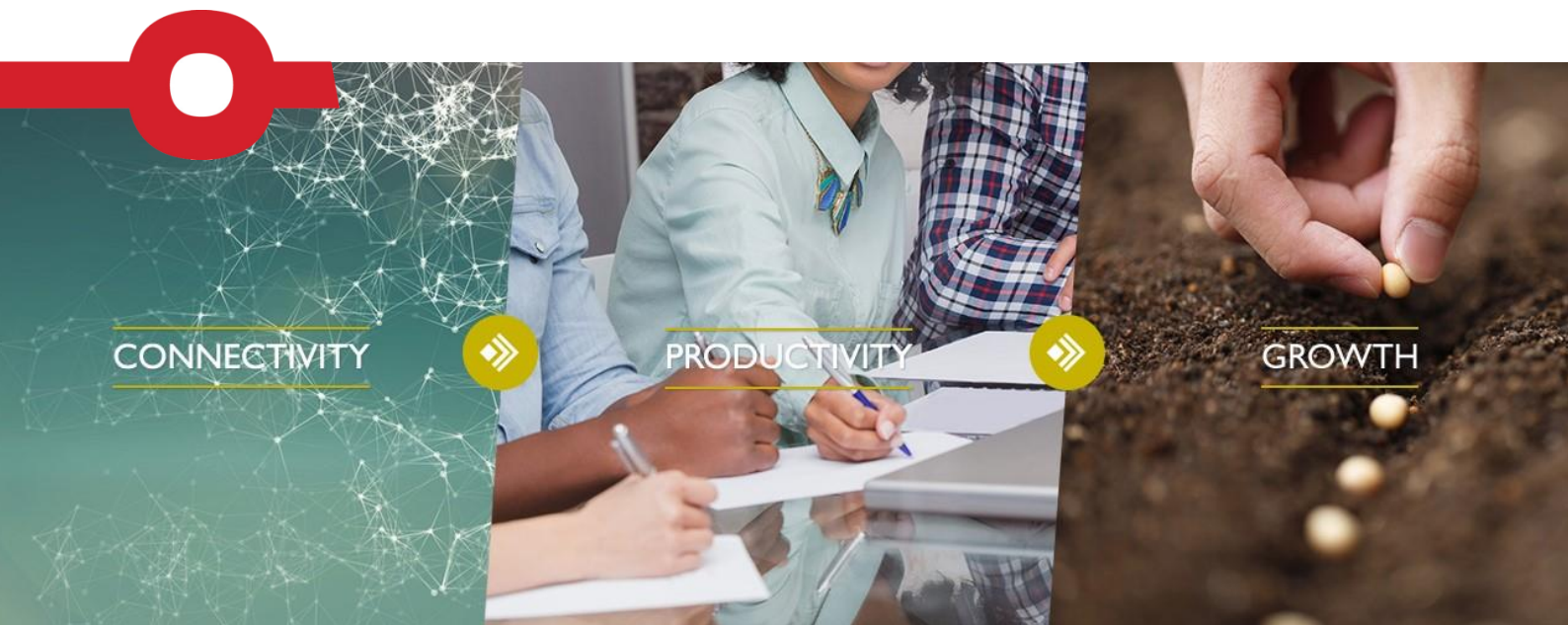


PHASE 2B WESTERN LEG AGGLOMERATION IMPACTS



HS2 EAST ECONOMIC BENEFITS

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Technical Note

1.1 Introduction

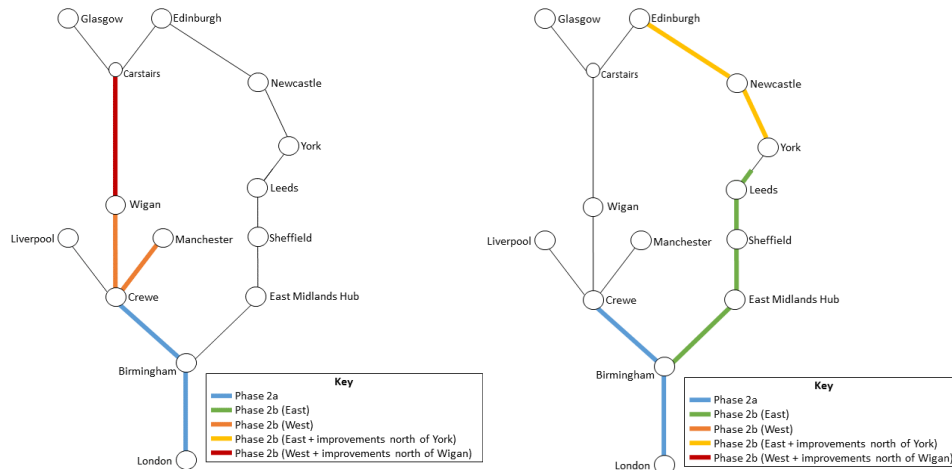
- 1.1.1 In June 2016 SYSTRA JMP Consultants was commissioned by the HS2 East Consortium to indicate the scale of impact on the economy from developing the Eastern Leg of High Speed 2 (HS2). The aim was to understand the wider economic benefits¹ of the leg of HS2 from Birmingham through the East Midlands to Leeds/York (known as HS2 Phase 2b), combined with a significantly upgraded East Coast Mainline (ECML) between York and Edinburgh to serve Scotland and the North East of England.
- 1.1.2 In August 2017 SYSTRA Ltd was awarded a further commission by HS2 East to undertake an equivalent assessment of the agglomeration benefits of serving Scotland via the Western Leg of HS2 Phase 2b and the West Coast Mainline (WCML) - following the methodology previously used to assess the benefits from the Eastern Leg of HS2 and the ECML in the 2016 study.
- 1.1.3 In order to estimate the economic value of the Western Leg we have used the same modelling tool that was initially developed for the East Coast Mainline Authorities (ECMA), and which is based on an approach originally developed by Network Rail as part of their series of Market Studies in 2013. The model estimates changes in GVA arising from the agglomeration economies that result from improved rail connectivity.

1.2 Aims

- 1.2.1 The specific aims of the current study were to understand:
- The wider economic impacts of the Western Leg of Phase 2b
 - The impact of options for further reducing journey times between the northern end of Western Leg and Scotland via the West Coast Mainline.
- 1.2.2 The two scenarios are illustrated in the figure below which also shows the comparable sections for the Eastern Leg analysis from 2016.

¹ The economic impacts included in this analysis are essentially the agglomeration benefits measured in terms of Gross Value Added. It should be noted that the analysis presented here is not comparable with work being undertaken by HS2 Limited on the wider economic benefits of HS2. Our analysis looks at a single measure of wider economic benefit – the agglomeration impact – and is concerned only with benefits accruing from the specific accessibility improvements that the Eastern and Western legs of HS2 Phase 2b, plus any upgrades to the ECML and WCML, would provide to the economies of the North, East Midlands and Scotland. Note also that the HS2 Ltd scheme does not incorporate the potential improvements to the ECML or WCML between the north of England and Scotland that have been assumed in our analysis.

