Meeting the Rail Needs of the Midlands and the North—a Review

A report by *Greengauge 21*
February 2021

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Shaping tomorrow's railway

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Contents

Foreword

Greengauge 21 is an independent not-for-profit policy research group that has supported the development of a national high-speed rail network for 15 years. We are naturally delighted at the progress that is now being made with constructing HS2.

Government has decided—quite rightly, we believe—that the set of complementary and sometimes overlapping major rail proposals for the Midlands and North of England—which include further sections of HS2—should be brought together in an Integrated Rail Plan. This is expected to set out plans and priorities for the next few decades.

The ambition to 'level up' the UK is central to the Government's thinking. With London's Crossrail coming to completion, the era of major rail network development and reconstruction in the South East is drawing to a conclusion, or more likely, a pause. Never has there been a better time to look afresh at what the rail network could do to support the economic growth of England's North and Midlands.

The Integrated Rail Plan is being prepared by the Department for Transport: nearly all of it will be based on schemes developed by HS2 Ltd, Network Rail, Transport for the North and Midlands Connect. Ahead of its publication, the National Infrastructure Commission was asked to examine the 'rail needs' of the Midlands and North as a key input to the Integrated Rail Plan. The Commission's final report was published in December 2020 and this report has been prepared in response to it.

Greengauge 21 has a small, highly experienced team who have prepared it. The report entirely and exclusively expresses Greengauge 21 views alone.

Jim Steer
February 2021

Executive Summary

Greengauge 21 welcomes the National Infrastructure Commission's December 2020 report on the rail needs of the North and Midlands. It breaks new ground in seeking to direct rail investment to where it can be most effective in supporting economic and other Government policies within budget constraints that are set nationally.

Its approach shifts the analysis away from traditional cost: benefit appraisals. Some stakeholders may feel uneasy at the hard edge of budget constraints, but then virtually none of the investments under consideration have published benefit/cost ratios. A fresh approach, we suspect, is timely.

The budget set by the National Infrastructure Commission (NIC) provides a fairer basis for allocating resources, based as it is on regional population levels. There is a clear justification for examining (as the Commission does) +25% or +50% budget scenarios, having found that the base level allocation is insufficient once all committed HS2 costs and regional enhancement schemes are paid for. We do not regard these higher budgets as risky, as the Commission suggests. Indeed the regional budget allocation is only fair if these higher budgets are adopted.

We set out to review the Commission's report speedily, ahead of the Department's Integrated Rail Plan for the North and Midlands which is expected to follow in the coming weeks. We were able to draw on a body of work that Greengauge 21 has carried out and published over the last few years (all of which is available and free to download from the Greengauge 21 website).

The Commission's method of calculating benefits to city economies

We reviewed the Commission's methodology that sought to measure amenity/quality of life benefits alongside economic benefits to cities. It assessed agglomeration effects (which rely on greater transport capacity in places where growth is currently constrained—this applies to many rail routes into city centres in the North and Midlands); and also improved trade which it sees as following improved rail connectivity.

We point out that the consequential effect of Covid-19 may well be to cause a shift in the frequency of commuting (downwards) and in the length of commuting (upwards). This may affect the 'distance decay function' in agglomeration models, calibrated pre-Covid, with the economic benefits spreading over wider employee work catchments. But we agree with the NIC that rail is crucial to the functioning of cities, and their economies. And we share the view that cities can be expected in due course post Covid-19 to resume their high activity and output levels.

Hesitancy to commit to rail investment expenditure in support of the great cities of the Midlands and North in the face of post Covid-19 uncertainties would be a mistake. Regardless of any future shifts in patterns and trends in work-home location choices, rail operates as a network—a set of routes and nodes, with city centre stations acting as key interchanges as well as gateways to city centres. Location preferences may alter, but the rail network will continue to support economic activity provided these key interchanges, the hub stations, are able to accommodate the mix of travel demands placed on them and support their wider hinterlands.

The economic and social mobility evidence points to a need to address not just the accessibility needs of those living in the major conurbations. It is easy to overlook the polycentric nature of the North and the Midlands, which could be a risk with a focus solely on strategic corridors and the big cities. Our report points up where Midland/Northern towns, as well as cities, can benefit from rail investment.

Key results from the analysis

The Commission examined packages of (a) regional investments—which included Northern Powerhouse Rail and Midland Rail Engine; and (b) a long distance package which included completion of the full HS2 plan. In both cases, other complementary schemes and enhancements to the existing rail network were included, as appropriate, with two enhanced budget caps (+25% and +50%).

Overall, the regional packages perform more strongly, but not by a great margin and cities to the east of the Pennines do better from the long distance packages. This reflects the current commitments to progress HS2 on the western side of the country but not the east, where there is evidence of a more widespread need to 'level up'. It is important that in implementing the Integrated Rail Plan, a way is found to ensure that an unwanted east-west imbalance is not accentuated, deepening the effects of the sequential implementation plan for HS2.

Major schemes

The Commission recommends that an 'adaptive' approach is taken to setting the Integrated Rail Plan. We question whether this brings sufficient certainty to commercial development, inward investment and to the rail sector supply chain.

The 'adaptive plan' envisages that the Trans Pennine Route Upgrade would be completed, with electrification of the York-Leeds-Manchester route throughout. Other upgrades and electrification schemes costing £10bn in total are envisaged. Northern Powerhouse Rail schemes would follow, with sections of new lines built where their addition would relieve otherwise over-subscribed railways. This makes good sense but we concluded that there is a risk of overlooking:

- The needs of towns that can feel (and be) 'left behind' and where rail services could be a key factor, for instance in overcoming social mobility challenges (these, we show, are far more prevalent in Yorkshire/Humber and the East Midlands than elsewhere in the area under study)

- The importance of upgrading rail networks in major city centres. Neither in Manchester nor Leeds is the existing network able to support the additional services that the various rail projects will provide. Investing here should be a priority, ensuring that more rail services can run on a 'cross-city' rather than terminating basis. Neither of the current HS2 station designs in these city centres fits the bill.

HS2's Eastern Arm

The Commission introduces the possibility of delivering HS2's Eastern arm in phases to deliver benefits earlier, starting with a high-speed line between the West and East Midlands. It calls for a modest revision of the alignment, making a connection with the Midland Main Line south of the junctions at Trent, possibly at East Midlands Parkway. Whether an HS2 station should be provided at this point will need detailed study; the Commission—rightly in our view—sees Parkway' style stations as being inferior to city centre stations which will have a greater economic stimulus effect. But prioritising this line is a great call: it connects the largest city in the West Midlands with the largest city in the East Midlands, reducing journey times from 72 minutes to 27 minutes between Birmingham and Nottingham.

The great benefit of this approach is that HS2 trains could then proceed northwards serving existing stations in Nottingham and in Derby, or indeed bypassing them. The current HS2 design only allows bypassing both cities.

There is no doubt that this first phase should be followed by a complete route: the East Midlands–Yorkshire connection is a strategic route and cannot be overlooked. But there are weaknesses with the current design of the HS2 Eastern arm:

- It serves Leeds but misses Derby and Nottingham and serves Sheffield only on a lengthy loop line
- Its design at Leeds precludes services being extended to Bradford and other parts of Yorkshire
- The plan to operate a set of fast Leeds-Birmingham point-to-point shuttles looks appealing, but, as we show, the market they would serve is small, and they cannot replace the long-distance cross-country services (such as Edinburgh–Plymouth) that operate over this corridor, accommodating multiple pairs of station-station flows en route
- It would not free up any capacity on the Midland Main Line into London St Pancras, or on the routes taken by long distance cross country trains
- Its construction over a period of years is likely to cause significant disruption to the M1 motorway which it closely follows.

These limitations are exacerbated by the risk that the full HS2 service plan may become undeliverable with the revised arrangements at Euston, where fewer additional platforms are now planned, and this means that planned London-Newcastle services would quite probably need to be dropped. Without them, the planned eastern bypass of Leeds part of the HS2 plan would become unviable.

We believe it would be prudent now to recognise this likely service reduction (while retaining. the possibility of extra HS2 train paths into London emerging later kept as a prospective upside).

The Commission sees a need to consider options to address the situation and progress beyond the initial part of the Eastern arm across the Midlands:

1. Complete the HS2 line as planned northwards to Leeds
2. Upgrade existing lines instead.

To these, we add a third option, which would in effect place the East Midlands-Yorkshire high-speed line 15 miles further east in the East Coast Main Line corridor, where its benefits would be so much greater.

HS2's Eastern Arm as planned misses major cities

Numbers show city travel to work area populations in 000s (data source: Commission report)

This would be achieved by extending HS2 services that serve Nottingham onwards to reach the East Coast Main Line near Newark. From there new high-speed line investment would add capacity and speed up services to all of the destinations in Yorkshire/Humber, North East England and Scotland.

At the Birmingham end of the cross-Midlands section of HS2 the Commission recommends that the Midland Rail Hub scheme should be prioritised. This would allow long distance cross country services to call at Moor Street station (in effect an adjunct of the new Curzon Street HS2 station now under construction) in Birmingham's city centre and continue onwards to the south—for instance to Bristol and Cardiff. This allows the conversion of the HS2 network from a Y-shape to an X-shape, strengthening the value of the Eastern arm and freeing up capacity at New Street for more West Midland commuter services. The Eastern arm, as we envisage it, would carry long distance cross country trains (routed via York-Doncaster-Nottingham-Birmingham), leaving York-Leeds-Sheffield-Derby-Birmingham in place as the second (slower) cross country route.

Initial assessments show that only the Leeds–London journey times would be slower with this approach (and then by only around 10 minutes) whereas the gains for all the other cities—Bradford, Doncaster, Hull, York, Harrogate, Darlington. Middlesbrough, Newcastle—and of course, Nottingham, would be greater. Moreover, some of these gains could be delivered ahead of new HSR construction, by adopting 140 mile/h operation (for which the ECML train fleet is already equipped), electrifying and using the Selby–Leeds line (part of the Hull–Leeds scheme electrification scheme which should also be progressed), and upgrading the Leeds–York–Newcastle line as per Transport for the North's proposals.

This third option would free up train paths on the Midland Main Line (from which fast Sheffield/Chesterfield/Derby and Nottingham to London trains would transfer to HS2) into London St Pancras. One option would be to use some of the newly spare MML paths to provide Mansfield with a London service, and this could call at a new station provided at Toton which would support the development currently planned there.

This can be only a preliminary assessment, but it is evident that the National Infrastructure Commission is right to call for HS2 options north of the Trent to be examined thoroughly. We believe there is a promising path to a much stronger case for completing HS2's Eastern arm if it is focused on the East Coast Main Line corridor rather than along the M1 corridor/ Erewash Valley.


NORTH
EAST
NORTH
WEST
YORKSHIRE
AND THE
HUMBER
EAST
MIDLANDS
WEST
MIDLANDS

1.0 Introduction

Asked to define the North & Midlands' rail needs, in December 2020, the National Infrastructure Commission (NIC) offered up a powerful analysis of what would deliver transformational economic benefits. Side-stepping the usual pitfalls of cost-benefit analysis, it sought to assess how rail investments could best deliver Government's fundamental aim of 'levelling up'.

It quickly drilled to the heart of the problem. On current estimates, the capital cost of planned rail investments across the North and Midlands are unaffordable (a conclusion reached in its interim report of July 2020[1]). The outstanding parts of HS2 Phase 2b, 'Northern Powerhouse Rail'—new lines between the North West and Yorkshire/the North East—and its much smaller cousin, the trans-Pennine Route upgrade, along with a programme of measures for the Midlands—('Midland Rail Engine')—and a basket of rail enhancements, including outstanding electrification projects on existing main lines, exceed the available budget.

The scale of these projects is such that very few of them could be delivered in the 2020s. While some could materialise later in the 2030s, the more substantial elements are unlikely to be deliverable before the 2040s. There are both timing questions and budget realities to face.

The terms of reference of the Integrated Rail Plan start with a clear Government commitment to greater rail investment in the Midlands and the North. So the critical question for the Commission was how best to do this, rather than whether to do it at all. The Commission's methodology therefore "assesses which rail interventions deliver the most potential benefits within a given budget". It avoids using traditional Benefit Cost Ratios to do this.

1. https://nic.org.uk/app/uploads/RNA-Interim-Report-Final.pdf

2.0 Understanding the National Infrastructure Commission's Methodology

The available budget

The question of budget has not been well addressed by the various rail scheme promoters. Instead, while seeking to reconcile the various rail schemes one with another, they have focused on the case for their particular proposals. Budgets for project implementation, it was hoped, would be allocated on the basis of strong cost benefit performance. But in general these estimates have not been published, and budgets have not progressed beyond support for exploratory studies.

The answer to the question **how was the NIC budget set?** was addressed by the NIC in its interim report.[2] This explained how the Commission is required to demonstrate that its recommendations for economic infrastructure fit within "gross public investment in economic infrastructure of between 1.0 per cent and 1.2 per cent of GDP in each year between 2020 and 2050." It says that: "an illustrative budget for the assessment requires assumptions about the future division of funding between road and rail enhancements, and the share of enhancements funding in the Midlands and North relative to the rest of the country."

To determine the budget share between road and rail investment, the NIC used the average shares of forward plans for rail and road enhancement expenditure across the period 2020/21 to 2029/30 and rail is allocated 43% of the national budget on this basis. In effect, the committed and planned road and rail investment shares for the 2020s are rolled onwards, unchanged.

Next, the share of rail enhancement funding in the Midlands and North relative to the rest of the country was determined by using ONS-sourced projections of the population for the Midlands and North regions as a percentage of the total projected population in England and Wales.

2. RAIL NEEDS ASSESSMENT FOR THE MIDLANDS AND THE NORTH Technical annex: *The fiscal remit and the assessment budget*, National Infrastructure Commission, July 2020.

These two allocation steps lead to a total budget for the North & Midlands rail needs assessment between 2020 and 2045 consistent with the *National Infrastructure Assessment* fiscal remit set at £86.2 billion. In the Rail Needs study, two further budget possibilities are examined: the first assumes that money available for rail spending is 25 per cent higher: £107.8 billion in total between 2020 and 2045, and the second assumes that money available is 50 per cent higher: £129.3 billion between 2020 and 2045. As the NIC advised in July 2020, the full expected costs of the schemes being considered by the assessment do not fall within even the higher +50 per cent scenario. In accepting that a case could be made to increase the available budget by 25% or 50%, the Commission points out that this still requires choices to be made on which rail schemes should be progressed.

But is the allocation process used in setting the compliant budget fair, reasonable and appropriate in all respects? We can see three arguments why it might be considered not to be.

