GREENGAUGE21
Shaping tomorrow's railway

Sheffield–Leeds: What's Next?

December 2022

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Executive Summary

The need to re-examine the case for high-speed rail between the East Midlands and Leeds was determined a year ago in the Government's £96bn Integrated Rail Plan. Waiting for the conclusions of a review which has not yet started risks a damaging hiatus, especially in the key corridor between Sheffield and Leeds, where the train network is astonishingly weak, and where the alternative—the speed-restricted M1 motorway—is already congested.

The corridor has nationally significant economic growth potential, having been identified as an Innovation Corridor. It contains the nation's major advanced manufacturing cluster. To build on achievements to date and attract new investment, the corridor needs to allow businesses to partner readily and to access in-corridor research facilities. It needs to feel 'joined up'—say in the style of the Dutch Randstad ring of cities. Better transport is crucial if economic potential is to be realised.

The report shows how the Sheffield and Leeds economies can each expand through planned commercial development around their respective city centre stations. But these two great cities are linked by just one fast train, each hour. As a starting point, this service frequency can and should be doubled to half-hourly, possibly as early as 2023.

Between these two great cities lie multiple former industrial towns and communities, many of which have new housing developments, but can still feel 'left behind', with their original source of employment and pride long-gone. Inclusive growth would embrace Wakefield, Rotherham and Barnsley (in each case new or existing stations serving as 'multi-modal hubs'), and the smaller towns in the corridor too.

For Sheffield, there is a key policy aim to attract the professional services and knowledge-based jobs that the city currently lacks, centred on a new commercial cluster around Sheffield Midland station. As an anchor to the Innovation Corridor, for Sheffield better within-corridor connectivity needs to be matched with better rail connections to the city's key local airport—which happens to be Manchester.

While HS2 and Northern Powerhouse Rail services remain on the longer term agenda, the Sheffield–Leeds corridor is 'book-ended' by major rail improvements already in-hand: the (£11.4bn) east–west Trans-Pennine Route Upgrade for Leeds; and Midland Main Line electrification extended from the south to Sheffield. But the network between Sheffield and Leeds risks being the national rail network's 'land that time forgot'.

The report sets out a strategy for rail transformation by 2030, which can be implemented without prejudice to long term ambitions and some of which can be implemented as soon as 2023.

Interim Sheffield–Leeds Corridor Strategy

Note: local stations and some lines omitted for clarity

1

The challenge and opportunity

Many years planning of major rail investments—in High Speed Two (HS2) and 'Northern Powerhouse Rail' (NPR)—came to a conclusion in the Government's Integrated Rail Plan, published in November 2021. Despite committing to spend £96bn on rail investment across the Midlands and North, the IRP left some key planning questions unresolved. It provided no clarity on what might ultimately be delivered for Sheffield–Leeds.[1]

Further studies have been called for but—a year on—have not yet been commissioned. They will focus on long term solutions. That leaves a worrying gap in thinking about 'what next?' for transport in the Leeds-Sheffield corridor. This report is designed to help address this question.

Communities and stakeholders in South and West Yorkshire have been keenly awaiting better rail services and so the challenge we address here is:

"what can be done with the rail network in the short to medium term to bring benefits to the local, regional (and so national) economy?"

In responding, we have benefitted from the opportunity to discuss this question with staffers at both South and West Yorkshire Combined Authorities and with Network Rail. We are most grateful for their time. The work, however, remains our responsibility alone, as do any errors.

1. Transport for the North (TfN) expects the IRP-recommended Leeds-East Midlands HS2 study (not yet commissioned) to take 18 months to 2 years to complete.

The views of City leaders

"Delivering stronger connections between Leeds and Sheffield will allow our economic centres to finally function more like a single economy, encouraging agglomeration and knowledge transfer between industry and academic institutions—improving our productivity and enabling us to compete globally alongside some of the world's leading cities and regions.

Together we make up one of the three biggest regional economies in the UK outside London, supporting two million jobs and 175,000 businesses, with an annual GVA of £96bn and a GDP of £50bn.

We are already home to internationally-competitive businesses in growing sectors and clusters including our Yorkshire Space Hub cluster.

World class universities, teaching hospitals, and research and translation organisations are fuelling success in knowledge-intensive industries, with thriving digital and creative businesses producing new products and services, and enabling growth across sectors such as financial technology and health technologies.

Our two cities, alongside the respective combined authorities, are driving plans for a globally-recognised Innovation Corridor, to harness our existing strengths by nurturing further growth and building even better links between our businesses and universities.

But a superior rail service is vital to the success of this corridor and our economic prosperity. It will improve sustainable access to labour markets so businesses can draw on a wider net of apprentices, graduates and skilled workers.

Getting this right, will not just improve the quality of life for people in our two cities, but connect regional towns and communities and unlock Yorkshire's stifled potential."

Source: Connecting Leeds and Sheffield will help us build out of a recession - James Lewis & Terry Fox | Yorkshire Post 14th November 2022. The authors are the City Council Leaders at Leeds and Sheffield respectively.

The Challenge

The main railway line between Sheffield and Leeds was closed in the early 1980s.[2] Those services that survive run over less direct routes and face network capacity constraints. Only one fast service operates each hour. For intermediate places, services are sparse and punctuality is poor. Commuting in the corridor is therefore largely road based. The M1 Motorway which traverses this corridor was not designed for large-scale commuting; it is congested and in places subject to speed restrictions because of local air quality impacts.

Earlier plans had envisaged the HS2 route north to Leeds being used to provide part of a faster, more reliable and more frequent connection between Sheffield and Leeds (as well as bringing faster services to London and Birmingham).[3] Fast trains would inter-connect the two cities 4 times per hour. But following the IRP, which found the East Midlands-Yorkshire part of the HS2 scheme to be unaffordable, other options are to be considered in fresh studies for the Department for Transport (DfT). Five distinct options are in play, and while one of them is the original HS2 scheme, others do not serve the Sheffield–Leeds corridor at all.

So the balance of probabilities suggests there will most likely not be a future high-speed line which can also be used to support a better Sheffield–Leeds train service.

This means that when looking at interim improvements for rail in the Sheffield–Leeds corridor, it is important to:

i. avoid any presumption about specific longer term HS2/NPR commitments

ii. avoid approaches that might in the longer term (when the East Midland-Yorkshire comparative study is complete and a way forward has been chosen) prove to be poor value for money—or even incompatible with the chosen longer term option

iii. find developments that bring early benefits, which are cost effective, and that support Government policy objectives

iv. recognise that there are important railfreight flows in the corridor, some of which—including intermodal long distance flows to/from various private sector-owned terminals—are growing, and

v. be cognisant of the capacity limitations of the existing railway, especially at Leeds station and on the northern approaches into Sheffield station. As we shall see, both are critical.

So this means choices need to be realistic, affordable and deliverable. Not all local ambitions can be met, but this report sets out a possible plan and priorities based on current evidence: a 'no regrets approach' that can help build rail markets and revenues ahead of major expenditure that might follow.

The Sheffield–Leeds corridor is home to a population of around 5m people[4] and has been estimated to have an economic value (measured in gross value added (GVA))

2. A section of the then mainline linking Swinton-Cudworth-Normanton was closed in the 1980s due to mining subsidence.

3. The planned eastern arm of HS2, while connecting Birmingham with Leeds did not serve Sheffield, except by means of a lengthy loop using existing lines. To create a new faster route between Sheffield and Leeds it would be necessary to upgrade existing railways northwards from Sheffield as far north as near the village of Clayton where the existing railway would be crossed by the new HS2 route onwards to Leeds. At this roughly half-way point a new high-speed connection would be needed ('Clayton Junction')—between Thurnscoe and Moorthorpe.

4. The 2021 census shows that the population growth in Leeds was higher than the national average growth over the last 10 years at 8.1%, from 751,160 in 2011 to 812,000 in 2021 HS2 Project: Michael Gove Suggests High Speed Rail Investment Will Be Reviewed—Bloomberg.

of around £96bn.The aim of this report is to help avoid leaving this important part of the country with a hiatus in thinking on how rail services can be improved in the short/medium term. Inadequate transport links inhibit economic growth, hinder growth prospects and limit horizons and opportunities for individuals and businesses.

Looking across the 2020s

Across South and West Yorkshire, there are some key rail developments underway or at least planned.

There is Midland Main Line Phase 3, which includes electrification and covers the existing main line railway southwards from Sheffield to Market Harborough (beyond which electrification and line speed improvements have already been carried out, into the terminus at St. Pancras, London). And there are east–west developments—increasing capacity on the adjoining Sheffield-Manchester rail route (the 'Hope Valley line'), and the Trans-Pennine Route Upgrade (TRU) that are both in hand. There is a stated intention to accelerate delivery of Leeds station improvements too (the Leeds Area Improvement Programme—LAIP).

This suggests that a target timescale of 'by the end of this decade' (31st December 2029) is appropriate here. Modest but still valuable improvements in the corridor could be delivered within this timescale. But we will also:

- look beyond that decade into the 2030s and beyond to ensure that, as far as possible, what is proposed here works well with potential long term developments—of HS2 and Northern Powerhouse Rail (NPR) in particular;
- look beyond the confines of the existing railway lines between Sheffield and Leeds to ensure possible wider interactions and benefits are considered,[5] and
- look between and beyond the two cities at either end of the designated corridor to consider the needs and opportunities of places both within the Leeds-Sheffield corridor (which include Wakefield, Barnsley and Rotherham) and beyond it—so Bradford, Huddersfield, Doncaster and York, and indeed along trans-Pennine routes, since wider connectivity can be affected by what happens in the Sheffield–Leeds corridor.

Policy Aims

Government has an over-arching ambition to achieve a return to economic growth. The Combined Authorities share this ambition, which they would qualify: **inclusive** growth is their stated aim.

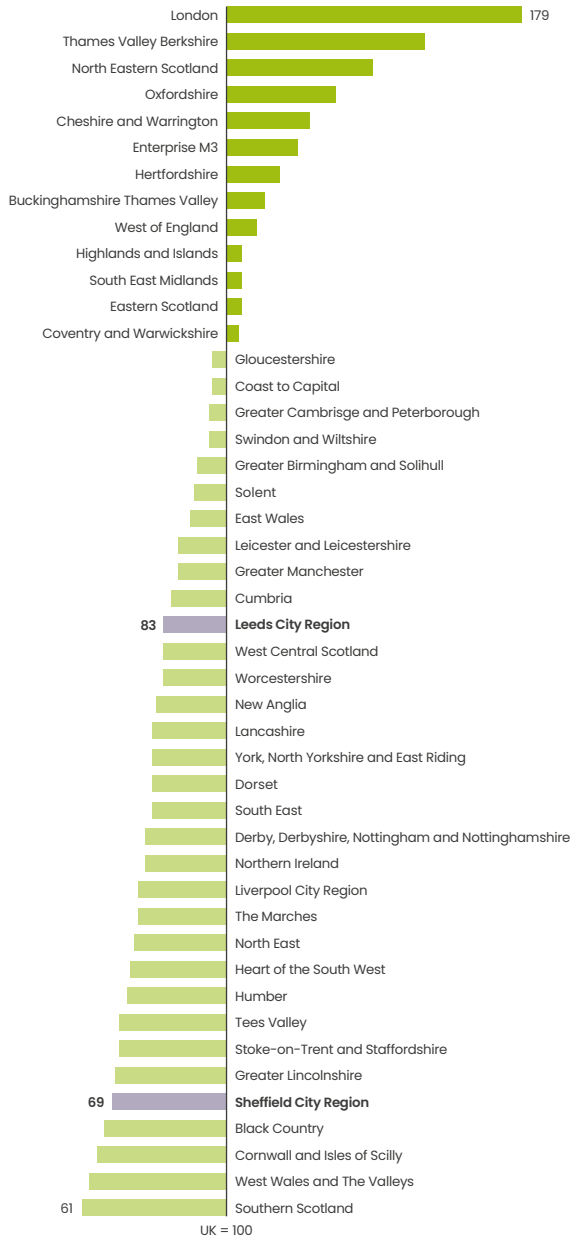
With a Government and Combined Authority ambition to improve on the UK's poor record on economic growth, it is instructive to look at recent (pre-Covid) economic performance across the corridor. Both Leeds (83% of national average) and Sheffield (69%) city regions score poorly on the economic measure of gross value added (GVA), well below the national average (see below—Sheffield City region is fifth from bottom of this ranking). Indeed, Sheffield is the **lowest rated city region** in Great Britain. This is partly attributable to its high level of (lower rated) public sector employment.

More recent ONS economic data on 'gross value added' (GVA) data is available (for 2020—summarised below) which tells a similar story but also shows how poorly Barnsley/Doncaster/Rotherham perform, closely followed by Bradford.

5. Questions such as capacity constraints at the northern approach to Sheffield Midland station cannot be usefully considered for a single corridor in isolation from the several other corridors that share final approaches into the city.

But inward investment is at an all-time high within South Yorkshire—and this is leading to major development and regeneration across the County.[6] There is a focus on the Northern Powerhouse, on the city's universities' expanding their estates, and on other major developments.

Regional Economic Statistics: Gross Value Added (GVA) 2017



Source: ONS

6. https://www.built-environment-networking.com/event/south-yorkshire-conference/ September 2022

GVA (balanced) per head of population, current basic prices

Region	2020	Index UK=100
United Kingdom	£29,063	100
England	£29,757	102
North East	£20,364	70
North West	£25,363	87
Greater Manchester	£26,277	90
Merseyside	£21,714	75
Yorkshire and Humber	£22,855	79
East Yorkshire and Northern Lincolnshire	£22,027	76
City of Kingston upon Hull	£23,403	81
East Riding of Yorkshire	£20,532	71
North and North East Lincolnshire	£22,497	77
North Yorkshire	£24,685	85
York	£28,967	100
North Yorkshire CC	£23,229	80
South Yorkshire	£19,656	68
Barnsley, Doncaster and Rotherham	£17,695	61
Sheffield	**£22,404**	**77**
West Yorkshire	£24,467	84
Bradford	£18,275	63
Leeds	**£33,544**	**115**
Calderdale and Kirklees	£19,343	67
Wakefield	£22,906	79
East Midlands	£23,057	79
West Midlands	£23,530	81
East of England	£26,096	90
London	£52,239	180
South East	£31,176	107
South West	£24,965	86
Wales	£21,010	72
Scotland	£26,572	91
Northern Ireland	£23,035	79

With the informal guidance of SYMCA and WYCA, therefore, we have concentrated on the prospects for new development and on how the private sector could be attracted to invest more in the corridor if transport connectivity is improved, as covered in chapters 4 and 5.

