services by 2043.

Recommendation – Investment to resolve crowding if HS2 Phase 2b or NPR are not delivered: Crowding on ECML trains is forecast if the major programmes are not delivered, so increasing capacity north of York is recommended in this case. Part F sets out infrastructure options to support an increased volume of trains, and those recommendations mostly apply whether the trains are delivered through HS2 and NPR or not.



¹ An indicative metric of the number of rail vehicles (i.e. carriages) required in each hour to relieve forecast crowding

D.02.02 Scenario B: services agreed by the Working Group, plus HS2 Phase 2b trains

Crowding identified in Scenario C is relieved by planned HS2 services on London services up to 2050. This highlights the benefits of HS2 Phase 2b for the area.

In the baseline ITSS, only one CrossCountry service runs north of York each hour following introduction of HS2 Phase 2b, with the second existing train terminating at York. Figure 7 shows forecast crowding on the remaining service by 2043, with up to three passengers standing per square metre south of Newcastle, in excess of acceptable standards. This leads to an indicative vehicle gap of five cars, rising to six by 2050. Section D.02.04 combines the capacity

and connectivity analysis undertaken for CMSP to provide a recommendation to relieve crowding and maintain connectivity.

The recommendations given for Scenario C also apply here, with crowding on some Transpennine Express trains and HS2 inducing slightly increased demand for Tyne Valley services.

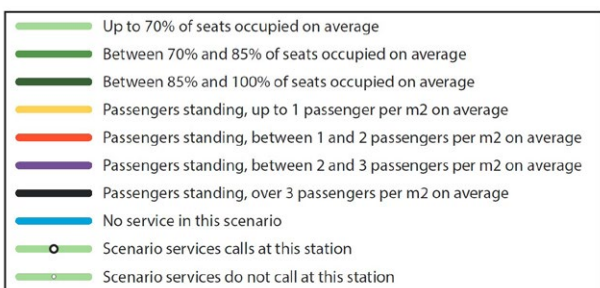
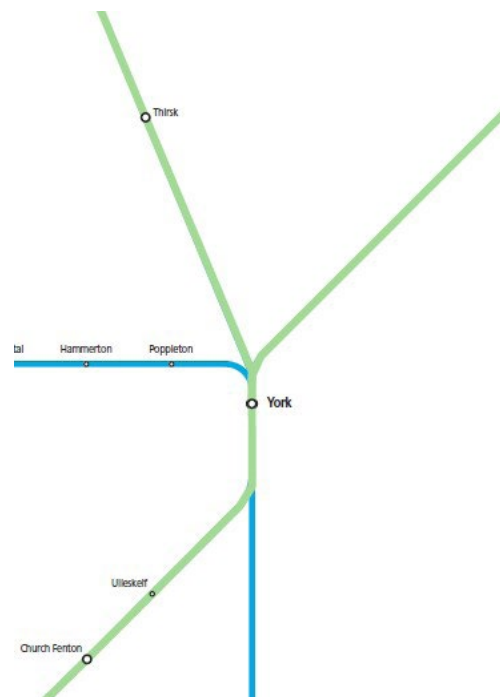
D.02.03 Scenario A: agreed services plus HS2 Phase 2b and NPR trains with EDGE forecast growth

Once the inclusion of NPR services is tested, longer trains negate crowding impacts on services crossing the Pennines as shown in figure 9, despite additional demand resulting from faster trains. The recommendations given for Scenarios C and B still apply and crowding on CrossCountry services is not relieved by NPR trains.

Figure 8 Scenario A (EDGE growth) 2050 service loading, Northbound NPR services



Figure 9: Scenario A (TfN growth) 2037 crowding, Southbound CrossCountry services



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D.02.04 Scenario A: agreed services plus HS2 Phase 2b and NPR trains with TfN forecast growth

Section D.01.01 highlights the methodology behind TfN's growth forecasts, which contain higher levels of growth due to transformational changes across the north's economy. In general, this leads to more acute crowding on the same services identified in the other scenarios. If only one CrossCountry service were to run north of York, an indicative vehicle gap of six cars by 2037 would occur.

Whilst demand for local services at well-served locations such as Darlington does grow following introduction of NPR and HS2, it is not until TfN's forecast growth is applied that additional vehicles are found to be required east of Darlington, with an indicative vehicle gap of one car per hour from 2043. Train lengthening would be able to accommodate this additional demand, though as crowding only occurs between Eaglescliffe and Darlington it could also be hypothetically relieved by the aspirations to provide Darlington with a direct link to the Durham Coast Line, as referenced in section F.05.01.

Recommendation: Across all relevant scenarios, it was found that running only one CrossCountry service north of York results in passenger crowding. There are different ways that crowding can be mitigated, including timetabling services or pricing tickets to encourage passengers to use less busy trains. However, following planned delivery of HS2 Phase 2b (and NPR), service substitutions should be carefully considered. This should include detailed analysis of the crowding and connectivity impacts of any changes to journeys to and from locations currently served by CrossCountry, such as Sheffield.

D.03 Connectivity – connecting places and people

Improving connectivity benefits passengers and supports the economy. As well as providing enough seats, CMSP assesses the impacts of changes to connectivity. The National Rail Passenger Survey shows that frequency is a significant driver of

passenger satisfaction, and just 43% of respondents making journeys within the study area were satisfied with their connections with other train services.

Analysis of changes in generalised journey time (GJT) between major destinations has been undertaken for each scenario. GJT is an industry-standard metric which is a factor of journey time once a passenger boards a train, frequency of services and interchanges required to get from a to b. As such, GJT applies a time-penalty when passengers change trains as part of their journey. Longer distance flows tend to have longer GJTs, so comparing GJTs without reference to the distance is not advisable.

Figure 11 and 12 show changes in GJT with Scenario B (HS2 Phase 2b) compared to Scenario C, highlighting the improvements in connectivity across the area with the introduction of HS2 Phase 2b services. As smaller GJT changes are highly responsive to precise train timing assumptions, they should not be relied upon to provide insight until later in the timetable development process. As a result, only changes greater than 15 minutes are shown here.

Some passengers in the Derby area have the opportunity of starting their journeys at the proposed East Midlands Hub station, though this analysis reflects the impacts on those who begin or end their journeys at Derby, thereby incurring an interchange penalty. For Nottingham passengers who require an interchange today when travelling to Newcastle, there is a significant improvement in GJT, which highlights the benefits of HS2 Phase 2b in connecting Yorkshire and the north-east with the East Midlands.

Beyond the improvements shown above, NPR also improves connectivity significantly. Sunderland, Darlington and Newcastle to Manchester journeys benefit from GJT reductions of more than 30 minutes, and upwards of 50 minutes to Liverpool. There are no GJT disbenefits as a result of NPR for any journey pairs tested.