The first is this. If it is taken that rail networks in the Midlands and North have suffered from years of relative neglect that the highway network has not, a continuation of current trends in highway-railway expenditure is arguably inappropriate. 'Relative neglect' of rail vs highways may well be a reasonable summary of the state of affairs in capital expenditure terms, but not necessarily in terms of overall Treasury funding support, which would take into account factors such as fuel tax and rail subsidies. Moreover, any shift in the road-rail balance of capital expenditure would logically require a reduction in highways capital spend in the Midlands/North. This would seem to undermine the Commission's strategic case for rail investment which is for a comprehensive programme of measures (rather than an isolated set of rail improvements) in the Midlands and North to re-balance the national economy.

The second questionable aspect of setting the financial remit is the allocation for the Midlands & North regions as a proportion of the nation-wide allocation, using population projections as the guiding metric. This is likely to yield more support for Midland and Northern projects than has been the case in recent years. But if the intention was to right an historic wrong, should the Midlands and North now gain more investment than would be allocated on a per capita basis? This would mean that other regions (East of England, South East England, South West England as well as London) would be allocated less than with a per capita allocation. But some of these places have also experienced under-funding, and it is presumably not the aim of 'levelling up' to redress historic imbalances by 'levelling down' elsewhere and especially in the uncertain post-Covid-19 world.

The third question is trickier. The Commission's methodology examines project benefits if they arise in the Midlands and the North but not those arising elsewhere. This is consistent with the latest guidance on the Treasury Green Book[3], and in any event, the NIC's approach does not focus on benefit cost ratios. Its multi-criteria approach excludes the incremental costs and benefits of HS2 phases 1 and 2a. However, in its budget calculation, all project costs, regardless of where there are incurred, are counted against the budget calculation. This may not be a material concern for within-region schemes, but it is for HS2 Phases 1 and 2a. Virtually none of the construction of these parts of the project is in the North and only a proportion in the Midlands. True, this approach avoids an arbitrary allocation of HS2 costs between the North/Midlands and the regions to the south, including London. But in attributing all HS2 costs to the budget allocation for the Midlands and North, this does remove a significant amount of budget that would otherwise be available to a regional capital allocation. HS2 is also, after all, not without significant benefit to London.

Allocating regionally on a per capita basis overcomes the long-standing problem of project budgets being disproportionately allocated to London & South East England on the basis of higher cost-benefit ratios, because of higher congestion and income levels. And for the North & Midlands, capital investment in its rail network should not result in de-funding its highways.

It would not be right to seek to redress historic underfunding by re-allocating forward funds in favour of the North/Midlands to the disadvantage of the rest of the country. But insisting that all of the costs of HS2 (rather than an allocation) should fall under the North/Midlands heading limits the spend available for the other rail investments under consideration. Correcting for this simplifying analytical assumption provides a justification for the +25% or +50% budget scenarios identified by the NIC. These can be regarded then not so much as a 'strategic bet' (the term used in the Commission's report) but as a fair way to achieve a pattern of expenditure suitable for 'levelling up'.

3. Green_Book_Review_final_report_241120v2.pdf (publishing.service.gov.uk) November 2020.

An approach centred on economic outcomes

The general case for rail investment across the Midlands and North is powerfully set out by the NIC. In contemplating which rail investments to include, it considers three possible approaches. These are:

1. by setting a metric—say in terms of accessibility to rail—that could be adopted as a uniform standard; investment would be directed towards those places which fall short of achieving this standard

2. by identifying problem parts of the rail network ('pinch-points') and carrying out such remedial work as would be necessary to ease them. Whether the resulting improvements in services would reach those places needing an economic boost would be open to question

3. by recognising that rail investment on its own will not transform economies, but that in support of and in conjunction with other measures, it could help bring about transformational economic outcomes.

While recognising the third approach is riskiest (combining actions across Government departments has a poor track record), the NIC chooses to adopt it, because it can be focussed on delivering the most valued outcomes. This is a strategic approach to prioritising investment that is a welcome development. It is in line with the emphasis that HM Treasury is placing on the strategic case component of investments, addressing the question directly of why a given project should proceed, rather than relying on a quantified comparison of project costs and benefits.

Measuring economic outcomes

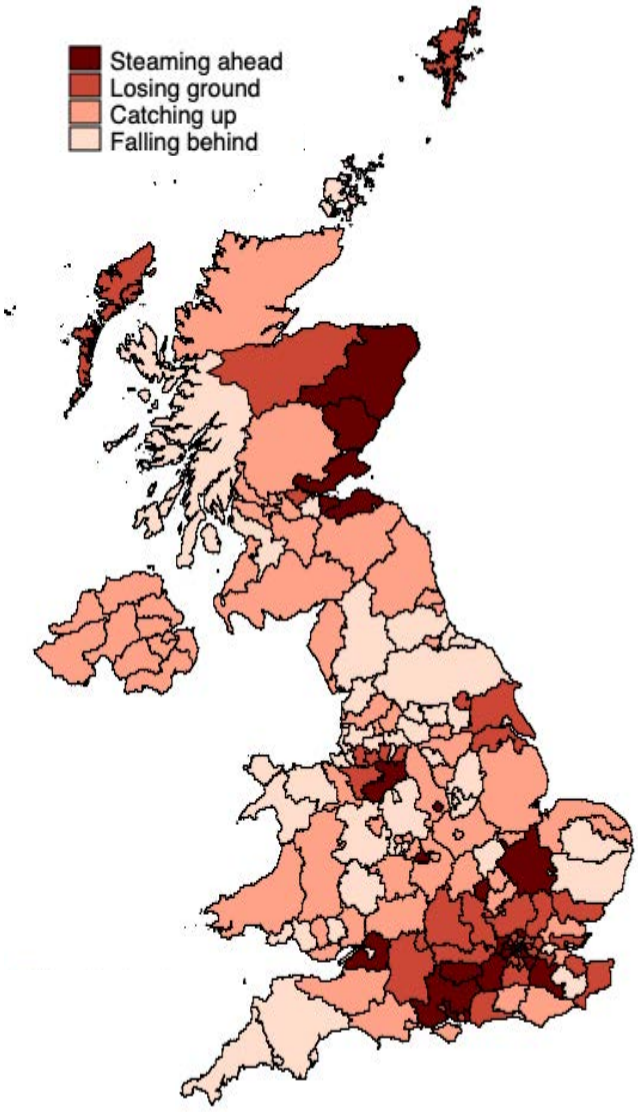
In fairness, this shift in Treasury emphasis is recent and scheme promoters have been previously encouraged to be more concerned with benefit cost ratios. The Commission's approach helps overcome what it found from the social research it commissioned to inform its Rail Needs work, namely that there is little public understanding of how investment in transport flows through into economic improvement.

The Commission went on to note that while other countries "face persistent regional economic variation, the extent of regional variation within England appears to be unusually high compared to other countries".[4] While the cities of the North and Midlands reveal lower productivity levels than the national average, each region (the North East, the North West, Yorkshire/the Humber, East Midlands and West Midlands) "has different economic strengths and opportunities [that] they wish to unlock to improve economic outcomes in the region … Many of these are high skilled, knowledge based sectors which particularly benefit from improvements to productivity in cities."[5].

4. p24, Rail Needs Final Report, NIC.
5. Illustrated in Figure 2.1 in the NIC Final Report.

One indication of variation in regional economic performance is provided in the figure below based on ONS data and extracted from an Industrial Strategy Council report.[6]

This map classifies places according to their productivity levels in 2008, and their productivity growth rates over the 2008–17 period. Regions with an above-average productivity level in 2008, whose productivity grew faster than average in the subsequent decade are described as "steaming ahead". These places have increased their productivity advantage over the average during the last 10 years. Regions with an above average productivity level in 2008 whose productivity grew less than the average are described as "losing ground". Most of these regions are still doing well compared to the average, but they were further ahead a decade ago. Regions with a below-average productivity level in 2008 whose productivity grew faster than average are described as "catching up". These regions have narrowed their gap with the national average in the recent period. Finally, regions whose productivity was below average in 2008 and whose productivity grew less than average subsequently are described as "falling behind". These regions were already behind the national average in productivity in 2008, and their gap with the average has increased further since.



The significance of the pattern illustrated here is that it shows a remarkably varied pattern across the North and the Midlands. Few places are seen to be 'steaming ahead'. Places falling behind are typically more rural, containing some significant towns, but not large conurbations. This is significant because it means that rail investments centred on city-city connectivity and intra-conurbation alone will not help achieve 'levelling up' within the North/Midlands.

6. Extracted from https://industrialstrategycouncil.org/sites/default/files/attachments/UK%20Regional%20Productivity%20Differences%20-%20An%20Evidence%20Review_0.pdf

Another picture emerges from the pattern of social mobility across the North and Midlands. Places in the lowest quartile of social mobility scores comprise 25% of local authorities (lower tier/unitary authorities) in North West England, and 29% of West Midland authorities, but 46% of local authorities in Yorkshire/Humber and fully 92% of East Midland local authorities.[7] This is evidence of an east-west divide.[8]

While overall rail travel in the North and Midlands is a small proportion of all travel, it is significant for travel into cities. Prior to Covid-19, rail services into Birmingham, Leeds, Manchester, and Nottingham were growing year on year, crowding levels were rising and rail service reliability was worsening. To continue to feed employment and productivity growth in these key centres, more rail capacity would be needed.

The Commission goes on to say: "The Integrated Rail Plan is intended to support the government's strategic objective of 'levelling up' by contributing to economic growth in the North and the Midlands. There are four ways identified by the Commission that this process works in practice—as shown in the panel below.

How rail improvements drive economic growth

Rail can contribute to improving economic outcomes by:

- increasing the density of clusters of people and businesses, which can increase the productivity of existing firms and workers in cities, improve the environment for innovation and make cities more attractive for businesses and workers to locate in
- facilitating 'trade' between cities by providing faster, more frequent rail connections to businesses, enabling them to source a wider range and better quality of inputs to their supply chains, and increasing the size of the market any one business can access, allowing successful firms to grow, and encouraging workers to specialise and upskill
- making places more attractive to live and work in
- encouraging commercial investment by signalling that an area is worth investing in.

Source: NIC Rail Needs in the North Final Report, December 2020, p30.

7. See *Beyond HS2*, Annex A, Greengauge 21, May 2018.
8. See http://www.greengauge21.net/the-uks-2070-transport-infrastructure-requirement/

The first of these is a 'success breeds success' mechanism, which is measured under the agglomeration label. The essence of this notion stems from the observation that productivity levels—measured through income (plus rents and corporate profits) per capita are generally higher in city centres. In transport terms, agglomeration is essentially about urban (travel to work area) activity, aided by connectivity between businesses ('local' face-to-face contact) and better access to labour. In benefit appraisal terms, it is all about numbers of jobs and the pay levels associated with them. In the context of 'full' and congested transport networks, measures that increase capacity—and for city centres, this is where the rail mode is relevant, given the implausibility of increasing capacity by other means—can have a direct bearing on increasing numbers of high-value jobs.

Agglomeration

Measures of agglomeration have been studied and used extensively[9] yet remain vulnerable to questions of causality and of measurement. And now, with the extensive behaviour changes wrought by Covid-19, with work from home an option for many office-based workers, the question arises as to whether the agglomeration model remains valid—and whether it at least needs recalibration. This is very much a question of whether cities will resume their pre-Covid-19 economic dominance and general business. The Commission has expressed its view that after a period of recovery, cities are likely to resume their role—as business, cultural, entertainment, political and financial centres.

The Commission's modelling approach to estimating the economic benefits of alternative packages is to identify the economic potential that transformative rail investment could unlock, recognising that other regenerative measures are likely to be critical in its realisation. It is also recognised that its multi-criteria approach is not exhaustive in attempting to measure all economic impacts.

Both the amenity and productivity calculations of agglomeration benefits are restricted to those larger cities for which there is a more robust case that these benefits will be realised. This is prudent in terms of not over-promising benefits, but it could introduce a systematic bias in favour of investment for those larger cities. For example, whilst agglomeration benefits for Hull might be smaller, if they're not included at all in a proxy for economic impacts then solutions which incorporate improvements for Hull are unlikely to score well.

Agglomeration benefit estimation relies on the 'step change' release of capacity on local rail services as the key constraint to productivity gains. A number of simplifying assumptions are made, such as the 1:1 freeing up of local capacity by investing in new inter-urban services, and the stated assumption that capacity will fill up ("if you build it, they will come"[10]). Whilst the method recognises the synergy of wider regeneration factors in realising productivity gains, this assumption implies that for each assessed city, rail capacity is a constraint to this benefit.

9. For instance, in the case for funding Crossrail in London.
10. National Infrastructure Commission *Capturing the value of urban transport investments*, October 2019, p6.

Whilst it is not yet possible to determine the long-run impact of the Covid pandemic on the demand for public transport, the following factors appear likely to be in play:

- there will be more of a mix of travel to the workplace and working from home, accentuating recent trends
- workers may choose to live further from their workplace to enjoy cheaper and/or more spacious accommodation if they need to travel less frequently, via an extension of Marchetti's constant travel time concept[11]
- the acceptability of crowding on public transport is more uncertain, which may fundamentally change the definition of capacity.

This brings additional uncertainty to capacity as the driver of agglomeration. Whilst the sensitivities used in the modelling are sensible in this context, the out-turn ranges of benefit estimates are wide as a result and overlap significantly between the Regional and Long-Distance packages. These ranges are driven by the sensitivity of benefits to agglomeration elasticities[12]—as is illustrated in the research work that underpins this approach.[13] As the Industrial Strategy Council report[14] into UK productivity differences recognises: "The appropriate evidence base for the "agglomeration" narrative is the trickiest to determine. This is precisely because circular reasoning is at the heart of the narrative".

The rate at which agglomeration benefits decline—the distance decay function—is likely to be critical to the relative benefits of the alternate packages. There is a question as to whether the historic value for this would hold if the factors bulleted above are realised.

Trade

The second way rail investment can impact on the economy beneficially is about trade in its widest sense. This second measure is about labour and product (customer) market reach in a wider regional and inter-urban context. It covers business to business connectivity and the spill-over benefits to supply chains from business synergies. It can be supported through carefully constructed measures to improve connectivity. These are unlikely, the NIC notes, to be measures solely in the transport sector.