But first we need to answer the question 'why focus on rail transport in this corridor?' as well as how rail network and service developments might interact with plans evolving at city level with metro schemes of various sorts.

2

Why Rail offers the best opportunity to stimulate connectivity and growth in the Sheffield–Leeds corridor

Rail transport meets specific needs: for travel to, from and between cities and other urban areas. It addresses the needs of those travelling over medium and longer distances. It can avoid the congestion inevitably associated with road-based transport in major urban areas. In the Sheffield–Leeds corridor, a dependable and punctual set of rail services can provide a better alternative to the M1.

This part of the M1 is one of the most congested trunk roads in the north of England with levels of congestion in the top twenty percent nationally. The South and West Yorkshire Multi-Modal Study (SWYMMS) reported twenty years ago that the motorway should be widened to four lanes and that this capacity improvement should be protected by use of Active Traffic Management and physical demand management measures to control traffic flows.[7] These initial proposals were rejected on cost grounds, and lower cost 'Smart Motorway' measures for the most congested sections were adopted instead.[8]

Sheffield–Leeds is 36½ miles by car using the M1 (the two cities are 29 miles apart in terms of straight line distance). Car journey times are typically 1 hour according to Google Maps. By train the journey distance is 38 miles, with the single fast train each hour taking just 40 minutes (with one stop at Wakefield Westgate). This might be considered a good alternative to the car were it to be reliable (the fast connection forms part of a long-distance 'Cross Country' route between Scotland and the West Country)—and if it was available more often than just once an hour.

Semi-fast services running via Barnsley take around one hour and stopping services typically take 1¼ hours. Service improvements by rail could see a significant shift away from motorway use, both between the two cities and to/from key intermediate stations. The most recent journey to work census data (2011) suggests that travel market share between the two cities is 90% by car.

Many activities require travel and this means that in periods of economic recovery there will be an uptick in travel, and in this corridor, increased road congestion levels. Congestion is a drag on business productivity. This is why quality of service on transport networks is so important to achieving the productivity improvements that underpin economic

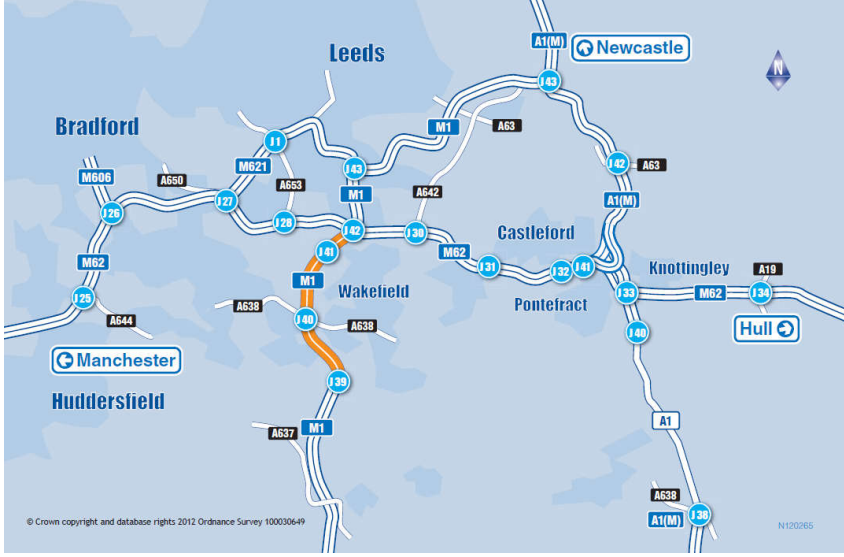
7. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/872103/M1_J39_J42_POPE_OYA_with_foreword_FINAL_Jan_2020.pdf

8. It is no longer planned to extend these sections of SMART motorway, following safety concerns.

growth. And it is why economic expansion (which will add to travel demand) cannot be left reliant on an already stretched national motorway system for which there are no plausible capacity expansion plans.

The M1 motorway in the Sheffield–Leeds corridor is a key part of a wider national network, of course—see diagram right—with the M18/A1/M62 also providing access between the wider Sheffield and Leeds City Regions. This serves as a reminder that the rail network should be assessed as part of a network of services, not individual routes.

In rail network terms, while South and West Yorkshire accommodate three of England's ten largest regional cities (Leeds, Sheffield, Bradford) it is notable that there are no direct Bradford-Sheffield trains. And there is a wider point to make here. Both South and West Yorkshire are polycentric, with multiple towns and cities. Most of the latter (but certainly not all) have a rail service of sorts, but few are inter-connected by rail. A rail alternative and hence congestion relief for the M1/M18/M62 motorways can come in part by better services into Leeds and Sheffield city centres, but creating new rail links between the multiple towns and cities across South & West Yorkshire could also make a significant difference. Services will also need to be viable, generating extra revenues.



Source: Post Opening Project Evaluation M1 Junction 39 to Junction 42 Smart Motorway All Lane Running—One Year After August 2017 for Highways England.

Carbon emissions for the journey between Sheffield and Leeds are over three times higher for a car journey than a rail journey today: by train 2.07 KG CO2 e and by car 6.95 KG CO2 e.[9] Currently, rail journeys are provided by diesel trains. There is scope to eliminate carbon emissions from rail travel with a switch to electric traction and reliance exclusively on zero-carbon sources of electrical power generation as per Network Rail plans. In other words, the significant advantage that rail already offers in carbon terms—just 30% of the carbon emissions of the car alternative—can be made better still.

The Sheffield–Leeds corridor is served by the M1 Motorway, which operates at or close to capacity through peak periods. Economic growth will create additional travel demand that cannot be accommodated at peak periods on the M1 or the wider highway

9. Source: LNER carbon calculator. The calculations are based on:

- Car = average petrol car 0.35915 kgCO2e/mile / 1.5 (average loading for a car DfT statistic dataset vehicle mileage and occupancy) = 0.2394333333 kgCO2e/pass mile
- Train = National Rail 0.0689119388 kgCO2e/pass mile
- Plane = Domestic flight with radiative forcing 0.4389957652 kgCO2e/ pass mile

*Conversion factors are all taken from https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021.

network without adding to existing congestion, extending journey times and further adding to carbon emissions. Roads into each of the two main city centres are also congested.

Green economic growth in the Sheffield–Leeds corridor depends on attracting more people to use rail. There is strong policy support for enhancing rail connectivity between Sheffield and Leeds within the Sheffield City Region Strategic Economic Plan.[10]

Decarbonisation

Over short distances, it is possible that a switch from using cars to walk, cycle and 'micro mobility' (e-bicycles e-scooters and the like) could take place: a policy of encouraging active travel. Expanded or new urban mass transit systems can also help substantially—an opportunity area for both the Sheffield and Leeds city regions.

Elsewhere, a policy of reducing car usage is being considered . The York and North Yorkshire LEP that covers a more rural part of Yorkshire, for example, has drafted a plan to achieve a carbon-negative position based on utilising its natural assets. This calls for a 48% reduction in car usage by 2030. Although the South and West Yorkshire Combined Authorities are committed to delivering decarbonisation,[11] neither has (yet) matched this particular type of ambition. Without policies that actively seek to reduce road traffic levels along with suitable enforcement measures, road traffic congestion will rise in the years ahead.

With a national commitment to reach net zero carbon emissions by 2050, a major shift in transport use and behaviour is needed. Transport is the UK sector with the biggest carbon emissions. Of course, a switch to electrically powered cars has started and will no doubt help achieve decarbonisation. But a switch to travel by electric car still carries environmental detriments: air pollution particulates arising from brakes and from car tyre-road interface; and traffic noise (which comes from the same source). These effects have serious and costly human health consequences. Travel by higher capacity modes—bus, tram and (especially) train—offers far better fuel/energy consumption and much lower carbon emissions per person-mile travelled.

In short, the changes needed to improve environmental performance include changes in travel behaviour, as reflected in DfT's transport decarbonisation strategy of 2021.[12]

10. SCR_SEP_Full_Draft_Ja (southyorkshire-ca.gov.uk) (p62).

11. But both metropolitan counties have established decarbonisation plans – see https://westyorkshire.moderngov.co.uk/documents/s16572/Item%2011%20-%20Appendix%201.pdf and https://www.scrgrowthhub.co.uk/2021/12/making-net-zero-a-reality-by-2040-in-south-yorkshire/

12. https://www.gov.uk/government/publications/transport-decarbonisation-plan

3

Existing plans for rail: Sheffield–Leeds

Demand recovery

As of Autumn 2022, the rail industry in general is in post-Covid recovery mode. One former franchise, LNER, has reported passenger levels exceeding pre-Covid demand levels.[13] Freight flows by rail continue to expand (including to/from terminals in Yorkshire).[14] But overall, rail passenger demand has not yet recovered to pre-Covid levels. Service levels have suffered cutbacks, including for example on Trans Pennine Express and Northern Trains routes.

While the trend is one of demand recovery, it is clear that patterns of rail use have shifted, but not so much in the North of England where there is much less historic dependence on 5-day/week rail commuting, the dominant pattern for South East England. Indeed, Northern Rail which operates most local services reports has overall demand at 89% of pre-Covid levels,[15] with even better progress on revenues, which have reached 100%. Commuting has fallen, but has been in effect replaced in the customer mix by other journeys by rail, including for a wide range of leisure activities as well as for business. By Autumn 2021, Leeds station was already experiencing Friday passenger volumes back at pre-pandemic levels and weekend volumes well ahead of those recorded pre-Covid. And rail passenger demand recovery at Sheffield is just as encouraging.

The North may have recovered faster, but nationally rail passenger demand levels are getting back to pre-Covid 19 levels: **"It is clear from DfT passenger figures just published that passengers are coming back in force, even during the working week. With 99% of pre-Covid levels recorded on Friday 18 November, we are getting tantalisingly close to the figures recorded in early 2020, a period which marked the second highest year on record for UK rail passengers."**[16]

Subject to affordability concerns and resolving industrial disputes, the prospects for rail in the Sheffield–Leeds corridor are on an upward trend. Capacity pressures on the approaches to both Leeds and Sheffield stations remain post-Covid and need to be addressed.

13. https://www.lner.co.uk/news/lner-leads-the-way-with-post-pandemic-passenger-recovery/

14. See, for example, https://www.railfreight.com/intermodal/2022/10/13/yorkshire-and-scotland-linked-by-new-intermodal-service/

15. ORR Passenger Rail Usage statistics Quarter 2, 2022. In comparison, London & South East operators recovered to 72% of pre-Covid levels by the same time.

16. Darren Caplan, Rail Industry Association, December 1st 2022

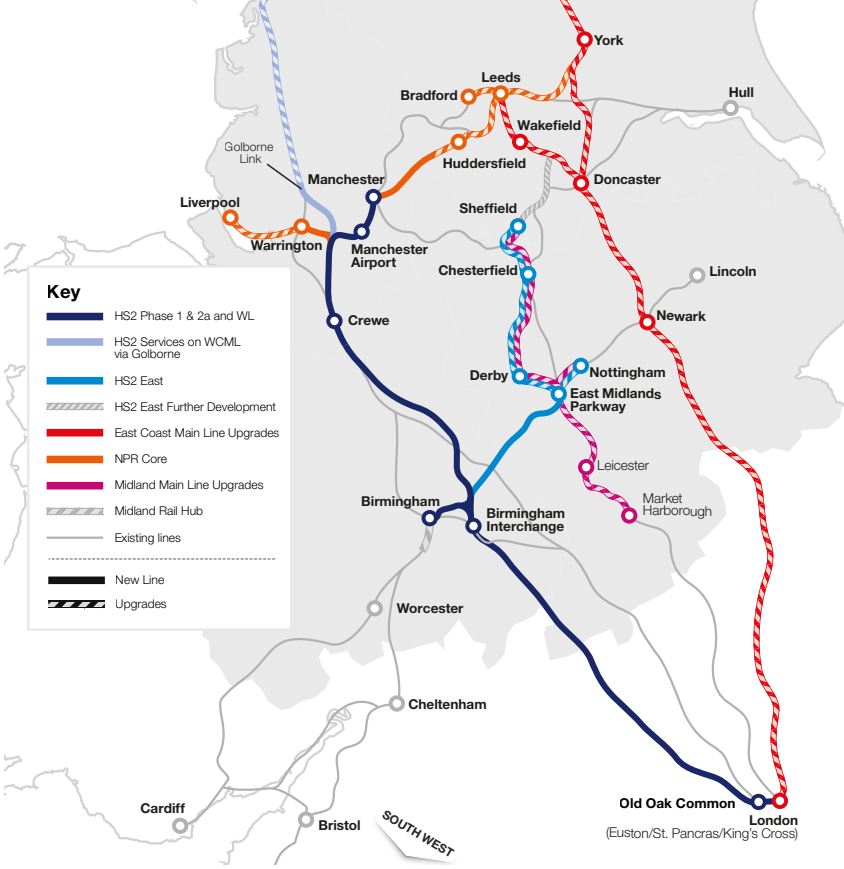
The longer term funding position, however, is not clear, with uncertainty surrounding major investment plans and an ongoing delay in the release of the rail sector's enhancement programme.[17]

Integrated Rail Plan (IRP)

Government's Integrated Rail Plan for the North and Midlands, published in November 2021 proposed that new connections between the East Midlands and Yorkshire—which embraces the Sheffield–Leeds corridor—should be the subject of further consideration of options rather than progressing with HS2's 'Eastern Arm'. This leaves a gap in the high/higher speed network between Sheffield and Leeds—see plan, right.