Figure 10: Most frequent journeys within, to, from or through the study area based on recent ticket sale data

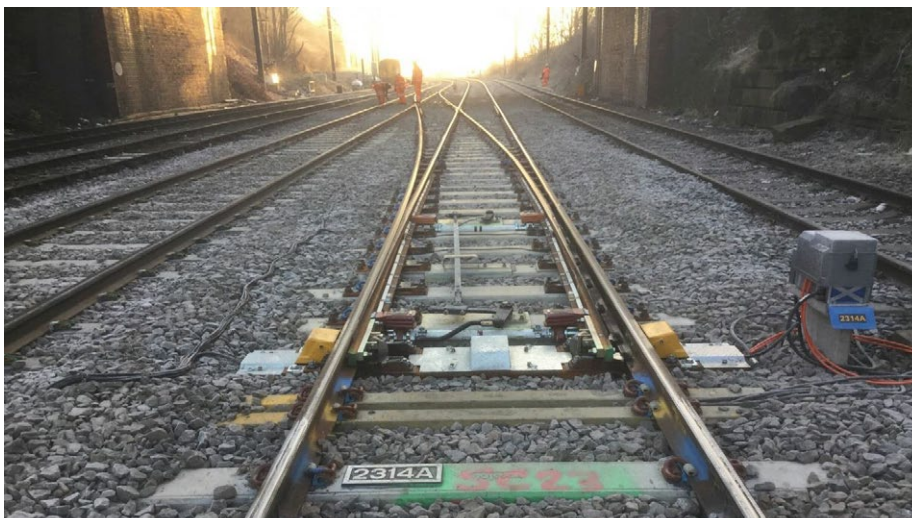
Origin	Destinations	Journeys/Annum
York	Leeds	>1,500,000
London Stations	Edinburgh	>1,400,000
York	London Stations	>1,350,000
London Stations	Newcastle	>1,300,000
Newcastle	Durham	>1,150,000
York	Newcastle	>700,000
Newcastle	Edinburgh	>650,000
Newcastle	Darlington	>450,000

Figure 11: Current GJTs, measured in minutes

	York	Darlington	Newcastle	Scarborough	Middlesbrough	Sunderland	Edinburgh
London Stations	143	175	204	292	284	283	300
Birmingham BR	158	191	222	301	297	323	304
Derby	118	149	181	250	246	275	302
Nottingham	182	228	269	324	325	367	408
Sheffield	83	116	146	200	199	231	265
Liverpool Lime Street	135	183	214	201	275	306	330
Manchester Stations	89	136	167	159	170	252	243
Leeds	37	77	108	111	119	182	217
York		44	75	85	90	137	176
Darlington			46	155	53	102	147
Newcastle				197	102	38	115
Scarborough					230	275	327
Middlesbrough						90	247
Sunderland							198

Figure 12: Changes to GJT, measured in minutes, between Scenario C and Scenario B

	York	Darlington	Newcastle	Scarborough	Middlesbrough	Sunderland	Edinburgh
London Stations	-32	-27	-25	-35		-14	-20
Birmingham Stations	-76	-80	-74	-67	-68	-71	-42
Derby		16	19		18		
Nottingham	-59	-55	-50	-62	-39	-47	
Sheffield			17				



D.04 Journey Time – improving the passenger experience

Journey time has a significant impact on crowding and connectivity, and reductions encourage modal shift towards rail, improving the productivity of new and existing passengers by reducing the time spent travelling.

Figure 13 presents benefits resulting from hypothetical one-minute journey time reductions across the area for all trains using the infrastructure. This gives an indication of the capital expenditure which could be spent on speeding up journeys to recoup costs in revenue and socio-economic benefits.

Figure 13 Indicative present value of a one-minute journey time reduction	
Location of journey time improvement	Value of revenue and benefits, £m. Present Value over 60 years (2010 prices)
Thirsk - York	277.7
Northallerton - Darlington	253.3
Northallerton - Yarm	14.6
Hartlepool - Seaham	7



Part E The Needs of the Future Railway

E.01.01 National Rail Passenger Survey

The National Rail Passenger Survey (NRPS) provides a network-wide picture of satisfaction with the railway. The Spring 2019 survey was taken by more than 30,000 passengers nationally, providing a valuable insight for planning of the network. The overall journey satisfaction for rail passengers was recorded as 83%, with the key drivers of satisfaction identified as punctuality, train cleanliness, frequency, length of journey and crowding.

E.01.02 A punctual railway

There were 693 NRPS Spring 2019 respondents who started or ended their rail journey within the Church Fenton to Newcastle study area. Of these, 74% were fairly or very satisfied with the reliability of their journey. Nationally, the variance for different train operators ranges from 64 to 96%. This provides a clear indication that improvements to punctuality, as the most significant driver of satisfaction, should be sought. The recommendations made through CMSP are firmly rooted in this principle, with potential impacts on train performance factored into recommendations throughout Part F.

Analysis was undertaken to understand key factors impacting performance in the study area. Of delays within Network Rail's responsibility, track faults caused the most delay minutes between May 2016 and November 2019. It is also noteworthy that the worst areas for track faults in terms of delay impact include two-track sections of the ECML where trains cannot easily be switched onto unaffected lines to bypass the problem. The importance of diversionary routes is a factor in the recommendation of progression of Leamside line options in section F.06.

E.01.03 A safe railway

Operation of a safe railway is key to Network Rail. Industry incident data was analysed to create a baseline understanding of the current factors impacting railway safety and steer recommendations accordingly. The most common safety incidents involved trespass onto the railway and passenger injuries. Many passenger injuries were recorded at York, Darlington and Newcastle stations, with the most common being slips, trips or falls. Methods to reduce this should be progressed, including a review of signage directing passengers to the lifts. At York in particular, the changes recommended in section F.02 would also provide greater consistency of service platforming and likely lead to a small reduction in passengers rushing between platforms.

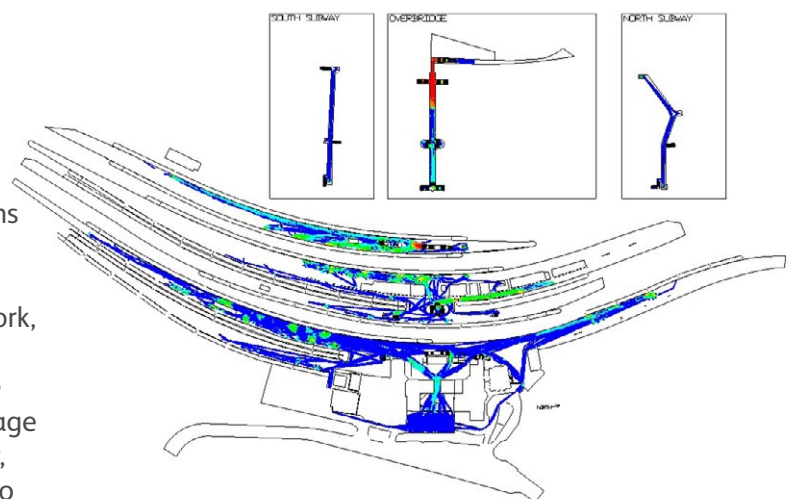
Trespass onto the railway was most frequently recorded at Northallerton, Sunderland and Darlington areas. Regardless of motivations for trespass, the recommended changes to stations in Part F can reduce the interaction between passengers and the running lines. At Northallerton, the primary option identified would remove passenger calls from the fast lines, enabling fencing to protect members of the public from non-stop trains.

E.01.04 Station pedestrian capacity

It is crucial that stations have capacity for not only the required increase in train services, but also the increased volumes of peoples using the railway and station facilities. To that end, the impacts of forecast passenger numbers have been assessed for York, Darlington and Newcastle stations. For York, a modelling exercise has been undertaken to model passenger behaviours as they move throughout the station in detail.