Figure 1. HS2 Phases Western and Eastern Legs



1.3 Phase 2b Western Leg

1.3.1 This section describes the analysis and the main findings from our modelling of the wider economic impact of the Western Leg of Phase 2b of HS2.

Description and Service Level

1.3.2 The Western Leg of Phase 2b extends HS2 from the end of Phase 2a at Crewe on to Manchester via Manchester Airport. In addition a line will run from Crewe to just south of Wigan linking to the West Coast Mainline. As can be seen from Figure 1 the extent of the Phase 2b Western Leg is thus much more limited than that of the Phase 2b Eastern Leg with Phase 2a having subsumed much of the Western Leg distance.

1.3.3 The main service impact of the Phase 2b Western Leg is the introduction of direct services over HS2 from Birmingham to the North West which do not exist in Phase 2a. This reduces journey times significantly, with Birmingham to Manchester falling from 88 minutes to 40 minutes for example. The impact of the Western Leg on London journey times is somewhat more muted with London to Manchester services seeing a reduction of around 24 minutes from a journey time of 91 minutes in Phase 2a, to 67 minutes in Phase 2b.

1.3.4 The Phase 2b Western Leg services that we have modelled are as follows:

- 2 trains per hour (tph) Euston – Liverpool calling at Stafford or Crewe alternately, Runcorn and Liverpool
- 1tph Euston – Preston calling Crewe, Warrington, Wigan North Western and Preston
- 3tph Euston – Manchester of which:
 - 1 tph calling at Birmingham interchange, Manchester Airport and Manchester Piccadilly
 - 1tph calling at Manchester Airport and Manchester Piccadilly

- 1tph calling at Manchester Piccadilly only
- 2tph Euston – Glasgow/Edinburgh calling at Birmingham Interchange (1tph), Preston, Carstairs where the train divides and one portion calls at Glasgow Central and the other at Haymarket and Edinburgh Waverley
- 2tph Birmingham – Manchester calling at Manchester Airport and Manchester Piccadilly
- 0.5 tph Birmingham – Glasgow calling at Wigan North Western, Preston Lancaster, Oxenholme Lake District, Carlisle, Lockerbie, Motherwell and Glasgow Central
- 0.5 tph Birmingham – Glasgow calling at Wigan North Western, Preston Lancaster, Penrith, Carlisle, Lockerbie, Haymarket and Edinburgh

1.3.5 Rather than an increase in the quantum of services to/from London the main change in service level that the Western Leg of Phase 2b brings over and above Phase 2a is the introduction of services radiating from Birmingham.