This plan is important because it illustrates the Integrated Rail Plan for the Midlands and North, which, after a short period of uncertainty, was re-confirmed in the Chancellor of Exchequer's Autumn 2022 Financial Statement as the Government's £96bn long term plan. It shows:

- The Eastern branch of HS2 extended to East Midlands Parkway, from where HS2 services will continue over upgraded existing lines, including to Sheffield
- A combination of new infrastructure (Manchester-Marsden) and upgrades of existing lines being deployed across the Manchester-Leeds-York corridor
- Upgrades to both the East Coast Main Line and the Midland Main Line.



Source: Integrated Rail Plan for the North and Midlands.

While the parts of the plan needing new infrastructure are likely to have long lead times,[18] there are some more immediate developments in the offing, and these could have great significance to the Sheffield–Leeds corridor. The Midland Main Line electrification programme is inching steadily northwards. As of summer 2022, Network Rail remains committed to completing the scheme over the section north from Market Harborough[19] through Leicester to Nottingham, Derby and Sheffield. This will fulfil an ambition of local authorities including Sheffield City Council dating back as far as the 1980s.

As ever with electrification projects, the question of leaving gaps arises. In this case, the lines between Sheffield and Moorthorpe (near the half-way point on the main Sheffield Leeds route) would be a stand-

17. https://www.riagb.org.uk/RIA/Newsroom/Stories/Show_us_the_Rail_Enhancements.aspx

18. Although some acceleration at least of the planning consenting process would be possible if the habit of pursuing only one major rail scheme at a time through the Parliamentary Bill process—which can take several years—is dropped.

19. With work now underway between Market Harborough and Wigston (to the south of Leicester).

out electrification gap[20] (since the route onwards from Moorthorpe to Leeds is already electrified) as would be the connection from Swinton across to Doncaster (which is on the electrified East Coast Main Line).[21]

The value of electrifying the Sheffield-Moorthorpe line as an adjunct to completing Midland Main Line electrification has been identified in Network Rail's 'Continuous Modular Strategic Planning' process.[22] It would allow electric traction to be used by both longer distance and local train services, allowing a potentially valuable tightening of train timings, and reducing the impact of poor-acceleration levels with older diesel powered trains used on local services. Its business case is strengthened because it creates a second fully electrified diversionary route between Leeds and London, for use at times of major service dislocation on the East Coast Main Line.

So this relatively short electrification scheme would have wider network resilience benefits as well as local service gains and decarbonisation merit.

HS2 Eastern Arm options, NPR and Trans Pennine Route Upgrade

The Northern Powerhouse Rail (NPR) ambition was for four fast trains/hour between Sheffield and Leeds. Although the HS2 Eastern arm bypassed Sheffield, its northern section into Leeds was expected to be used to accommodate this improved city-to-city service, through a combination of extending London-Sheffield and other services, operating into/from an expanded Leeds city station. Sheffield–Leeds journey times were expected to be under 30 minutes.

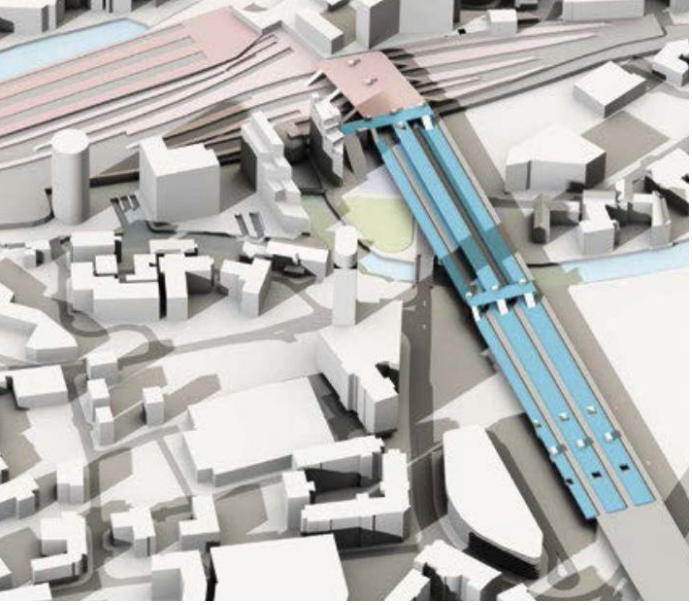
This in turn would have required investment to the existing line northwards from Sheffield to a point near Clayton (between the stations at Thurnscoe and Moorthorpe), where a junction with the HS2 route would be built. The section of existing line that would be used is unsuited to high-speed operation and neither does it have the capacity for additional non-stop services—hence the need for upgrades as well as the connection to HS2. At Leeds, the HS2 line would approach from the south and form a terminus adjoining the existing station[23] but at right angles to it—so with no possibility of service extensions beyond Leeds, to Bradford, for example.

20. See Railway Industry Association (https://www.railway-technology.com/news/ria-north-classifies-line-electrification-priority/) in October 2022, which identifies this part of the network as the number one next priority: "It also highlights a range of connections between major towns and cities in the North as "first priority", including Sheffield to Doncaster/Moorthorpe…"

21. Modern bi-mode rolling stock, electric but with retained diesel power offers a way to 'bridge' unelectrified sections of line, but at a significant cost in terms of train weight, capital and operating costs and of carbon impacts. The Swinton-Doncaster line has also been mooted for possible tram-train service which may compromise the case for a conventional main line rail electrification approach. But this would need to have 25kV-capable tram-trains in order to operate on an electrified 'main line'.

22. Doncaster Area Strategic Advice, Network Rail, Continuous Modular Strategic Planning (CMSP) programme, February 2021.

23. We later refer to this is the T-station because of this orientation.



Revised HS2 station design (HS2 platforms in blue) at Leeds

Source: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/480396/Higgins_-_The_Yorkshire_Hub.pdf

The original HS2 eastern arm scheme (see schematic diagram, below) offered a partial solution to the aim of improving the Sheffield–Leeds connection. Another approach the Government wants to see assessed is an upgrade of existing lines rather than new build (one of which is as shown right, below). The upgrade approach would probably entail improving the line northwards (the Erewash Valley line, mainly used for freight today) through Chesterfield and thence via the so-called 'Old Road' through Barrow Hill and Rotherham to Wakefield to reach Leeds. This option still begs the question of how the section of route northwards from Sheffield should be upgraded to improve Sheffield–Leeds connections.

The Integrated Rail Plan suggested that instead of proceeding with the eastern arm of HS2, alternatives should be considered. To re-iterate: this means that no interim plan for the Sheffield–Leeds corridor can rely on any one particular approach being adopted for HS2 (eastern arm) in the longer term.

So any interim investment will face a challenging business case question: might any expenditure involved now (say in the 2020s) be found to be wasteful in the longer term—in effect superseded later by whatever is the outcome of the study of HS2 eastern arm options? This long term study might take 18-24 months to complete, but it would be unusual (although of course welcome) if a decision on implementation of its findings didn't take at least as long again.

The challenge is to avoid planning blight and to find a way forward for Sheffield–Leeds with a business case that is robust in the face of uncertainty around these possible longer term schemes which cover a wider geography.

Original HS2 plan

Upgrading existing lines

Source: Greengauge 21

But the IRP suggests that further options also need consideration since they too might be less costly and offer other benefits. These include the alternatives of:

- Using a Northern Powerhouse Rail route from Manchester to Leeds to extend London (and Birmingham)—Manchester trains to Leeds

- Using the cross-Midlands part of HS2 Eastern arm to link with the East Coast Main Line near Newark to provide HS2 services from London and Birmingham to Leeds.

These further options bring no direct benefits to the Sheffield–Leeds corridor.

The first requires a trans-Pennine NPR route to be built as well as Phases 1, 2a and 2b of HS2—and some would argue—a 'through' underground HS2/NPR station in central Manchester too. So a completion date before 2050 seems unlikely.

The second option is more promising. It expands on the cross-Midland part of HS2's eastern arm which is retained in the Integrated Rail Plan. This envisages the HS2 route continuing via Nottingham to reach the East Coast Main Line near Newark. From here northwards, **a new high speed line could add capacity and speed in the East Coast Main Line corridor**. This would lead to improved and expanded services between London (Kings Cross/HS2 Euston) and West Yorkshire and the North East (see below). Services from London would approach Leeds from the east (Hambleton Junction).[24]

HS2 built in ECML corridor

Source: Greengauge 21.

The option involving high-speed rail investment in the East Coast corridor (see plan above) adds capacity to the southern section of the East Coast Main Line (by providing access to HS2 into London) and provides a speed-up and extra capacity to its northern section. It could obviate the need for a large-scale and disruptive upgrade of Doncaster station (and its northern and southern approaches) identified by Network Rail as being needed if the original HS2 Eastern arm is dropped.[25] It would also create a faster NE-SW cross country corridor, as well as putting Nottingham on to the HS2 services map more usefully as an intermediate station call, rather than another stub terminus.

24. See http://www.greengauge21.net/east-coast-high-speed/

25. https://www.networkrail.co.uk/wp-content/uploads/2021/04/Doncaster-Area-Strategic-Advice.pdf

Shorter term service and infrastructure developments

LNER, the operator of the East Coast Main Line services, is experiencing demand growth and would like to add a new Leeds-London service, potentially routed via Hambleton Junction.[26] An imaginative move would be to make this a faster, non-stop, London-Leeds service, extended to Bradford, where platform capacity (unlike at Leeds) is available for train turnrounds. This would deliver a sub 2 hour Leeds-London journey time and transform Bradford's connection with the capital. **This 15-minute speed up of London-Leeds services could be delivered before 2030**. It would help pave the way for a more widely improved London-Leeds service post-IRP.

Another scheme that is proceeding to implementation is the Trans Pennine Route Upgrade (TRU), with a quadrupling of the existing route between Ravensthorpe and Huddersfield. This might appear to have no direct relevance to the Sheffield–Leeds corridor, but we note an opportunity it may create in Chapter 5, below. The Leeds Area Improvement Programme (LAIP) will target capacity needs on the approaches to Leeds station, potentially of great significance to the Sheffield—as well as other—corridors.

Corridor Schemes

There are some important local schemes in contemplation for the Corridor focussed on the route via Moorthorpe. The shared ambition of SYMCA, WYCA and Network Rail is to improve the limited stop service between Leeds and Sheffield.[27] At present this comprises a single hourly train operated by Cross Country that operates with one intermediate station call (at Wakefield Westgate). Expanding the existing one fast train/hour service has to overcome the problem of capacity constraints which arise:

- On the northern approaches to Sheffield station
- Over the existing main line via Moorthorpe where a mix of services has to be accommodated
- At Leeds station and its approaches.

Current indications are that Northern Trains—a publicly owned train operating company[28]—plans to introduce an hourly fast shuttle service between Leeds and Sheffield, in a timetable path set 'opposite' the existing clockface Cross Country train timing. This will double fast train frequency and the combined service can then be presented as half hourly between the two cities. The new service would call at Wakefield Westgate only, initially at least.

A separate but potentially related option under examination is a plan to provide a new station for Rotherham. This would be located on the 'main lines' with a preferred station site near to (and connected to) the current tram-train terminus at Parkgate. This would allow an existing timetabling

26. This would avoid the problem of adding a service to the Leeds-Wakefield -Doncaster line used by existing Leeds-London Kings Cross trains which is also used by fast Leeds-Sheffield trains (the line via Moorthorpe).

27. They also have an ambition to improve the frequency of stopping services between the two cities. For WYCA, this would mean doubling the local/regional stopping train service frequencies to a base standard of 2 train/hour.

28. It is owned by DfT OLR Holdings for the Department for Transport.

Sheffield Midland station looking north.

Photo: Network Rail.

constraint, the slow, tightly curved single track, 'Holmes chord' to be avoided. Such an arrangement would allow—potentially—the extension of London-Sheffield trains to serve this new Rotherham station.

Another possibility is the addition of a new station near Goldthorpe—so called Dearne Valley Parkway. This might serve a wider car-based catchment, but it is some distance from Barnsley, for example, and longer distance travellers in this part of Yorkshire are likely to continue to 'railhead' at Doncaster, with its wide range of intercity rail services. It is unclear that additional station calls at Goldthorpe/Dearne Valley Parkway would ease rather than add to capacity pressures on the Sheffield-Moorthorpe railway line. But better station facilities at the existing station, together with better bus service connections, might work well with housing development in the station catchment if that proceeds.

But the capacity constraints at the north end of Sheffield station would remain.[29] One approach to addressing this problem that has been suggested is an elaboration of the existing Sheffield-Rotherham tram-train services. This, it is argued, might then release some train paths on the northern approaches to Sheffield Midland station (assuming travellers were content to travel on slower but more accessible tram-trains). Other approaches include those that would add a third (and possibly a 4th) track through the tunnel to the north of Midland station. Neither approach would come cheap. Lower cost options such as applying bi-directional signalling to selected tracks at Sheffield station which would feature as part of the Midland Main Line upgrade/electrification works may help to some extent. The use of ETCS (train control systems) could also ease the constraints of the existing signal block sections arrangements—as could a Communications Based Train Control

29. This critical section of the national network would be used by local trains using the 'Barrow Hill' line which has been put up for a 'Restore Your Railway' grant.

(CBTC) system application, potentially at much lower cost. Such measures should be examined before major capital works project are advanced—and without delay.

So far discussion has centred on only one route between the two cities, albeit the fastest. The second line splits off at Meadowhall (where until recently consideration was being given by Network Rail[30] to grade separation to ease capacity constraints) and continues northwards via Barnsley to Leeds. This line also serves key West Yorkshire freight terminals, and is constrained by the need to operate through multiple junctions between Horbury and Woodlesford. Services over this route (the 'Hallam line') include two semi-fasts/hour calling at Meadowhall, Barnsley and Wakefield Kirkgate,[31] provided by Northern. There don't appear to be any significant plans to upgrade this route which serves important intermediate places.

Of these, Barnsley could be served by extensions of East Midlands Railway (EMR) London-Sheffield services. As the photograph below indicates, there is room for platform extensions at Barnsley station needed to accommodate the longer trains that would be used. Barnsley interchange is a rare but excellent example of a fully integrated bus-rail hub facility, well located for the centre of the urban area.

Barnsley Interchange—a modern multi-modal interchange, centrally located and with the scope to extend the existing short platforms

Barnsley Interchange. A modern multi-modal interchange, centrally located and with the scope to extend the existing short platforms.

Photo 2022: Greengauge 21.

