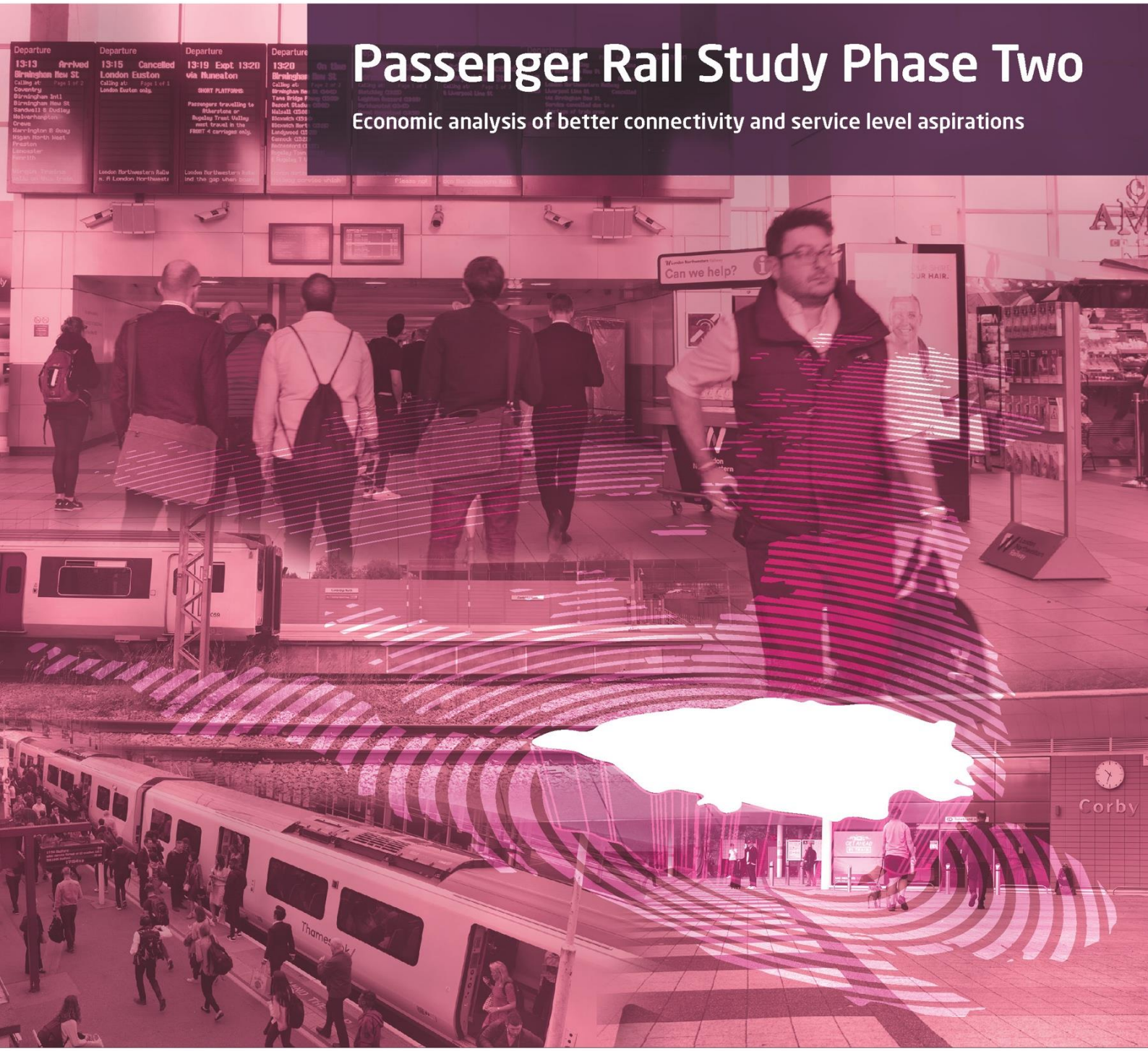
ENGLAND'S ECONOMIC HEARTLAND

NetworkRail

Passenger Rail Study Phase Two

Economic analysis of better connectivity and service level aspirations



A technical report produced by Network Rail for the EEH evidence base

Preface

Realising the full potential of the Heartland's rail network is central to achieving a transport system which supports sustainable economic growth while achieving net zero carbon by as early as 2040.

This study forms a key part of England's Economic Heartland's (EEH) work to implement our recently published transport strategy, Connecting People, Transforming Journeys. It provides the basis for a long-term rail investment plan for the Heartland.

Carried out in partnership with Network Rail, it is an exemplar for how sub-national transport bodies (STBs) and infrastructure owners can work together to understand the requirements for our transport networks and – crucially – how we can then make this happen.

