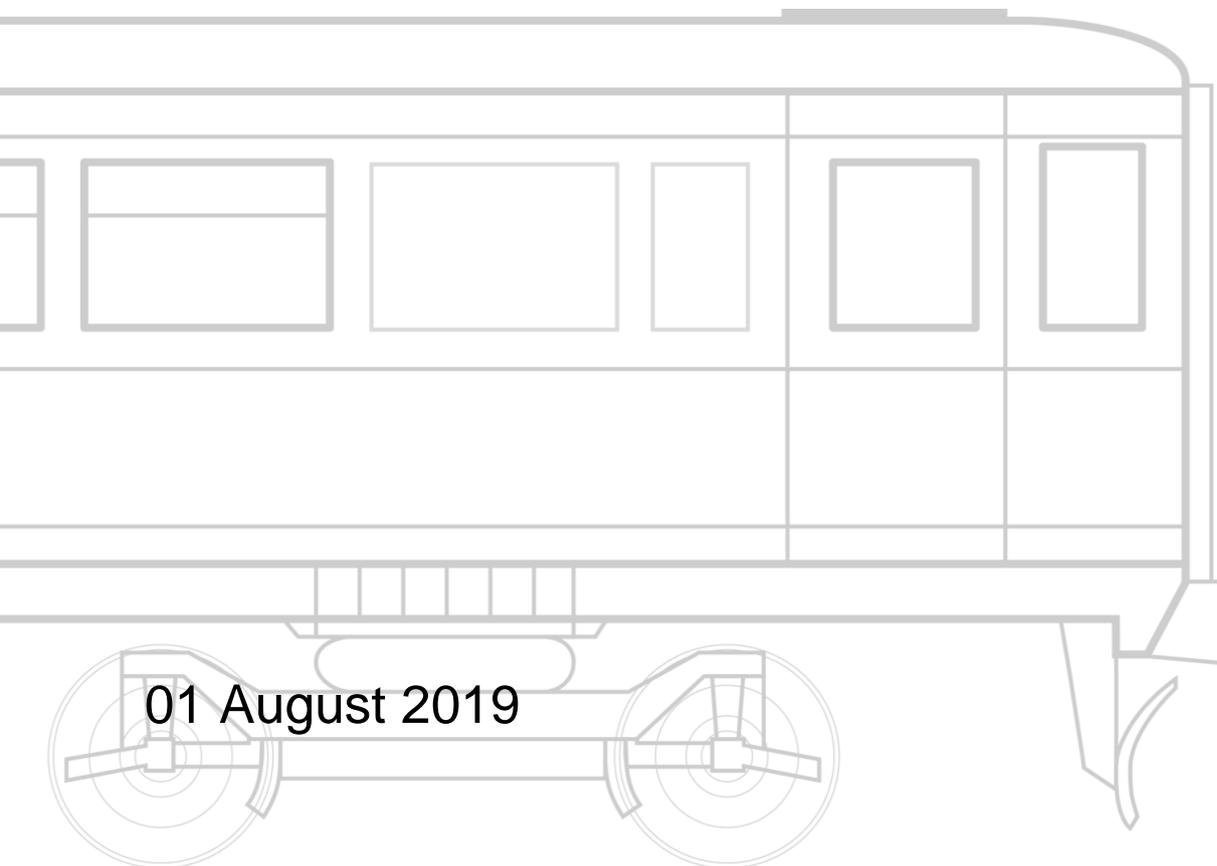


Continuous Modular Strategic Planning

Sheffield Area Strategic Question



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Part A: Foreword

The railway industry is pleased to present the response to the Sheffield Strategic Question, asked and answered as part of the Continuous Modular Strategic Planning (CMSP) approach being adopted for the Long Term Planning Process (LTPP).

To secure long term sustainable growth for the Sheffield area, investment in the railway is vital to support economic, social and environmental objectives. The railways of the North of England are an asset that are vital to the economy of the region and the UK as a whole and investing in the growth of the railway is the same as investing in that economy. Network Rail has worked collaboratively with rail industry partners and stakeholders seeking to maximise the role of a safe, reliable, efficient and growing railway in securing this growth – a better railway for a better Britain.

This study has considered the impact of increased demand for passenger and freight services in the medium and long term, starting from a baseline of today's railway, and taking account of the known changes to be delivered through the current passenger franchises. It has also considered the impact of large-scale programmes such as High Speed 2 (HS2) and Northern Powerhouse Rail (NPR), and the aspirations of bodies such as Transport for the North (TfN), with their Long Term Rail Strategy (LTRS).¹

The study has considered all these things to assess how the required capacity, frequency, and connectivity can be delivered. This includes such service-based options as longer trains, but also considers how infrastructure enhancement may be employed to support future aspirations and produce a railway that will benefit the communities and economies of the Sheffield area in particular, as well as the North of England as a whole.