'Metro' plans

Mention has been made of extensions of the Sheffield supertram network, specifically its tram-train line at Rotherham. On a larger scale, there is an evolving plan for Metro in West Yorkshire, serving Leeds, Bradford and the surrounding area—see illustration below. The absence of a 'metro'[32] has long been identified as a planning failure in the Leeds city region which also limits the value of its rail services. Local rail, long distance rail and metro schemes need to be progressed together to provide the type of accessible, convenient inter-linked network that will attract people away from car use and ease West Yorkshire's congestion levels and cut its carbon emissions.

30. https://www.networkrail.co.uk/wp-content/uploads/2019/08/Sheffield-Area-Study-2019.pdf

31. With a London open access rail service, the Kirkgate station area has been the subject of improvements to the public realm. Both Kirkgate and Westgate stations in Wakefield are connected by a Freebus service to the city centre.

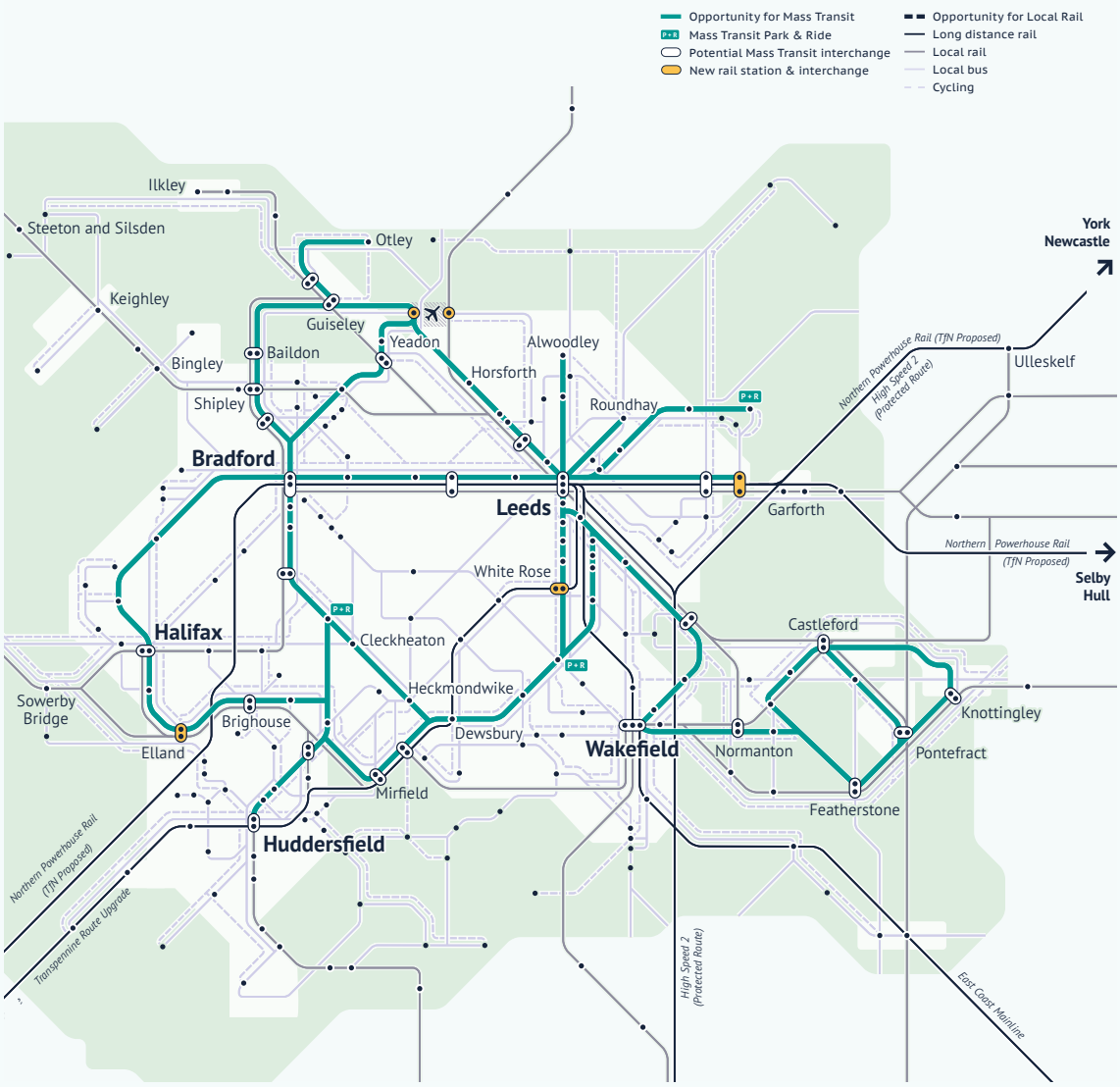
32. The current work uses the term Metro to cover enhanced bus rights of way, Light Rail, Tram-train and segregated metro systems.

Outline Mass Transit plan for West Yorkshire

One area of relevance for the Leeds-Sheffield corridor is the possibility of 'Mass Transit' for the Leeds/Normanton-Wakefield area. In due course it might be worth exploring how this part of a future Mass Transit system could interface with a new Sheffield-Barnsley-Wakefield Kirkgate -Castleford-(Church Fenton)-York service, adding overall network coherence and improving the business case for both developments. It is understood that the Light Rail Transit components of the West Yorkshire plan are seen as being needed to fill gaps left by current bus and rail services, rather than a potential replacement of any of them.

Outline Mass Transit plan for West Yorkshire

Source: West Yorkshire Mass Transit Vision 2040.



4

Economic Development

Overview

Leeds is overwhelmingly the dominant regional centre across Yorkshire in economic terms, competing with other leading UK cities. Sheffield functions more at a sub-regional level.

Notwithstanding the dominant position of Leeds, both the Leeds and Sheffield City Regions share polycentric settlement patterns—a legacy of the settlement patterns that evolved through the industrial revolution and into the 20th century alongside the growth and then decline of employment in steelmaking, heavy engineering, textile and woollen industries and coalmining.

According to Centre for Cities' 2021 data, the two regional cities rank 5th and 6th largest in population terms: Sheffield 854,200 and Leeds 798,800.

How to help local economies to grow

By the mid-2000s, contemporary thinking on economic development, encouraged by HM Treasury, was reflected in the policies of the former Northern Way, and from 2014 onwards, the same policies underpinned the Northern Powerhouse idea: larger and better inter-connected cities would be at the forefront of growth ambitions. This thinking continues to hold sway: 'agglomeration effects' lead to higher productivity—with gains made from closer competition between firms and from wider employee catchments and wider customer markets. The focus is on creating more jobs in the higher value 'knowledge-based industries'.[33]

But not all growing businesses are in city centres. One of the key strengths of the northern economy—advanced manufacturing –spans South and West Yorkshire (and also is a strength in South Lancashire/Preston).[34] The Advanced Manufacturing Park on the east side of Sheffield is illustrated below.

33. As reflected for instance in the way that the Integrated Rail Plan was developed based on the advice of the National Infrastructure Commission: https://nic.org.uk/studies-reports/rail-needs-assessment-for-the-midlands-and-the-north/ (report published December 2021).

34. As identified in the Northern Powerhouse Independent Economic Review. The transport connection between Sheffield and Preston is poor: a 2-hour, 70 mile journey by car (source: https://ukdistance.com/route/sheffield/preston) and around the same time by train -although there are no direct services (source: https://www.rome2rio.com/s/Sheffield/Preston) .

Advanced Manufacturing Research Centre, Sheffield.

While the Advanced Manufacturing Research Centre and associated business park is an 'edge city' development, it could yet be served by rail (by the possible new Barrow Hill line service, see below). But in general, knowledge-based industries cluster in city centres. Here the economic gains can only be fully realised if there is the capacity to accommodate additional employment and excellent connectivity. Surrounding areas then benefit from 'spill-over' effects (although in practice, specific measures may be needed to ensure that these arise).

The other major towns and cities in the Leeds and Sheffield City Regions are a varied group including Barnsley, Rotherham and Wakefield (each of around 100,000 population with sub-regional populations of 250-350 thousands) served by Leeds-Sheffield rail services. And also of relevance to the corridor are Bradford, Dewsbury, Doncaster, Halifax and Huddersfield and a number of smaller towns and settlements. They are vulnerable to competition from the bigger cities, to out of town business and retail locations and to the shift to internet-based shopping and leisure. At the same time, all of these places suffer from many of the road congestion problems of Leeds and Sheffield. A policy that pursues and strengthens the growth prospects of Sheffield and Leeds needs also to ensure the effects are not simply a within-region transfer of GDP output, strengthening the two cities and weakening the surrounding region.

The corridor has a multitude of smaller towns and villages with an industrial heritage. The former coalfield covering most of South Yorkshire and parts of Leeds and Wakefield requires particular comment. The rundown of coalmining in the late 1980s and 1990s was much more rapid than the decline of the textile and engineering industries in West Yorkshire, outpacing any capacity to adapt and leaving a legacy of damage to the economic and social fabric. South Yorkshire and the Coalfields and particularly the Dearne Valley Development Zone became the top regional priority for the Yorkshire and Humber Region in statutory regional plans[35] in the early 2000s. By the mid-2000s policy quickly shifted towards agglomeration economics and cities but the policy tension between cities and communities that feel left behind has not gone away. Improved connectivity is required to help bind places together.

Serving local needs

Many of the former coalfield towns are directly served by the Leeds-Sheffield rail corridors—Chapeltown, Elsecar, Wombwell, Darton, Normanton, Castleford and Woodlesford on the route via Barnsley; and Swinton, Bolton upon Dearne, Goldthorpe, Thurnscoe, Moorthorpe, Fitzwilliam, Sandall and Agbrigg and Outwood on the route via the Dearne Valley. But for former coalfield places like Bolton upon Dearne, Goldthorpe,

35. The Regional Spatial Strategy (RSS) for Yorkshire and the Humber prepared by the region (the Yorkshire and Humber Assembly) and issued by Government in 2004 following consultation and a Public Examination identified the coalfield and the Dearne Valley Development Zone as a top regeneration priority. Local authorities were required by statute to take RSS into account in preparing development and transport plans.

Thurnscoe, and Moorthorpe, the service is a basic one train per hour to both Sheffield and Leeds with negligible immediate prospect of improved frequency due to capacity constraints and to Northern Powerhouse Rail ambitions which prioritise more fast services between Leeds and Sheffield. Plans were mooted in the past for a new station between Swinton and Bolton at Wath Manvers to serve the Dearne Valley Development Zone and never progressed for similar reasons.

Places and communities that can feel 'left behind' are often on the fringes of major urban areas. Here development patterns are not usually conducive to good public transport service provision. While not suffering from the transport problems that deep rural communities face, they demand attention, as a report for the UK2070 Commission

The regeneration inheritance: a case study

Wath Manvers lies at the heart of the Dearne Valley Development Zone. At the start of the 1990s Wath Manvers was known as the largest area of derelict land in Western Europe—a complex of former collieries, coking works, coal chemical plants, spoil heaps and rail marshalling yards.

Wath Manvers is now the home to office parks (including back office functions for RBS Lombard and the National Trust and the head office of Morphy Richards), logistics (including a major distribution centre for Next), engineering and manufacturing businesses, Dearne Valley College (delivering courses and apprenticeships for school leavers and adults, as well as degrees and other higher-level and professional training), housing developments and RSPB Old Moor—a wetland reserve frequently featured on BBC's Springwatch and at the heart of a corridor of wetlands in the Dearne Valley.

A network of bus routes has evolved to support the new developments, including links to the nearest station at Swinton over 2 miles away. The Leeds-Sheffield route via Moorthorpe crosses the eastern end of the development.

A cocktail of funding was brought together at the start of the 1990s—primarily the 1st round of City Challenge, Derelict Land Grant, transport funding for the A6195 Dearne Valley Parkway link to the M1 and the Manvers Way spine road, Enterprise Zone status to support the marketing of reclaimed land and training and development funding.

showed.[36] The current commuter flows from the Dearne Valley area by train into Sheffield (and Rotherham), and further afield to Leeds, may be modest in scale, but with city centre employment in the two main cities set to rise, may see a demand increase. Out-commuting brings cash back into local residential communities, and reduces tendencies for out-migration which does the opposite.

Rail services to local communities in the corridor form part of the means by which the cities of Leeds and Sheffield can fairly expand their economic footprint: they support the generation of 'spill-over benefits' from the growth of Leeds and Sheffield city centres.

Two Inter-connected City Regions

Leeds and Sheffield City Regions have both seen significant structural change in the last thirty years. Some parts of Yorkshire are more advanced than others in this process—notably Leeds and some other parts of West Yorkshire—as well as North Yorkshire and York to the north. Sheffield City Region, by comparison, continues to struggle to recover from the reduction of employment in steel making and the loss of coal mining and coal related industries.

Sheffield City Region was eligible for EU Objective 1 funding between 2000 and 2006, becoming a "phasing in region" and then a "transition region" in the 2007-2013 and 2014-2020 periods. As compared to regions not eligible for Objective 1 support, Sheffield City Region initially grew faster but these gains didn't lead to a self-sustainable development path. Following the loss of Objective 1 status Sheffield City Region has displayed one of the worst performances among English regions, despite being in receipt of EU funding as part of the phasing-in programme.[37]

The Northern Independent Economic Review[38] considered the productivity gap at the North of England level and identified the main factors impacting productivity growth as:

- Insufficient high-skilled workers and too many low-skilled workers
- Not enough exploitation of innovation and technology
- Lower levels of investment
- Lower levels of enterprise (measured by business start-ups per capita)
- Lack of agglomeration
- Sub-optimal transport links and underinvestment in transport.

So, if improving productivity is the aim, then investment in transport will be a key part of what's needed, along with other policy measures.

The Review concluded that improved economic performance would be led by growth in the North's distinctive offer of four 'prime' capabilities, supported by three 'enabling' capabilities.

The four prime capabilities were identified as:

36. http://www.greengauge21.net/challenging-region-inequalities-the-transport-element/

37. The impact of EU Objective 1 funds on regional development: Evidence from the U.K. and the prospect of Brexit; Marco Di Cataldo, Department of Geography and Environment, London School of Economics Journal of Regional Science March 2017.