The study's publication follows the release of the Williams-Shapps Plan For Rail by the Department for Transport, which includes the creation of a single governing body for rail, Great British Railways (GBR). As the plan makes clear, rail has a pivotal role to play in the future of the country's transport system.

The creation of GBR is an important step forward, reducing the complexity and fragmentation that exists in the rail industry. EEH and England's other sub-national transport bodies (STBs) are uniquely positioned to work with the new body to realise the potential of our rail network, building upon the strong working relationship we have with Network Rail and the wider rail sector.

Our work, including our transport strategy and this passenger rail study, ensures GBR can develop its long-term strategy at pace. By aligning its activity with the STBs, GBR can deliver on the shared ambition for improved integration of transport modes. We can work together to provide leadership on decarbonisation, support economic recovery and unlock opportunities to help level-up communities.

We are particularly keen to ensure that the development of the rail sector is not inadvertently constrained by the legacy of our Victorian forebearers. This study demonstrates the extent to which we need to develop stronger inter-regional rail linkages (particularly east-west) in order to ensure that the rail sector better reflects the more diverse pattern of movements of our 21st century economy. The pandemic has only served to accelerate these changing travel patterns.

Our evidence base, which is further strengthened by this study, means it is essential that EEH has a clear role in helping develop GBR's specifications for future rail concessions and being involved in the oversight of their implementation. EEH provides an invaluable and unique perspective, one that is critical to ensuring that the development of detailed proposals for GBR meet the expectations and requirements of the communities that it will be serving.

Working with GBR, and our other partners and Government, we will take forward the recommendations of this study to help deliver our ambition for a decarbonised transport system which supports sustainable economic growth and unlocks opportunities for our residents and businesses.

Mayor Dave Hodgson
Chair, England's Economic Heartland Strategic Transport Forum
July 2021

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1. Executive Summary

1.1.1. The England's Economic Heartland (EEH) Passenger Rail Study Phase 2 is the second report produced by EEH and Network Rail to understand how the rail network across the region could be better connected. This report develops the connectivity assessment of the existing network detailed in Phase 1 and identifies new or improved service levels for priority journey pairings where analysis has demonstrated that a stronger connectivity by rail would generate a significant return on investment and better support the economic centres.

1.1.2. The EEH region is set to experience transformational levels of economic and housing growth. Currently, the absence of choice in the region's public transport network has limited productivity due to increased road congestion and reduced resilience of the existing transport network. Improving the provision of rail services has the ability to address many of the objectives of EEH's *Transport Strategy: Connecting People, Transforming Journeys.* An enhanced rail offer can achieve this by boosting economic activity, improving inter-regional connectivity, and contributing to the levelling up of the entire economy in a way that is consistent with legally binding net-zero carbon obligations.

1.1.3. The Phase 2 study has applied multiple levels of economic analysis to identify the valuable flows both internally and externally that connect EEH key locations. Thirty-six flows were identified as having the potential to generate a significant return on investment as a result of improved rail connectivity. These flows were converted into service level aspirations to express what is required to unlock the partial or full value of the flows. Table 1 below summarises the extent of change required to improve connectivity and therefore unlock economic, social and environmental benefits across the EEH region.

Table 1 Summary of changes required to achieve the flow potential.

Type of Change Required	Number of Flows
Minor Change – *requires changes that could be incorporated into existing services.*	4
Incremental Change – *requires changes to existing services which are likely to be achievable on current or enhanced infrastructure.*	10
Transformational Change – *requires significant infrastructure interventions to deliver.*	22

1.1.4. The delivery of future schemes such as East West Rail (EWR) (including the eastern section), the capacity released via HS2 on the West Coast Main Line (WCML), Midland Main Line (MML) electrification, and various route enhancements will help contribute to improved connectivity across the EEH region and beyond. However, business as usual investment will not be enough to achieve the ambitions of the region's Transport Strategy and subsequently there is a need to go above and beyond these enhancements to provide a step-change in rail connectivity in this region.

1.1.5. The service level aspirations identified in this study will be developed further by EEH. EEH, on behalf of its partners, will consider which flows to take forward as a programme of feasibility studies and business cases to understand how best to realise the value of the service level aspirations set out in this report.

2. Introduction

2.1. Aim of the Passenger Rail Study

2.1.1. The England's Economic Heartland (EEH) Passenger Rail Study Phase 2 has been prepared by Network Rail's North West and Central Regional Strategic Planning team in collaboration with EEH.

2.1.2. The EEH Passenger Rail Study was separated into two phases. The first (Phase 1 now published) involved a baseline assessment of the current network and levels of service. Phase 2 identifies and prescribes new or improved service levels for priority journey pairings where analysis has demonstrated stronger connectivity by rail would generate a significant return on investment.