Agglomeration Benefits of Phase 2b Western Leg

1.3.6 The economic benefits derived from the modelling of these services is shown in Table 1 below.

Table 1. Agglomeration Benefits HS2 Phase2b Western Leg by Region/Sub region

REGION	ADDITIONAL GVA £M
London	158
West Midlands	27
North West	174
Scotland	11
Total	369
Total (Net of London)	211

1.3.7 Overall, the Western Leg of Phase 2b delivers substantial economic benefits of around £369million per year compared to current levels. These GVA uplifts are arising from the agglomeration economies from improved connectivity between the economies en-route. As would be expected given the size of their respective economies the North West and London dominate.

1.3.8 When reviewing these figures it is important to remember that we are only looking at the benefits arising between the economies linked by the Phase 2 extensions north of Birmingham, so that the benefits from major flows such as those between London and Birmingham are not included in these figures.

1.3.9 The other point to note is that around 75% of the Phase 2b benefits on the Western Leg are actually delivered by the Phase 2a element to Crewe. Again, this is unsurprising since, compared to the Eastern Leg of Phase 2b, the Western Leg is relatively short, being largely subsumed into Phase 2a.

1.4 Phase 2b Western Leg with Enhanced WCML

1.4.1 This section presents the main findings from the analysis of the impact of further reducing journey times between the northern end of the Phase 2b Western Leg and Scotland via the West Coast Mainline. This test is comparable to the equivalent analysis for the East Coast Mainline completed for the 2016 report.

Description and Service Level

1.4.2 For the purpose of this analysis we have examined the impact of a set of potential classic line improvements for the West Coast Mainline north of Wigan in addition to the construction of the HS2 Phase 2b Western Leg. These potential improvements are set out in the HS2 Report *“Broad options for upgraded and high speed railways to the North of England and Scotland”* published in March 2016.

1.4.3 The report set out options for the development of the existing rail network to support the extension of the operation of HS2 services, with a particular focus on reducing journey times between Scotland and England.

1.4.4 The table below sets out the scope of the options for the WCML.

Table 2. Interventions and Journey Time Impacts North of Wigan

INTERVENTION	JOURNEY TIME SAVINGS (MINUTES:SECONDS)	DISTANCE (KM)
Bypass of Beattock Summit & Crawford Curve	04:37	26
Link from Lockerbie Bypass to Crawford Curve	01:14	4.8
Bypass from Gretna to Lockerbie	08:22	47.3
Bypass to the south of Carlisle	03:09	16.0
Bypass from north of Shap to Penrith	06:07	31.4
Bypass of Shap Summit	00:15	6.4
Bypass of Lancaster to the south of the Lune Gorge	10:44	48
Preston to South of Lancaster	03:12	18.4
Grade Separation of Euxton Jn and four track upgrade from Balshaw Lane	-	3.5
HS2 Phase 2b to Coppull	02:28	18.8
TOTAL	40:37	218.6