38. *The Northern Powerhouse Independent Economic Review*, SQW Ltd, with Cambridge Econometrics, Steer Davies Gleave and John Jarvis Consulting, June 2016.

- Advanced manufacturing—as noted above—with a particular emphasis on materials and processes

- Energy, in particular expertise around generation, storage and low carbon technologies, especially nuclear and offshore wind

- Health innovation, with a focus on Life Sciences, Medical Technologies/ Devices, e-health, and emerging new models of service provision; and

- Digital, focusing particularly on computation, software tools/ design and content, data analytics and simulation modelling, and wider media strengths.

These four prime capabilities are supported by three enabling capabilities, which play a crucial role in supporting growth and development in the North: (i) Financial and Professional services; (ii) Logistics and (iii) Education (primarily Higher Education).

These prime and enabling apply as much to the Sheffield–Leeds corridor as to other parts of the North. The importance of higher education serves to underline the importance of good access to both Leeds and Sheffield, which are well-placed to strengthen economic performance but there are also higher and further education facilities within the corridor in Barnsley, Wakefield and the Dearne Valley. Funding for a new South Yorkshire Institute of Technology—a collaboration between Doncaster College, Sheffield Hallam University, Barnsley College and Sheffield University's Advance Manufacturing Research Centre (AMRC) Training Centre—will for example see the establishment of an Institute of Technology centre in the centre of Barnsley.

Spatial trends and their legacy

Economic forces have driven decentralisation of employment and services in the Leeds City Region as well as the Sheffield City Region—in part linked to the regeneration of brown field sites such as in the Dearne Valley and in part linked to market demand for business and logistic park development in close proximity to junctions around the Yorkshire motorway box formed by the M1/M18/M62/A1(M). The result is a complex mix of radial journeys to work into city and town centres (with Leeds City Centre by far the most significant magnet) and a web of journeys to work at out of centre locations that are much more challenging to replicate by public transport without a well-defined network of transport hubs, reliable interchange and good service frequencies.

Decentralisation of activity has been most pronounced in South Yorkshire. For example, Meadowhall, built on former steel land, is a leading retail centre across the City Region and has become a transport hub in its own right with rail, tram and bus services. The Parkgate Retail Park, also on former steel land, is the leading retail centre in Rotherham and has tram-train and bus services and is also the preferred location for Rotherham's Northern Powerhouse Rail station.

The Northern Powerhouse Independent Economic Review draws out some key implications for transport in the North:

- The transformational scenarios should be expected to lead to increases in the number of workers employed in urban areas in general and city centres in particular. This will place new and increased demand on road and public transport links within and between the North's towns and cities for passengers and freight.

- Enhanced pan-Northern city-centre to city-centre rail links, east–west and north-south are needed to facilitate the bigger labour markets that support the success of knowledge-based firms. To be effective, they must be integrated with city-region local public transport networks. Currently poor connections, low frequencies and complex fares, as well as slow journey times constrain rail's market appeal. The North's rail network can overcome this deficiency if it is designed to operate through a series of nodes that also link with other public transport networks. Most of these rail nodes (interchanges) are in city centres.

- The increase in town and city centre employment in the knowledge-based 'Prime' and 'Enabling' capabilities cannot be accommodated through private (car) travel alone. It will require enhanced public transport connectivity within city regions: coherent, user-friendly joined-up networks, involving frequent rail services (including cross-city operations), light rail and bus, all supported by smart, multi-modal ticketing with simplified fares.

- Global connectivity is critical if the North's Smart Specialisation opportunities are to be realised fully. A growing Northern economy will support strengthened air links from the northern airports, but at present surface access is one of the principal constraints to their collective growth. For ports, constraints on rail capacity and the limitations on the network's capability to cater for the latest generation of inter-modal containers on standard wagons need to be addressed.

Source: Workstream 4 Report of the Northern Powerhouse Independent Economic Review: Scenarios for Future Growth in the North, June 2016

Sheffield and Leeds

The Leeds City Region (LCR) has over 125,000 businesses and an annual GVA of £69bn, the largest in the UK outside London, while South Yorkshire has a GVA of around £27bn and is home to almost 50,000 businesses.

Global businesses such as McLaren, HSBC, Boeing, Rolls Royce and Amazon are among many international companies which have already seen the benefits of locating in Sheffield City Region. But to transform the local economy requires a paradigm shift so that the city is seen as a worthy and plausible location from which to serve a wider north and midlands catchment. This requires the full range of professional service firms being located in the city, and the local authorities have a plan to achieve just that.

The Sheffield city region (South Yorkshire) mayoral combined authority recognises the relative weakness of the financial and professional services in Sheffield as being the key limitation to be addressed. It has a development framework that centres new build and the transformation of the area around Sheffield Midland station as the core device to achieve this economic transformation (see below).

Source: Stallon-Brand and Moxon, Architects.

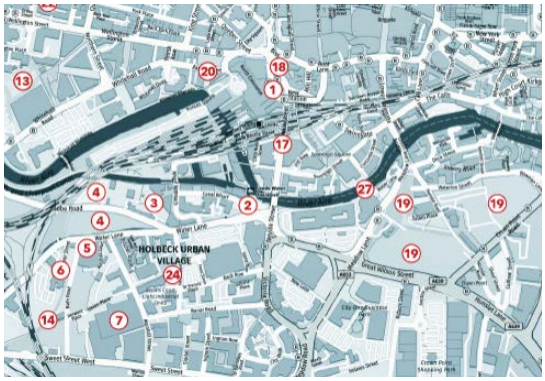
The Sheffield Midland Integrated Station Masterplan forms the core of the Sheffield Midland Station and Sheaf Valley Development Framework, a £1.5bn plan to develop the area around Sheffield Midland Railway Station, with a mixed use residential/commercial community as a first phase of the Masterplan to maximise the economic potential of the area and make the most of improved rail connectivity. The city region's Strategic Economic Plan portends the creation of 70,000 new private sector jobs and 6,000 businesses, generating £5 billion for the local economy.

Source: https://sheffielder.net/2020/03/11/sheffield-midland-station-and-sheaf-valley-development-framework/

Instead of the feel of a provincial town, the sense of arrival at a major city is intended.

By way of contrast, Leeds is already a regional city par excellence. It lacks nothing in terms of professional services. It has a very well-located city centre rail station.

In Leeds there is already strong demand for premises from organisations such as Channel 4, UK Infrastructure Bank, FCA, and the Bank of England who are choosing city centre locations close to the existing and proposed rail infrastructure. These occupiers are part of a major £500m regeneration plan for doubling the size of the city centre through expansion into the South Bank which will be home to the British Library North. The key development sites are illustrated below, centred on Leeds station.



Source: Leeds city centre development map—key development sites.

Towards a Leeds-Sheffield Innovation Corridor

The Northern Powerhouse Independent Economic Review identifies sector strengths and opportunities across all local areas and city regions in the North including Leeds and Sheffield.[39] It helps provide baseline evidence about how a Leeds Sheffield innovation corridor initiative could evolve.

Sheffield has particular strengths in advanced manufacturing focussed around high precision engineering, metals, alloy projection, high quality design and manufacturing, industrial machinery, rail automotive and aeronautical engineering, and hydraulics and specialist facilities including the Advanced Manufacturing Research Centre, the National Metals Technology Centre, the Advanced Manufacturing Institute at Sheffield University and the Materials and Engineering Research Institute at Sheffield Hallam. Leeds advanced manufacturing strengths lie in metal forming machinery, bearings, gears, taps and valves; electric motors, generators & transformers as well as spinning, weaving and finishing textiles with specialist facilities including the University of Bradford's Automotive Research Centre and Leeds University's National Facility for Innovative Robotic Systems as well as nearby York University's Robotic Laboratory.

Both city regions have strengths in health and life sciences. Across Leeds these include medical equipment manufacturers, leading pharmaceutical companies, research-driven analytical service companies and tissue repair companies. Other assets include the Medical Technologies Innovation and Knowledge Centre at Leeds University and the Medipex Healthcare Innovation Hub. Sheffield has niche specialisms in Medical and Dental Devices, Advanced Wound Care, Orthopaedics, and Clinical Research—with assets including the Medical Advanced Manufacturing Research Centre linking manufacturing technologies to medical research and clinicians and the Advanced Wellbeing Research Centre at Sheffield Hallam University.

There are strengths across a broad range of the digital and creative sector. Particular specialisms include satellite telecommunications activities, one of the UK's three standalone internet exchanges in Leeds, world-class games companies and software development and product design. Supporting assets include the Advanced

39. https://transportforthenorth.com/wp-content/uploads/Northern-Powerhouse-Independent-Economic-Review-Local-Area-Profile.pdf

Digital Institute in Saltaire, the Media Centre in Huddersfield, the Leeds Institute for Data Analytics, the Advanced Digital Institute at Leeds University and Sheffield University's Advanced Computing Research Centre.

And there are strengths also across low carbon and environmental industries with eight internationally recognised centres of low carbon expertise across Leeds and neighbouring York, and the Nuclear Research Centre in Sheffield.

Summary

Leeds and Sheffield and their respective combined authorities have been developing plans for an 'Innovation Corridor' between the two cities to exploit their strengths, including in advanced manufacturing. This is believed to be the UK's largest research-led advanced manufacturing cluster employing 50,000 people across 3,000 companies and several major universities.

Achieving agglomeration benefits (as the Innovation Corridor is seeking) calls for a multi-centred approach. Investors and businesses want to see that they can work in a wider growing community of common interest. In practice this means drawing upon a knowledgeable and highly trained/experienced workforce, with easy-to-form collaborations which feature so strongly in advanced and higher value business activities. In practical terms, this means that business locations and research sites need to be conveniently inter-connected.

Rail can meet the needs of a significant part of this requirement by providing an efficient and dependable way to access sites in the major cities and towns of the corridor: Leeds, Wakefield, Barnsley, Rotherham and Sheffield. Improved rail interconnections between these places will complement and extend the value of investment in city-region 'metros' too. They would lend themselves to a sustainable housing policy that took away the current reliance on car-based commuting. The plans described in the next chapter would increase the attractiveness and market for town centre living in Wakefield, Barnsley and Rotherham (along with bus/rail and car/rail interchange for journeys from more outlying places), with easy rail commutes towards both Leeds and Sheffield.

Investor perspectives are unlikely to be constrained to think in corridor terms. Advanced research in particular operates in an international context, and so ready access to airports—especially the range of air services available at Manchester— is a factor too. And access to other locations will also be important: Bradford has notoriously poor rail connections southwards, and Sheffield—Manchester is a connection where adverse winter weather can restrict road use (and where some modest improvements to the existing rail connection are now in-hand).

These wider considerations affecting economic ambitions, as well as those specific to the Sheffield -Leeds corridor need to be considered when it comes to formulating corridor-level rail improvement plans for the 2020s.

5

A 2030 plan for rail

Achieving economic growth

There is always scope to improve the national rail network, but our examination of the Sheffield–Leeds corridor, a key and not-to-be-forgotten part of the 'Northern Powerhouse' vision, shows better rail services are needed now to support economic ambitions.

Leeds-Sheffield is seen by the combined authorities of South and West Yorkshire as an 'innovation corridor' centred on advanced manufacturing and other strengths. To fulfil the aims of attracting investment in research, development and manufacturing, **the corridor needs to be able to function as an entity**—more like Rhein-Ruhr (Germany) or Randstad (the Netherlands) than (say) London. At the very least, this means at least an ability to travel easily and **dependably** between the two anchor cities, Leeds and Sheffield. Neither the M1 motorway nor the railway offers this at present.

Both cities have substantial regeneration plans and both are centred on major development of land adjoining existing city centre stations. These developments in turn will rely, to a greater extent than would developments elsewhere, on rail to provide the necessary connectivity and capacity.

The most recent data on rail travel into major rail stations, published by DfT in September 2022, shows that against a post-Covid national recovery level of +138% nationally, both Sheffield and Leeds stations have experienced 2020-2021 growth rates of around +200%.[40] The smooth functioning of both stations is critical to economic recovery. Expansion of station facilities and improvements to their approaches are needed not just to support better corridor rail services but in order to support the economic growth of both South and West Yorkshire economies. Foreign direct investment (FDI) into the Northern Powerhouse has increased 72% in the last five years despite dropping across the rest of the UK, according to a new analysis of FDI markets data by the Northern Powerhouse Partnership (NPP).[41]

40. https://www.gov.uk/government/statistics/rail-passenger-numbers-and-crowding-on-weekdays-in-major-cities-in-england-and-wales-2021

41. https://www.northernpowerhousepartnership.co.uk/news/foreign-direct-investment-into-the-north-soars%ef%bf%bc/ EU companies with direct investment links in the UK (immediate control) accounted for the highest value of the UK inward foreign direct investment (FDI) position in 2020 (£743.1 billion) according to a July 2022 analysis by ONS.

A focus on 'building on success' through the so-called agglomeration benefits of expanding cities is a now widely used measuring stick in transport investment appraisals.[42] It has a particular bearing on the economies of Sheffield and Leeds where economic plans depend on improved rail services into city centres. But if this was the exclusive focus, it would risk exacerbating existing patterns of relative social, health and economic deprivation.[43] This risk can be avoided. In practice, rail in this corridor can also help to address the connectivity needs of major intermediate towns (Barnsley, Rotherham and Wakefield) and the former colliery towns along both of the railway lines in the corridor, helping these places:

- to develop in their own right;
- to contribute to the wider Innovation Corridor economic initiative, and
- to support sustainable development and the re-use of brownfield land, so supporting economic restructuring and rebalancing across both city regions.

It has to be recognised too that business location decisions are based on several factors. Transport accessibility is of importance and is the subject of ongoing research,[44] but any business decision is unlikely to be considered narrowly in terms of a single corridor. The ambitions to have Sheffield become a regional centre in its own right—with a mix of professional services centred on development around the city's railway station—will depend on suitable connectivity to other places besides those in the corridor to Leeds. These will include ready access to international airports,[45] to the other city regions of the north and midlands, London and the rest of the country.