2.1.3. Mirroring the approach taken to develop the Phase 1 report, the Phase 2 analysis was overseen by a steering group to shape the workstream and agree outputs. Members of the steering group consisted of partner local authorities that represent the EEH Transport Officer Group, East West Railway Company, Rail Delivery Group, Swindon and Wiltshire Local Enterprise Partnership and Network Rail. This partnership enabled collaboration and input from rail and transport industry experts, integrating local and regional priorities with robust technical analysis. The combination of evidence-led transport planning with local and regional priorities allows EEH and Network Rail to promote the initiatives that best improve the railway for passengers, freight users and local communities.

2.2. An Area of National Importance

2.2.1. The Heartland is an economic powerhouse, powered by science and technology innovation and home to world-leading universities. Encompassing the entirety of the Oxford-Cambridge Arc, a national economic priority for the Government, the region is a net contributor to the Treasury. Its location at the heart of the UK, stretching from Swindon across to Cambridgeshire, and from Northamptonshire to Hertfordshire places a unique importance on the quality, reliability, and resilience of its strategic connections regionally and with the rest of the country.

2.2.2. The Heartland is home to 5.1 million people and 280,000 businesses employing 2.7 million people in a diverse range of sectors as well as key logistic hubs. The economy was valued at more than £163bn in 2018. Its economic growth (expressed by GVA) has consistently outstripped the UK average; with GVA growth of 25 % recorded in the five-year period between 2013 and 2018 (compared to the UK average of 20 %).

2.2.3. The region is set to experience transformational levels of economic and housing growth. It has a higher than average rate of population growth, contains some of the UK's fastest growing cities and will increase its housing stock by 25 % by the early 2030s; with over half a million new homes committed in local plans.

2.3. A Region with Challenges

2.3.1. Notwithstanding the headline economic success, lack of capacity within EEH's current transport system acts as a constraint on growth and reduces resilience and reliability. Productivity levels remain consistently below that of global competitors, which is a consequence in part of increasing congestion and reduced resilience of the existing transport system. In addition, the absence of choice in the region's public transport network has contributed to carbon emissions from transport being higher than the national average and growing faster, resulting in multiple Air Quality Management Areas being declared.

2.3.2. EEH's *Transport Strategy: Connecting People, Transforming Journeys* sets the policy framework supported by an initial investment pipeline to achieve the 2050 legal target of net-zero greenhouse gas emissions (with an ambition to achieve this by 2040) whilst enabling future economic growth. Enhancing connectivity through environmentally sensitive transport infrastructure is at the heart of ensuring the region reaches its full economic potential.

2.3.3. In a similar vein to Phase 1, this study is driven by the need for the strategic rail network to realise the ambitions of the region's Transport Strategy by delivering on its four key principles:

- Achieving net zero carbon emissions from transport no later than 2050, with an ambition to reach this by 2040
- Improving quality of life and wellbeing through a safe and inclusive transport system accessible to all which emphasises sustainable and active travel
- Supporting the regional economy by connecting people and businesses to markets and opportunities
- Ensuring the Heartland works for the UK by enabling the efficient movement of people and goods through the region and to and from international gateways, in a way which lessens its environmental impact.

2.4. The Role of Rail in the Heartland

2.4.1. Rail has the potential to offer enhanced connectivity to people and businesses by broadening labour market access, unlocking sustainable housing and stimulating new opportunities for economic growth. High quality railway infrastructure must act as a catalyst to accelerate productivity and expand the business capacity of the Heartland's employment clusters by enabling greater levels of economic agglomeration across the Heartland; making the region an attractive place to live, work and invest in.

2.4.2. The EEH region benefits from an extensive reach across the country, spanning six of England's most important main lines. Consequently, investment in its strategic rail infrastructure drives economic activity across the nation. Improved inter-regional rail connectivity, particularly the more diverse travel patterns which are no longer necessarily served solely by travel along one main line, will support other economies within the UK and contribute to the levelling up of the entire economy in a way that is entirely consistent with legally binding net-zero carbon obligations.

2.4.3. Investment in transformational infrastructure, particularly East West Rail and mass rapid transit schemes such as those planned for Cambridgeshire and Milton Keynes, supported by high quality first and last mile provision, is the catalyst for improving public transport networks across the whole region and is central to supporting sustainable growth. Securing the right service offer is crucial, given the diverse work patterns of the communities and the need to unlock opportunities for all, including those in rural areas with limited access to the public transport network.

2.4.4. Supported by the policies of the region's Transport Strategy, rail must, and can, provide a competitive alternative to motorised private transport in order to address wider social, economic, and environmental commitments. It is in this context EEH and Network Rail have worked in partnership to develop an evidence led assessment of the benefits of enhancing the region's rail connectivity.