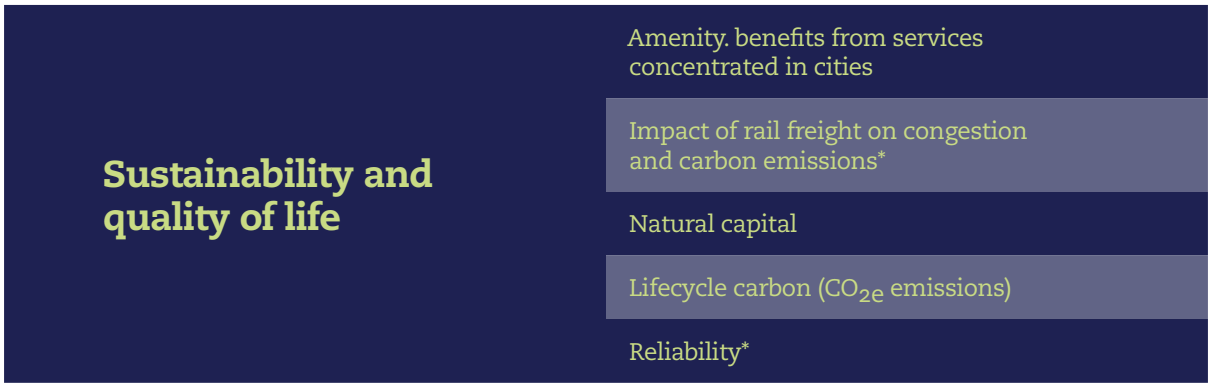
The primary distinction between these two measures is spatial: as used by the Commission, agglomeration benefits arise in concentrated city centre activity hot-spots (but have spill-over beneficial effects within wider travel-to-work areas); improved trade benefits are much more widely spread. Both measures have been translated into monetised benefit estimates in the Commission's report and applied to tests of the various rail investments under consideration.

11. Marchetti (1994) Anthropological Invariants in Travel Behaviour.
12. NIC Modelling Annex A. Table 2.3 shows the variation in elasticity values used.
13. National Infrastructure Commission *Capturing the value of urban transport investments*, October 2019, p11.
14. Industrial Strategy Council: UK Regional Productivity Differences. February 2020.

While the third and fourth economic effects may yet prove to be significant, the Commission has not attempted to quantify them at this stage.

Sustainability and Quality of Life benefits

Continuing to avoid building a single benefit cost measure, the Commission also set out to examine a small cluster of other effects of rail investment, three of them quantified for the options assessed, as listed below.[15] In some of the NIC's assessment tables, amenity benefits are added to agglomeration benefits.



*Not quantified in the Commission's analysis.

When is Rail Investment Effective?

According to the NIC report: "Rail investment alone is unlikely to be enough to transform the economic outcomes of a region, city or a town." On the other hand: "rail is much more likely to contribute to the type of nonlinear benefits that true transformational change can bring … in combination with other policies".[16]

An example of the combined approach that the NIC is seeking should, it suggests, come from the £43 billion of additional investment that the NIC has separately called for, to be made available between now and 2040 for major urban transport projects in the fastest growing, most congested cities. A good example of where this budget might be applied is West Yorkshire, where the Combined Authority has just released first details of its thinking on a Mass Transit system and how it might be developed alongside Northern Powerhouse Rail and HS2.[17]

15. Source: https://nic.org.uk/app/uploads/RNA-Modelling-Annex.pdf p7.
16. Rail Needs Final Report, National Infrastructure Commission, p31.
17. https://www.westyorks-ca.gov.uk/all-news-and-blogs/ambitious-plans-for-clean-and-connected-transport-system-supporting-better-future-for-west-yorkshire/ published January 27th, 2021.

"Enabling places with low productivity to 'catch up' with more successful places requires a step change in growth that outpaces the more successful places for a sustained period, which is very hard to achieve", the NIC says. But it takes encouragement from Industrial Strategy Council work, which found that:

> ***"the evidence also clearly suggests that reversing the cycle of stagnation is possible provided policy measures are large-scale, well-directed and long-lived. Regional differences typically have deep roots and are long-lasting. They emerge in an evolutionary fashion due to the complex interplay of various factors acting in a self-reinforcing cycle - transport, education, skills, innovation, housing, civic and community infrastructure. For well-performing places, this is a virtuous circle. For left-behind places, it is a vicious one."***[18].

It left the NIC in no doubt that investment needed to be 'at scale' if it was to be effective: "the only way to move a city from a bad equilibrium to a good one is with a big push … but the track record of these policies is mixed. To succeed the push needs to be really big".[19]

We observe that consistent with these observations, transport (rail) improvement might indeed form an essential part of overall sustained and targeted economic transformation efforts of considerable scale as the NIC calls for. The conurbations of the North and the Midlands are themselves highly polycentric and the towns on the periphery of the large conurbations and in the wider hinterlands beyond also have their connectivity needs. More localised and modest rail investments should therefore not be overlooked if levelling up is to have widespread meaning across the North and Midlands.

We endorse the Commission's approach to stepping away from a benefit cost framework to identify more specifically which investments deliver on the Government's levelling up agenda and economic recovery programme.

The NIC is right that rail is crucial to the functioning of cities, and to the major city economies. We share the view that cities can be expected, in due course post Covid-19, to resume their high activity and output levels.

Any hesitancy to commit to rail investment expenditure in support of the great cities of the Midlands and North in the face of post Covid-19 uncertainties is understandable but would be unfounded. This is because regardless of any shifts in patterns and trends in work-home location choices, rail operates as a network—a set of routes and nodes, with city centre stations acting as key interchanges as well as gateways to city centres. Location preferences may shift, but the rail network will continue to support economic activity provided these key interchanges, hub stations, are able to accommodate the mix of travel demands placed on them and support their wider regions.

18. Industrial Strategy Council (2020), *UK Regional Productivity Differences: an evidence review*.
19. Moretti, E (2013), *The New Geography of Jobs*.

The economic and social mobility evidence points to a need to address not just the accessibility needs of those living in the major conurbations. It is easy to overlook the polycentric nature of the North and the Midlands, which could be a risk with a focus solely on strategic corridors (see next chapter) and the big cities.

Because carbon reduction is regarded as a 'quality of life' gain, using current carbon valuation levels which are due to be revised upwards shortly, rail electrification risks being given too little prominence in option testing.

3.0 Creating and assessing packages of rail investment

The Commission developed five packages of rail investments within three illustrative budgets. The first package, compliant with the available budget of £86bn provides for some upgrades of existing lines, including the East Coast Main Line (ECML) and Midland Main Line (MML).[20] The Commission believes this will not achieve the transformational impact it is seeking.

Proposals for further rail investment were identified and grouped into packages based on potential options for eight strategic rail routes:

- Liverpool–Manchester, Manchester–Leeds, and Leeds–Newcastle
- Sheffield to each of Manchester and Leeds
- Birmingham to each of Manchester and the East Midlands
- East Midlands–Yorkshire.

Rather than look at each route (corridor would be more accurate) in turn, the Commission recognised that decisions on investment across these eight corridors are inter-related. It also clearly felt a need to address a question that has been unanswered over the last 5–7 years when candidate rail investments have been developed alongside the plans for HS2, namely: 'which is more important for the North and the Midland economies—better connections within the North or the Midlands, or better between the North & Midlands and London?' Of course, the answer could be (and generally is): some or a balance of both, please.

20. The majority of the £86bn is allocated, in this option, to already committed HS2 expenditure, along with an allocation to Network Rail enhancements, with at least £15 billion for ongoing transformation programmes for decarbonisation, digital signalling and for 'early wins', consistent with the spending on rail investment in the Midlands and the North in the fiscal remit table in the National Infrastructure Assessment (July 2018) which covers the period to 2050. These commitments are rolled forward into the other packages tested.

Instead of simply comparing and contrasting schemes such as Northern Powerhouse Rail (NPR) and Midland Rail Engine (MRE) with the outstanding parts of HS2[21], and in order to ensure that these alternatives were considered within common budget limits, the NIC developed packages of measures that could be characterised as either 'regional' and 'long distance' for two possible budget allocations identified earlier, both of which require an increase in the allocation, of either +25% or +50%.

Regional packages of investment (for the two budget levels) were put together, largely developed from schemes promoted by Transport for the North (TfN) and Midlands Connect (MC). More fully developed versions of these schemes are assumed in the +50% budget package than in the +25% package, and the +50% regional package also includes an adaptation of the first part of the Eastern arm of HS2, with a high-speed line built from Birmingham to the Midland Main Line at East Midlands Parkway. They also draw to some extent on work commissioned by DfT to examine 'strategic alternatives' to relevant sections of the HS2 scheme.

The regional packages both took as given that Phase 1 and 2a of HS2 would be provided, along with the Crewe-Manchester part of Phase 2b which is currently being progressed and readied for a Parliamentary Bill submission.[22] This has an important bearing on the results of the NIC analysis because it means that Manchester (especially) as well as the wider North West and West Midlands have a built-in 'long-distance' connectivity improvement that is not shared by the North East/Yorkshire/Humber or East Midlands. These regions on the eastern side of the country remain unserved by HS2 until the Eastern arm is provided—in whole or part. This is a critical point—as we show later—when the merits of the Regional packages come to be considered.

21. The outstanding part of HS2 is Phase 2b which comprises two elements: connections north of Crewe to Manchester and to Wigan in the west; and a line from Birmingham to Leeds and to south of York in the east. Phase 1 London-Birmingham and Lichfield is under construction and Royal Assent is awaited for a new Parliamentary authority to construct Phase 2a from Lichfield onwards to Crewe.

22. The Rail Needs report says this is included throughout because "it will help deliver the full benefits of HS2 Phase 2a, which already reaches Crewe from Birmingham, and [because] there are no viable alternatives to increase capacity into Manchester." The first part of this argument could be used to contend that the full Eastern arm should also be included; the second part is based on a finding in DfT's HS2 Strategic Alternatives work which is implausible. The fact that Ministers have prioritised the Crewe-Manchester section of HS2 which is subject to consultation prior to Bill deposit is a reality that probably determined this approach. The Commission notes that the government and HS2 Ltd are continuing to prepare legislation for the western leg but only one package includes the Golborne link (the reconnection south of Wigan of HS2 to the West Coast Main Line).

For the two pairs of regional/long-distance packages the Commission selected the following schemes, summarised and set out in Table 1 below.

Table 1: Investment packages specified by the National Infrastructure Commission

Regional links with a +25% budget	Regional links with a +50% budget	Long distance links with a +25% budget	Long distance links with a +50% budget
Major upgrades (including some new line) Liverpool–Manchester–Leeds–York, with improved links to Bradford	Building new lines across the Liverpool–Manchester–Leeds corridor which also serve Bradford	Delivering the full HS2 Phase 2b network to improve long distance connectivity	Delivering the full HS2 Phase 2b network, along with all other schemes in the 'plus 25 per cent' long distance package
A new high-speed line from Birmingham to the East Midlands providing direct services to Nottingham	Increasing capacity between Leeds and Newcastle	Completing the Trans-Pennine Route Upgrade between Leeds and Manchester	Additional tracks for the Trans-Pennine Route Upgrade between York and Manchester
Enhancements across the Midlands (the Midlands Rail Hub[23] scheme)	Upgrading the route from Manchester to Sheffield	Midlands Connect schemes that utilise the eastern leg of HS2	Upgrading connections and capacity from York to Newcastle, and Manchester to Liverpool
Upgrades to the Midland Main Line	Delivering a new high-speed line into Leeds, providing improved journey times to/ from Sheffield		Building Midlands Rail Hub
	Upgrading the Erewash Valley route, as well as the Midland Main Line		
	Building a new high-speed line from Birmingham to the East Midlands and the Midland Rail Hub (both as per the +25% budget option)		

Note that both the +25% and +50% regional packages include part of HS2 Phase 2b, a high-speed link from Birmingham to the East Midlands. In practice, this link could have been categorised as a long-distance link since it would accommodate north-south long distance services such as London–Nottingham as well as regional services such as Birmingham-Nottingham.

23. This is costed at £2bn by Midlands Connect and includes construction of the 'Bordesley Chords', two viaducts creating new routes to the East Midlands and South West from Birmingham Moor Street Station; and the reinstatement of direct services between Coventry, Leicester and Nottingham with investment at Nuneaton.

In addition to the schemes summarised above, there is mention of various improved access arrangements to Manchester and Birmingham Airports, but for neither airport do these improvements appear to envisage new rail links that are not described elsewhere. This means that the potentially transformative short western rail access scheme to Manchester Airport has been overlooked.

An £18bn programme of electrification needed for the North and the Midlands rail network is identified separately. There **is** an allocation for traction decarbonisation (£10bn) within all of the packages, so in effect just over half of the electrification funding needed might to be accommodated in the NIC packaged options. But as it stands, it is unclear where and how the full electrification programme, presumably essential for achieving net zero carbon (but not essential for economic transformation), is to be funded and incorporated into the Integrated Rail Plan.

While there is some more detail of options tested in the report, it is unfortunate that the details of TfN schemes in particular have so far not been published. Neither have their benefit: cost ratios. This lack of transparency is disappointing and might be taken as a sign that they are generally poor performers in economic case terms.

The NIC analysis shows how the overall packages perform against the economic aims, helped by analysis presented at a city level as well as for each package. It is then possible to infer to some extent how well each component part of each packages performs, although there is no quantified analysis at the individual project level. No doubt the DfT will have that information when it comes to setting out the Integrated Rail Plan drawing on the NIC's evidence in due course.

The Commission assessed quantified benefits of each of the packages in terms of:

- improvements to productivity in city centres (from agglomeration impacts)—essentially delivered by rail capacity improvements into cities
- improvements to connectivity from faster journeys, primarily between places in the Midlands and the North, but also to Scotland, and London and other parts of England and Wales and the rest of the world via airports
- amenity benefits from connecting people to services concentrated in cities.

Appraising the Packages—the Commission's findings

The Commission concluded its appraisal in the following terms:

- the package focussing on **upgrades** is unlikely to meet the strategic objective of levelling up in the North and the Midlands. The benefits it delivers are not at scale and would be less likely to trigger long term economic transformation than other packages
- the packages prioritising **regional links** appear to be most likely to bring the greatest benefits, overall, to cities in the North and Midlands and to support levelling up
- there is a strategic case for **increasing the budget to 'plus 50 per cent'**. However, this high level of investment is described as a 'strategic bet' and comes with higher risks. The costs and benefits of all the necessary schemes are not sufficiently well articulated for the Commission to take a firm view on this question of budget enhancement.