Recommendations – York station: Modelling finds some platform crowding on Platform 8 by the 2030s, which is generally used by commuter services. As trains arrive, alighting passengers are impeded by narrowing at the throat of the platform and platform furniture. It is recommended that potential crowding in these areas is monitored with a view to Network Rail undertaking minor adjustments such as station furniture decluttering or allowing station facilities to only be accessed from the Platform 9.

Figure 14: Example of York pedestrian capacity modelling outputs, showing Scenario B (EDGE growth) with a York Central uplift



Modelling included an indicative uplift to reflect additional users accessing the station from the planned York Central development on the west side of the alignment. Along with the forecast uplift in rail demand, potential crowding may occur on the existing footbridge if no further changes were made by the 2030s. This highlights the importance of ongoing collaborative plans to improve York station for passengers, including access from the west, which should include provision of step-free access.

At Darlington, mathematical analysis has determined that the baseline infrastructure can accommodate the uplift in demand, including HS2 Phase 2b services, though it is recommended that more detailed assessment is undertaken as part of later development based on NPR service timings, which have not been assessed here. Darlington's large platforms reduce the safety risk associated with crowding, though the ticket gatelines are the key constraint. Almost 250 passengers are forecast to exit the station during the busiest minute of the evening peak, which exceeds the free flow limit of the gateline, so could lead to queues of around sixty seconds for some passengers. Given the narrow nature of the gateline, this would cause inconvenience for passengers, so funders may choose to invest to relieve this constraint. As development of Tees Valley Combined Authority's planned upgrade of Darlington station continues, opportunities to improve pedestrian flow should be considered.

At Sunderland, Network Rail is working with interested parties on potential improvements to the station area, which, combined with the recommendations set out in section F.05, provide an opportunity to improve the passenger experience.

Investment is also planned for the area around Grade I listed Newcastle station through Central Gateway proposals, which include a potential new entrance. High-level mathematical analysis has focused on the gateline and the bridge-deck, with almost 500 passengers using the gateline during the busiest forecast minute including HS2 services. This level of demand can theoretically be processed through the gateline within just over sixty seconds, though as with Darlington, funders may choose to invest to improve the passenger experience.

Recommendation – Newcastle station: Analysis found that the width of the footbridge is a constraint to comfortably clearing passengers at the busiest forecast time, when multiple trains arrive. More detailed analysis of pedestrian flows is recommended as part of major programme development. Physical changes to the footbridge are not necessarily the only option; changes to the times at which trains arrive at Newcastle could naturally reduce crowding.

E.01.05 Power supply

Making sure the rail network has enough capacity to support services extends beyond provision of track and platforms. The ECML provides capability for electric trains, and its power supply is currently being upgraded. The scale of change required to support the uplift in services recommended by CMSP though will require further investment. The precise power supply requirements for the 2030s and beyond cannot be known this early in the process, primarily because power-draw is dependent on the arrival times of trains within the section of railway supported by a given feeder station. Whilst CMSP capacity analysis is based on train timings, these are not yet mature enough to provide anything beyond a high-level requirement for power supply assumptions.

As an indication, figure 15 shows additional power demand requirements across the geography over and above the train service baseline (which is expected to be delivered on completed on the planned Power Supply Upgrades). All figures below relate to Scenario C and include HS2 and NPR services. This is a high-level assessment only, and electrification may not be the most appropriate method of decarbonisation for all services, so local services and freight are excluded from the first set of figures below. The final column gives an indication of the scale of power required to support net-zero carbon emissions by 2050 based on electric rolling stock for all passenger and freight services. A national Traction Decarbonisation Network Strategy is being undertaken by the rail industry, so the figures should be treated as a guide at this stage.

Figure 15: Indicative additional power requirement over December 2021 for the 2030s and beyond

Section	Indicative power supply uplift required for passenger services (excluding local service groups)	Indicative maximum power supply uplift required for full passenger and freight traction decarbonisation
York Area	67%	167%
York to Northallerton	33%	116%
Northallerton to Newcastle	40%	120%

Part F Accommodating Future Services

F.01 Approach to Recommendations

Though development of HS2 Phase 2b and NPR is being progressed based on detailed analysis using the government's Five Case model, capacity and connectivity analysis for CMSP shows that their delivery would relieve forecast crowding and improve connectivity across the area. It is important however to provide an impartial assessment of the capacity and capability of the infrastructure to deliver passenger and freight demand across scenarios with and without HS2 Phase 2b and NPR. As Section G.01 highlights, all recommendations here are for progression for further development, and their ultimate delivery is subject to a detailed understanding of affordability and value for money.

F.01.01 Capacity analysis

Two phases of capacity analysis have been undertaken; initially, a capacity utilisation exercise for the whole study area took place in order to identify constrained locations and guide the identification of potential interventions. Calculations of capacity were undertaken based on the baseline infrastructure and Train Planning Rules. The scenarios tested are listed in Part D, with additional sensitivity analysis for each undertaken to understand the implications of one additional or one fewer passenger service between Northallerton and Newcastle on the ECML, a known capacity constraint.

Following identification of constrained locations, potential interventions which could alleviate capacity constraints were identified and tested using a Concept Train Plan (CTP) for the ECML section of the study area. A CTP is a form of iterative timetable production aiming to identify the most efficient service timings within the Church Fenton to Newcastle area. Whilst no fixed timings for trains arriving into the study area were assumed, where possible, the spacing of trains within the timetable is mindful of passenger experience. Similar services are therefore spread across the hour where possible.

F.01.02 Development and cost ranges

In parallel with the capacity analysis, early-stage development has been independently undertaken for the interventions identified.

Some additional interventions were developed over and above those recommended here. These options are not recommended to be progressed for a variety of reasons including technical feasibility, conflicts with

committed developments and the identification of more effective interventions. Order of magnitude cost ranges were produced and validated by Network Rail for all developed options, though, as with any early-stage development work, these cost ranges should be considered indicative and subject to more detailed costing as recommendations are progressed.

The costs have been categorised utilising a low, medium, high and very high approach using the following ranges:

Figure 16: Indicative order of magnitude cost ranges

Low	Up to £5m
Medium	£5-£50m
High	>£50m
Very high	>£250m

The analysis for CMSP has found that various options should be progressed to support increasing volumes of services, including whether HS2 Phase 2b and NPR trains are included. The recommendations here therefore focus on the commonality between tested scenarios, such that progression of these recommendations is supported across scenarios to deliver a railway fit for the 2030s and beyond.

F.02 York Area

Multiple interventions are recommended for progression between Colton Junction and Skelton Bridge Junction. When combined, these interventions provide capacity for up to thirteen through services, as well as terminating trains.

There is a high degree of consistency between interventions found to be required to support planned NPR and HS2 Phase 2b (scenarios A and B) services alongside the growth scenarios tested at York. This means that CMSP can recommend with confidence options which funders may wish to progress. There is a tangible benefit to these options across the scenarios tested, because they support a defined frequency of trains, regardless of whether those trains are delivered as part of HS2, NPR or through growth in background demand.

F.02.01 Two additional through platforms at York station

Indicative Cost Range – High

In order to enable anticipated demand growth and the benefits of NPR and HS2, two new through-platforms are recommended on the west of the

existing alignment at York station (as shown in figure 18). These platforms must be capable of accommodating trains of at least 200m length, though capability to accommodate trains of up to 260m length would provide additional platforming flexibility.