2.5. Covid-19

2.5.1. The Coronavirus pandemic has adversely affected public transport usage and the impact has been felt most acutely in the rail industry. The short-term implications of Covid-19 has seen passenger numbers at a low of c.5 % and an average of c.30 % of usual patronage. The pandemic's medium- and longer-term consequences are yet to be understood although it is anticipated that numbers travelling by rail will recover to pre-Covid levels but with potentially more off-peak journeys as a result of new or different travel patterns. EEH, along with other STBs, is supporting the Rail Covid Forecasting Group chaired by Network Rail which is working to establish a portfolio of evidence to analyse and forecast rail use as a result of the pandemic.

2.5.2. The Passenger Rail Study is long-term and identifies the relative benefits of introducing or improving connectivity between two places, based on a 'pre-pandemic' assessment of the rail network. The potential long-term impacts following the pandemic have naturally cast doubt on the future role of public transport and this will need to be considered, when known, as part of further work that takes forward the outputs of this study. For example, looking forwards it is acknowledged that the levels of overcrowding previously experienced are not going to be acceptable and therefore the rail network must provide a suitable level of capacity to cater for both existing and future passenger numbers.

2.5.3. It should be recognised that investment in infrastructure that connects people, supports growth and levels up the country will play an important role in delivering a swift and strong economic recovery from the pandemic. It is important that industry continues to plan for a transport system that makes public transport the natural choice for travel. Bringing this region's burgeoning economic centres closer together by rail will connect people and places with opportunities and services, essential for the future success of the Heartland and the rest of the country.

2.6. Phase 1 Recap and Summary

2.6.1. In 2019 Network Rail was appointed as the technical lead for the first phase of the Passenger Rail Study. The aim of Phase 1 was to provide a baseline review of the Heartland's rail network. It provided an evidence-led assessment of the region's existing rail infrastructure, reporting where gaps in strategic connectivity exist. Gaps in the rail network were indicated through generalised journey times/ speeds and levels of decarbonised and non-decarbonised services.

2.6.2. The Phase 1 report was the first step in developing a plan for the region's rail network. It was endorsed by EEH's Strategic Transport Forum and Network Rail in June 2020 and informed the development of EEH's Transport Strategy. Conclusions drawn from the Phase 1 report have served as the basis from which service level aspirations have been developed as part of this Study. Figure 1 illustrates the relationship between the two phases of the Rail Study.

Figure 1 EEH and Network Rail's Approach to the Passenger Rail Study

2.6.3. The summary findings of Phase 1 relevant to this report confirmed that passengers generally experience good levels of rail connectivity when making journeys on a single main line. Each main line is typically served by fast and frequent services that connect important towns and cities directly to London, enabling passengers to travel easily to and from destinations along each arterial route. Constraints emerge when passengers make journeys across the Heartland that involve moving from one main line to another. The need for interchange worsens journey times which subsequently make journeys by car more attractive. Many of these journeys require interchange via Zone 1 in London, an already congested part of the rail network.

2.6.4. One of the report's key findings is the need to improve strategic east-west cross connectivity by rail. The analysis confirmed that delivery of the East West Main Line will not sufficiently address this issue. A key point observed in many case study examples demonstrated that whilst the East West Main Line will transform journeys made along its core between Oxford and Cambridge, the need for multiple interchanges to reach destinations beyond this is a significant barrier to modal shift.

2.6.5. Phase 1 recommended that electrification of East West Rail should act as the catalyst for electrification of the rest of the network. By addressing some of the main gaps where diesel trains operate such as Didcot and Oxford to Banbury and the Leicester to Ipswich route via Peterborough and Ely, a case could be made to electrify the East West Main Line and by doing so create a continuously electrified corridor for the benefit of freight, passengers and the environment.

2.6.6. The report set out the impetus to utilise released capacity on the classic network resulting from the delivery of HS2. Recasting the timetable presents an opportunity to improve connectivity on the West Coast Main Line (following HS2 Phases 1 and 2A) and on the Midland Main Line and East Coast Main Line respectively (following HS2 Phase 2B).

2.6.7. Phase 1 identified ten corridors where generalised journey times between key nodes are noticeably poor. These are a mixture of existing rail corridors where direct services are non-existent or infrequent or sections of the network where there is currently no railway infrastructure to support a journey. The Phase 1 findings have informed the methodology adopted for the economic analysis in Phase 2 and the identification of key nodes discussed in Chapter 3 of this report.

2.7. Study Assumptions

2.7.1. To achieve the objective of this piece of work, the Passenger Rail Study Phase 2 has three core assumptions underpinning the analysis:

- The Passenger Rail Study Phase 2 has not considered flows into and out of London termini. These flows were excluded to prevent the duplication of Network Rail's London Rail Strategy which is an ongoing workstream

- Whilst the Western and Central sections of East West Rail were assumed in the base data, the Eastern section (Cambridge – Norwich and Ipswich) was not. This decision was taken due to the uncertainty associated with the Eastern section scheme which meant the input data was not available

- The December '19 Timetable was assumed as the base timetable from which the economic analysis was derived.