¹ LTRS is embedded into the recently launched Strategic Transport Plan for the North that outlines the 30-year vision and includes an Investment Programme that sets out a pipeline of transport interventions to better connect the whole of the North. This is statutory advice to Government on what the ongoing priorities are for enhancing sustainable and inclusive connectivity across the North. The Investment Programme includes interventions at major hubs including Sheffield.

<https://transportforthenorth.com/onenorth/>

Part B: Executive Summary

The Study examines the requirements to accommodate forecast growth and large programmes (NPR, HS2) in the Sheffield area

It sets out proposals and railway investment packages for the short, medium and long term with a view to providing legacy benefits.

B.01 Strategic Question

This report examines the following Strategic Question:

What is required to accommodate future train services in the Sheffield area?

This was in response to the previous findings of the Yorkshire Rail Network Study which suggested the rail network in the Sheffield area may require capacity enhancement by the end of Control Period 6 (CP6). Working with stakeholders this was developed to ensure it was cognisant of future demand growth for passenger and freight to 2043, High Speed 2 (HS2) and Northern Powerhouse Rail (NPR).

B.02 Findings

In order to accommodate future growth in passenger and freight demand, service amendments may go some way to enable a robustly performing train service. However, it should be noted that this is almost certainly at the expense of connectivity valued by local stakeholders in particular. Alternatively, a package of infrastructure interventions could be considered. If HS2 and NPR services are to be provided, different packages of infrastructure interventions need to be considered.

Scenario	Growth & connectivity	HS2	NPR
Infrastructure option	Package 1	Package 2	Package 3
Potential infrastructure interventions	<ul style="list-style-type: none"> •Wincobank Junction grade separation •Roundwood chord reinstatement •Improved junction margins at Nunnery Main Line Junction •Improved headways and junction margins Dore to Nunnery •Sheffield Station remodelling •Platform lengthening across the study area 	Package 1 plus: <ul style="list-style-type: none"> •Further headway and junction margin improvements •Dore Junction remodelling • Aldwarke Junction to Swinton capacity 	Package 1 & 2 plus: <ul style="list-style-type: none"> • • •Masborough Junction remodelling •Additional tracks Dore to Wincobank
Order of magnitude cost	£240 -£280m	tbc	tbc

Table 1 – Summary of infrastructure options²

The ‘Growth & connectivity’ package is largely driven by service changes which are current franchise commitments anticipated to be delivered within the early part of CP6.

It should be noted here that the infrastructure options above are precisely that – options. Much more detailed work will be required in order to identify a specific set of interventions, work which would include consideration of a wider range of potential interventions.

A separate piece of analysis looked at pedestrian flows in Sheffield Station. This found that the station area is able to accommodate prediction growth in passenger numbers, subject to appropriate operational changes.

² Note that all of these are new interventions over and above committed schemes such as the Hope Valley improvements affecting the Dore area

B.03 Recommendations

It is recommended that further consideration is given to service amendments and/or infrastructure enhancements as contained within Package 1, in order that the required train service is able to run on the network with robust performance. This should be undertaken with an eye to producing a Strategic Outline Business Case (SOBC). This should include consideration of alternative solutions to those developed as a package here.

Noting that Package 1 is driven in large part by current and anticipated franchise commitments, this further work should be pursued as a matter of urgency. In particular, the impact of known changes to the Northern and Transpennine franchises should be tested independently of potential service changes resulting from East Midlands Trains and Cross Country refranchising.

As potential service changes resulting from East Midlands Trains and Cross Country refranchising are more clearly understood these should be included in any development of Package 1.

Continued engagement should take place with DfT, TfN, HS2 Ltd to ensure that the changing requirements of HS2 and NPR are fully understood, and Packages 2 and 3 amended as necessary.

The station pedestrian flow analysis recommendations that consideration should be given to enhanced signage or staffing to direct passenger flows more evenly across the station facilities should be considered for implementation in CP6 or CP7 as appropriate.

Part C: Introduction

Long Term Planning Process develops evidenced answers to questions facing the railway.

How to provide additional services on a network that is already busy?

C.01 An Investment Strategy to Support Growth

This document provides investment choices for funders for infrastructure that can support the growth of rail in the North of England, specifically the Sheffield area. Its starting point is an understanding that growth in the provision of railway transport is closely linked to economic growth. Railways move large numbers of people, and large volumes of goods safely, quickly and efficiently; enabling businesses to connect and grow.

Together, these activities help form the economic engine that powers the UK economy, and investing in rail to promote growth forms an opportunity that an increasingly wide range of businesses and organisations show an interest in taking.

This document is strategic in that it looks at the railway in the North of England as it is now, yet also considers the capacity challenges and opportunities that are likely to occur in the period up to 2043. The aim of doing this is to understand how the railway needs to adapt and be improved in the near future, and to do so in such a way that long term growth is encouraged. The railway is a complex system with infrastructure that lasts for many decades, and we need to be sure that the changes we make now will be relevant over the lifetime of the trains, track and technology that support it.