This recommendation enables services using the Leeds lines south of York to mostly utilise the western through platforms, including planned HS2 and NPR services. Many of the scenarios tested only found the need for one new through-platform, but, progression of two is recommended because it is likely that there would be cost efficiencies to delivering both new platform-faces simultaneously, and the second new through platform would be required to deliver the full thirteen trains per hour through York station required to deliver NPR and HS2 plans. This also reduces the risk of unacceptable performance detriment by providing greater operational flexibility, also providing the opportunity to align plans with the recommended step-free access identified in section E.01.04.

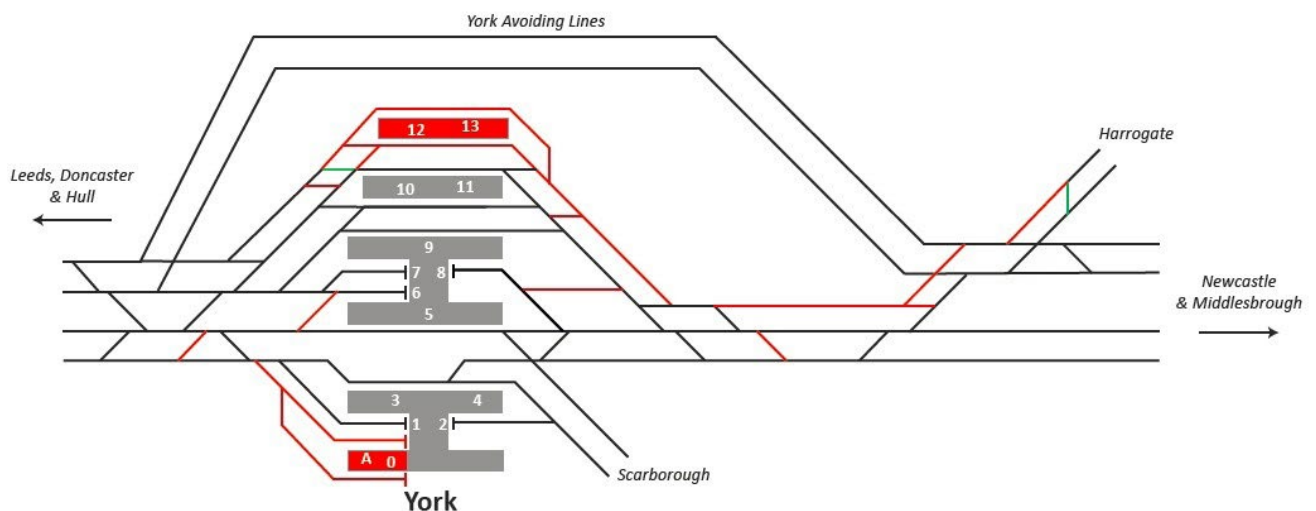
In relation to the proposals for the York Central development, land identified as required to support these new platforms has been safeguarded by Network Rail.

F.02.02 Additional south-facing bay platform(s) at York station

Indicative Cost Range – Medium / High

As well as the new through platforms, the growth scenarios tested found the need for two additional south-facing bay platforms, which should be situated on the east-side of the alignment as shown in figure 18. These platforms would be predominantly utilised by terminating services which use the Normanton lines to the south, reducing the need for trains to cross multiple lines to reach their platform at York. An option for a bay platform capable of accommodating a 200m train has been developed and further work is recommended to determine the marginal cost of the second platform.

Figure 17: Recommended interventions for York Station



F.02.03 Additional switches and crossings at York station

Indicative Cost Range – Low (subject to development)

In order to deliver the full train service, changes to switches and crossings are also needed to allow for parallel movements for north and south-bound services both south and north of York station. An additional crossover from platform 10 at the north of the platforms allows access to the recommended third line towards Skelton Junction, illustrated in figure 17. An additional crossover between platforms 3 and 5 also enables additional train movements required to support the growth in train services.

F.02.04 Additional track between York and Skelton Junction

Indicative Cost Range – High

Future demand requires additional services running between York and Skelton Junction alongside freight and two passenger trains each hour towards Harrogate. The network is unable to accommodate these services without additional infrastructure in all scenarios. An option to run Harrogate services via the freight avoiding lines into a new platform was explored but should not be progressed because the recommended intervention supports the required service specification alongside the economic benefits on the planned York Central development.

A third line on the west of the existing alignment between York and Skelton Junction is therefore recommended as the primary option to deliver growth in demand, as shown in figure 17. Development of the line should be consistent with plans for the new bridge near Water End into York Central. An alternative third line on the east of the alignment between Water End Bridge and York was also explored but found to provide insufficient benefit.

F.02.05 Exploration of signalling options to improve capacity and performance in the York area

Indicative Cost Range –High to Very High (subject to development)

Multiple routing options were considered in both directions for the two freight paths through York each hour tested. The consistent conclusion was that options should be explored to allow trains to safely run more closely together in order, largely due to the speed differential between passenger and freight trains. As a minimum requirement, changes would be required to Train Planning Rules to allow trains to be planned three, rather than the current four, minutes apart between York and Colton Junction. Additionally, the time required for the crossing movement of the freights from Holgate Junction to Colton Junction and vice versa would need to be reduced, though this can be avoided by routing freights through York station rather than the avoiding lines. No requirement has been identified to grade-separate junctions around York.

Changes to planning rules often require amendments to signalling, which presents an opportunity to explore the benefits of digital signalling for the area, particularly when aligned to planned renewals. Whilst demand can be accommodated with the recommendations indexed here, any further capacity requirement, for example, hypothetical timetable constraints as a result of HS2 or NPR services being required to arrive at certain times, would be likely to necessitate digital signalling in the York area. Further, the National Rail Passenger Survey makes clear that train performance is a crucial factor in passenger satisfaction.

Digital signalling provides an opportunity to deliver growth in services without additional strain on train reliability, whilst not specifically required for York (or elsewhere) if the recommendations here are delivered, as the industry continues to develop plans for HS2 and NPR, it must do so with cognisance of the opportunities and costs of digital signalling.

F.03 Northallerton Area

Freight and passenger trains to and from Middlesbrough, Sunderland and other Teesside locations diverge from the East Coast Main Line at Northallerton. Trains travelling north can avoid crossing the southbound track using the grade-separated Longlands Junction to the south of the station, however for passenger trains to call at the station they must use the two-track fast lines before crossing the southbound line at grade. The railway also has a crucial impact on Northallerton town centre due to multiple level crossings in the immediate vicinity of the town.

In order to deliver the demand forecast for the 2030s and beyond across each scenario, it is necessary that passenger trains do not call on existing fast line platforms. This change would allow non-stopping services to utilise capacity and would make the railway safer by reducing the interface between waiting passengers and fast trains. There are multiple potential options to facilitate this, as set out in figure 18 below.