2.8. Strategy and Policy Context

2.8.1. The intention of this analysis is to be consistent with and provide further supporting evidence to existing rail and transport strategies across EEH. Through the support of the steering group the project team has sought to collate and analyse all existing rail strategies that complement this study. Where applicable, service level aspirations identified in Section 4 support the ambitions of local rail priorities. A list of these strategies can be found in Appendix A: Existing Strategies Across EEH. Network Rail and many of the EEH partners involved in the Passenger Rail Study Steering Group have been actively involved in the studies referred to in Appendix A. This has ensured this regional study is both consistent and complementary of work undertaken and ongoing at the local level.

3. Methodology

3.1. Overview

3.1.1. The aim of the second phase of the Passenger Rail Study is to identify flows internal to EEH and, to and from EEH to selected external locations that could generate a significant return on investment if connectivity by rail is improved. This assessment was undertaken using a multi-criteria economic analysis process which examined the socio-economic and wider economic benefits of improving connectivity to and from a selection of the region's most important key nodes. The outputs from the economic assessment were then converted into aspirational service level improvements.

3.1.2. The study consisted of five stages as identified in Figure 2 below. The first stage (2A) identified the role of rail to realise the ambitions of EEH's Transport Strategy. Stages 2B, 2C and 2D then focused on identifying the most valuable flows using a range of economic analysis methods. Finally, stage 2E converted these outputs into service level aspirations.

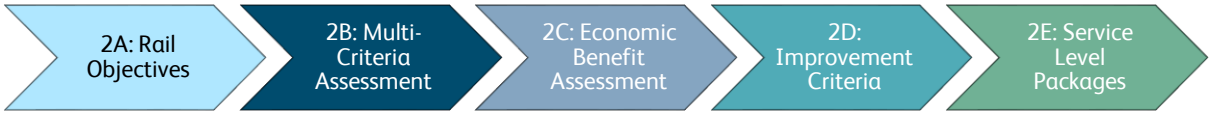


Figure 2 EEH Passenger Rail Study Phase 2 Methodology

3.2. Economic Assessment

3.2.1. The economic assessment was undertaken within stages 2B, 2C and 2D to prioritise the journey pairings both internally to EEH and from EEH to external locations that are most economically sensitive to a service level uplift.

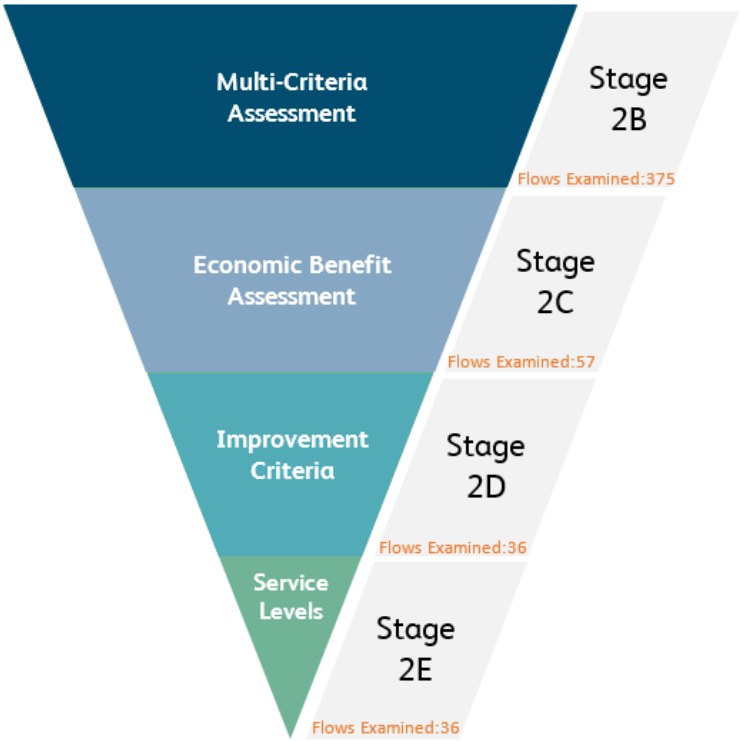


Figure 3 Economic Assessment Summary

3.2.2. Figure 3 above highlights how each stage of the economic assessment identifies the flows to produce the Service Outputs (2E).

3.3. Multi-Criteria Assessment (Stage 2B)

3.3.1. Multi-criteria analysis was used to prioritise the list of 29 locations identified in Phase 1 of the Passenger Rail Study to produce a priority shortlist of locations where rail has the potential to deliver the ambitions of the EEH Transport Strategy (the full methodology can be found in Appendix B: Multi- Criteria Analysis). This shortlisting was evidenced-led and focused on five quantifiable macroeconomic factors where increased rail provision was most likely to have the biggest impact to passengers, communities, and the economy. Each of the 29 locations received a score for each criterion culminating in a final score to help rank locations. The economic criteria agreed by the Steering Group were: Population, Employment Density, Gross Value Added (GVA) per job, Rail Service Opportunity, and Market Opportunity. The top scoring 15 locations listed in Table 2 were taken forwards into stage 2C.