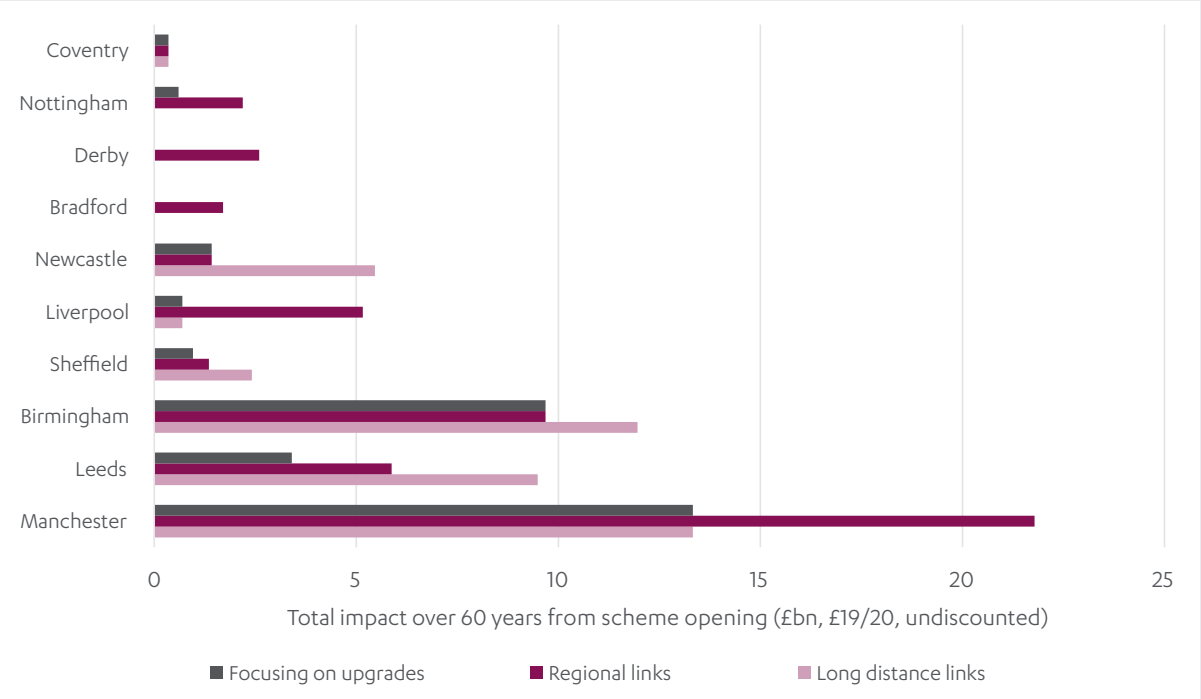
The quantified headline economic benefits across the packages are shown in the table below, extracted from the Commission's final report. Here, benefit values have been discounted in the conventional way, across the lifespan of the investments. The NIC states that "with some assumptions about the monetary benefits of improved connectivity, the benefits of the packages should meet or outweigh the costs [of the relevant packages]".

Package	Economic growth and competitiveness		Sustainability and quality of life		Costs
	Improvements to connectivity from faster journeys	Improvements to productivity in city centres, discounted	Benefits from connecting people to city services, discounted	Environmental impact (combined quantified partial valuation of the loss of natural capital and monetised lifecycle carbon impact)	Net discounted costs without HS2 Phases 1 and 2a, electrification, digital signalling and 'early wins', central estimate
Focus on upgrades	7%-9%	£7-12bn	£2-4bn	-£0.2 to -£0.1bn	£21bn
Plus 25 per cent					
Regional links	9%-15%	£12-20bn	£3-7bn	-£0.4 to -£0.3bn	£36bn
Long distance links	10%-11%	£10-17bn	£2-6bn	-£0.4 to -£0.3bn	£34bn
Plus 50 per cent					
Regional links	11%-19%	£16-29bn	£4-10bn	-£0.6 to -£0.4bn	£49bn
Long distance links	11%-12%	£13-23bn	£3-8bn	-£0.5 to -£0.4bn	£48bn

Source: NIC Report on Rail Needs for the North and Midlands—Figure 5.1 extract.

The benefits from higher productivity (from rail capacity increases) and greater amenity at a city level are shown in the following chart, also extracted from the Rail Needs report.

Figure 5.3: Total impact of agglomeration (amenity and productivity benefits) per city, central estimates[96]



This shows that the **upgrade** package (which includes the whole of the HS2 route from London to Manchester) provides a lot of benefits (as denoted by the grey bars), unsurprisingly to Manchester (c£13bn), and a lot to Birmingham (c£10bn), but much less to Leeds (which gains instead from some investment in the ECML—c£3bn). No other city gains more much above £1bn from this package, with Derby and Bradford gaining nothing at all.

The **regional** links also benefit Manchester most, adding a further £9bn benefits over and above the upgrade package, but every city does as well as/better than in the upgrade-only case. The **long distance** links provide greater gains to Birmingham, Sheffield, Leeds, and Newcastle, reflecting the additional rail capacity assumed to be provided into these cities with the full HS2 scheme.

A further table in the NIC report shows the impact of higher connectivity for the two +50% budget packages. This measure is reflecting overall weighted rail journey time improvements, and Birmingham and Manchester Airports are added to the city list, as well as Glasgow and Edinburgh, as shown below. The measure is designed to inform the benefits at city level of increased 'trade', broadly defined.

This chart shows that both types of enhancement (regional and long distance) are of value, in many places at a broadly similar level under the two packages, but with the regional links (darker colour) adding as much or more value in 11 places and the long distance package adding more value in three English cities (Leeds, York and Newcastle) as well as in Glasgow and Edinburgh. It is clear that while overall the regional packages may perform more strongly, this does not hold for cities to the east of the Pennines in the NIC's analysis.

Wider effects

The NIC report covers a set of wider impacts, including connectivity with Scotland, to airports for international travel, freight, and the need for rail sector de-carbonisation. Each of these are subjects in their own right and Greengauge 21 addressed them in its comprehensive review Beyond HS2, published in May 2018[24] and in the case of Scotland in a submission to the Union Connectivity Review[25]. They are each important subject areas worthy of full attention, but do not appear to significantly affect the key conclusions that emerge from the NIC report. We comment on the implications for freight at a strategic level in the panel below.

Rail freight

The Commission's report covers the needs of railfreight, if briefly. The importance of using rail investment in the North and Midlands is hugely important to deliver carbon reduction by achieving a significant switch of mode from HGV to rail. Here we cover two strategic network issues affecting rail freight.

The NIC report rightly points out that north of Crewe, the West Coast Main Line will remain capacity constrained towards Wigan, Preston and Scotland unless the Golborne link is added back into HS2's plans. This connection has been met with strong local opposition and its future appears to be in some doubt. This does not augur well for the possible NPR scheme from Manchester Airport to Liverpool in this territory.

The alternative to the HS2 Golborne link is to add capacity by upgrading. the existing line via Warrington Bank Quay. There is an implication for the Crewe-Manchester scheme now being progressed. If it is decided to drop the Golborne link and opt for an upgrade approach instead, then the argument that the existing network north of Crewe cannot accommodate more and faster trains (from HS2) into Manchester could be overcome. Freight trains that currently use the Crewe–Manchester line could be switched to travel northwards instead via Weaver Junction, including to Trafford Park with some short new connections.

The second key question is across the Pennines which the Rail Freight Group advises is already turning away railfreight demand because of lack of capacity. Simplistic solutions like adding into the specification of the Trans Pennine Route Upgrade an obligation to provide a single hourly freight path via Marsden-Diggle risk being ineffective. This is because this scheme has no viable plan to create a freight path across Manchester, where even running the 2019 passenger service was found to over-stretch network capabilities. A better approach would be to create freight paths between Lancashire and Yorkshire/North East/East Midlands using the Calder Valley line. This would require electrification and also some localised schemes to provide access to Liverpool docks as well as existing Mersey belt freight terminals, avoiding the need to cross Manchester.

24. http://www.greengauge21.net/wp-content/uploads/Beyond_HS2WEB.pdf

25. http://www.greengauge21.net/wp-content/uploads/Union-Connectivity-Review-Submission-Greengauge-21-response.pdf

There is also a short section on design choices, which while purporting to be about station design—especially for new/high-speed lines—is actually about rail network design. It compares the case for parkway as opposed to city centre stations (seeing the former as risking the loss of agglomeration benefits) and terminus vs through stations (seeing the former as failing to add capacity in the most efficient way). On the latter point, it is certainly clear that one of the major ways by which railway networks across western Europe are being radically improved is by replacing out-dated city termini with new through stations, built underground as needed (Stüttgart, Antwerp, Zurich, for example). These questions about station design have major budget implications and they have strategic effect. The initial thinking of the NIC on this subject area merits further development. How city centre stations are developed—as the NIC notes in respect of Leeds and Manchester, is crucial.

Distinguishing between regional and long distance measures and testing packages of each is a helpful way of exposing which approach has the greatest impact on measurable economic effects. The regional packages do better, but not by much; they also have the benefit of the Birmingham-Nottingham HS2 link which brings with it a long distance connectivity function too. The implication is that it is not possible to conclude that (say) NPR is more valuable than HS2 or vice versa. While the regional package enhances more city economies than the long distance package, there is a troubling exception in Yorkshire/the North East.

4.0 The Commission's Conclusions for the Integrated Rail Plan

The Commission sees a way forward with an 'adaptive' programme. It acknowledges that there could be a case to increase the budget available for rail to the +25% or even +50% category to help fulfil the Government's stated 'levelling up' ambitions. Given its insistence on rail investment being part of a package of measures to improve economic performance, quality of life and better environmental outcomes, this raises questions about the lack of visibility of a comprehensive Government strategy to 'level up'. The Institute for Fiscal Studies found in Autumn 2020 at least eight existing place-based spending programmes relevant to the 'levelling-up' agenda, if not a single overall strategy.[26]

Early Delivery Priorities

The Commission sees where some early delivery priorities might lie based on a common upgrade programme common to each tested package of investments:

- HS2 Phases 1 and 2a, which were not part of the scope of the Rail Needs study and the decision to proceed with them is outside the scope of the National Infrastructure Assessment
- the western leg of HS2 Phase 2b from Crewe to Manchester
- Trans Pennine Route Upgrade, which includes line speed increases and full electrification from Manchester to York and four tracking between Huddersfield and Dewsbury
- East Coast Main Line—including line speed increases from 125mph to 140mph and an upgrade at Welwyn to improve journey times between London and Leeds, York, Newcastle, and Edinburgh

26. See https://www.ifs.org.uk/publications/15055 October 2020.

- Midlands Rail Hub—line speed and capacity benefits to rail links between Birmingham, Leicester, Nottingham, Coventry, Derby, Hereford and Worcester and improved services to Wales and the south west

- Midland Main Line—line speed increases and electrification between Derby and Sheffield

- Manchester to Sheffield—which includes line speed increases in the Peak District National Park and capacity upgrades

- Birmingham Airport Connectivity - improves links to Birmingham International airport and Coventry from Derby and Sheffield in the North and Oxford and Reading in the South.

The Trans-Pennine Route Upgrade and some Midlands Engine Rail schemes could probably be delivered in the 2020s, according to the NIC. The latest delivery timescale of some of these 'early delivery' schemes would likely be for the western leg of HS2 Phase 2b from Crewe to Manchester, which is currently expected to complete in 2038. An implication is that further **major** schemes, none of which are at such an advanced stage as the HS2 link into Manchester, are unlikely to be deliverable sooner than 2038 and most likely into the 2040s.

And within this programme of upgrades, the NIC sees a number of further concerns:

- the upgrades to the East Coast Main Line considered in the package require further development, as these have come out of the work on strategic alternatives to HS2[27]

- further work may be required at Manchester Piccadilly in the absence of (or ahead of) planned Northern Powerhouse Rail infrastructure, and at Edgeley junction, to accommodate the increased frequency of services between Manchester and Sheffield

- there is also a risk around network capacity, as the upgrades between Liverpool and York are unlikely to be able to accommodate expected growth in demand in the medium to long term.

27. Which while developed with some input from Network Rail have only been subject to preliminary work.

Suggested Way Forward

The Commission concludes as follows[28]:

1. There is a strategic case for increasing the budget to 'plus 50 per cent'. However, this high level of investment would be a 'strategic bet' and comes with higher risks. The costs and benefits of all the necessary schemes are not sufficiently well articulated for the Commission to take a firm view on this

2. The Commission has had to develop packages on the basis of existing proposals, which do not necessarily fit within the Commission's preferred adaptive approach, so it is not possible to set out exactly which additional schemes should be considered under an adaptive framework

3. If the pipeline of investments was based on the Commission's 'plus 25 per cent' package prioritising regional links or something similar, then this would provide:

   a) major Northern Powerhouse Rail upgrades (including some new lines between Liverpool, Manchester, and Leeds)

   b) the Trans Pennine Route Upgrade, which includes line speed increases

   c) full electrification from Manchester to York and four tracking between Huddersfield and Dewsbury to allow fast trains to bypass stopping services

   d) congestion relief between Leeds and York

   e) better links between Leeds and Bradford

   f) a new high-speed line from Birmingham to the East Midlands which provides direct services to East Midlands Parkway and Nottingham

   g) an upgrade of the Midland Main Line from East Midlands to Sheffield and Leeds

   h) an upgrade of the East Coast Main Line between Leeds and London, which will also benefit the North East.

   i) line speed and capacity benefits to rail links between Birmingham, Leicester, Nottingham, Coventry, Derby, Hereford and Worcester and improved services to Wales and the south west through the Midlands Rail Hub

   j) improved links to Birmingham International airport and Coventry from Derby and Sheffield in the North and Oxford and Reading in the South, due to the Midlands Engine Rail programme.

28. Extracted from the NIC Rail Needs final report Executive Summary.

4. further schemes or enhancements under a 'plus 50 per cent' budget could include:

    a) a phased approach to the remaining sections of the Eastern arm of HS2 Phase 2b from the East Midlands to Leeds

    b) prioritising improved connectivity between Sheffield and Leeds—as set out in the 'plus 50 per cent' package prioritising regional links and improved connectivity between Sheffield and Manchester

    c) a new line from Manchester to Leeds via Bradford, building on the partial new line option in the 'plus 25 per cent' package.

There is the possibility of approaching the Eastern arm in phases to deliver some benefits earlier, starting with a high-speed line between the West and East Midlands to significantly enhance capacity and connectivity between these two areas.

5.0 Overall Assessment

The National Infrastructure Commission provides a strategic view of a very complex picture in terms of rival and inter-connected possible rail investments across the Midlands and the North.[29]. It is relentless in examining choices in terms of outcomes that Government is seeking and which will justify HM Treasury funding. This is far from a flawed report as critics naturally concerned for their schemes have claimed. It is surely to be welcomed after several years where moving on from a study phase to decision-making seems to have been problematic. It will now be for the Department for Transport to reflect on the Commission's advice and speedily publish the North and Midlands Integrated Rail Plan (IRP).