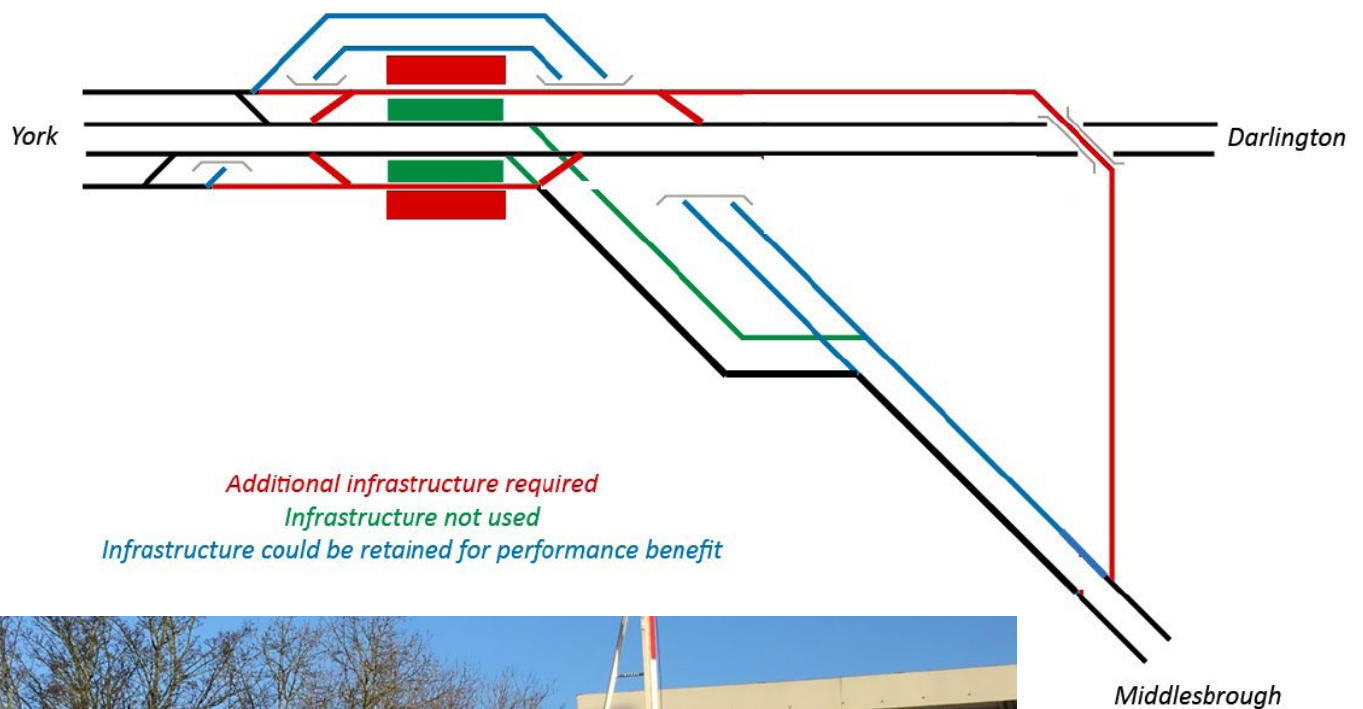
Figure 18: Summary of options to deliver growth in services in the Northallerton area

Option	Comment
1 New platforms on the Eaglescliffe lines	Construction of new platforms on the Eaglescliffe lines would enable stopping passenger trains to/from Teesside to avoid calling on the fast lines. Services calling at Northallerton to/from the Darlington direction would still be required to stop on the fast lines however, and analysis for NPR has established that this is likely to restrict the railway's ability to deliver the full train service tested. Further, the impacts on level crossings would require mitigation (see section F.03.02).
2 Two additional tracks through Northallerton station, new platform-faces on the new lines	Extension of the existing Up and Down Slow lines from the south through Northallerton station would allow platform-faces to be added to the new slow lines on the outside of the existing alignment. This would free capacity for non-stopping services and remove passenger calls from the existing platform-faces, which would have a safety benefit. This option has been developed through CMSP and has a high order of magnitude cost. Analysis of the capacity implications has determined that northbound trains crossing the southbound lines towards Eaglescliffe would restrict the railway's ability to deliver growth in demand.
3 As prior option (2), with grade separated access to Eaglescliffe lines north of the station	The prior two options would not enable the full train service planned by NPR to be delivered. Even without NPR, growth in demand on the ECML requires additional trains. This would be enabled by continuing the slow lines through Northallerton station to re-join the fast lines north of the station, with a new dive-under or fly-over connection to the north of the station, from the northbound line to the Eaglescliffe lines. Initial development work for this option has been undertaken as part of NPR and has a very high order of magnitude cost.
4 New station on four-track section to the south	Construction of a new station, with platforms on the existing slow lines to the south of the existing station, could facilitate growth in demand by allowing passenger trains to call on the slow lines regardless of origin and destination. However, moving the station away from the town centre is likely to have a detrimental impact on the town's economic development.

F.03.01 Exploration of options to facilitate growth at Northallerton, including two new tracks through the station, platforms on the new lines and grade separated access to the Eaglescliffe lines

The option shown in figure 19, below, would deliver NPR's planned train service or the increase in forecast demand growth. This option further provides a potential boost to train performance by retaining the existing grade-separated connection to the Eaglescliffe lines to hold freight trains and allow a passenger service to overtake in times of delay. Although Option 3 is the optimal rail option, due to the very high order of magnitude cost of this option, it is recommended that thorough analysis of the socio-economic costs and benefits of options should take place as development continues, factoring in impacts on the town as well as the rail network.

Figure 19: Option 3 for Northallerton



F.03.02 Northallerton's level crossings

There are multiple level crossings on lines close to Northallerton, including Romanby Road, Boroughbridge Road and Low Gates level crossing, a staffed and barriered crossing where the A167 High Street approaches the town centre. Any increase in the number of train services increases the down-time of the barriers and can lead to road traffic congestion, especially when barriers remain closed for multiple trains to pass in succession. In Northallerton, this causes specific challenges with air quality, as road traffic can back-up along the High Street. Option development must involve appropriate evaluation of the impacts on level crossings and work with interested parties to explore multi-modal transport solutions. This is in part because, as section F.09 highlights, routing additional freight trains via the Eaglescliffe lines is recommended to facilitate forecast growth in demand.



F.04 Darlington Area

At Darlington, services from the Middlesbrough and Bishop Auckland directions currently cross the East Coast Main Line, supporting the economy of the Tees Valley and the wider north-east. Network Rail is working with Tees Valley Combined Authority to explore options for improvements at Darlington, transforming the station into an enhanced rail gateway and accommodating plans and aspirations for improved national, regional and local rail services. TVCA's plans include a more advanced level of option development and cost estimating compared with CMSP. CMSP though does play a crucial role in validating that the proposal is consistent with future railway strategy and supports growth in demand with or without HS2 and NPR services.

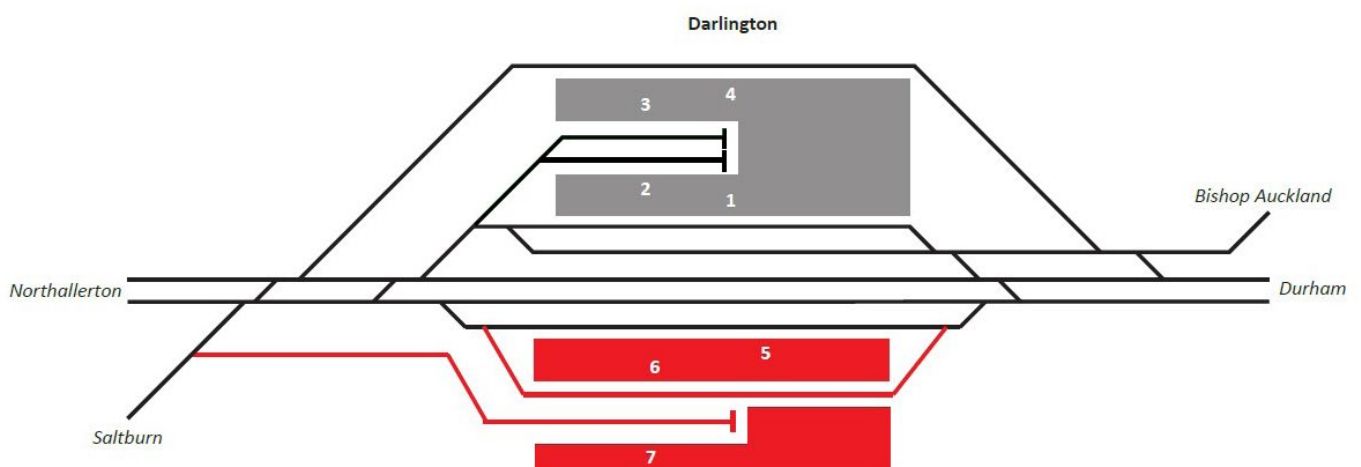
F.04.01 Progression of two additional through platforms and one south-facing bay platform at Darlington