To further these goals, Network Rail has developed a Long Term Planning Process (LTPP),³ which is facilitated through the Continuous Modular Strategic Planning (CMSP) process. This allows us to consult colleagues in the rail industry and those who would like to promote the benefits of investment in rail transport, and to develop evidenced answers to some of the questions that will be asked of the railway over coming years.

The breadth of this engagement aims to capture the widest range of voices with an interest in developing rail services in the North of England.

³ <https://www.networkrail.co.uk/running-the-railway/long-term-planning/>

C.02 The railways in the Sheffield area

The geographic scope of the Sheffield Area Strategic Question has been developed working with stakeholders.

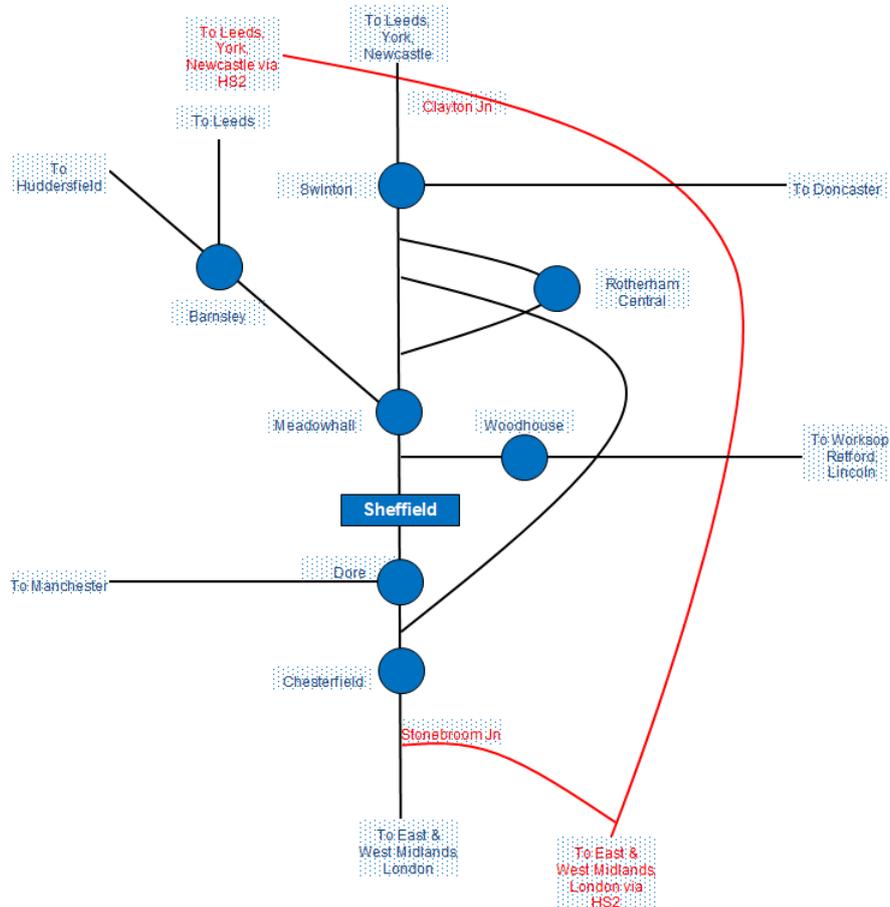


Figure 1 – Sheffield Strategic Question study Area

The study area is bounded by Swinton to the north and Chesterfield to the south. Beyond Swinton, services continue north to Leeds, York and Newcastle; beyond Chesterfield lie the East Midlands, London, and Birmingham and the South West. To the west, boundaries exist at Dore and Barnsley, beyond which services continue to the Hope Valley, Manchester, Liverpool and the North West, and the Penistone Line to Huddersfield and West Yorkshire. To the east, Nunnery Main Line Junction acts as a boundary beyond which services continue to Retford, Lincoln and the East Midlands, whilst Swinton also acts a boundary for services which continue eastwards to Doncaster and the East Coast Main Line, Hull, Selby and East Yorkshire.