Early 2021 is not an easy time to be seeking Treasury funding commitments. The Commission wisely talks of an 'adaptive approach' going forward but also points out the need for supply chain continuity of workload. **The question for Government is whether it is prepared to commit to funding rail investment projects in the Midlands and North on a scale that has become common-place in London and the South East to help re-balance the national economy**.

It is surely worth ending a situation of the sort illustrated by a recent and surely embarrassing DfT announcement (23rd January 2021). Under a heading '£794 million investment to boost rail links in north and south', the Transport Secretary announced funding for two rail re-opening schemes: £760m to re-open the line between Bicester and Bletchley in the English Economic Heartlands and £34m to help progress plans to reopen the Northumberland line between Newcastle-upon-Tyne and Ashington, Northumberland. The imbalance is palpable, but not untypical. Over the last 20 years, London and the South East has seen Government funding support the implementation of London's Crossrail, Thameslink 2000, and the East London Line project that allowed the creation of the orbital London Overground, for example.

Of course, there will be some further investments in rail to be made in the South East, but the Integrated Rail Plan (IRP) is a clear chance to set out a plan for the Midlands & North that will enable Transport Secretaries rapidly to reverse the imbalance so clearly evident presently. The Commission has made clear that significant investment is needed in the North & Midlands and is justified by the direct economic impact it is likely to bring.

29. See http://www.greengauge21.net/greengauge-21-welcomes-the-national-infrastructure-commissions-report-on-rail-needs-for-the-north-and-midlands/ (also published in RAIL Issue 922).

In arguing the case for carefully directed rail investment, the Commission has argued that a wider programme of support is needed. It is hard to think of a reasonably recent precedent for such an approach, although it is somewhat easier to envisage and to fashion at the scale of the devolved nations. But in this instance, **Greengauge 21 is of the view that the rail investment programme can act as a beacon project, helping to draw in supporting programmes to the North and Midlands as appropriate**.

It can do this, we believe, provided it demonstrates its green credentials alongside the boost to city and other economies. This implies a focus on electrification schemes for sure, but also planning to bring about modal switch, from less environmentally-friendly ways of travel to the best available for all but the most local journeys (where walk and cycle are unbeatable). The advantages rail offers in taking pressure off the highway network, reducing HGV flows and longer distance car journeys (a good fit with a switch to electric power supply), and reducing the need to travel by air for longer domestic journeys are all relevant to the wide geography covered by rail in the North and Midlands, but are not covered in the NIC's assessment. Taking into account these further benefits, the NIC's conclusions in favour of regional schemes over 'long distance' investments may need some adjustment.

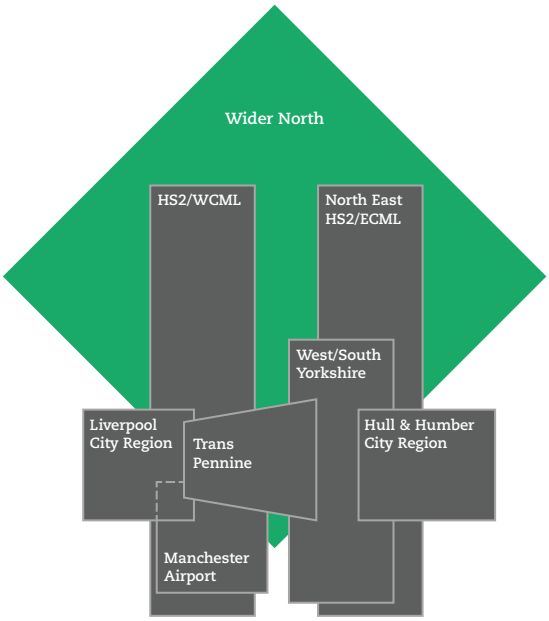
But as we have seen, the regional package presumes HS2 is completed into Manchester and includes making a start on the 'long distance' HS2 Eastern arm, and the suggested programme of upgrades includes further programmes on the 'long distance' rail network, with completion of Midland Main Line electrification through the Midlands to Yorkshire and enhancements on the East Coast Main Line too.

So the 'adaptive programme' of rail investment called for by the Commission could provide, through its series of what we are calling beacon projects a comprehensive way froward, addressing the need to support and strengthen the growth and competitiveness of city economies, and strengthening both regional and long distance connectivity and giving a boost to the nations' green credentials. This would require a significant ramping up of expenditure and resources needed for oversight and managed delivery.

We have shown why planning for a more ambitious budget total is not a 'strategic bet' but an appropriate scale at the +50% level. If this is not adopted as an 'adaptive' funding target (able to adapt as project costs are refined and delivery against budgets and timescales progresses), then there will be scant chance of 'thinking big' for the North and Midlands, as called for by the NIC, nor of building a strong rail programme delivery capability in Britain and gaining the efficiencies from investment (and export potential) that a confident supply chain can bring.

In the main, the Commission's report on Rail Needs is not prescriptive on how sought for economic gains should be delivered. There is a high level of inter-related planning decision-making ahead: looking at oversight on a project by project basis can follow, but forming a strategic plan is needed first—and this will need to be updated as circumstances unfold. Overall, the aim has to be to make all of the major cities attractive, well-connected places to live, learn and create viable businesses, with proper attention given to the many other places that feel (and measure up to be) 'left behind'.

In taking this forward, the Integrated Rail Plan is likely to focus on the large schemes and priorities that need to be set at a high-level. This can set a framework for planning at regional and sub-regional level. It is at that smaller scale that cost-effective solutions to multiple objectives can often be found—for long-distance rail services, local rail, and metro-style services and for freight.[30] A way that the North of England could be sub-divided to facilitate this is shown in the following diagram. Of course, all of the regional/sub-regional elements need to be progressed and coordinated to make a coherent whole and the large schemes provide a framework for that.



There is also the question of whether there are any strategic decisions that could be taken that would reduce the overall capital costs of the major rail projects. Two areas (as of January 2021) remain open to achieve this in respect of the specification of HS2 infrastructure:[31]

- Build the remaining new lines (in effect those to serve the eastern side of the country) to accommodate fast trains that are all designed to run on existing lines as well as HS2 and drop the requirement to be able to operate European-gauge trains at some future date. This would reduce tunnel sizes, structure clearances, and remove the need for dedicated HS2 platforms—offering a significant capital cost saving with only an abstract long term loss of future flexibility

- Eliminate the fixity of high-speed train lengths at 200m/400m. Intercity trains and their stations today are designed for train lengths of (broadly) around 300m length. The HS2 specification risks capacity under-provision (200m) or a need for very expensive station modifications (400m) when a happy medium would avoid both problems.

Enough has been set out on the key rail planning choices to see where the crucial decisions lie. The Commission has made clear that it welcomes any further evidence on what should inform these choices. Having examined these areas at a strategic level over the last few years, and with the advantage of seeing the results of the Commission's analyses, Greengauge 21 is in a good position to help set out how the Integrated Rail Plan might best be framed. There are two areas in particular where we find that the studies to date may have missed the best opportunities, somehow having constrained thinking into solutions that have fairly glaring weaknesses.

30. This is rather like Network Rail's Strategic Modular Continuing Planning process, but with a distinct metropolitan focus added in to address the interface with urban public transport development.

31. Both of these propositions were introduced in Greengauge 21's *Beyond HS2* report of May 2018 and remain relevant today.

We therefore complete this response by setting out options which deserve further consideration under two main headings:

1. **Better, largely east-west, connectivity across the North**—again building on the Commission's findings but seeking to emphasise the criticality of decisions that need to be taken for Manchester and Leeds, and reflecting on this key choice: if the aim is to improve rail capacity and connectivity in the next 10–20 years, then a progressive upgrade programme is the right answer with a fully specified Trans-Pennine Rail Upgrade (TRU) and associated measures put in place. If, on the other hand, it is acceptable to defer until the 2040–50s the transformational benefits that a totally new east-west railway can bring, then a new Northern Powerhouse Railway (NPR), integrated with the completion of HS2 as appropriate is the right prescription. This in truth can't be an either TPU or NPR question: but how is a suitable blended approach to be fashioned?

2. **The East Midlands-Yorkshire connection**. This is one of the eight key corridors identified by the NIC but questions have been raised about the HS2 Eastern arm. In assessing the options that arise, we also cover much of the ground across the Midlands as a whole. We find ways to increase significantly the scope and scale of benefits that could—and we argue—should be realised.

These are the two areas of focus in the next two chapters.

6.0 *The Needs of the North*

The Commission's Analysis

The total costs of all rail investments examined in the Rail Needs study total £185bn. The NIC, recognising that major schemes across the North will take many years to deliver, says it wants to see at least some of the benefits of these investments come earlier. It says in summary:

> ***"Government should commit to an affordable, deliverable, fully costed pipeline of core investments to improve rail in the Midlands and the North. If further funding is available there could then be options to either enhance these schemes."***[32]

This means that the key question around the NPR and TRU schemes should be resolved by an adaptive plan that delivers early benefits and allows more substantial enhancements to follow, avoiding 'over-promising' in the meantime. Both NPR and TRU appear in the regional package in line with the 'plus 25 per cent' budget which specifically delivers:

- major Northern Powerhouse Rail upgrades (including some new lines) on the route between Liverpool, Manchester, and Leeds

- the Trans Pennine Route Upgrade, which includes line speed increases and full electrification from Manchester to York and four tracking between Huddersfield and Dewsbury to allow fast trains to bypass stopping services.

Note these are references to the same corridor. To these two endeavours can then be added the plus 50% package schemes, which usefully improve connectivity with Sheffield and elsewhere[33]:

- delivers wholly new Northern Powerhouse Rail lines on the route between Liverpool, Manchester, and Leeds, which would also serve Bradford (**replacing** the options in the 'plus 25 per cent' package)—emphasis added

32. NIC final report on Rail Needs, p9.
33. NIC final report on Rail Needs, p79.

- increases capacity between Leeds and Newcastle
- upgrades the Hope Valley route from Manchester and Sheffield
- delivers a new line into Leeds off the existing network north of Sheffield.

The implication is that the process of plan adaptation would see the NPR project evolve over time: "further schemes or enhancements might include … a new line from Manchester to Leeds via Bradford, building on the partial new line option [in the initial package].[34].

The subtleties to be unpicked here are to do with the phrases '**building on the partial new line**' and '**replacing the options**'. We take this to mean that early stages of work between Manchester and Leeds could include some new line construction and no doubt some plans for further upgrades which could then be replaced if further new lines (e.g. to serve Bradford) are adopted later. An indication of how this might be achieved in practice is buried in a footnote: "This could be done incrementally. However, it would require passive provision for a new junction on the new Manchester–Marsden line and there would be a significant cost for this flexibility."[35]

The Manchester–Liverpool section of Northern Powerhouse Rail is presumed to be delivered by a 'combination of major upgrade and some new line' and is shown as connecting out of the Manchester HS2 line, south of the new Airport parkway station, taking a westward route via Warrington (new station) and thence to Liverpool in the regional packages. In the 'long distance' investment packages, no schemes are shown for Liverpool-Manchester at the 25% budget level, but the +50% budget package has an upgrade of the existing line **via** Warrington Central.

The NIC concludes that: "The package prioritising regional links can:

- improve the quality of regional, largely east to west rail links between cities in the North, which are generally inferior to longer distance rail links
- focus on schemes that can provide the biggest potential improvements in productivity across the North
- deliver greater improvements to connectivity for several key cities, including Manchester and Liverpool, while also providing significant improvement to a range of smaller places, such as Crewe, Doncaster, Huddersfield, and Warrington, and potentially Hull under the electrification programme
- address the biggest problems of existing poor capacity and connectivity, with significant further capacity added to Manchester and around Leeds, particularly on the route to York
- focus improvement on the journeys that people are most likely to take—into cities from the surrounding area, rather than into London"[36].

34. NIC report p59, again extracting just those elements addressing the North of England.
35. This extract is from footnote 13 in the NIC report.
36. This extract from the NIC report comes from p55, and it has been edited to remove the references to the Midlands for clarity.

The claim here that this would deliver 'greater improvements to connectivity for several key cities, including Manchester and Liverpool' is true but it certainly doesn't deliver any improvement to the connectivity between Liverpool and Manchester. The right approach here is to draw on an original report prepared by the late Professor Peter Hall who, writing with Ian Wray and David Thrower, showed how a programme of progressive enhancement of the existing fast line between the two cities would meet the need. This work was updated and published in May 2020.[37]

As for which schemes could be accelerated in the North, the Commission points to two:

- the Trans Pennine Route Upgrade where work is already underway
- the Hope Valley Line Upgrade between Sheffield and Manchester being taken forward by Network Rail.

It also identifies examples of smaller scale 'early wins' for Newcastle-–Ashington, Darlington and Middlesbrough.

Outstanding Issues

Manchester and Leeds

Within the complex of multiple schemes that have been developed for the North by TfN, supported by DfT, mainly concentrated on improving east-west city-city connectivity to match the gains that HS2 offers north–south, lies the Leeds–Manchester connection. This is of pan-Northern relevance, since it serves places as geographically dispersed as Liverpool, Chester, Hull, Middlesbrough, and Newcastle (as well as Manchester and Leeds, of course).

There is reference to the capacity and station arrangements in Manchester and Leeds in the NIC report. These are crucial to unlocking extra capacity over the core Leeds–Manchester corridor. In general, the NIC makes clear that it finds terminus rather than through stations an inefficient way to add rail network capacity. This is undoubtedly true, yet this is the arrangement planned in both cities. Left unchanged, this is destined to preclude the development of the full range of services that these two major cities and the wider North need and deserve.