Table 2 Stage 2B- 15 Internal EEH Shortlisted Locations

Internal EEH Locations	
Aylesbury	Northampton
Bedford	Oxford
Cambridge	Peterborough
Hemel Hempstead	St. Albans
High Wycombe	Stevenage
Kettering	Swindon
Luton	Watford
Milton Keynes	

3.3.2. In addition to the 15 internal EEH locations shortlisted, a further ten locations external to EEH were also selected by the Steering Group to examine the connectivity of EEH locations to economically significant external hubs. These locations listed in Table 3 were selected qualitatively based on their size, economic importance, and location. It should be noted, the external EEH locations were divided into two sub-groups: Core Cities and External Hubs. The Core City locations were selected from the Organisation for Economic Co-operation and Development's (OECD) list of core cities. The External Hubs were identified by the EEH Steering Group as locations beyond the EEH region which had significant existing flows. The separation into two categories was to ensure a fair comparison was made between the value of flows analysed in later stages. A technical note explaining the Multi-Criteria Analysis process can be found in Appendix B: Multi- Criteria Analysis .

Table 3 Stage 2B- 10 External EEH Locations

External EEH Locations	
Core Cities	**External Hubs**
Birmingham	Ipswich
Bristol	Leicester
Leeds	Norwich
Manchester	Reading
Newcastle	Southampton

3.4. Economic Benefit Assessment (Stage 2C)

3.4.1. The socio-economic and wider economic benefits of enhancing connectivity to and from the key nodes within the EEH region and beyond were tested to identify the low, medium, and high value flows. For the internal EEH locations, each individual flow was tested resulting in a 15 x 15 matrix and a 15 x 10 matrix for each internal EEH location to each external EEH location. These benefits were measured for direct rail users (Level 1) and wider economic benefits (Level 2).

3.4.2. To calculate the Level 1 benefits a 10% reduction in the average Generalised Journey Time (GJT) (*see description in Figure 4*) was applied on a flow by flow basis to identify the economic impact of improving connectivity. The Level 1 benefits measured the value of time (measuring journey time savings and new users who switch to rail) and non-user benefits (the indirect benefits arising from an improved rail service by abstracting journeys from road e.g. environmental benefits for business, leisure and commuting passengers).

Generalised Journey Time (GJT)
GJT is a measure of rail connectivity between two destinations and takes into consideration a number of factors of the journey. These include the average train frequency, in-vehicle journey time and any interchanges required to reach the destination. The values for the service frequency penalty (a lower frequency service receives a higher penalty to reflect the inconvenience to passengers) and the interchange penalty (the inconvenience experienced by passengers having to change train) are taken from the Passenger Demand Forecasting Handbook (PDFH) and differ based on the market and distance of the journey undertaken. The GJT value takes into consideration the train service across the day and provides a single figure to represent the rail connectivity expressed in minutes for each flow. GJT is often significantly longer than the headline (advertised) journey time.

*Generalised Journey Time = **T + S + I** where;*
***T** = the total station-to-station journey time (including interchange time)*
***S** = the service interval penalty*
***I** = the sum of the interchange penalties for any interchanges required.*

Figure 4 Generalised Journey Time (GJT) description

3.4.3. To calculate the wider economic (Level 2) benefits, the Department for Transport's (DfT's) Wider Impacts in Transport Appraisal (WITA) model was used. Wider economic benefits are improvements in economic welfare which are not captured in typical project appraisal and arise when there are transformation changes to the structure of the economy. There are four types of wider economic impacts:

a) **Agglomeration impacts** i.e. the concentration of economic activity

b) **Labour market impacts** i.e. if the cost of travel goes down, working consequently becomes more attractive

c) **Increased or decreased output in imperfectly competitive markets** i.e. the reduction in transport cost allows the increase in production and service which consequently increases employment

d) **Labour market impacts from move to more or less productive jobs** i.e. the change of where people chose to work could lead to more efficiency.

3.4.4. After combining the Level 1 and Level 2 benefits for each flow, flows categorised as "low value" were discounted. Each category; Internal EEH x Internal EEH (Table 4), Internal EEH x Core Cities (Table 5), and Internal EEH x External Hubs (Table 6), had its own threshold to determine economic value. The flows that were classified as medium and high value for each category and therefore progressed onto Stage 2D are as shown on the next page.