Passenger services in this area are operated by a variety of operators, each dealing with different service groups:

Operator	Service type	Routes
Northern	Local	Sheffield to Manchester, Leeds, Barnsley, Doncaster, Rotherham, Retford, Worksop, Hull, Lincoln, Nottingham
Transpennine Express	Regional	Manchester Airport to Cleethorpes via Sheffield and Doncaster
Cross Country	Long distance	South West and Southern England to North East England and Scotland
East Midlands Trains	Long distance	Sheffield to London via the Midland Main Line Liverpool to Norwich via Sheffield, Nottingham and Peterborough
Supertram	Tram-train	Sheffield to Rotherham Parkgate via Rotherham Central

Table 2 - Rail operators and routes

There are 10 stations in the study area. The largest of these, Sheffield had almost 10 million entries and exits per annum and 1 million interchanges in the year 2017-18.⁴

⁴ https://orr.gov.uk/_data/assets/excel_doc/0007/39967/estimates-of-station-usage-2017-18.xlsx

With the commencement of the Northern and Transpennine Express franchises in April 2016 a series of service increments and rolling stock improvements are being delivered as part of their franchise commitments. In particular, these improvements include the use of new and refurbished rolling stock by Northern and the use of longer trains by Transpennine Express. New 'Northern Connect' services will connect Lincoln to Leeds via Sheffield and will provide a direct connection between Sheffield and Bradford for the first time in recent years thanks to a Nottingham – Sheffield – Leeds – Bradford service.

In the coming years it is expected that the reletting of the East Midlands Franchise including the remapping of Liverpool-Nottingham via Sheffield services to TPE or Northern and the anticipated Direct Award of the Cross Country franchise will see improvements to both service and rolling stock.

The Sheffield area also has a significant number of freight services using its railway network including such flows as:

- Intermodal Container traffic from Yorkshire and the North East to Southampton.
- Construction services from the Peak District quarries at Peak Forest, Tunstead, Dowlow and Hindlow which flow North and South to serve Yorkshire and numerous other aggregate terminals across the country.
- The Cement production facility at Hope makes significant use of rail-freight for distributing its product to numerous locations across the country
- There are also Metals services between Teesside and South Yorkshire to/from the West Midlands and South Wales

These railway lines are a key asset to the communities which they serve. They play a critical role in providing connectivity both within and outside the study area through connecting people to education, key services, leisure and tourism opportunities. They also link people with key employment sites within the study area.

In the diversity of services using the infrastructure lie some of the key challenges the railway faces in terms of growth:

- Line capacity – the number of trains per hour that can fit on a section of route – is ultimately limited by signalling technology, but gradient and curvature can also be key factors.
- The interaction of trains - faster trains catch up slower ones and can only pass where additional tracks are available.
- The stopping patterns of some passenger trains mean that the network capacity needed for others to run can be limited.
- Where the paths of trains cross, space on the network is taken up to make sure that safe margins are kept at intersections.

In the study area these issues are manifest in the following specific issues:

- Between Chesterfield and Swinton there are 7 at-grade junctions used by passenger and regular freight services; these create conflicting moves which use up more capacity
- The majority of the network is two track only therefore passing opportunities are very limited. This is exacerbated by the mix of short-and long-distance services, non-stop and stopping services, passenger and freight.

The result of these limitations is that the choice of changes that customers want to see in rail transport can be affected: opportunities for new passenger and freight services can be limited, as is flexibility in specifying new timetables. These are the challenges that have to be addressed when considering how to provide additional services on a network that is already busy.

The enhancement choices presented later in the document will be ways in which the existing infrastructure could be upgraded to accommodate demand and promote growth – but it is important to remember that, in a complex system such as the railway network, there will always be alternative options. This report sets out a choice for funders, not necessarily *the* choice for funders. The DfT's Rail Network Enhancement Pipeline⁵, by which infrastructure projects are progressed, allows for a full analysis of all options to be undertaken.

⁵ <https://www.gov.uk/government/publications/rail-network-enhancements-pipeline>

Part D: Developing the Study

Developed through collaboration between the rail industry, funders and stakeholders.

The report utilises Network Rail's forecasts from guidance developed by the DfT and Network Rail for passenger demand, and evidence from the Freight Market Study and Freight Network Study.

D.01 Stakeholders

The process that has been followed in generating the required information for this report has actively sought to be collaborative. As such, stakeholders have been involved from the beginning.

In early 2017 a group of stakeholders were invited by Network Rail to attend a series of workshops in order to generate strategic questions for consideration as part of the North of England Strategic Questions.

A number of the strategic questions related to the Sheffield area. It was therefore decided that the Sheffield Area would be considered as part of the first tranche of North of England Strategic Questions work (Phase 1).

Stakeholders were chosen to represent the railway industry, funders and other interested parties. Stakeholders are represented on the CMSP Governance groups, have assisted in generating and prioritising strategic questions, and have been directly involved in the Sheffield Area Strategic Question by their inclusion in the Working Group.

The Working Group is composed of the following organisations:

- Department for Transport
- Freightliner
- GB Railfreight
- Sheffield City Region
- Sheffield City Council
- South Yorkshire Passenger Transport Executive
- Arriva Rail North
- Transpennine Express
- Cross Country Trains
- Transport for Greater Manchester
- East Midlands Trains
- Transport for the North
- Transport for the North Strategic Rail (formerly Rail North)
- Network Rail High Speed 2 Ltd

The first meeting of the Working Group was held in Sheffield in July 2017 and a further 6 meetings have been held subsequently.