In summary, in this corridor, the economic drivers for rail enhancement are:

1. better inter-city connectivity
2. supporting the expansion of the city centre economies in Sheffield and Leeds[46]
3. better connectivity for the intermediate corridor towns, with
4. assured two way 'commutability' for the smaller rail-served places in the corridor—to help capture spill-over benefits, and
5. contributing to the two city-regions' wider connectivity needs.

Each of these economic ambitions is relevant to the short-medium term outlook adopted by this study, over the years to 2029. In shaping a programme of action for rail, we have been mindful of:

- the need to reflect the aims, priorities and ambitions of the respective combined authorities
- the intense **pressures on Government funding availability**, while noting too:

42. As explained in the National Infrastructure Commission's 2020 report on meeting the rail needs of the North and Midlands for example.

43. https://democracy.sheffield.gov.uk/documents/s52832/10%20APPENDIX%201%20Sheffield_interim_evidence%20base_eds_committee_v2_0.pdf

44. https://www.researchgate.net/publication/277763787_The_importance_of_transport_in_business_location_decisions-scoping_study/link/558c075c08ae1f30aa808744/download

45. And to Eurostar services. Sheffield and Leeds both enjoy direct rail links to the Eurostar terminal at St Pancras International, which provides high-speed services to Paris, Brussels and Amsterdam.

46. With a recognition that Sheffield is the city region with the greatest need of a boost from its current, below-par economic position and that the relative contribution on the corridor under study is likely to be greater for Sheffield than for Leeds, which is served by more rail corridors and where mass transit is yet to make a contribution.

- the importance of the economic growth imperative in this corridor

- areas where Network Rail has been able to bring about cost effective and rapid project delivery using **Project Speed** approaches and

- the risk of damage to corridor economic growth prospects given the uncertainty of the **long term options** for rail, following the Integrated Rail Plan of 2021

- **existing investment programmes** that are well advanced and therefore suitable for implementation in the Sheffield–Leeds corridor in the 2020s.

Current Rail Enhancements affecting South and West Yorkshire

Existing rail enhancement programmes with the greatest implications for the corridor are:

- Trans Pennine Route Upgrade, which is a multi-stage programme already in hand, with electrification of Manchester-Stalybridge and York-Church Fenton completed recently

- Midland Main Line Electrification Stage 3, which will extend the St Pancras (Midland Main Line) electrification as far north as Sheffield)

- Hope Valley line upgrade (Sheffield-Manchester) with completion likely in 2023/4

- The Leeds Area Improvement Plan (LAIP), which is likely to focus capacity improvements on the west-side track approaches

In effect the railway network at either end of the Sheffield–Leeds corridor is being improved, further emphasising the need to examine what can and what should happen between Sheffield and Leeds. This is in danger of becoming the part of the rail network 'that time forgot'. The corridor forms a somewhat complex part of the national rail network, as illustrated overleaf, which shows key stations and locations referenced in this report.

Sheffield–Leeds Rail Proposed Enhancements

The key measures identified as being needed to address the immediate economic opportunities and challenges in the Sheffield–Leeds corridor over the 8-year period to 2030 are:

- Doubling fast train frequency via Wakefield

- Increasing city centre station and approach capacity (Leeds and Sheffield)

- Extending East Midlands Railway's St Pancras trains from Sheffield to Barnsley and beyond

- Retaining, improving and extending the train service to intermediate stations.

The improvements described here carry additional operating costs, but will increase revenues. Notably, they entail only limited capital investment in infrastructure.

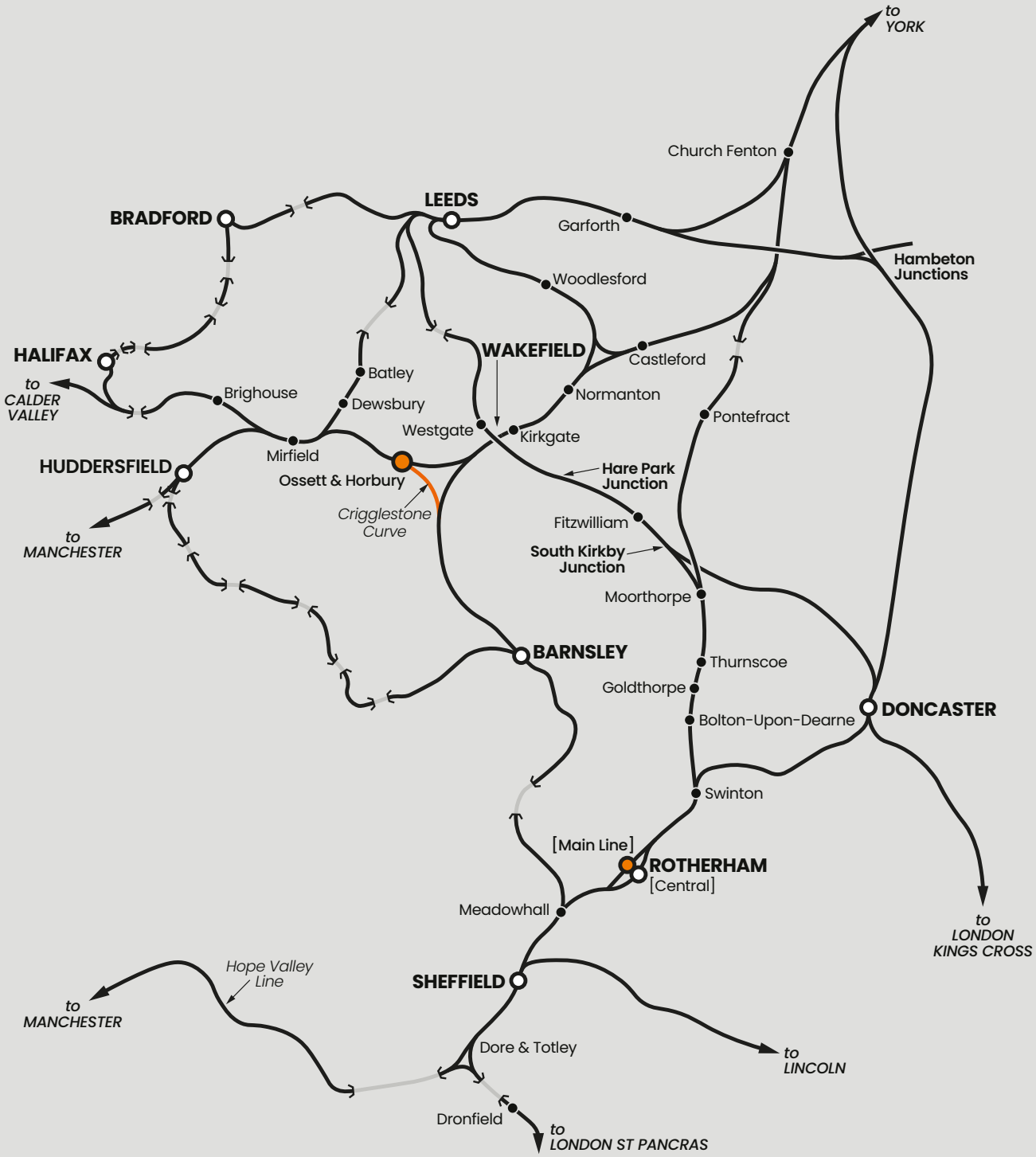
i) Doubling fast train frequency

Creating a second hourly fast Sheffield–Leeds train (taking just 40 minutes, with one intermediate stop at Wakefield) to create a 30 minute interval city-city connection.

The existing hourly fast service is provided by Cross Country, and this would continue. It serves the corridor (and connects the three cities of Leeds, Wakefield and Sheffield with many others as part of the long-distance NE-SW axis (Edinburgh-Newcastle-Birmingham-Bristol-Plymouth)). Trains are 125 mile/h units but operate at lower speeds between Sheffield and Leeds.

Sheffield–Leeds corridor map

Some lines and stations not shown for clarity



With stakeholder support, the rail industry has been seeking a way to introduce a second fast train each hour. Current thinking is that a second service could now be introduced, which is a breakthrough.[47] It would be provided by Northern Trains, possibly as soon as 2023. Current thinking is a simple shuttle between Leeds and Sheffield. To offer a matching 40 minute journey time this would probably only stop at Wakefield, but consideration might also be given in future to a second intermediate station call at the new station at Rotherham.

A new station at Rotherham Main Line

Rotherham suffers from comparatively poor rail connectivity. A new main line station in Rotherham is referenced in both the Sheffield City Region Strategic Economic Plan and Integrated Rail Plan. Rotherham Metropolitan Borough Council has allocated up to £10 million from its Towns Fund programme to the purchase of land required for the new station, underlining local commitment to the scheme.

The new station could be served by three fast trains per hour in each direction, formed of existing services including to/from Sheffield, Doncaster, Manchester, Leeds, Newcastle and Birmingham. A preferred location for a new station has been identified, adjacent to the existing tram-train line and close to existing bus routes, so creating scope for a multi-modal hub.

A Leeds-Sheffield fast train frequency uplift from hourly to half-hourly will make a real difference, while still being well shy of the 4 fast trains/hour ambition of Transport for The North. A 15-minute interval service does not appear to be possible given the mix of other services on the approaches to both Leeds and Sheffield without major infrastructure works. These might be considered in due course, once the impacts of the service frequency doubling have become known.

Meanwhile, we see three issues to address with the 30-minute interval service plan:

i. consistency of service offer and quality
ii. service punctuality; and
iii. value for money.

The first challenge is to try to get **similar service quality** standards on the two services operating each hour. It might be worth looking at common service branding between the two cities to reassure customers that this is a cohesive joined-up service offer within the corridor.

There are likely to be markedly differing train types operated by Northern and Cross Country. Can the need for seat reservation be made the same on the two very different train services, operated by different companies? Can tickets/fares be made to work for both operators (so miss one train and easily switch to the next one)? A genuine half hourly interval service should present a consistent customer offering. Can the availability of catering and First Class be made available on both of the two services?

The second issue is that while the current Cross Country service offers useful onward connectivity with many other places, it is harder to **ensure service punctuality** than with a local shuttle service. Can service reliability on Cross Country be improved? One option ahead, provided the pre-Covid Cross Country

47. Attempts to introduce a second hourly Cross Country service via Leeds were sought as long ago as Yr 2000, but deemed impossible.

train plan is fully restored in due course[48] would be to terminate the current hourly Cross Country service to/from Sheffield and the south at Leeds (or perhaps York if Leeds station capacity for a new long-distance service turnback is unavailable). With the Cross Country train starting and finishing at Leeds, it should be easier to achieve on-time service in the Sheffield–Leeds corridor.

Through cross-Yorkshire connections could largely be provided using the Cross Country train service that operates via Doncaster rather than Leeds, suitably extended to Scotland. This would have the advantage of speeding up longer distance services between south/south western England/ the Midlands and north east England and Scotland, since the NE-SW route via Doncaster is much faster than the route via Leeds.

Onward connections to North East England and Edinburgh from the Cross Country train that terminates at Leeds could be provided by Trans Pennine Express. True this introduces an unwanted interchange for some journeys, but this approach might ease the conflicting pressures on the over-subscribed section of the East Coast Main Line between York and Newcastle. Here LNER, Trans Pennine Express, Cross Country, and open access operators are competing for train paths.

The third issue is that a shuttle service operating Leeds-Wakefield-Sheffield has limited direct connectivity benefits, so it may offer **poor value for money**. Serving just three station pairs, passenger appeal could be limited, risking weak revenues in relation to operating costs.[49]

One possibility the rail industry has considered to ameliorate this limitation is an extension of the new Sheffield train onwards from Leeds to Bradford to provide a direct Sheffield-Bradford connection (currently missing). But this would entail an unappealing service reversal at the already stretched Leeds station (and there may be better ways to provide a Bradford-Sheffield connection—as discussed below).

An alternative approach to service extension that is worth examining would be an extension of the Leeds-Sheffield shuttle from the Sheffield end rather than from Leeds. One possibility would be to take over the 'fast' connection to Nottingham currently provided by a service that calls at Sheffield and Barnsley, allowing a speed up of the Leeds-Nottingham Connection. Such an arrangement might make sense if combined with Midland Main Line St Pancras trains being extended to Barnsley, so retaining southwards connectivity across Sheffield for Barnsley customers.

ii) Increasing city centre station capacity

In the case of both Leeds and Sheffield stations, attention needs to be given to expanding station capacity. This is, of course, driven by wider considerations than those of a single rail corridor.

48. There is a second hourly train between North East England and the South (Southampton/Bournemouth) that runs via Sheffield and Doncaster – a significantly quicker route than via Leeds. But this service is currently reduced to around 4 trains/day, generally operating only as far south as Banbury, rather than hourly service frequency provided pre-Covid.

49. A relatively high proportion of the fleet/crew operation would be 'non-earning' downtime each hour at Leeds & Sheffield turnrounds.

In the **Sheffield** case, the planned surrounding development is designed to transform Sheffield into a city capable of attracting professional services businesses and creating in the process a city able to offer a viable alternative to Leeds and Manchester as a regional HQ setting. It may lead to changes to access arrangements at Midland station.[50] The station itself has an unmodernised platforming arrangement but it is nonetheless judged to be capable of accommodating some new services in the short term, including those that may arise from the Midland Main Line Phase 3 electrification into Sheffield.

At a later stage, HS2 services will commence using the cross-Midland part of HS2's eastern arm and the existing route into Sheffield via Chesterfield. By then, overall, train frequencies can be expected to have risen further. Consideration will have to be given to a station upgrade at such time (beyond our chosen horizon). It is worth noting, in passing, that Sheffield Midland station can accommodate train lengths of up to 300m (but not 400m as per current HS2 standards).[51]

In the Leeds case, current plans for improving the approaches to Leeds station and at Leeds station itself are being developed and taken forward under the 'LAIP' and Trans Pennine Route Upgrade projects—see 'wider area network development' below.