Table 4 Internal EEH High and Medium Value Flows

Internal EEH Flows	
High Value Flows	**Medium Value Flows**
Cambridge – Peterborough	Northampton – Watford Junction
Oxford – Cambridge	Milton Keynes – Bedford
Milton Keynes - Northampton	Watford Junction - Hemel Hempstead
Oxford – High Wycombe	Aylesbury - Luton
St Albans – Luton	Milton Keynes – Hemel Hempstead
Oxford - Swindon	Swindon - Cambridge
Cambridge – Stevenage	Bedford - Kettering
Aylesbury – High Wycombe	Cambridge - St Albans
St Albans – Bedford	Oxford - St Albans
Bedford – Luton	Northampton – Oxford
Milton Keynes – Watford Junction	Oxford - Peterborough
Peterborough – Stevenage	Milton Keynes – Swindon
St Albans – Stevenage	

Table 5 Internal EEH x Core Cities High and Medium Value Flows

Internal EEH x Core Cities Flows	
High Value Flows	**Medium Value Flows**
Milton Keynes - Manchester	Peterborough - Leeds
Swindon - Bristol	Watford - Birmingham
Northampton - Birmingham	Watford - Manchester
Milton Keynes - Birmingham	Cambridge - Birmingham
Peterborough - Newcastle	Stevenage - Newcastle
Oxford - Manchester	Peterborough - Manchester
Stevenage - Manchester	Peterborough - Birmingham
Cambridge - Manchester	Cambridge - Leeds
Oxford - Bristol	Cambridge - Newcastle
Cambridge - Bristol	
Stevenage - Leeds	
Oxford - Birmingham	

Table 6 Internal EEH x External Hubs High and Medium Value Flows

Internal EEH x External Hubs Flows	
High Value Flows	**Medium Value Flows**
Oxford - Reading	Kettering - Leicester
Cambridge - Norwich	Cambridge - Southampton
Oxford - Southampton	Cambridge - Reading
Swindon - Reading	Peterborough - Ipswich
Peterborough - Norwich	Swindon - Southampton
Cambridge - Ipswich	
Peterborough - Leicester	

3.5. Improvement Criteria (Stage 2D)

3.5.1. The final stage of the economic analysis was to identify which of the medium and high value flows were underperforming relative to a respective benchmarked speed. This was determined by setting a minimum aspirational Generalised Journey Speed (GJS) (*see description in Figure 5)* for each flow to achieve based on its market and the necessary reduction in GJT to achieve that GJS. A reduction in GJT was considered by means of three types of intervention; reducing the overall journey time, improving the service frequency by one train per hour (tph), or reducing the interchange required by one.

Generalised Journey Speed (GJS)
GJS is an additional measure of a journey which incorporates the GJT value (Figure 4) but considers the distance covered that is required for the journey. This helps to identify areas where the GJT is long because of slow journeys or poor frequencies rather than solely a factor of distance. Distance is assumed as the crow flies because in these markets rail is competing against car and removes bias caused by the current rail geography.

*Generalised Journey Speed = **D ÷ GJT** where;*
***D** = Distance travelled by the route the rail journey takes (as the 'crow flies' distance)*
***GJT** = Generalised Journey Time*

Figure 5 Generalised Journey Speed (GJS) Description

Aspirational Generalised Journey Speed

3.5.2. To understand what level of improvement may be required for each flow it was first necessary to establish the required GJS in order to make rail more competitive compared to car travel and therefore encourage modal shift. To do this a benchmarking assessment was undertaken to establish a target GJS for each market.

3.5.3. In total, the study set six aspirational GJSs based on analysis examining best in class connectivity within the region and benchmarking against similarly sized flows from across the UK. These target speeds take into account different market dynamics and affordability. For example, given that Core Cities have access to the inter-city (higher speed) network, it would be unreasonable to expect GJSs to Birmingham to be comparable with Leicester. Thus, each market group has different target GJS. Furthermore, medium value flows are less likely to support investment compared to high value flows and therefore have a lower speed target.

3.5.4. Flows that were overperforming in their allocated market group were not examined further as only limited gains could be made from improving the flow. Instead, underperforming flows within the High and Medium Value categories were assessed and given a target GJS to reach.

Internal EEH Flows

3.5.5. Flows within the EEH region were benchmarked against the best in class GJSs from within the EEH region. The benchmarks were set against existing well-connected flows in the EEH region because of the strong connectivity found between two locations within the region. The aim of this is to replicate these well-connected flows across the region.

3.5.6. The GJS for all high value flows was calculated, and the 75th percentile, or the GJS that 25 % of flows meet was set as the target GJS. For the high value flows, the aspirational GJS was set at 32.3 mph. The same method was repeated for medium value flows using the 50th percentile; the aspirational GJS was set at 26.4 mph. The method and aspirational GJS identified is outlined in Table 7.