D.02 The problem statement and strategic questions

The Working Group developed a Strategic Question Capture Sheet which set out the key elements of the study – geographic scope, stakeholders, strategic questions, methodology etc.

The Strategic Question Capture Sheet included an overall problem statement, and a list of strategic questions to be answered.

D.02.01 Problem statement

-A set of possible strategies is required for funders that would accommodate passenger growth in the short-, medium- and long-term for the Sheffield area under different demand growth scenarios, and which would also provide choices around options for accommodating HS2 services and NPR aspirations, around journey time, capacity and frequency improvements in response to the LTPP conditional outputs, and around the amount of capacity assumed to be available to freight.

D.02.02 Strategic Questions

- **SQ-SHF-C-001** Will track, platform and rolling stock capacity on all lines into Sheffield Station no longer be able to meet forecast demand, and what are the options to respond to that?
- **SQ-SHF-C-002** What are the interventions to improve the Barnsley Line corridor comprising: 1. Capacity 2. Connectivity, 3. Journey times?
- **SQ-SHF-C-003** What are the interventions to improve the Swinton corridor comprising: 1. Capacity 2. Connectivity, 3. Journey times?
- **SQ-SHF-C-004** What are the interventions to improve the Worksop Line corridor comprising: 1. Capacity 2. Connectivity, 3. Journey times?
- **SQ-SHF-C-005** What are the interventions to improve the Midland Main Line corridor comprising: 1. Capacity 2. Connectivity, 3. Journey times?
- **SQ-SHF-C-006** What are the interventions to improve the Hope Valley corridor comprising: 1. Capacity 2. Connectivity, 3. Journey times?
- **SQ-SHF-C-007** How could the Sheffield station area accommodate different levels of freight, including that forecast in FMS/FNS
- **SQ-SHF-C-008** What are the impacts of HS2 services using Sheffield Midland?
- **SQ-SHF-C-009** Show how planned HS2 services could be accommodated alongside other services in the agreed ITSS(s)
- **SQ-SHF-C-010** Show how NPR aspirations could be accommodated alongside HS2 and other services in the agreed ITSS(s).
- **SQ-SHF-C-011** When Sheffield re-signalling occurs, whatever the driver of that re-signalling, what are the opportunities to revise the track layout in the station area to reduce journey time and increase the number of trains the station can accommodate?

The strategic questions can be considered as relating to the following main areas:

- Network capacity (number of passenger and freight trains on the network)
- Rolling stock capacity (number of passengers that can be accommodated)
- Connectivity (frequency of trains between particular locations)
- Journey times

D.02.03 Journey Times

Journey time is currently being considered in a separate workstream being undertaken by Transport for the North (TfN) which will include journeys within the Sheffield area, and connections beyond it. For that reason, journey times are not considered in this report as the options being developed by TfN are not at a sufficient level of maturity.

D.02.04 Connectivity

Connectivity is a key question for many stakeholders, who may often have different aspirations for the frequency of connections between any two locations. For that reason, it was decided that the Sheffield Area Strategic Question would take its lead from TfN's Long Term Rail Strategy (LTRS), and the outputs of NR's Regional Urban Market Study (RUMS) and Long Distance Market Study (LDMS), with LTRS taking precedence.

D.02.05 Network capacity and rolling stock capacity

These represent the core of the study – the capability of the rail network to move passengers and freight in and beyond the study area. This was analysed for a variety of growth scenarios, over a variety of timelines.

Part E: Methodology

Service specifications developed to test the rail network against future capacity demands

An assessment was made of HS2 and NPR requirements in addition to future growth

To understand what changes may be required of the railway, and answer questions 1 to 11 above, the core activity is summarised below (taken from the Strategic Question Capture Sheet)

Stage 1: Accommodating Growth

- Agree passenger and freight growth figures to be used
- Generate ITSSs based upon current timetables and agreed passenger growth figures for 2024, 2033, 2043. These ITSSs will also take account of:
 - Confirmed Northern and Transpennine franchise changes
 - Freight aspirations as captured in the Freight Market Study and Freight Network Study
 - Connectivity and frequency conditional outputs as per Network Rail's market studies
- Generate an ITSS for 2033 which builds on the above to account for HS2 aspirations
- Generate an ITSS for 2043 which builds on the above to account for HS2 and NPR aspirations
- Carry out a capacity study to test each ITSS against baseline infrastructure (current infrastructure and committed enhancements). This study will inform a report detailing, for each ITSS, capacity constraints and options to address any capacity gaps.