Indicative Cost Range – High

Network Rail supports TVCA's proposals at Darlington with the option to deliver two through platforms and at least one south-facing bay on the east side of the alignment, shown indicatively in figure 20. This option also supports the scenarios including HS2 and NPR trains, and allows more efficient platforming, improving capacity by reducing train crossing movements at Darlington South Junction. It is important to note that the tested scenario with the fewest passenger trains found that only one additional through-platform and one additional bay would be required. Despite this, the two through platforms are recommended due to the expected cost efficiency of delivering both planned through platforms concurrently and the operational resilience benefits of the second through platform.

Figure 20: Option for Darlington

Detailed design should further consider provision of an additional crossover allowing access from the Saltburn direction into platform 6 without using the existing ECML, which would provide greater operational resilience. Subject to detailed timetabling assessment during development, the benefits of the recommended option may require that the through Saltburn to/from Bishop Auckland service is split into two services at Darlington to accommodate nine or more passenger services through Darlington on the ECML. Planned station improvements would though facilitate improved passenger interchange. Further, TVCA's plans would create capacity on the east side of Darlington station which could support improved connectivity. Progression of any plans for additional local services must also consider interventions necessitated at other locations.



F.05 Durham Coast Line

The Durham Coast Line fulfils an important role in connecting communities between Middlesbrough and Newcastle, including key economic and population centres such as Hartlepool and Sunderland. A new station, Horden Peterlee, opens in 2020. The line is currently served by a stopping service each hour, with potential operator plans for a second. The line also serves services between Sunderland and London, and Tyne and Wear Metro services between Sunderland and Pelaw Junction.

The Durham Coast Line is a crucial artery for freight services, and the capacity implications of a freight train along the entire length of the line alongside growth in passenger services has been tested using the capacity utilisation methodology set out in section F.01. As well as to present day services, the impacts of an additional Metro service each hour and of a second stopping passenger service along the length of the line has been considered. This is in keeping with the conditional outputs of Transport for the North's Long Term Rail Strategy and known aspirations.

F.05.01 Options to support connectivity aspirations on a high-performing Durham Coast Line

Analysis shows that rail capacity utilisation is high on the Durham Coast Line. Whilst tested freight and passenger services can be theoretically accommodated, there is a risk that high capacity utilisation could impact on the reliability of the railway, which would be unacceptable, because the National Rail Passenger Survey confirms that train performance is a critical factor in passenger satisfaction. This is particularly relevant because there are also local aspirations to open a station in the Gateshead area, and separately Network Rail has undertaken early discussions with partners to explore the feasibility of further improved connectivity for Durham

Coast Line stations. This could potentially make use of planned new platform capacity at Darlington to provide a direct connection with service(s) terminating at destinations such as Hartlepool or Sunderland, coupled with potential public realm improvements. Although a direct Darlington passenger service has not been tested as part of CMSP, analysis shows that it is extremely unlikely that an increased volume of passenger services beyond those tested could be accommodated.

When taken together, these factors mean that as options to improve connectivity across the north-east are explored, the full impacts of proposals impacting capacity or train performance must be assessed in detail. No specific infrastructure recommendation is made here because train origins and destinations have a significant impact on the potential infrastructure required to support any further new services. Despite this, figure 21, below, shows options for which early development work has been undertaken, and should inform any consideration of any proposals.



Figure 21: Summary of options to improve capacity on the Durham Coast Line

Option		Comment	Order of magnitude cost range
1	Sunderland station – new through-platform	Due to interaction with Metro services and London services turning back at Sunderland, the station is a particularly challenging location to accommodate new services. Reinstatement of the former platform at Sunderland to create a new through platform would support additional growth in services, although would be an expensive option with engineering challenges.	High
2	Sunderland station – new bay platform	It is likely that a new south-facing bay platform, capable of accommodating 120m trains, would be a less costly option compared with a through-platform, though train service flexibility would be reduced.	High
3	Turnback to the north of Sunderland station	To reduce the need for expensive engineering works at Sunderland station, an option for a turnback between St Peters and Stadium of Light Metro stations has been explored, which would allow 120m terminating trains to avoid utilising through-platform capacity. Though less expensive, this would also provide reduced additional capacity compared with the new platform options. There may also be operational challenges related to turnaround time for terminating trains.	Medium
4	Reinstatement of through-platform at Hartlepool	Additional through-platform capacity at Hartlepool would improve the capacity and resilience of the railway by allowing stopping trains to pass at Hartlepool.	Medium

F.06 Leamside Line

Recommendations throughout Part F have been presented geographically, with the holistic approach to CMSP making no distinction between supporting freight and passenger services on a mixed-use railway. Section F.09 however does present a summary of freight recommendations for purposes of clarity. Analysis finds that eight or more passenger services each hour/direction between York and Newcastle cannot be delivered alongside freight services on the ECML.

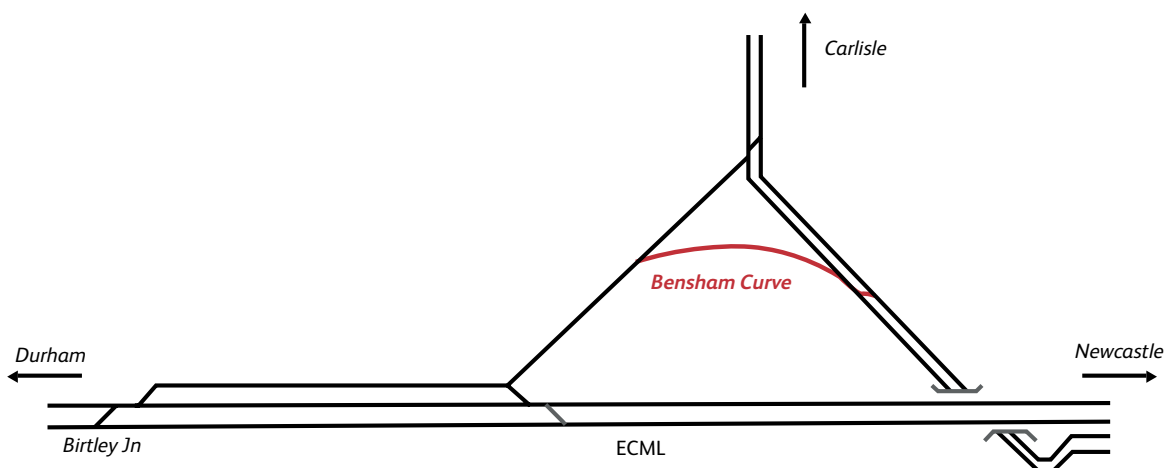
F.06.01 Progression of options to reinstate the Leamside line in part or full

Indicative Cost Range – Very High

One of the key constraints to delivering growth is between Newcastle and Tursdale Junction, where the railway reduces to two tracks in County Durham. Given the constraints of the Durham Coast Line as an alternative route to carry additional services, it is recommended that feasibility of options to reopen the former Leamside line are progressed to Strategic Outline Business Case level maturity in order to deliver growth for the 2030s and beyond. This would provide an alternative route for freight services, a diversionary route for long-distance passenger services and potential local connectivity benefits for passenger services.