50. https://sheffielder.net/2020/03/11/sheffield-midland-station-and-sheaf-valley-development-framework/

51. This means that HS2 trains to Sheffield on current plan would need to be 'half-length', that is 200m. But to make full use of line capacity over the core HS2 route between Birmingham Interchange and Euston and the 400m train length that new HS2 stations are designed to handle, this would lead to a need to 'divide and join' HS2 Sheffield services en route connecting/disconnecting with (say) a Nottingham 200m train portion. This operation would add to journey times and add risk to service punctuality: poor planning and an operational approach that is avoided where possible. A better approach would be to deploy 300m (or similar length trains) on the planned HS2 eastern arm.

iii) Corridor rail service development

Here we summarise how best to meet the needs of intermediate places. Over the two railway routes in the corridor which diverge at Meadowhall, there are:

- On the faster route **via Moorthorpe**:
  - The major centres of Wakefield (Westgate) and Rotherham—where a new main line station is planned
  - Swinton, the Dearne Valley towns and Moorthorpe (which are also served by 3 trains/day which operate between Sheffield and York via Pontefract;[52] Swinton is also served by local services between Sheffield and Doncaster)
  - Local stations between Fitzwilliam, and Leeds (mainly served by trains operating between Leeds and Doncaster)
- On the second route via Darton (the '**Hallam**' line)
  - the major centres of Wakefield (Kirkgate) and Barnsley
  - Chapeltown, Elsecar and Wombwell which, like Barnsley, are also served by Sheffield-Huddersfield services
  - Local stations north of Barnsley: Darton, Normanton and Woodlesford.

Both routes have a mix of semi-fast and stopping services which limit line capacity (there is no scope for trains to overtake). And on both routes, train formations tend to be short (with resultant peak overcrowding) and

52. The idea of increasing this service to hourly would be of most benefit to Pontefract, but offers little other benefit to Sheffield since Sheffield -York trains operating via Doncaster would be faster (although the route is less direct). Pontefract connectivity features in the West Yorkshire Metro plans.

with timings set by the performance of an older generation of rolling stock.[53] The Hallam line in particular has multiple junctions and interfaces with a number of freight train movements to negotiate. There is scope to re-base train journey times and while the proper consideration of achieving high standards of punctuality will as ever lead to the addition of a few minutes' worth of 'allowances' in the timetable, there should be scope for not of tightening schedules.

Moorthorpe Route

Over the Moorthorpe route, Wakefield (Westgate) and (potentially) a new main line Rotherham station could benefit from the second hourly fast train in the corridor. On this line, it would be important to retain the current hourly stopping service to both Sheffield and Leeds (and (possibly) in the longer term increase the service to 2 per hour). The aim is to support local economies and communities, ensuring they remain viable as locations from which rail-based commuting is feasible. Route electrification in due course would help accelerate these trains further and improve the ability of the line to sustain an increase in overall train frequencies. But given the capacity constraints at Leeds and Sheffield stations, longer trains would be the preferred method in the first instance to provide increased passenger capacity as/when it becomes needed. Both Swinton and the new Rotherham main line station could provide valuable public transport interchange (hub) functions with onward connections to local buses and/or to Supertram.

Hallam Line

On the Hallam line, the key challenge is to improve the connectivity of Barnsley which has a role in the wider advanced manufacturing innovation corridor. Alongside an hourly all-stations service, there is currently a twice-hourly semi-fast service between Leeds and Sheffield with alternate trains extended to Nottingham and to Lincoln.[54] These are useful wider connections for Barnsley. But journey times are poor and not competitive with car times.

The stations between Barnsley and Sheffield are also served by Huddersfield/Penistone line trains. It may be that Barnsley, which is provided with an excellent public transport interchange built around the city centre station, will see more interchanging passengers in future. Certainly, if local authority ambitions to see the Huddersfield line service frequency increase to 2 trains/hour are to proceed, it would make sense to have these trains terminate at Barnsley, with onward connections provided by other services. A simple turn-back facility would need to be provided, but this would avoid adding to existing pressures on the northern approaches into Sheffield station.[55]

53. Understood to be 1980s Class 158 units for the semi-fast/stopping service timings: modern stock has better acceleration/deceleration performance.

54. Leeds-Lincoln via Sheffield is a sub-optimal route, so not good for end-to-end journeys. Better options could be created if/when the Doncaster-Lincoln service is increased to hourly with a more direct Leeds-Lincoln connection alongside a curtailed Lincoln-Sheffield service.

55. An alternative solution to this problem could arise from the possible Barrow Hill Restore Your Railway fund proposals

Barnsley residents are clear on what needs to change to help economic regeneration: "addressing perceived rising crime rates, **improving poor transport links** and investing in quality public services are all seen as integral to the revival of the area" (emphasis added).[56]

iv) Extending East Midlands Railway's St Pancras trains to Barnsley and beyond

In the past, some East Midland (EMR) London services were extended north of Sheffield and served Barnsley. This worked well with the use by EMR of the depot facilities at Leeds Neville Hill, but these have now switched to Derby Etches Park, removing the operational rationale for this service extension.

But there is no reason (subject to pathing) why London-Sheffield EMR trains should not be extended to Barnsley, potentially hourly. Obviously, it would have an impact on fleet and operating costs, but Barnsley is a significant place in its own right, and has excellent feeder services (both bus and rail) across a wide and mixed catchment.

Barnsley station platforms can be readily extended. If EMR trains were to terminate at Barnsley, additional turnback facilities (a siding and crossover) would be needed too, and the contribution to improving connectivity would be limited. So a better approach would be to extend London EMR trains onwards from Barnsley. An approach that would avoid the network constraints at Leeds would be an extension to York via Wakefield (Kirkgate), Castleford (and Church Fenton). This would add a useful direct connection from York (and North East England) to the East Midland cities and St. Pancras. .

In summary the priorities for developing corridor rail services are:

1. **Adding a second hourly fast service between Leeds and Sheffield** [Moorthorpe route]

2. **Retaining the existing stopping services**, on both lines, with longer trains used to provide additional passenger capacity as needed[57]

3. **Extending East Midlands Railway London St Pancras–Sheffield services to Barnsley, hourly** [the Hallam route] **and onwards to York via Wakefield** and Castleford.[58] Note that it is not necessary to electrify the route to make this feasible post-Phase 3 MML electrification, since the new EMR 125 mile/h fleet is bi-mode— that is, diesel and electric

4. **Restoring the Cross Country service to an hourly service on both the via Leeds and via Doncaster routes**, and examining the case for the potential service re-structuring described in the text above.

There are other relevant Mayoral Combined Authority ambitions including doubling the frequency of Sheffield-Barnsley-Huddersfield services. Given the network capacity pressures on the northern approaches to Sheffield station, not all ambitions are likely to be realisable. The possibility of a second hourly Huddersfield line train connecting at Barnsley into an existing service should be considered, with provision of a bay platform as needed. This would save adding to the pressures on

56. See What is it that the people of Barnsley want from levelling up? - Suzanne Hall | Yorkshire Post Suzanne Hall director of engagement at The Policy Institute at King's College London and is co-author of the report Levelling Up: What England Thinks.

57. Of course, the usage of these services would increase if service frequency could be doubled, but that might entail major capital expenditure which is unlikely to be delivered during the 2020s. And it should be noted that since other local services operate at either end of each route, only stations north of Barnsley (Darton and Normanton on the Hallam line) have no other services and only Bolton, Goldthorpe, Thurnscoe, Moorthorpe lack other frequent services into either Leeds or Sheffield on the 'main line'.

58. Or Leeds (and York) if capacity is available post-LAIP investment.

the network approaching Sheffield. Through services may be preferred by passengers, but use of purpose-built customer-friendly interchanges at Barnsley, Rotherham and Wakefield (multi-modal hubs with a full set of amenities) , combined with using longer train-sets may be better value for money.

Wider area network development and rail access to airports

If Sheffield is to fulfil the Combined Authority's ambitions to up-rate the city to a full service regional centre, it will need, amongst other things, to provide rail connectivity that better matches that provided in other major cities.

Our focus has been on a single corridor (albeit with two routes) which may (or may not) see substantial investment in the longer term following the outcome of the review of HS2 options identified as being needed in the Integrated Rail Plan. Significant benefits would flow from the proposals identified here for what could be a lengthy interim period. With limited infrastructure investment, the risk of incurring wasteful expenditure on assets that will be superseded when longer term plans come to fruition is minimised.

The improvements proposed here complement the plans already in hand which entail significant infrastructure investment as noted: Phase 3 of Midland Main Line electrification and Trans Pennine Route Upgrade. These two projects will benefit Sheffield and Leeds respectively and could start to provide benefits by 2030.

Midland Main Line electrification Phase 3

This investment is in hand. It involves electrification through complex parts of the rail network in the Leicester and Derby areas as overhead wires are extended north from Market Harborough and connected as needed to the electrical power supply grid. Since the train operator (EMR) has an order for bi-mode 125 mile/h trains, it may be that the project will be expedited in part by the use of 'discontinuous electrification', avoiding some capital expenditure without detriment to the public service offering.

Its completion to Sheffield will raise questions of whether resulting electrification gaps such as Sheffield-Doncaster/Moorthorpe should also be electrified. This could make good sense as an immediate follow-on project. A switch to better performing electric rolling stock for local as well as longer-distance trains would help meet the challenge of timetabling the mix of local/stopping and longer distance/non-stopping services in our identified key corridor. But while such studies should form part of the corridor strategy, it would be a mistake to await an electrification approval before improving services in the corridor right away.

Trans Pennine Route Upgrade (TRU)

The TRU programme extends from York through Leeds to Huddersfield, Manchester and Liverpool. The budget now ascribed to the project of £11.4bn is much higher than originally quoted—a budget level that takes account of expected inflation (so can be thought of as being in future year prices).[59] It also takes full account of estimated risk.

59. See letter Rob McIntosh, Regional Managing Director Eastern, Network Rail, *Modern Railways*, November 2022.

The TRU scheme is now known to comprise a much broader investment programme than it had in earlier incarnations and it brings significant improvements to Leeds[60] and its approaches. The TRU comprises:

- Full route electrification
- Gauge clearance for standard size container trains
- Adding a third track for 6 miles to allow overtaking of slow trains by fast trains Huddersfield-Marsden
- Extending the planned 4-track section between Huddersfield Mirfield and Ravensthorpe onwards to Dewsbury, allowing a 45% increase in (seating) capacity between Huddersfield and Leeds
- 4-tracking east of Leeds (possibly from Crossgates) to Garforth
- Substantial preparation works for the Northern Powerhouse Rail (NPR) project
- Line speed enhancements.

Completion is slated for the end of 2030s, but interim improvements will be possible.

There are four other important wider connectivity challenges outstanding. These are:

1. Rail connections to international airports from Sheffield
2. Rail connections between Sheffield and Bradford
3. Improving Cross Country services over the Leeds-Birmingham corridor
4. Speeding up London Kings Cross services from Leeds and Bradford.

Wider connectivity challenges

Rail Access to Airports

Rail access to airports from Sheffield is poor. The direct rail link to Manchester Airport (by far the biggest airport in northern England) has been lost because of congestion on the rail network in central Manchester following only partial implementation of the planned 'Northern Hub' investment. And this despite it having been described by Sheffield City Council leaders in the past as 'our local airport'.

Moreover, Sheffield Doncaster Robin Hood International airport has now closed.[61] Access to Leeds/Bradford Airport from Sheffield is problematic too (no rail connection, so needs a transfer to bus).

Unless another train path is sacrificed in the Manchester area, it would not be possible, it seems, to restore a Sheffield service from Piccadilly station in Manchester onwards to the Airport. But it needs to be realised that the absence of dependable year-round connectivity[62] to the nearest major international airport (Manchester) risks damaging the ability of Sheffield to fulfil its economic growth aspirations. Fortunately, another approach is possible.

The extra capacity being created on the Hope Valley corridor is expected to allow the introduction of a third hourly fast train path between Sheffield and Manchester. But given the constraints on the Hope Valley route, even after improvements at Dore

60. Noting again that there is a separate Leeds station area improvement programme.

61. Commercial flights from Doncaster Sheffield International Airport ended in November 2022 and the airspace around the airport is now set to be downgraded as part of the winding down process. Doncaster Sheffield Airport: Airspace to be downgraded - BBC News.

62. Weather conditions can make the road alternative unreliable in winter.

and elsewhere, increasing the Sheffield-Manchester Piccadilly service interval from 30 minutes to 20 minutes is going to have to wait until later. The additional fast train path is likely to be fairly close to an existing fast service, so not adding much to overall Sheffield-Manchester service appeal and value. So could the additional path be put to better use by providing a Sheffield-Manchester Airport connection that avoids central Manchester rail network congestion?

Possibly yes. A train from Sheffield, instead of proceeding to Piccadilly station would diverge at Hazel Grove and take the east–west line to Northenden junction (avoiding all of the radial lines into Piccadilly station) and continue via Baguley (where a planned new station would provide direct access to the existing Metrolink into Manchester Airport), then onwards to Altrincham and Chester. This creates a new trans-Pennine route between Sheffield and Chester that serves Manchester Airport by a Metrolink connection via a purpose-built interchange. It is deliverable in the 2020s.

A later stage could see both Chester and Sheffield trains access the airport directly by means of the protected western rail access to the Airport which would avoid the need for transfer to Metrolink. This would have the huge side-benefit of freeing up constraints at Manchester Airport rail station, converting it into a through station, and in the process resolving some of the central Manchester rail network performance problems. But we believe that the new more direct route between Sheffield and Manchester Airport using a Metrolink connection could be pursued for implementation in the 2020s.

Sheffield-Bradford

The absence of a Sheffield-Bradford connection could also be addressed, and without adding to the challenges at Leeds station. This would require re-instatement of the closed south-to-west ('Crigglestone') chord at Horbury. A new station could serve Horbury & Ossett[63] and services would make use of the additional grade-separated network capacity being created as part of the TRU project at Ravensthorpe-Deighton (so avoiding conflict with the Leeds-Manchester line and services).

The disused Crigglestone Curve (track bed to the right) at Ossett.

Photo: Graeme Bickerdike.

63. Ossett has been identified as the largest place in Yorkshire without a rail station.

A service pattern might be:

Sheffield-Meadowhall-Barnsley-Horbury & Ossett-Mirfield-Brighouse-Halifax-Low Moor-Bradford.

Interchange at Mirfield could provide connections with Dewsbury, Batley and Calder Valley line stations. Housing development, it should be noted, in the Mirfield-Ravensthorpe-Ossett area is substantial.