Capacity gaps can be accommodated through:

- Timetable and Train Service Specification interventions
- Operations interventions (i.e. train lengthening)
- Infrastructure interventions
- Rolling stock solutions

Stage 2: Enhancing Connectivity

- Identify where enhanced connectivity can be achieved in the Sheffield area, particularly where identified within RUMS and LDMS, and Rail North's Long Term Rail Strategy

E.01 Growth scenarios and service specifications

Passenger growth figures used were initially supplied by Network Rail, DfT and TfN, and based on the figures within RUMS. These were applied to a baseline train service specification (TSS) to identify where additional capacity was required, and a suite of Indicative Train Service Specifications (ITSSs) produced.

Whilst the study was underway, the Department for Transport's WebTAG guidance was updated in May 2018 to reflect new evidence in Passenger Demand Forecasting Handbook Version 6 on the drivers of rail demand. In response to this, DfT and Network Rail's System Operator generated new guidance on developing passenger demand forecasts.

Network Rail further developed the model to reflect recent trends, providing an amended growth figure. TfN have also been developing updated demand forecasts based upon the new guidance. At this time the Economic Analysis team are unable to provide a direct comparison since the TfN growth figures do not exist in isolation, but include significant uplifts based upon the new demand derived from NPR and HS2. However, it is anticipated that the figures will be broadly similar to those produced by System Operator and DfT.

In all cases the growth was significantly below that previously predicted by RUMS, to the point where a single ITSS – Growth 1 – was able to act as a proxy for all growth scenarios over all timescales – 2024, 2033 and 2043. By extension, this meant single ITSSs could be used to represent the HS2 and NPR services overlaid on this growth Scenario – 'HS2 1' and 'NPR 1' respectively).

Under the new guidance regarding demand growth, the following ITSSs inform the findings and recommendations contained in this report:

ITSS	Covers	Notes
Growth 1	Growth to 2024, 2033 and 2043	Based on current service, known Northern and Transpennine franchise commitments, franchise assumptions re: rolling stock (East Midlands Trains and Cross Country) & committed schemes (an additional Man-Sheff fast service facilitated by the Hope Valley infrastructure scheme on which a Decision to Deliver is anticipated in 2019.)
HS2 1	Growth to 2033 and 2043 + HS2 overlay	As per Growth 1 plus HS2 2b service as understood in early 2018: <ul style="list-style-type: none"> • 2 tph London Euston to Sheffield • 2 tph Birmingham Curzon Street to Leeds via Sheffield
NPR 1	Growth to 2033 and 2043 + HS2 + NPR overlay	As per HS2 1 plus additional NPR services to provide connectivity as per NPR aspirations understood in early 2018: <ul style="list-style-type: none"> • 4 tph Sheffield to Leeds fast • 4 tph Sheffield to Manchester fast • 2 tph Sheffield to Hull fast

Table 3 – ITSS summary⁶

⁶ HS2 and NPR service aspirations continue to be developed

Once agreed, the ITSSs were then passed to NR's Capability and Capacity Assessment (C&CA) team for network capacity testing.

Part F: Findings

The baseline network cannot accommodate those service specifications tested for growth without a performance risk

Significant infrastructure interventions would be required to maintain those predicted services in full, without removing or rerouting services

Sheffield Station is able to accommodate future growth if minor operational changes are made

F.01 Summary

Network Rail's analysis of network capacity required for the ITSSs found that, in all cases, the baseline infrastructure could not support the ITSS in a way that was likely to provide robust performance⁷.

Service amendments were tested, but unable to offer significant improvement without a reduction in connectivity. Infrastructure amendments were then suggested and tested against the ITSSs, producing a set of interventions which offered sufficient capacity to allow the ITSSs to be accommodated in full on a well-performing basis.

Table 4 below summarises the findings of the capacity analysis work. It sets out how different packages of infrastructure interventions could be built up in order to deliver the network capacity required to accommodate growth, HS2 and NPR in the Sheffield Area.⁸

⁷ In short, a value of greater than 85% in the Track Capacity Used metric is used as an indicator of potentially poor reliability. This is an existing normal practice in the absence of a more formal, agreed, industry standard. More detailed assessment of the reliability implications of different service amendments or infrastructure interventions would be undertaken as part of the recommended work to develop an SOBC, in line with Government transport appraisal guidance.

⁸ For clarity, please note that this is focussed on the study area and does not imply that the network capability exists outside the study area to support this

Scenario (Package)	Growth 1 (Package 1)	HS2 1 (Package 2)	NPR (package 3)
Intervention			
Dore – Sheffield, 2.5" headways		✓	✓
Dore – Sheffield, 3" headways	✓		
Sheffield - Nunnery, 2" headways	✓		
Sheffield – Holmes Junction, 2.5" headways		✓	✓
Nunnery Junction, 2" Junction margin	✓	✓	✓
Wincobank Junction grade separation	✓	✓	✓
Dore Junction remodelling		✓	✓
Roundwood Chord reinstatement	✓	✓	✓
Aldwarke Junction – Swinton Junction capacity		✓	✓
Masborough Junction remodelling			✓
3 or 4 tracks Dore to Sheffield to Wincobank			✓
Platform lengthening at Meadowhall, Rotherham Central, Swinton, Barnsley, Chapeltown, Elsecar, Wombwell	✓	✓	✓
Sheffield Station – increased line speeds in Station area	✓	✓	✓
Sheffield Station – enable northbound departure from platform 6	✓	✓	✓
Sheffield Station – extend platforms 1a, 2c, 4	✓	✓	✓
Sheffield Station - Enable simultaneous use of platform 1 and 2 in opposite directions (south end)	✓	✓	✓