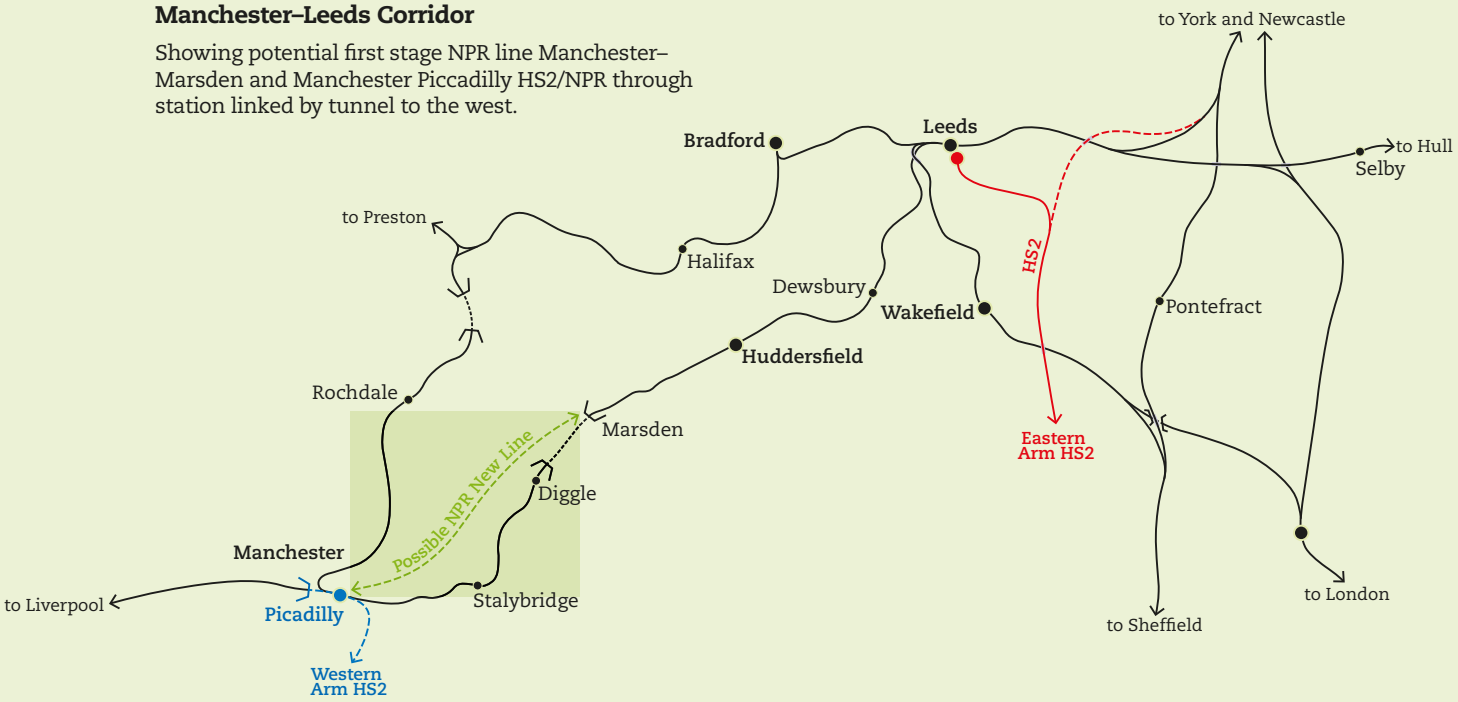
37. http://www.greengauge21.net/revisiting-high-speed-north/

In the case of Manchester, Ministers have agreed to fund detailed design and costing of an underground through station alternative at Piccadilly, that would serve both HS2 and NPR trains. The latter, it is thought, could avoid a need for reversal at the station if the through/underground variant is adopted. But no consideration appears to having been given to how this will support the objective of faster, more reliable services linking the major centres on the Liverpool–York axis. On current plans—reflected in the regional package variants, current Liverpool–Manchester timings will be **slower** because to access the new HS2/NPR station trains will have to operate over a new circuitous route via the new HS2 Airport parkway station and Warrington, where a new low level station is envisaged at Bank Quay. They will then take longer to progress onwards towards Leeds too, having either to accommodate a train reversal or negotiate a 120° curved tunnel under central Manchester.

A far better approach was set out in Greengauge 21 work in 2018.[38] This would provide a direct tunnelled route to the west from an underground version of the through station at Piccadilly, providing quick access to the fast line from Manchester to Liverpool and avoiding the need to create the 120° curved tunnel, so speeding up the route onwards to Leeds (and Sheffield). Unless this variant is assessed too, the option selected at Piccadilly is bound to be inadequate or regressive.

Manchester–Leeds Corridor

Showing potential first stage NPR line Manchester–Marsden and Manchester Piccadilly HS2/NPR through station linked by tunnel to the west.



For Leeds, the need is to increase the proportion of platforms available for through east-west services, as necessary at the expense of terminating (bay) platforms. Current HS2 plans envisage doing the opposite—adding more terminating platforms, driving up the need for passengers to change between trains and precluding the development of convenient and efficient through train services, both at a regional and long-distance level. Transport for the North as well as the NIC have been strangely silent on this matter.

38. See *Beyond HS2*, Greengauge 21, May 2018, p103.

In both cases, the capability of the city centre stations has a huge effect not just on the cities themselves, but also on the constellations of towns where rail use is likely to entail travel via Leeds or Manchester (sometimes both), either on through cross-city trains or using the city centre stations as an interchange.

Sheffield and Leeds

The HS2 project provided a partial answer to the transformation needed in what is at best a slow rail connection today (over 40 minutes) between these two Yorkshire cities. But it would entail use of a lengthy section of existing line (18 miles, with multiple local stations) northwards from Sheffield and then rely on an additional HS2 junction being provided to reach the main part of Leeds station, again over existing lines. Yet this is the corridor with the North's strongest volume of cross-commuting between free-standing major cities. Creating a faster, electrified, route using HS2—which was the presumption in delivering Northern Powerhouse Rail is not provided for in the HS2 project budget.

Worryingly, local proposals have referred to the possibility of extending tram train along the critical section of line between the two main cities, from the current terminus at Rotherham Parkgate. Another idea floated is the creation of a new parkway station to serve the wider Barnsley/Dearne Valley areas, at which no doubt, longer distance and fast Leeds–Sheffield services would be expected to call. The Commission's report does not comment on this, but it is clear that it does not favour parkway stations where there is an urban centre alternative. We share this view, and instead have proposed that London–Sheffield HS2 services are extended to Barnsley (and possibly Wakefield too). An urban centre focus (Barnsley has an excellent public transport interchange) in combination with further Supertram extensions running on their own right of way would be a sound approach, bringing inter-regional and local connectivity together to create a good low-carbon transport system that reduces reliance on car use and availability.

That still leaves a question on how to speed up the Leeds–Sheffield connection and it would seem most likely that a new connecting line from the Ackworth area to near Methley might be the best approach, but clearly this would need further study.

Bradford

There is no doubt that Bradford is poorly served by the national rail network. As the Leader and CEO of the City Council put it recently:

> ***"We are the nation's eighth largest economy; the UK's youngest city bursting with talent; home to world-renowned industries, university facilities, advanced manufacturing, filmmaking; and we have the ability to enable clean growth industries. Despite this, we remain the largest city in the UK not on a mainline train line."***[39]

39. How Bradford's future success depends on Northern Powerhouse Rail—Susan Hinchcliffe and Kersten England | Yorkshire Post 22/1/2021.

The failure to create a cross-city link across Bradford a century ago needs to be put right. There are several ways to achieve this. The approach favoured by the city's leaders is likely to be the most expensive and take longest to deliver: it would place Bradford as an intermediate station on a new Manchester-Leeds NPR line. Other approaches that achieve similar outcomes in terms of transformed access to Manchester (currently 56 minutes away) and quicker access to Leeds (currently 20 minutes for a journey of 9 miles) that can be delivered more quickly need to be examined. Ways to place Bradford on 'a mainline train line' much sooner are discussed further in the next chapter.

Liverpool, Hull, Tees Valley, and Newcastle

We have seen that current thinking on NPR will not deliver faster journey times eastwards from Liverpool. It would make much more sense to concentrate effort on increasing line speeds and adding further capacity to the existing fastest, newly electrified, and most direct route via Newton-le-Willows. It should be possible to commission and implement the first stage of these works before the bi-centenary celebrations in 2030 of the opening of this, the world's first inter-city railway.

The lines to Hull and Middlesbrough[40] need to be electrified to ensure the most efficient operation of through services. Hull–Leeds timings in particular could then be improved. Newcastle–York is highlighted in the NIC's work for upgrades which are expected, in combination with improvements between Leeds and York, to add capacity and to be able to deliver significant route acceleration, with Leeds–Newcastle trains saving 26 minutes. Much of this saving would also translate into faster journey times for Edinburgh–Newcastle–London services. These developments are of considerable importance to gaining benefits to the eastern side of the country as covered next.

40. Tees Valley is looking to pioneer the use of hydrogen power for its local train services and electrification would complete this area's green transport credentials.

7.0 Connecting the Midlands to Yorkshire

With the London-Manchester HS2 line taken as a given in the Commission's work, any assessment of further options is likely to leave the eastern side of the country at a disadvantage unless specific effort is made to redress the imbalance. **There is little merit in addressing the north-south divide only to create a new east-west divide. It is essential instead that the IRP commits to early and sustained investment for the eastern side of the country**.

Reality dawned for the NIC: the Eastern arm of HS2—which was always intended to balance the project's benefits east and west—is weaker than the Western arm. This is because it is now evident that:

- it cannot accommodate so many train paths to London (two thirds at least will already be taken up by Western arm services)
- it is unlikely to be deliverable until the 2040s while the western side of the country will benefit from HS2 opening probably at least 10 years earlier. Business location decisions will follow the trace of certainty that a committed rail project brings.
- places beyond Leeds either are not served directly (Bradford for example) or can be reached from the capital almost as quickly if the East Coast Main Line is upgraded further: it is more direct, even if not offering such high operating speeds as HS2
- it fails to serve directly significant 'intermediate' cities (again in contrast to the western arm, which will provide HS2 services to Stafford, Crewe, Stoke on Trent, Warrington…).

To these limitations, we must add a fifth: the Eastern arm as planned, unlike HS2's Western arm, is very poor at releasing capacity on existing lines. In particular, it will not free up any paths over the Midland Main Line into London St Pancras.

Nevertheless, the NIC report does not rule out completing HS2's Eastern arm in full. But even if a budget for rail in the North/Midlands allocated regionally on a per capita basis to aid levelling up is increased by 50%, it would not then also be possible to fund Northern Powerhouse Rail according to the Commission. It is right to look at cost effectiveness and ways of delivering the sought after economic, quality of life and environmental benefits at lower cost to the Exchequer, but investment priority choices have to be made.

Rightly, the Commission has raised the prospect of considering changes to the Eastern arm of HS2 that could start to address its design weaknesses. **The Integrated Rail Plan should establish a priority task force to examine the options available to ensure that the eastern side of the country is not disadvantaged. Significant expenditure is unavoidable, but the benefits could be very much greater than with the original HS2 eastern arm concept. Planning is lagging compared with the western side of England, and this must be put right as a matter of some urgency. Benefits could be delivered early for the East through a phased implementation approach**.

HS2's Eastern Arm as planned misses major cities

Numbers show city travel to work area populations in 000s (data source: Commission report)

Greengauge 21 has examined the current plans for the Eastern HS2 branch in earlier studies.[41]. Newly armed with the Commission's analysis, we are now able to take this much further. As the Commission's report says:

> ***"It is worth emphasising the scale of work involved in some cases, particularly potential strategic alternatives to the full eastern Leg of HS2 if these are to be considered. Further work will be needed to assess the costs and benefits of these potential strategic alternatives, but also to ensure that they are optimised to deliver benefits to the key places on route."***

The Commission concluded that the Eastern Arm of HS2 could not be recommended at this stage because, if it was, then budget constraints would preclude also including the Northern Powerhouse Rail project. The report suggests that an adaptation of the cross-Midland part of the Eastern Arm should proceed since this provides significant gains in regional connectivity, with the option of completing the Eastern arm in full later.

41. See http://www.greengauge21.net/what-is-the-purpose-of-hs2s-eastern-arm/ July 2016.

HS2 was formulated in a Y-shaped form in 2010[42] with a stated objective of linking Leeds (along with Manchester and Birmingham) to London. There was no remit to serve intermediate locations. Table 2 illustrates the impact of this approach. The Eastern arm provides additional capacity only into Leeds, and connectivity gains to other cities are limited by the design of the Eastern arm, which serves Derby and Nottingham only by local connecting services, Sheffield only by means of a lengthy loop line, and Bradford only prospectively if an additional connection is provided to create a route (largely over existing lines) via Wakefield. It makes little sense to serve directly a city with a travel to work area population of 800,000 and ignore the possibility of serving four cities with a combined population of over 2.1 million in the same corridor.

Table 2: Travel to Work Area (TTWA) populations (000s) and HS2's Eastern arm

Cities directly connected by HS2 Eastern Arm	TTWA population	Cities missed by HS2 Eastern Arm	TTWA population
Leeds	800	Bradford	550
		Sheffield	850
		Derby	450
		Nottingham	820

Data source: NIC Rail Needs Final Report.

The NIC report has suggested that an adaptation of the cross-Midland part of the Eastern arm should proceed since this provides significant gains in connectivity, and the option of completing it in full later. The cross-Midland section of HS2 would follow much of the planned full Eastern route but would provide a new connection into the Midland Main Line such that services could continue onwards from HS2 to Nottingham and to Derby/Sheffield over existing lines (which would need to be electrified and could be upgraded too). It provides a fast Birmingham-Nottingham link—27 minute journey times rather than 72 minutes today. But, as we will show, its function extends well beyond that.

Stakeholder reaction has been largely negative, with calls for a commitment to the full original scheme. Local authorities have of course developed plans for the new HS2 stations planned at Leeds and at the one intermediate station at Toton. But this location is not favoured by the NIC, which in general cautions against parkway-style stations rather than those in city centre locations.

42. http://www.greengauge21.net/government-abandons-the-s-shaped-network/

Three Options for East Midlands–Yorkshire

Given a commitment to early implementation of a West-East Midlands section of HS2 there are three choices for the route further north to Yorkshire:

1. The original HS2 high-speed line
2. An upgrade of existing lines
3. Extending high-speed services through Nottingham, re-joining the East Coast Main Line near Newark.

The merits of each of these options is circumscribed by the HS2 configuration and capacity of the wider HS2 network. Specifically:

- **The capacity limits of HS2's trunk line from Birmingham Interchange to London Euston**. It appears unlikely that the originally conceived 18 trains/hour capacity over this common section of route will be available given the emerging plan for a single-phase development at Euston. Path capacity over this section may be restricted to 16 or even 14 trains/hour, and this would leave only 3-5 paths/hour for London trains from the Eastern arm

- **The configuration of HS2 stations at both Birmingham and Leeds as terminals** which rules out the operation of through services over routes such as Newcastle-Leeds-Birmingham-Bristol—the country's main cross country corridor.