Reopening the railway would be a major infrastructure undertaking, and the recommendation to progress options should not be construed as an indication that an affordable and value for money option will be identified. Furthermore, analysis finds that a partial Leamside reopening would be sufficient to deliver the tested train service alongside the Bensham Curve option highlighted in section F.07. Whilst some of the socio-economic and connectivity benefits of a full Leamside reopening would not be fully facilitated by a partial reopening, it is recommended that the feasibility of multiple options is explored.

Figure 22: Bensham Curve



The partial Leamside option would involve deviating from the ECML at Tursdale Junction before re-joining just to the north of Durham city centre. No specific plans for land requirement have been produced. The full Leamside reopening would involve connecting Tursdale Junction to the railway around Pelaw Junction, with the junction potentially facilitating access for freight between Tyne Dock and Leamside. Factors such as impacts on freight end-to-end journey times and dependencies on existing local land use plans must be considered from the start.

F.07 Bensham Curve

F.07.01 Reinstating the Bensham Curve

Indicative Cost Range – Medium

Figure 22 below shows the Bensham curve, connecting the Norwood to Low Fell line with the Tyne Valley lines south of Newcastle. A single-track, bi-directional chord would enhance capacity by enabling services to cross the ECML without crossing the main line at grade. Specifically, it gives freight trains from King Edward Bridge Junction grade separated access to Tyne Yard, providing opportunity for freight trains to depart from the yard at optimal times. This would further provide capability for northbound passenger services to access platform 1 at Newcastle without conflicting with southbound trains.

Bensham Curve has been found to be required across all scenarios tested except where the Leamside line is delivered in full, so it is important to note that the requirement for Bensham curve is therefore intrinsically linked to Leamside option development. The curve has value as a standalone scheme in delivering up to seven passenger trains per hour in each direction alongside freight services, as set out in figure 23.

F.08 Newcastle Area

Newcastle is a major transport hub, with the railway important to the regional economy and significant forecast growth in demand across all scenarios tested. Recommendations made here are cognisant of Central Gateway investment proposals for the station and its surroundings. Platforming for potential passenger services between Ashington and Newcastle has been considered through CMSP, although the capacity implications of these services between Benton Junction and Newcastle requires separate analysis.

F.08.01 Development of options to lengthen the four south-facing bay platforms at Newcastle to accommodate 200m trains

Indicative Cost Range – High (four platforms)

Currently, only the through platforms at Newcastle can accommodate longer trains terminating from the south, which uses vital track capacity. The bay platforms (nine to twelve) are ideally positioned to accommodate the longer services required to facilitate forecast demand, including HS2 and NPR terminating trains. This is because access from the northbound fast line requires few crossing moves, so trains can arrive and head back southbound with little impact on other services. Analysis has found that, to allow up to six terminating long-distance trains alongside other services, at least three of the platforms would be lengthened to accommodate trains of up to 200m length.

Lengthening only three platforms though would necessitate some planned HS2 services using the through platforms and can only be timetabled if the high-speed services depart south around 20 minutes after arrival. This would present an unacceptable risk to train performance, so an option has been developed to lengthen all four bays, which would also allow improved operational flexibility.

Lengthening of all four bay platforms is recommended to facilitate growth for the 2030s and beyond, as train lengthening would be required even if planned HS2 and NPR services do not happen. Operational workarounds, such as stabling terminating trains on the Forth Banks branch, running trains empty to Heaton Depot or round via High Level Bridge create avoidable complexity and should be avoided in the longer-term. Synergies will be explored to align shorter-term plans in the Newcastle area with the 2030s requirement, though it is not expected that existing Central Gateway plans would be adversely impacted.

Lengthening of the four bay platforms would require severance of the Forth Banks branch, which is currently used as stabling for operational railway vehicles. Although removal of the branch may lead to economic development opportunities, replication of the stabling

facility may be required. One potential option would be a turnback at Manors. This was considered as an option to stable terminating trains for CMSP (medium order of magnitude cost range) before being ruled out due to the capacity implications of regular train movements.

F.09 Summary of Freight Recommendations

Recommendations throughout Part F have been presented geographically, with the holistic approach to CMSP making no distinction between supporting freight and passenger services on a mixed-use railway. This section, however, presents a summary of recommendations for freight routing, capability and required infrastructure, which is supported by the interventions referenced throughout. In doing so, further detail is provided on how the recommendations are rooted in trade-offs between delivering the full planned NPR and HS2 service volumes alongside passenger demand growth and freight services.

Whilst there would likely be end-to-end journey time and capacity benefits to utilising electric traction power for freight services on the ECML, the analysis here finds that in order to deliver the capacity required, alternative routing is required. Ongoing engagement with Freight Operating Companies is essential to understand operational dependencies as proposals continue to mature.

Across all scenarios tested, it was not possible to enable the Class 4 freight service to operate on the two-track section north of Northallerton, principally due to the speed differential between 125mph passenger services and 75mph freight. The main constraint is between Northallerton and Darlington from the south and subsequently on the 15-mile two track section between Tursdale and Birtley Junctions from the north, where there is no opportunity for services to overtake. It is also recommended that the necessity of routing freight via Dinsdale is reduced through the suggested interventions in the longer term, as Darlington South Junction provides an additional constraint.

F.09.01 Creation of a W12 gauge-cleared route for freight trains between Northallerton and Newcastle via Eaglescliffe and the Stillington branch

Gauge clearance refers to the dimensions of rail vehicles with reference to their kinetic envelope. In other words, whether the railway is clear of obstacles and structures to allow sufficiently tall and wide freight trains to pass. W12 clearance allows access to the railway for freight vehicles of 2.6m width and approximately 2.9m height. Not all services which run along the ECML today make use of existing W12 gauge clearance, though short sea container freight

and other intermodal trains are enabled by this capability. It is recommended that ongoing work to provide a gauge cleared route from Teesside to Northallerton continues, with additional gauge clearance work on the Stillington branch undertaken to support growth to the 2030s and beyond (order of magnitude cost subject to development). The Stillington branch connects the Teesside conurbation with the ECML at Ferryhill