Scenario (Package)	Growth 1 (Package 1)	HS2 1 (Package 2)	NPR (package 3)
Intervention			
Sheffield Station - enable southbound arrival into platform 6 without affecting platform 7/8		✓	✓
Sheffield Station - Enable simultaneous use of platform 1 and 2 in opposite directions (north end)		✓	✓
Sheffield station – 6-car capability			✓

Table 4 – Infrastructure intervention summary

It is important to note here that these are infrastructure *options*, and more specific work would be required before a detailed package of work could be developed. The outputs of both HS2 Phase 2B and NPR (in terms of service assumptions) remain under development and that variations on those assumptions from those used in this report (dating back to summer 2018) could have significant implications for the additional interventions proposed to accommodate them and therefore it is necessary to keep the options under review. This work should also consider alternatives to those infrastructure options outlined above.

F.02 Costs

Network Rail generated Order Of Magnitude costs for those infrastructure Interventions required in Package 1.

Key points to note are;

- To avoid duplicated effort, previously generated options (from programmes such as NPR) were reworked.

Table 5 summarises the OOM costs generated.

Intervention	OOM cost (low) (£m)	OOM cost (high) (£m)
Wincobank Junction grade separation	116.0	134.5
Roundwood chord reinstatement	6.4	7.4
Improved headways and junction margins Dore to Nunnery	51.1	58.8
Sheffield station amendments	45.0	51.8
Other platform lengthening	24.2	30.5

Table 5 – OOM costs

F.03 Answering the Strategic Questions

The findings above deal with the general problem statement as set out previously:

A set of possible strategies is required for funders that would accommodate passenger growth in the short-, medium- and long-term for the Sheffield area under different demand growth scenarios, and which would also provide choices around options for accommodating HS2 services and NPR aspirations, around journey time, capacity and frequency improvements in response to the LTPP conditional outputs, and around the amount of capacity assumed to be available to freight.

However, the Sheffield area Strategic Question Capture Sheet also listed a more detailed set of Strategic Questions which the study was required to answer. These are now answered in turn.

SQ-SHF-C-001 When will track, platform and rolling stock capacity on all lines into Sheffield Station no longer be able to meet forecast demand, and what are the options to respond to that?

Analysis of Growth 1 indicates there will be performance risks accommodating the full suite of services in the Sheffield area. Table 4 lists infrastructure options which could address this; service changes may also be able to contribute to this.

SQ-SHF-C-002 What are the interventions to improve the Barnsley Line corridor comprising 1. capacity 2. connectivity, 3. journey times?

As previously discussed, journey times are not discussed in this paper. Capacity and connectivity are covered in the Growth ITSSs, and Table 4 lists infrastructure options to deliver these. This could potentially include:

- Platform lengthening at Barnsley, Chapelton, Elsecar, Wombwell
- Wincobank Junction grade separation
- Sheffield Station remodelling

Service amendments should also be considered in combination with potential investment with infrastructure.

SQ-SHF-C-003 What are the interventions to improve the Swinton corridor comprising 1. capacity 2. connectivity, 3. journey times?

As previously discussed, journey times are not discussed in this paper. Capacity and connectivity are covered in the Growth ITSSs, and Table 4 lists infrastructure options to deliver these. This could potentially include:

- Platform lengthening at Meadowhall, Rotherham Central and Swinton
- Wincobank Junction grade separation
- Roundwood chord reinstatement
- Improved headways and junction margins

Service amendments should also be considered in combination with potential investment with infrastructure.

SQ-SHF-C-004 What are the interventions to improve the Worksop Line corridor comprising 1. capacity 2. connectivity, 3. journey times?

As previously discussed, journey times are not discussed in this paper. Capacity and connectivity are covered in the Growth ITSSs, and Table 4 lists infrastructure options to deliver these. This could potentially include:

- Platform lengthening at Woodhouse, Kiveton Park and Kiveton Bridge (outside study area)
- Improved junction margins at Nunnery Main Line Junction

Service amendments should also be considered in combination with potential investment with infrastructure.

SQ-SHF-C-005 What are the interventions to improve the Midland Main Line corridor comprising 1. capacity 2. connectivity, 3. journey times?