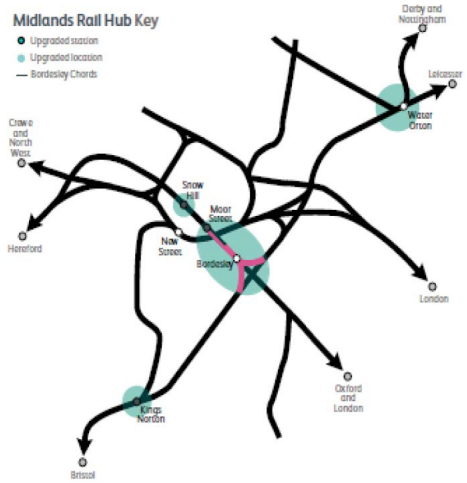
It is important that the third problem is overcome because otherwise the Eastern arm of HS2 risks being under-utilised. **Birmingham–Leeds is part of the rail network's prime cross-country corridor. For HS2 to be effective in this corridor, a way needs to be found to allow longer distance cross-country services to gain from the improved connectivity that high-speed rail infrastructure is designed to provide**.

Fortunately, a much improved cross-country capability can be created for each of the three options. The solution at the Birmingham end of the corridor was identified by Greengauge 21 in its 2018 work[43]. Its adoption allows longer distance trains using the Eastern Arm to serve Birmingham and continue southwards—to Cardiff, Bristol, Plymouth, and Southampton.

The critical step is the implementation of the Midlands Rail Hub scheme (see plan below), and this is fully supported in the NIC report. This scheme provides new connections from the north and south into Birmingham's Moor Street station which is adjacent to and connected with the new HS2 station being built in Birmingham at Curzon Street. Some of the new capacity that the new connections would provide would be used by the long distance cross country services which currently use New Street station in Birmingham but this station (unlike Moor Street) cannot be connected with the Eastern Arm of HS2.

43. See *Beyond HS2*, Greengauge 21, May 2018.

Midlands Rail Hub



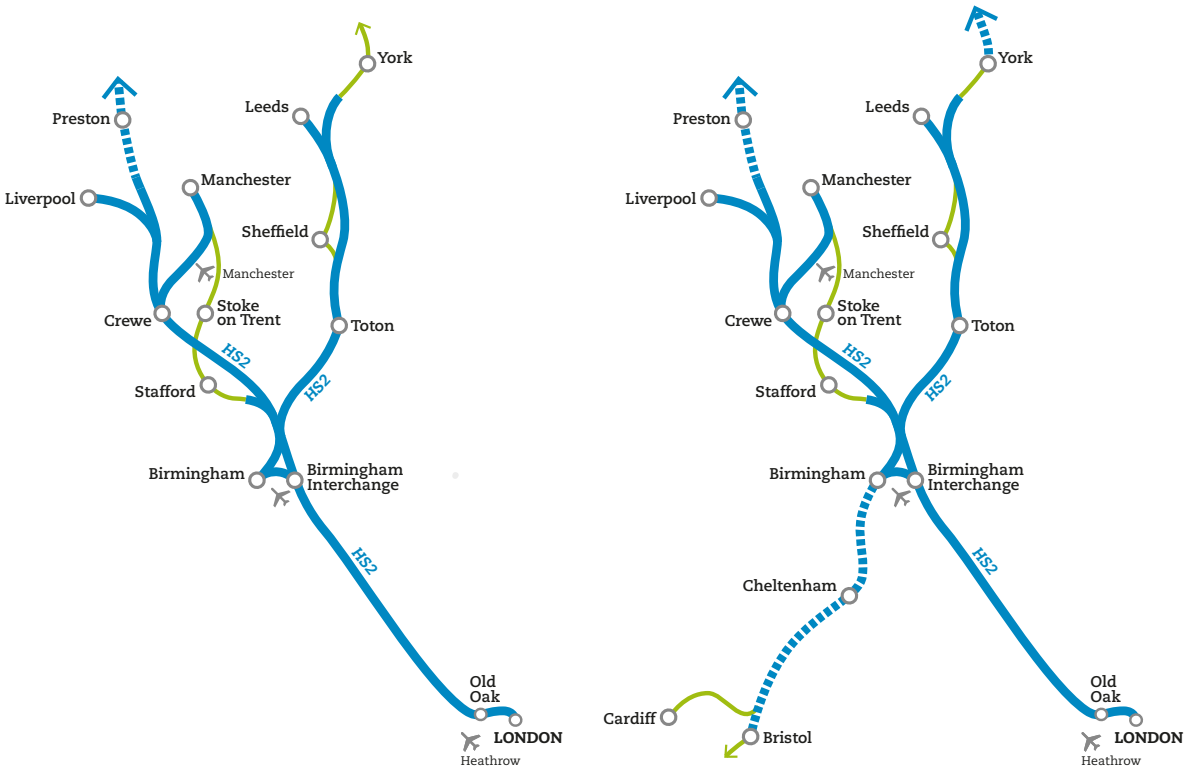
In effect, this development would complete a switch of longer distance services at Birmingham to Moor Street/ Curzon Street, with additional capacity being freed up for commuter/regional services at New Street, just as Midlands Connect are seeking, but with inter-regional (cross-country) services included in the mix.

This approach works with each of the three E Midlands-Yorkshire development options, although the details vary in terms of likely train service specifications. In effect, instead of a Y-shaped network, HS2 would become X-shaped, with the intersection centred on Birmingham. The key point is that this opens up many more locations to benefit from the capacity relief and speed-ups that high-speed rail investment can bring.

Next, we need to examine the three options carefully in a strategic assessment, with costs and service parameters developed so that benefits can be compared, extending the initial work by the NIC.

Changing HS2 from Y-shaped to X-shaped

Source: *Beyond HS2*, Greengauge 21, May 2018



Option 1: the original HS2 proposal

The 'complete HS2 option' needs to be considered in light of the revised capacity of the route into Euston. The original intention was to operate the following service pattern of 6 London trains/hour and 3 Birmingham Curzon Street trains/hour [44]:

2 trains/hour Newcastle–London Euston
1 train hour York/Sheffield–London Euston
2 trains/hour Leeds–London Euston
1 train/hour Leeds/Sheffield–London Euston
1 train/hour Newcastle–Birmingham
2 trains/hour Leeds–Birmingham.

As noted above, it now seems unlikely that all of the six trains/hour on this list could be operated into Euston. Those from Newcastle and York gain least time savings over trains routed over the East Cast Main Line.

It is also worth questioning the value of the (very fast) Leeds–Birmingham services. If these run as planned as terminal to terminal shuttles, then they will only serve the West Yorkshire-West Midlands rail travel market. In their report, the NIC noted that 'only' 10% of Yorkshire/Humber's rail travel was to/from London. **The flow to/from the West Midlands is one seventh of the size of the London market**.[45] The economics of such a limited service as Leeds-Birmingham must be in doubt, giving further emphasis to the need to convert HS2 into an 'X' shape, as noted.

This part of HS2 (and indeed the section from Crewe to Manchester) have adverse implications on the national motorway network: as pointed out by Highways England construction of a route that follows the M1 closely is likely to be disruptive for motorway users.

Best value from this option to build out the full Eastern arm is likely to rest on:

- A set of London HS2 services reduced in frequency (perforce) to serving Leeds 2 trains/hour, and (using the revised 'first stage' alignment) Sheffield via Derby (1 train/hour), and. Nottingham (also 1 train/hour)[46]

- Cross country services between Edinburgh-Newcastle-York-Leeds-Birmingham-Bristol/Cardiff 2 trains/hour (requires electrification Bromsgrove-Bristol Parkway) and operation of HS2 line trains into Leeds station's through platforms rather than the HS2 terminus

- Nottingham-Bristol/Cardiff/Southampton 1 train/hour (requires electrification Birmingham-Didcot and Reading-Basingstoke).

44. Source: HS2 Phase 1 Final Business Case, DfT, April 2020.

45. Source: ORR, regional flow tables, 2019.

46. If a suitable station site can be provided at East Midlands Parkway or nearby, the Sheffield and Nottingham services could divide and join there, doubling through service frequency but incurring a time penalty as portions are attached/detached.

Total utilisation is 7 trains/hour but, in addition, provided a suitable upgrade can be incorporated from Sheffield, there could also be Northern Powerhouse Rail services operated between Sheffield and Leeds. But the case for the new HS2 terminus station at Leeds would be much weakened and there would be no case for the Leeds eastern 'bypass' HS2 line.

Option 2: Upgrading existing lines

The NIC report noted the opportunity, as an alternative, to upgrade the Erewash Valley line north to Chesterfield which lies slightly to the west of the planned HS2 alignment. The route onwards to Leeds would require an upgrade of what was once a main line but is now largely used only for freight—the 'Old Line' **via** Rotherham Masboro'. If the aim was to achieve fast Leeds journey times in the absence of new high-speed lines north of Trent, then there would be no intermediate stops. Services to/from Sheffield from the south could also use the enhanced Erewash Valley line, which would presumably be upgraded to 125 mile/h operation where feasible. This concept was examined in DfT's Strategic Alternatives work in preparing the case for HS2.

Service plans could be similar to the full HS2 case, except that the scope to accommodate an NPR service between Sheffield and Leeds would be lost (although a more localised scheme could provide this capability). Whether Sheffield–London HS2 trains would be routed **via** the Erewash Valley line or via Derby would need to be considered carefully. An option that might also be considered with an improved 'Old Line' would be operation of East Midlands–Sheffield–Manchester services avoiding both the reversal at Sheffield station and the need to double-back between Dore and Sheffield.

Option 3: Extension north of Nottingham via the East Coast Main Line

This concept was documented in an earlier Greengauge 21 report.[47] There it was envisaged that the trans-Midland HS2 route would lead directly into Nottingham, similar in effect to the suggested first stage Eastern arm scheme in the NIC report. From Nottingham the route would continue in a north-eastwards direction over an existing line (suitably upgraded) to Newark, where it would join the East Coast Main Line for onward travel northwards to Yorkshire and the North East.

This approach required an adaptation of the southern part of the Eastern arm of HS2, and the NIC has developed this further with a plan to join the Midland Main Line, possibly at East Midlands Parkway (or a nearby location). This would allow services to continue northwards to Derby or over the Erewash Valley line to Sheffield as well as into Nottingham.

Extending services through Nottingham (rather than terminating there) has the advantage that it reduces platform dwell times at the station. The level and mainly straight line onwards to Newark and Lincoln has spare capacity (there are only 2 passenger trains/hour in each direction) and a new high-speed connection with the East Coast Main Line would avoid the 'flat crossing' of lines at Newark itself.

47. http://www.greengauge21.net/what-is-the-purpose-of-hs2s-eastern-arm/

There are the three key virtues of this approach:

- Long-distance cross country trains routed south of York via Doncaster to reach Birmingham and places further south which currently run hourly could be re-routed to operate via Nottingham rather than Sheffield (which remains served by cross country trains on the route via Wakefield and Leeds) and would be speeded up by around 22 minutes making use of the faster operating speeds of the East Coast Main Line. This time saving applies to many key station-station flows on the long distance cross-country network. New flows could become viable with this quicker route: a new Hull–Nottingham–Birmingham service could join the cross-country network, for example.

A new long distance cross-country route using HS2 via Nottingham and Doncaster

Also showing existing routes via Leeds–Sheffield and Doncaster–Sheffield

- Excitingly, this connection would provide an alternative route from the East Coast Main Line into London from the suggested new junction near Newark. London journey times would be similar either via the East Coast to Kings Cross or HS2 through Nottingham. North of Newark, the case for investment in new high-speed rail capacity would be much stronger than in the Midland Main Line corridor that HS2 follows: there are many more trains that could benefit from any speed up. These would not only be all those existing services over the ECML, but also any services serving Nottingham from the south over HS2 that could be usefully extended. This is a way to bring the benefits of HS2 (and by implication a HS3 route) to the whole of Yorkshire/Humber and the North East and not just to Leeds

- London-Nottingham HS2 services could be extended immediately to Lincoln. A Lincoln-Newark–Nottingham–London HS2 service would replace current Lincoln–London Kings Cross services and this means that this option also frees up some capacity over the critical south of Hitchin section of the East Cast Main Line. But with a new connection made from the Nottingham–Newark line to the East Coast Main Line, any service that operates over HS2 from London to Nottingham could be extended northward over the East Coast. This creates the opportunity to switch further ECML services over to HS2 (if say Nottingham–London HS2 frequency is increased to 2 or 3 trains/hour) feeing up valuable capacity over the very intensively used southern section of the ECML from Hitchin to London Kings Cross.

Leaving aside the prospect of later high-speed investment in the East Coast Main Line corridor, the type of interim service plan that could be operated over the cross-Midland link would be as follows:

1 train/hour Bradford–Leeds–Nottingham–London Euston
1 train/hour Sheffield–Chesterfield–Derby–London Euston[48]
1 train/hour Lincoln–Newark–Nottingham–London Euston
1 train/hour Edinburgh–Newcastle–York–Nottingham–Birmingham–Bristol/Cardiff
1 train/hour Hull–Doncaster–Nottingham–Birmingham–Oxford–Reading–Southampton
1 train/hour Leeds–Sheffield–Derby–Birmingham–Bristol–Plymouth.

The Bradford-Leeds–London service via Nottingham would be quicker than the regular Leeds-Kings Cross train and by operating across Leeds without reversal (via Hambleton Junction) would provide a much faster, regular hourly connection for Bradford, and reduce platform occupation times at Leeds station.[49] It would of course also transform the Leeds and Bradford–Nottingham journey times and validate providing Nottingham with a half hourly HS2 service to London.

Overall assessment

All three options would mean that Leeds station would still need extra platform capacity, and all three options would leave open the possibility of providing a new station at Toton. Options 2 and 3 which rely on a re-alignment of the HS2 route where it reaches the Midland Main Line, opening up the possibility of a further major related development at the Ratcliffe Power station site/East. Midlands Airport.

Journey times to London are preliminary estimates in the comparative Table 3 below and are mainly taken from the NIC report, where they carry the caveat of being 'developer's estimates'. We have added our own estimates of travel times achievable with Option 3. Each option presumes that the NIC's favoured approach of developing a first stage trans-Midland section of HS2 proceeds as a priority.

It is notable that very significant improvement in Leeds–London timings is possible with some enhancements using existing rolling stock. The current once/day fast Leeds–London (King's Cross) train is fully 15–20 minutes quicker than the regular half hourly services through the day. To improve Leeds–London journey times further requires avoiding the slow Doncaster–Leeds route, eliminating intermediate stops, and making full use of the ECML's train fleet 140 mile/h capability. Removing the one remaining intermediate stop from the current once-a-day fast train also speeds end to end journeys but of course loses demand and value. On the other hand, putting in extra stops beyond Leeds of course doesn't affect the Leeds–London journey times and ensures the benefits are spread beyond a single city. By routing fast Leeds trains via Hambleton (as GNER once intended), they can be readily extended without reversal at Leeds onwards to Bradford (or Harrogate/Skipton). This has the benefit of reducing platform occupation at Leeds too. This approach requires electrification of the Leeds–Selby (part of the Leeds–Hull route that the NIC suggest needs to be electrified), and a station upgrade at Bradford. Not all connectivity gains require major capital outlay.