The new Bradford service could usefully be extended over the Midland Main southwards from Sheffield. A direct rail service between Bradford and Leicester could have significant market appeal to the British Asian communities in these two cities.

A later development could see a more direct route from Ravensthorpe to Bradford via the Spen Valley, already identified for 'Metro' in West Yorkshire's plans, but potentially instead considered as a conventional rail service.

Cross Country service development

The link between Leeds and Birmingham is one that HS2 could improve dramatically. Current timings are slow, service frequency is only hourly, and it isn't very reliable.

The ambition of what was then a Virgin Trains Cross Country franchise 22 years ago was to operate two trains/hour over the NE-SW long distance corridor via Leeds. It has never been found possible to accommodate the second hourly train—although the Leeds-Sheffield shuttle described earlier will achieve this aim locally—so the second hourly service has ever since avoided Leeds and operated via Doncaster.

It might also be possible to create the second hourly Leeds-Sheffield train as a longer distance, Cross Country service. Operating onwards to Birmingham, this could be extended to destinations other than Bristol/Plymouth, which is the southern destination for existing Leeds Cross Country trains. If so, trains could operate to other southern destinations after providing a doubling of train frequency to Birmingham. These destinations could include Oxford-Reading-Basingstoke-Southampton-Bournemouth and Oxford-Guildford-Gatwick Airport-Brighton; these are all places currently without any direct service from Leeds.

The issue is likely to be line capacity, especially in the Birmingham area and especially in peak periods. An option that might avoid some of this problem is to forego doubling of frequency to Birmingham (New Street) in favour of faster connections to places further south—there is an 'avoiding line' that allows such services to bypass New Street station in Birmingham. To make sense of this acceleration, it would be appropriate to avoid the additional station calls that have been added to Cross Country services in recent years—stops at Chesterfield, Burton-on-Trent and Tamworth that together slow timings by 10-15 minutes.[64] Given that the Burton and Tamworth stops were probably added pre-Covid to provide additional commuting capacity into Birmingham, post-Covid, it could make sense now to remove them.

So the creation of a twice hourly, speeded up Leeds-Birmingham S/SW England service is a distinct possibility—perhaps achievable in the 2020s. It has implications for Leeds station development.

The suggestion of making Leeds the northern terminus of these Cross Country services is in part intended to relieve pressure on the railway between York and Newcastle[65] and also to improve the reliability of the

64. A sub-option of this approach would be to look for a very fast connection, perhaps Leeds-Sheffield-Derby-Oxford-Southampton-Bournemouth—a limited stop service with an airline style service, perhaps.

65. Leeds-Newcastle-Edinburgh connections would be provided by Trans Pennine Express operating from Liverpool/Manchester.

service southwards to Birmingham and beyond. But it could add to platforming pressures at Leeds station, especially if the usual railway practice of lengthy in-platform turnround layovers is followed, although these could be avoided if layover time was accommodated at Neville Hill depot (or York or even conceivably, Hull) instead.

The T-station platforms at Leeds

Could a scaled-back version of the HS2 'T-station' platform design for Leeds have a role to play, ahead of determining the long term plan for East Midlands—Leeds? The new platforms would be connected to the line through Stourton and Woodlesford rather than Wakefield (Westgate). Even if scaled back, this development is unlikely to be feasible in the 2020s, and in practice it would be important to understand the long term 'HS2 Eastern Arm' plans before committing to any such scheme.

A much lower cost arrangement than originally planned for HS2 could create a route southwards joining the Swinton-Knottingley line south of Pontefract. This would not serve Wakefield, but could allow a Leeds-Sheffield service acceleration.

A further new connection could be added at South Elmsall that would allow trains from the Doncaster direction also to access the 'T-station' platforms in Leeds. If these platforms are built, (presumably scaled back from the 400m HS2 lengths) they would also be able to accommodate an EMR service from St Pancras, extended onwards from Barnsley. This might increase the fast Leeds-Sheffield service plan to three trains/hour, nearer to the NPR service goal.

One other service development that could generate a new service demand for interim T-station platform capacity would be a re-instated passenger service between Doncaster and Leeds using the line via Askern (and Knottingley and Pontefract (Monkhill)).

But this would seem unlikely to be capable of supporting the level of funding needed to contribute to the capital costs of new platform capacity and approaches at Leeds.

Sheffield station northern approaches

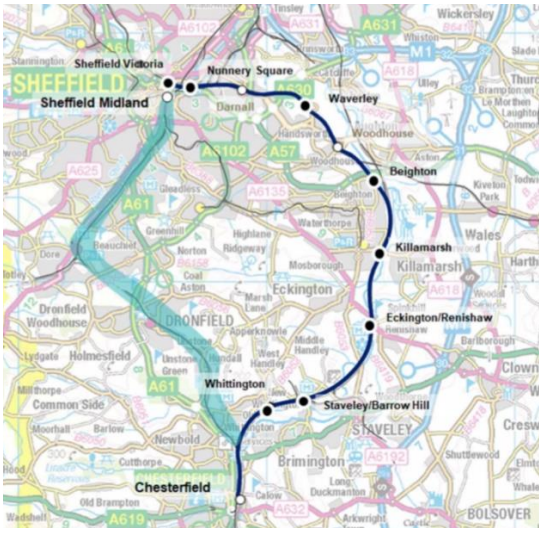
Access from the north into Sheffield station is seen by the rail industry as a very significant problem. Our 'interim'—that is to say from now to 2030—proposals for the Sheffield–Leeds corridor have had to take into account the capacity constraint on the northern approaches to Sheffield Midland station. Service plans need to get the very best value from each train path.

Development of corridor rail services can use the multi-modal interchanges at Barnsley (existing) and Rotherham Main Line (proposed) to make best use of the limited train paths available. Short extensions of EMR services from south of Sheffield (to either Rotherham or Barnsley) have been ruled out because they would not make sufficiently good use of sparse line capacity. But EMR extensions that would see good levels of seat utilisation by providing valuable connectivity gains more widely across Yorkshire, serving these existing and planned multi-modal hubs en route, could prove to be the best use of scarce track capacity.

It is also notable that the business case for the scheme to add a new passenger rail service over the 'Barrow Hill' lines from Chesterfield has faced up to this challenge by contemplating operating the possible new local commuter service into Sheffield at a re-opened Victoria station rather than attempting access to Midland.[66]

66. Appendix 2 Barrow Hill Line Restoring Your Railway Strategic Outline Business Case.pdf (derbyshire.gov.uk)

Barrow Hill Line Restore Your Railway scheme



Source: Appendix 2 Barrow Hill Line Restoring Your Railway Strategic Outline Business Case.pdf (derbyshire.gov.uk)

A further device has been identified arising from this proposal, which is that, with re-instatement of a section of line closed between Deepcar and Penistone, Sheffield Victoria could be used as a through station, with services operating Chesterfield-Sheffield Victoria-Huddersfield.[67] Welcome though such plans may be, they do involve creating a less-than-ideal situation of two separate city centre stations in Sheffield and capital costs will become a key factor. So it will be important to explore the investment alternatives of increasing track capacity into Sheffield Midland from the north. And it will also be important to ensure that any development of local services over the Barrow Hill lines from the south do not inhibit this rail corridor's use as a through route, which keeps freight services out of Midland station.

Freight

Although there are no detailed projections of railfreight prospects in the Leeds-Sheffield corridor available, it is clear that railfreight in the area will remain and most likely grow. It has an increasing role to play in multi-modal logistics and supply chains. This growth will also be driven by increasing costs of longer distance road haulage and the intrinsic difficulty of operating non-fossil fuel lorries over longer distances. A trebling of rail freight tonne-miles is in prospect.[68]

Speeding up London Kings Cross services from Leeds and Bradford

Currently Leeds-London Kings Cross services operate via Wakefield to reach the East Coast Main Line at Doncaster. This is the route also used by fast Sheffield trains to access Leeds. Increasing the Kings Cross service frequency over this line would probably not be feasible, especially with an extra fast Leeds-Sheffield train to be fitted in as well.

However, an acceleration of Leeds-London services need not wait for HS2. The suggestion made here is that an extra **non-stop** Leeds-London service is introduced operating via Hambleton Junction and extended to create a fast Bradford-Leeds-London service. This might run on a 2-hourly basis, consistent with line capacity and LNER contract aspirations. Leeds-London timings would be around 1h55, significantly faster than today's standard LNER timing. With trains calling at Leeds station (rather than terminating there with the lengthy in-platform occupations needed if the Wakefield route was used instead) additional platforming requirements at Leeds would be minimised.

67. (Public Pack)Agenda Document for MCA - Transport and the Environment Board, 30/06/2022 10:00 (southyorkshire-ca.gov.uk)

68. See Julian Worth, p37 Focus, CILT Journal, November 2022. This article also highlights electrification of the NE-SW Cross Country route as being of major benefit to freight operations.

6

Conclusions

According to Councillor James Lewis, Leader of Leeds City Council:

> **"New trains are part of a better economy. [The] Leeds–Sheffield railway line is appalling."**[69]

While currently services are seen as sub-standard, there is also frustration at the period of uncertainty regarding longer term plans, specifically for the HS2 Eastern arm. But there are plenty of plans for improvements in the area surrounding the Sheffield–Leeds corridor—and indeed some for the corridor itself. We suggest it is time to draw these together into a Sheffield–Leeds interim rail strategy and put some drive and momentum behind the significant improvements identified here that are possible with modest levels of infrastructure spend.

Of course, the city region combined authorities will be especially keen to see the longer term investment plans for the corridor fulfilled. But they will also welcome the focus here which is on what can be done in the short to medium term to secure benefits from rail investment. This type of aspiration has been expressed from a Sheffield city region perspective as:

> **"improving the speed and frequency of trains from the Sheffield City Region to Greater Manchester and Leeds [and] new Intercity rail connectivity direct into the town centres of Barnsley and Rotherham."**

This **Sheffield–Leeds interim rail strategy** avoids major new capital expenditures under the immediate action heading, which makes it deliverable by 2029 and also not at risk of being incompatible with the longer term strategy that eventually emerges. The second wave of proposals requires prudent planning, with appropriate challenge of design and specification assumptions.[70]

69. See https://southyorkshire-ca.gov.uk/getmedia/f958934e-2218-461d-9642-c011d1979644/SCR_SEP_Full_Draft_Ja

70. The new station and interchange at Rotherham Main Line has a likely capital cost in the £40m-£100m range for which funding has been part-secured from non-rail sector budgets. Space has been set aside to build the Metrolink interchange at Baguley (in south Manchester). The possible new station at Ossett and associated short section of line re-instatement could be funded through the Restore Your Railway fund. These investments could each be fast-tracked using Network Rail Project Speed techniques to meet timescales and budget limits. The infill electrification should proceed following Midland Main Line Phase 3 scheme (completion date for which has not, been specified) if it meets Network Rail's target per mile costs.

Sheffield–Leeds interim rail strategy

Immediate action

1. Adding a second hourly fast service between Leeds and Sheffield
2. Retaining the existing stopping services, on both lines, with longer trains used to provide additional passenger capacity as needed
3. Extending East Midlands Railway London St Pancras-Sheffield services to Barnsley, Wakefield Kirkgate and York, hourly.
4. Incorporating a new station for Rotherham, with fast connections to both Sheffield and Leeds

Initiate Planning

5. Provision of a new service between Sheffield and Manchester Airport, initially with a Metrolink connection to the airport
6. Creating a new direct link between Sheffield and Bradford via Barnsley and Halifax, using a restored 'Crigglestone Curve', with a new station to serve Ossett and Horbury
7. An examination of the scope for a second fast hourly Cross Country Leeds—Birmingham service (through extending the second hourly fast service between Leeds and Sheffield)

Renew investigations

8. 'Infill' electrification of Sheffield-South Kirkby/Doncaster following on from Midland Main Line electrification to Sheffield
9. A holistic examination of the Sheffield Midland station northern approaches capacity challenge, including digital (ETCS) re-signalling schemes to permit an increase in service levels

As this report has shown, improving rail connectivity in this key northern corridor is crucial to fulfilling economic growth objectives. While capital costs are modest, the scope for service improvements is significant. This is in part because of committed projects at either end of the corridor:

- The Trans Pennine Route Upgrade—which benefits the key east–west corridor through Leeds

- Midland Main Line Electrification Phase 3, which brings better and faster connections to Sheffield from the south.

These two projects effectively 'book-end' the Sheffield–Leeds corridor. While not themselves improving services between the two cities, they will address enhancements needed at Sheffield and Leeds stations. This makes it conceivable to implement a corridor strategy with major benefits at modest additional cost and without relying on any particular outcome from the Government's longer term examination of investment in the East Midlands-Leeds corridor.

The Interim Rail Strategy presumes that existing capacity constraints in the corridor remain. Increasing the 'fast' service (Leeds-Sheffield 40 minutes) from hourly to half-hourly is an important step but is still well shy of the Transport for the North aspiration for a 15-minute interval fast service. For train service provider Northern, the existing Leeds-Barnsley-Sheffield 'semi-fast' service is one of the best performers in terms of revenue. Providing more capacity and a more appealing service in this corridor should help address Government concerns about the cost to tax-payers of rail service provision: user revenues will grow.

Beyond the 2020s: a second interim development stage

Getting to a 4 trains/hour fast Sheffield–Leeds service would require capital works to increase line capacity. This might be achievable in the 2030s, and can sensibly be defined once the longer term strategy is known. Examination of the options available should begin in the 2020s. These might include:

- On the faster 'Moorthorpe' route, increased line and junction capacity, including between Hare Park and South Kirkby, possibly with four tracking through Fitzwilliam station[71]

- Improvements to the Sheffield-Rotherham-Swinton section of line. The new Rotherham Main Line station is being considered as either a 2-track or a (re-instated) 4-track version. But the station throat at Sheffield is likely to be the key focus of attention.

This report has identified further developments that could be implemented in a follow-on stage in the early 2030s. These should centre on improving Cross Country services and connections and creating a direct link between Sheffield and Manchester Airport. And infill electrification of the key lines northwards from Sheffield may also not take place until the 2030s given the timescales for existing electrification schemes.

71. See page 23 in https://www.networkrail.co.uk/wp-content/uploads/2021/04/Doncaster-Area-Strategic-Advice.pdf

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