As previously discussed, journey times are not discussed in this paper. Capacity and connectivity are covered in the Growth ITSSs, and Table 4 lists infrastructure options to deliver these. This could potentially include:

- Sheffield Station remodelling
- Improved headways

Service amendments should also be considered in combination with potential investment with infrastructure.

SQ-SHF-C-006 What are the interventions to improve the Hope Valley corridor comprising 1. capacity 2. connectivity, 3. journey times?

As previously discussed, journey times are not discussed in this paper. Capacity and connectivity are covered in the Growth ITSSs, and Table 4 lists infrastructure options to deliver these. This could potentially include:

- Sheffield Station remodelling
- Improved headways

Service amendments should also be considered in combination with potential investment with infrastructure.

Note here that the majority of the Hope Valley corridor will be considered separately by a future strategic question.

SQ-SHF-C-007 How can the Sheffield station area accommodate different levels of freight, including that forecast in FMS/FNS?

Differing levels of freight provision are to be found in the various Growth ITSSs. As a principle, freight and passenger growth are considered together, but Table 4 indicates the infrastructure required to provide capacity for freight. Growth 2a, 2b and 2d all include the highest provision for freight in this study but are able to be accommodated with similar infrastructure provision to Growth 1.

SQ-SHF-C-008 What are the impacts of HS2 services using Sheffield Midland?

ITSS HS2 1 assesses the impact of overlaying anticipated HS2 services on a train service which accounts for predicted growth. Table 4 indicates the additional infrastructure which could be required over and above provision for this growth., to provide the extra capacity to support HS2. This could include:

- Further headway improvement
- Dore Junction remodelling

Service amendments should also be considered in combination with potential investment with infrastructure.

SQ-SHF-C-009 Show how planned HS2 services could be accommodated alongside other services in the agreed ITSS(s)

As above for SQ-SHF-C-009.

SQ-SHF-C-010 Show how planned NPR aspirations could be accommodated alongside other services in the agreed ITSS(s)

ITSSs NPR 1 assesses the impact of overlaying anticipated NPR and HS2 services on a train service which accounts for predicted growth. Table 4 indicates the additional infrastructure which could be required over and above provision for this growth. For NPR this is a significant package of improvements over and above those required for HS2

SQ-SHF-C-011 When Sheffield resignalling occurs, whatever the drivers of that resignalling, what are the opportunities to revise the track layout in the station area to reduce journey times and increase the number of trains the station can accommodate?

Table 4 contains a variety of interventions in the Sheffield area which could be delivered as an enhancement to resignalling:

- Better headways
- Platform lengthening
- Better junction margins
- Parallel moves within Sheffield station
- Enhanced operability within the station e.g. bidirectional capability for platform arrivals and departures

F.04 Sheffield Station

As well as on-train and network capacity, the impact of demand growth on pedestrian flow has also been considered at Sheffield Station itself. This work commenced after the updated guidance for forecasting demand was issued by DfT and NR, therefore it only took account of the impact of ITSS Growth 1. This analysis was carried out by NR's Station Capacity Analysis team.

In summary, the key findings are:

- Sheffield Station will perform adequately in terms of station pedestrian capacity through to 2043
- No infrastructure changes are recommended at this time
- It is recommended that some non-infrastructure interventions are included on the stairs to platforms to ensure optimal distribution of passengers and to prevent crowding for alighting passengers, such as:
 - signage to split alighting loads
 - staff to direct passenger flows to different areas

It is not anticipated that these mitigations will be required in CP6, i.e. until 2024 at the earliest, and most likely to be towards the end of Control Period 7 (CP7: 2024-29). The assessment concludes that given the demand forecasts provided, the infrastructure remains adequate during normal operations to service the anticipated passenger flows.

Even under a high forecast scenario based on RUMS levels of passenger demand was also tested as a proxy for a high demand scenario. This found again that the current station infrastructure was adequate to deal with this level of demand; the only caveat being that under this higher demand scenario, the mitigations outlined above may be required earlier in CP7.

Part G: Recommendations

Having reviewed the findings above, Network Rail have the following recommendations:

- Further development of service amendments and/or infrastructure enhancements as contained within Package 1 should be undertaken. This should include consideration of alternative solutions to those developed as a package here.
- As Package 1 is driven in large part by current and anticipated franchise commitments, this further work should be pursued as a matter of urgency. The impact of known changes to the Northern and Transpennine franchises should be tested independently of potential service changes resulting from East Midlands Trains and Cross Country refranchising.
- As potential service changes resulting from East Midlands Trains and Cross Country refranchising are more clearly understood these should be included in any development of Package 1.
- Continued engagement should take place with DfT, TfN, HS2 Ltd to ensure that the changing requirements of HS2 and NPR are fully understood, and packages 2 and 3 amended as necessary.
- Enhanced signage or staffing to direct passenger flows more evenly across the station facilities should be considered for implementation as passenger growth takes place.