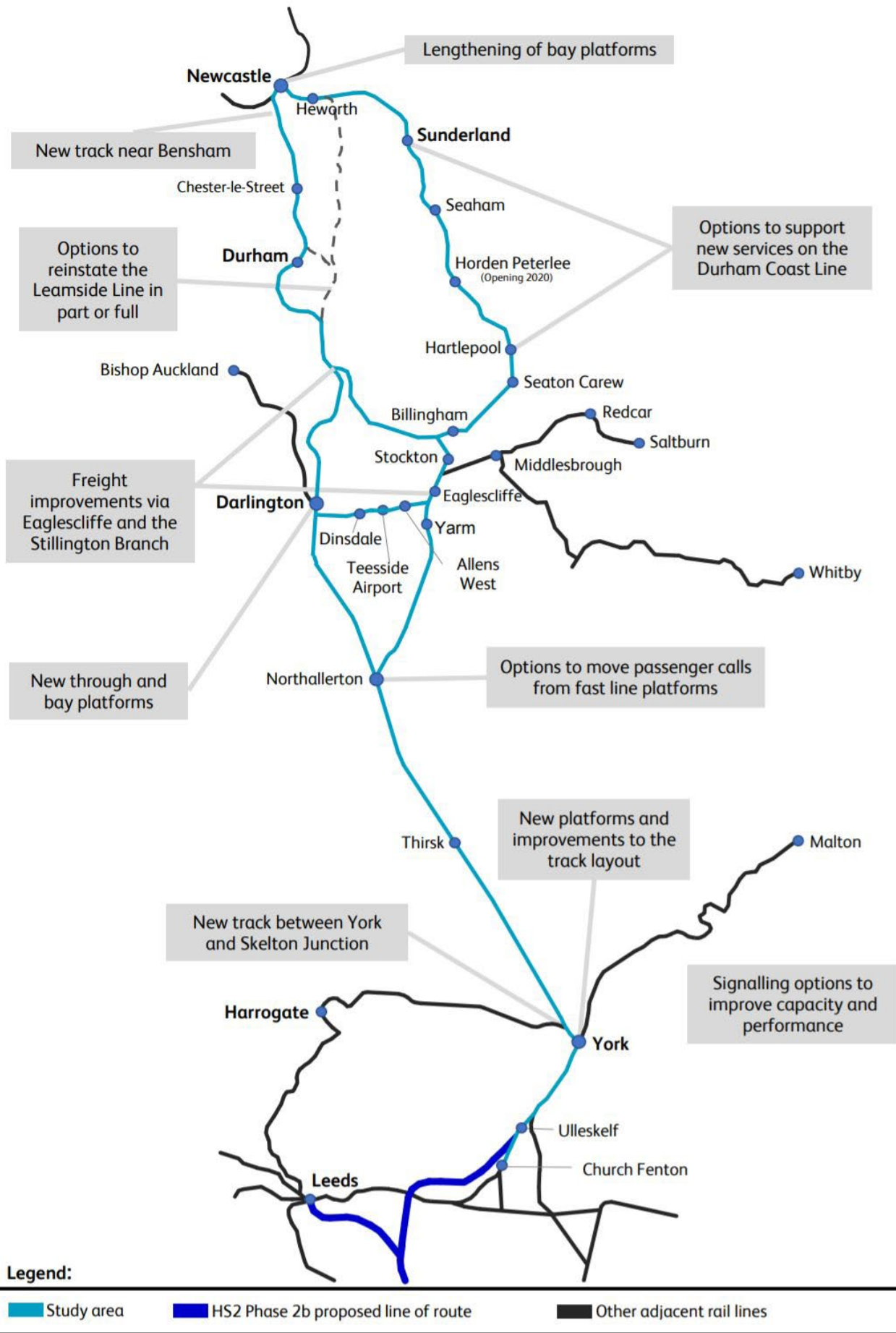
Junction, north of Darlington. Creation of a gauge cleared route would allow freight trains to be routed away from the ECML. This routing recommendation is in addition to the Durham Coast Line options referenced in section F.05, which provides a further routing possibility for services, but has capacity constraints of its own.

Figure 23: Recommended freight routing to support growth to the 2030s and beyond

To support 8+ passenger services/hour on ECML in each direction	To Support 7 passenger services/hour on ECML in each direction
York – Longlands Junction – Stillington branch – Ferryhill Junction – Partial Leamside Branch (to north of Durham) – Bensham Curve – Newcastle	York – Longlands Junction – Stillington branch – Ferryhill – Birtley Junction – Bensham Curve – Newcastle
Or	
York – Longlands Junction – Stillington branch – Ferryhill Junction – Full Leamside Branch – Newcastle	



F.10 Summary of Recommendations
Figure 24: Geographic map of recommendations



Part G Next Steps

G.01 Staging of Recommendations

Recommendations given in this document are subject to the caveats provided in Part F. It should be remembered that the interventions are not by default required to be delivered immediately; the economic growth scenarios considered are forecast to materialise during the 2030s and beyond. A case for investment has been identified with or without HS2 Phase 2b and NPR, factoring in any delay of change to scope, though the recommended options in such a case would be different. It is important that detailed analysis of the deliverability of not only infrastructure proposals, but also their planned outcomes, continues as plans mature. With that in mind, there are several 'no regrets' interventions which can be recommended for immediate progression towards development or design due to their commonality across tested scenarios. Bringing forward these recommendations would have significant benefits to the railway and economy over the coming years. The benefits would not only be measured in terms of capacity, but also crucially train performance, a key driver of passenger satisfaction according to the National Rail Passenger Survey.

- There is a timebound opportunity to develop an integrated solution for the York area alongside NPR, HS2 and York Central plans. Several elements of analysis, including the third line between York and Skelton Junction, are common across all scenarios. Given their immediate train performance benefits, development should be a priority.
- Network Rail will continue to work with Tees Valley Combined Authority to deliver the 2030s-ready proposals for the Darlington area, and will support integration of these plans with wider connectivity aspirations.
- Synergies between options to lengthen Newcastle's bay platforms to support potential shorter-term train lengthening requirements and the longer-term recommendation should be explored.

G.02 Rail Network Enhancements Pipeline Process

CMSP has identified several potential enhancements to deliver forecast rail growth for the longer-term. The options presented are recommended for potential

fundors to be considered for development and ultimately delivery. Development should be mindful of the emerging work being undertaken on the Depot and Stabling and Traction Decarbonisation Network Strategy workstreams. Where appropriate, schemes should look for synergies with identified future renewals to minimise disruption and improve value for money.

Network Rail is open for business and welcomes working with funders and interested parties to progress these recommendations. Given the opportunities identified to support and maximise the benefits NPR, this will involve working closely with TfN.

If central government funding is sought, the development of the schemes should align to the Rail Network Enhancements Pipeline (RNEP) process, established to create a rolling programme of enhancements. The decision points for investment in the railway are supported by the government's Five Case Model for business cases ensuring value for money throughout the lifecycle. Figure 26 illustrates the stages of the RNEP process and identifies where the key decisions for enhancement schemes take place. The first stage of the process, a Decision to Initiate, is the establishment of the case for intervention and agreement to produce a Strategic Outline Business Case (SOBC). This would form the next stage in progressing recommendation, entering the potential interventions into the pipeline. Should the next stage, a 'Decision to Develop' be agreed, further development through the pipeline and business case cycle would be undertaken. Only when a 'Decision to Deliver' has been agreed would the enhancement be considered committed.

The recommendations from this study have been produced collaboratively with industry stakeholders to deliver a collective view on what is required to deliver future train services to support socio-economic benefits for the 2030s and beyond. Network Rail will continue to work with funders to refine credible options that meet the needs of passengers and freight users; that drive social and economic benefits; and that fit with the long-term needs of a reliable railway system.

Figure 25: Illustration of the Rail Network Enhancements Pipeline process