48. Sheffield–London HS2 services could be started back at Barnsley, or Wakefield or even Leeds. Sheffield–London journey times would be little different from those achieved with the 'full' Eastern arm.

49. Alternatively, the fast Bradford-Leeds–London services could retain their route into Kings Cross and another ECML service could be switched to operate over HS2, for example: Edinburgh-Newcastle-Darlington-York-Nottingham-(HS2)-London.

Table 3: Eastern arm corridor options connectivity assessments

	Current regular hourly timings (not fastest)	Option 1 HS2 as planned (with/ without Leeds Eastern bypass)[1]	Option 2 Erewash Valley Line etc upgrades[2]	Option 3 Nottingham Newark line with a connection to the ECML	Option 3 with ECML corridor investment in HSL[3]
Leeds–London	2h13 (2h19 in peak periods)	1h21	1h33	1h53	1h30 (to Kings Cross)
Newcastle–London	2h50	2h50 (via ECML; 2h17 if using HS2 feasible)	2h50 (via ECML) c 2h30 if via Erewash Valley	2h45	2h15
York–Birmingham	2h22 (via Leeds) /1h51 (via Doncaster)	As current; HS2 inaccessible	1h55	1h29 (via Nottingham/ ECML)	1h09 (via Nottingham/ ECML)

[1] The Leeds eastern bypass would not be worthwhile with the limited number of trains using it if the full set of London HS2 paths is not available to the Eastern arm of HS2. If HS2 trains serve Leeds station's through platforms, London HS2 timings would be about 2 minutes longer.

[2] Here we judge the 'promoters" estimates to be optimistic. We have not accepted the 'optimistic' Leeds-Birmingham timing in the NIC report for the Erewash Valley line upgrade which posits a Leeds-Birmingham time as fast as that achieved by HS2.

[3] Assumes an 80-mile HSL southwards from Temple Hirst junction.

In comparison with HS2 timings, Option 3 with a section of HSL in the ECML corridor would be quicker than HS2 for locations such as Newcastle (and many other ECML destinations such as Bradford, Hull, Tees Valley, Edinburgh, and other Scottish cities), but about 9 minutes slower than Option 1 for Leeds–London journeys. It would be much quicker too for many cross country journeys over the core section between York/Doncaster and Birmingham. This development could of course, besides enhancing the rail network for Midland and Northern English destinations, help achieve greater connectivity through an enhanced East Coast Main Line for Scotland too: London ECML services reach Edinburgh, Glasgow, Stirling, Perth, Dundee, Aberdeen, and Inverness. Investment here rather than further north either side of the England-Scotland border would likely bring much greater capacity benefits, and so is of relevance to the Union Connectivity Review, currently under way.

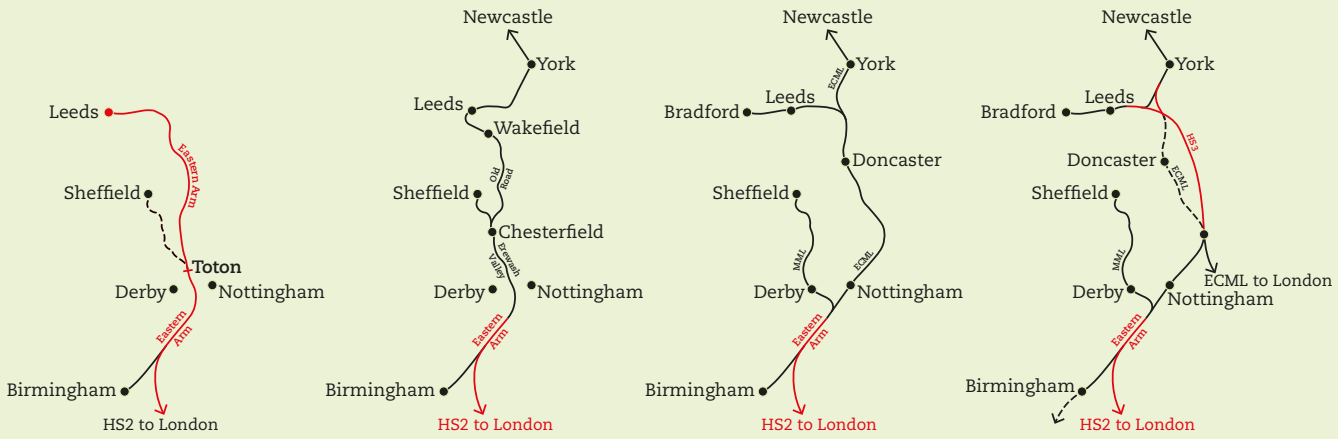
Option 2 timings are given in the NIC report but need further development dependent on the detail of the upgrades proposed.

Option 3, using HS2 from the south into Nottingham, an upgraded link to Newark and then a new high-speed line section in the less-intensively developed and easier terrain of the ECML corridor, would offer many places greater connectivity gains than HS2 achieves. Compared with Option 1 (the original HS2 proposal) only the Leeds–London HS2 time would likely be slower and then by only an estimated 9 minutes; all other journey times from across Yorkshire/Humber and the North East (and Scotland) to London would be quicker. Option 3 offers flexibility in enhancing services for the east side of the country that is lacking in the original Eastern arm plan.

All three options could also support new, faster, services extended northward from Leicester and the Midland Main Line to destinations in Yorkshire and beyond.

Because of the design of the HS2 station at Leeds, Option 1 can probably only offer connectivity improvements to Leeds and Sheffield in the North, whereas Option 2 (and especially) Option 3 opens up the prospect of a much broader set of places that could gain significant connectivity—and hence economic—benefits.

Capital costs are likely to be greatest for Option 1, but it is too early to provide estimates (and indeed the cost of HS2 north of Trent is unknown).



Option 1: HS2 as originally planned

Option 2: Upgrade Alternative

Option 3: First Stage

Option 3: Second Stage

The strategic case for new high-speed lines rests on the added economic value they can bring (as explored by the NIC) plus two other crucial effects. These are:

- Diversion of traffic from more carbon intensive modes of travel—especially from short-haul air flights and switching from freight from HGV road haulage to rail; and

- Freeing up capacity on main lines (and not just into city centres in the North and Midlands).

Option 1 performs weakly on both these accounts. Because it serves neither Derby nor Nottingham except by rather slow local transport connections to/from Toton, it is hard to see how any capacity southwards over the Midland Main Line (MML) would in practice be released. It would be difficult to justify, on the back of a high-speed service from London to Toton to remove either of the pair of hourly trains that separately serve Nottingham and Derby: one fast in each case, the other providing direct connections to a series of important intermediate locations. On the other hand, Option 1 would free up some ECML capacity.

With Options 2 and 3, on the other hand, there would be much faster direct services to London from the city centre stations in both Derby and Nottingham (as well as Sheffield), meaning that the existing MML 'fast' services from Sheffield/Derby and Nottingham could be taken out. This could provide extra MML capacity for rail-freight and/or permit the introduction of new services that currently cannot be accommodated. A suitable passenger service candidate would be a new hourly train operating Mansfield–Sutton Parkway–Kirkby-in-Ashfield–Ilkeston–Toton (new station) to London via Leicester, providing Mansfield with a through London service, and hopefully having a similar beneficial effect to that experienced by Corby, further south.

Option 3 would provide some capacity relief as soon as a London-Nottingham-Lincoln service is introduced over HS2, replacing Lincoln–Kings Cross services. Up to the limit that Euston can accommodate, this option provides flexibility, as further services from the northern part of the East Coast Main Line could be switched to operate into Euston via Nottingham and HS2, freeing up further ECML paths further south into Kings Cross.

The approach of upgrading the ECML to 140 mile/h operation north of Peterborough requires no new rolling stock. **All long distance services could be speeded up. Much faster London-Leeds-Bradford journey times could be provided than by today's services, accessing Leeds from the east via Hambleton Junction. Without a need to reverse at Leeds, Bradford would find itself as the terminus station on 'a main line train line'**.

So, there are plenty of reasons, even from this preliminary overview, to suggest that the original HS2 plan may not be the best option available. The analysis here has shown how important the East Midland-Yorkshire connection is; the NIC was right to include it in its consideration of the strategic corridors. But it looks like there could be better ways to deliver this connection than current HS2 plans suggest.

8.0 Conclusions

The National Infrastructure Commission has produced a report of significant value. It will form a key input into the Integrated Rail Plan for the Midlands and North which the Department for Transport is hoping to publish within the next few weeks.

The NIC has wrestled with an inter-related set of projects that have a total cost of £185bn. They have suggested an 'adaptive' approach' which entails phased implementation. Realistically, this is the only approach possible. With proper planning, this is an approach that can help build a strong supply chain, and help businesses invest with certainty.

Critics of new rail/high-speed rail expenditure will suggest the capital cost figures used are wildly under-estimated (they always do); proponents of the various schemes have responded to the NIC's reasoned assessment by demanding that all of the projects be funded in full. None of the responses have suggested how cost savings could be found. This report has proposed two key cost saving measures based on technical scope that have minimal downsides.

The Commission suggests a strategic case could be made for increasing its allocation of capital budget to rail in the Midlands and North. It had spelt out in July 2020 how this budget would be calculated (it operates under a cap set by Treasury, expressed as proportion of national GDP). It is not enough, however, to fund more than currently committed HS2 spend (including the line from Crewe and Manchester which Government has prioritised as the next stage after Phase 1 and 2a) along with a (substantial) programme of line of route enhancements. These measures alone, the Commission figures, would not be capable of supporting a transformational effect on the North's economy.

We agree they were right to test, therefore, additional spends of +25% and +50% over and above their original budget allocation. We do not agree that there is undue risk in doing so; our assessment shows that this increase would be fully appropriate (in essence because HS2 expenditure benefits the south of the country as well as the north, and this has been ignored). But even with a budget increased by 50%, the Commission finds that 'difficult choices' have to be made, and priorities set.

The NIC should not be criticised for shedding light on how well the various schemes are likely to contribute to strengthened (city) economies, to providing added amenity and improved quality of life. It is a relief that their approach was not reduced to an over-simplistic question of where the largest benefit:cost ratio was to be found—an approach which in the past has led to implementing major rail investment projects in London/the South East, but not in the Midlands and North (although HS2 is starting to change this picture).

We also judge it to be very helpful that the NIC has been prepared to ask difficult questions about the various projects and tried to see which 'packages' of investment perform best: those based on regions (so Northern Powerhouse Rail, for instance) and those based on longer-distance routes, including to London. On balance, the regional schemes appear to do better, except for those in Yorkshire/North East, where improving long-distance connections adds more value.

On the various schemes, with an enhanced budget, the Commission's approach would allow the Trans Pennine Route upgrade to be fully implemented (so a wholly electrified and improved line between York, Leeds, and Manchester) with the Northern Powerhouse elements following, adding new sections of line that would both add capacity and shorten journey times. This seems entirely sensible with a caveat that the idea that a new route built from the Manchester–Crewe line to connect westwards through Warrington to Liverpool remains questionable: the faster route would remain the existing line direct between Manchester and Liverpool and Warrington is already connected to both cities (on a third line).

Our major concern with the various schemes across the North is twofold: they are overly focused on new lines between the major cities and give insufficient attention to the operation of the major city centre stations they serve. Those in Manchester and Leeds are operating at (or beyond) capacity; in Liverpool a new Commission has just been formed to investigate new terminal capacity. A masterplan is needed for each of central Manchester and Leeds to accommodate the demand and new service patterns that the interurban improvements will bring. These schemes cannot be an after-thought and as the NIC report correctly points out, the focus should be on new through platform capacity not further inefficient bay platforms for terminating trains. The need to modernise major city stations is being tackled across Europe: Britain cannot afford to be left behind. This has to be a key part of the Integrated Rail Plan.

The proposals for the Midlands are more modest and helpfully focus on investment in the centre of Birmingham to allow more and better rail services to operate. This is also essential to deliver what many people are beginning to realise is not just possible, but essential, to making a case for investment in HS2's Eastern arm.

Greengauge 21 has long advocated the creation of a high-speed rail network for Britain. We have had doubts for some time about the wisdom of a 'Y'-shaped network design. With investment in Birmingham (the Midlands Rail Hub scheme) an 'X'-shaped network. becomes possible. With some constraints now looking likely on HS2 capacity into Euston, the only way an Eastern arm for HS2 can be fully utilised (and its expense justified) is if the 'X'-shaped network is created allowing longer distance services such as Edinburgh–Bristol/Cardiff; services which are essential to giving the nation a better low carbon alternative to short-haul air travel.

The Commission not only endorses the Midlands Rail Hub but shows how with some local alignment adjustments the first stage of HS2's Eastern arm can usefully be brought forward. We believe it would make good sense to accelerate the delivery of this part of the overall project.

In this report, we have shown more detail of what options this creates for the subsequent stage, linking the East Midlands with Yorkshire. These options will need proper appraisal that the IRP can embrace; not enough is yet known about the costs of these options (we identify three). One of these is the original HS2 alignment north to Leeds. But it may not be the best on offer. As we show clearly, the whole of the east side of the country could be better off with a different approach. Whereas HS2 as planned serves only Leeds, it would be better to create the Eastern arm of HS2 running on existing (recently upgraded) lines though Nottingham and continuing onwards to join the East Coast Main Line corridor. That is where investment in new high-speed line capacity should be made, where it can bring much greater benefits than the original HS2 alignment, which would be built following the M1 motorway (where it would place the risk of lengthy periods of disruption during HS2's construction).

Nobody likes changes, but those agencies planning regeneration schemes around Leeds and Toton HS2 stations should look to the greater likelihood that a revised version of the full Eastern arm will, by bringing much greater benefits, stand a much better chance of being implemented. And as we have shown, while the station designs in both Leeds and Toton would need to be revised, both places would gain a new role with new services and transformed connectivity. There is plenty of time to get these designs right. Meanwhile there is not a single major city in the East Midlands, Yorkshire/the Humber, the North East, and Scotland that would not benefit from adopting, what in our report, we term Option 3, which brings high-speed to the East Coast Main Line. And as we also show, it would then be possible for places of the scale of Mansfield and Barnsley to get new services and connectivity gains too.

The Commission's work is very focused on the Government's 'levelling up' agenda; we commend it and trust that the work reported here will be a further useful addition for the Department for Transport as it drafts its Integrated Rail Plan.

Meeting the Rail Needs of the Midlands and the North—a Review

A report by ***Greengauge 21***

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