- 1.4.5 Interestingly the level of time savings that could be achieved on the West Coast Mainline is broadly comparable with the equivalent options for the East Coast Mainline that we modelled in 2016, with around 40 minutes saved on the West Coast route, compared to 44 minutes on the East Coast route.
- 1.4.6 Reflecting the geography and topography of the route the focus of the interventions is on addressing those areas where there are hills and significant curvature in the existing layout, notably the climbs over Shap and Beattock summits. The cost of the works that we have outlined in Table 2 were estimated in the HS2 report to be between £17 Billion and £19 Billion.
- 1.4.7 The service level that we have modelled for this enhanced route is based around that specified for HS2 Phase 2b. However some modifications have been made to it to reflect the bypassing of some stations as result of the interventions. Additionally, services from Manchester to Scotland have been incorporated into the analysis since these will make use of the new infrastructure. The full set of services that we have modelled as using the route are:
- 2 trains per hour (tph) Euston – Liverpool calling at Stafford or Crewe alternately, Runcorn and Liverpool
 - 1tph Euston – Carlisle calling Crewe, Warrington, Wigan North Western, Preston, Lancaster, Oxenholme, Penrith and Carlisle.
 - 3tph Euston – Manchester of which:
 - 1 tph calling at Birmingham interchange, Manchester Airport and Manchester Piccadilly
 - 1tph calling at Manchester Airport and Manchester Piccadilly
 - 1tph calling at Manchester Piccadilly only
 - 2tph Euston – Glasgow/Edinburgh calling at Birmingham Interchange (1tph), Preston, Carstairs where the train divides and one portion calls at Glasgow Central and the other at Haymarket and Edinburgh Waverley
 - 2tph Birmingham – Manchester calling at Manchester Airport and Manchester Piccadilly
 - 0.5 tph Birmingham – Glasgow calling at Wigan North Western, Preston Lancaster, Oxenholme Lake District, Carlisle, Lockerbie, Motherwell and Glasgow Central
 - 0.5 tph Birmingham – Glasgow calling at Wigan North Western, Preston Lancaster, Penrith, Carlisle, Lockerbie, Haymarket and Edinburgh
 - 1tph Manchester Airport – Glasgow/Edinburgh (alternate hours) calling at Manchester Piccadilly, Preston, Oxenholme, Penrith, Carlisle, Lockerbie and Glasgow Central or Edinburgh.
 - 1tph Manchester – Barrow calling at Wigan, Preston, Lancaster and Carlisle using new alignments where possible.

Agglomeration Benefits of Phase 2b Western Leg and WCML Upgrades

- 1.4.8 The total additional value to the economy is £423 million per annum at 2016 prices compared to today. The upgrades to the WCML north of Wigan therefore bring an estimated £54 million per annum of additional agglomeration benefits over and above those modelled for the Phase 2b Western Leg.

1.4.9 The table below summarises the impact by region or sub-region served. The general pattern is similar to that of the Phase 2b Western Leg itself with the North West and London receiving the greatest level of benefit, reflecting not just the size of the two economies but also the quality of service they receive, with high frequency links to all of the main centres that the Western Leg serves.

Table 3. HS2 Phase 2b Western Leg Agglomeration Benefits with WCML Enhancements

REGION	ADDITIONAL GDP £M
London	167
West Midlands	33
North West England	188
Scotland	36
Total	423
Total (Net of London)	257

1.5 Summary and Comparison with the Eastern Leg of HS2 Phase 2b

1.5.1 In summary the HS2 Western Leg, coupled with improvements north of Wigan, would make a substantial contribution to the economy from improved connectivity between the West Midlands, the North West and Scotland (and between London and the North West and Scotland) with a total estimated increase in GVA of **£423** million per annum. Without the West Coast Mainline upgrades the Western Leg would generate **£369** million per annum.

1.5.2 As we noted earlier around three quarters of the benefit of the Phase 2b Western Leg is delivered by Phase 2a which will be delivered sooner. On its Western Leg Phase 2b brings additional journey time savings to/from Manchester and the south, and provides benefits for services from Birmingham to the north but overall it provides fewer improvements in journey times. This is largely related to the relatively limited additional mileage that the services add to the network.

1.5.3 In contrast the Eastern Leg of Phase 2b demonstrates very significant benefits. These were estimated in our 2016 report at **£717** million per year when the upgrades to the East Coast Mainline are included or **£604** for the Eastern Leg alone. This is partly because the benefits have not been diluted by earlier stages but also because the network produces substantial benefits from the range of economies in the East Midlands, Yorkshire, North East and Scotland that are linked by the Eastern Leg and the often large journey time savings that are produced where previously connectivity was poor.

1.5.4 Both Western and Eastern routes have a large impact on the economies of the areas they serve, although it can be seen that the bulk of the benefits are derived from the main part of the Y network rather than the proposed classic line improvements.

- 1.5.5 It is also worth noting that due to the way that we have calculated the benefits for the two reports they are largely additive between the West and East Coast routes. This is because the report on the Eastern Leg assumed that services between London and Scotland would be routed via the West Coast and consequently we did not include any Scotland to London or Scotland to West Midlands benefits in the Eastern Leg benefit calculations.
- 1.5.6 Finally, neither study has included any economic benefit from the recasting of the timetables on the West Coast, East Coast and Midland Mainlines as a result of the capacity released by the diversion of high speed trains onto HS2. By way of an example, the benefits from this release of capacity on the East Coast Mainline alone were estimated as being worth around £100 million per year in additional GVA in work by SYSTRA JMP Consultants for ECMA in 2013.

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