Table 7 Internal EEH GJS Methodology

	High Value	Medium Value
Methodology	75th percentile speed of **high value** internal EEH flows (13 identified as high value).	75th percentile speed of **medium value** internal EEH flows (12 identified as medium value).
Aspirational GJS	32.3 mph	26.4 mph

3.5.7. To calculate the aspirational GJS for high and medium value flows in the Core Cities and Other External Hubs, a three-step approach was used to identify similar flows to benchmark against. Locations of a similar population size to the largest EEH areas in this study were considered and are used to benchmark against to represent the aspiration and capability of the EEH region. These locations and the population size are represented in Table 8 along with the size of the largest areas in the EEH region for reference.

Table 8 Sample flows from similar sized locations for Core Cities and External Hubs GJS benchmarking exercise

#	Location	2020 Population (Estimated)
1	Bradford	299,310
2	Southend-on-Sea	295,310
3	Derby	270,468
4	Plymouth	260,203
5	Wolverhampton	252,791
6	Southampton	246,201
7	Blackpool	239,409
8	Norwich	213,166
9	Aberdeen	196,670
10	Portsmouth	194,150
11	Newcastle upon Tyne	192,382

#	Location	2020 Population (Estimated)
12	Ipswich	178,835
13	Wigan	175,405
14	Walsall	172,141
15	Warrington	165,456
16	Slough	163,777
17	Bournemouth	163,600
18	Doncaster	158,141
19	York	153,717
20	Poole	150,092
21	Gloucester	150,053

Table 9 Core Cities and External Hubs GJS Methodology

	Stage 1 Identify similarly sized locations across the UK	Stage 2 Identify flow details (demand & speed) to Core Cities & Other External Hubs	Stage 3 Identify flows which have similar demand levels to the prioritised list of flows
Number Examined	21 Locations	Core Cities – 87 flows External Hubs – 97 flows	Core Cities – 33 flows External Hubs – 17 flows
Description	Identify locations of a similar size to EEH locations in terms of population (150,000 – 300,000).	Using MOIRA, identify the demand and speed between each location to each of the Core Cities (5) or Other External Hubs (5).	Some flows are particularly slow (e.g. Leeds – Poole = 25mph) and therefore not comparable. The analysis therefore exclusively looks at flows with comparable demand to the key High and Medium value flows (identified in the Economic Benefit Assessment).

3.5.8. The second stage of this process used MOIRA[1] to calculate the demand and speed for each flow from the similar sized locations to each Core City and each Other Hubs. With this data, flows that did not meet the demand threshold were removed so to only include flows that were comparable in size to priority flows identified by the study. After the sifting process, there were 33 sample flows to Core Cities and 17 sample flows to External Hubs which are summarised in Table 9.

3.5.9. The sample flows are then used to calculate the target GJS for the Core Cities and Other Hubs individually. The 75th percentile is used to calculate the High Value target GJS and the 50th percentile is used to calculate the Medium Value GJS. Table 10 below demonstrates the difference in the aspirational speed target for Core Cities and Other External Hubs. The Core Cities have a faster speed because they are well served by the intercity network and currently have faster speeds (up to 125mph). The Other External Hubs have lower aspirational GJS because they are more geographically spread out and not always directly served by a rail service.

Table 10 Core Cities and External Hubs Methodology and Aspirational GJS

Category	Method	Aspirational GJS
Core Cities – High Value	75th percentile of 33 flows	39.4 mph
Core Cities – Medium Value	50th percentile of 33 flows	32.4 mph
Other External Hubs – High value	75th percentile of 17 flows	33.4 mph
Other External Hubs – Medium value	50th percentile of 17 flows	28.7 mph

3.5.10. The final sift stage prior to prescribing service level outputs, and which applies only to Internal EEH x Internal EEH flows, was to sift by target GJT for Business travel. Based on the MOIRA 2019 Demand data, 70 % of Business travellers are willing to travel up to 106 GJT minutes, after which demand begins to decrease. This implies that even if large GJT reductions can be obtained within the EEH region, there is unlikely to be much uplift in demand for flows with a GJT greater than 106 minutes. Therefore, internal EEH flows that have a GJT of more than 106 minutes were not considered further.

[1] A rail industry demand forecasting tool containing annual demand data that can be used to test the impact of timetable changes on rail demand by using parameters and appraisal values in Passenger Demand Forecasting Handbook (PDFH).

3.5.11. Making business travel more accessible and competitive against other modes was considered as this supports the objective of levelling up the economy by connecting economic hubs together. Levelling up is currently a key government objective and improving connectivity in the EEH region will facilitate this. Business travel often makes up a large proportion of the weekday off-peak travel market and business travellers have the highest value of time when travelling. This makes business travel a useful market to consider during the early stage of assessment.

3.5.12. The flows that were taken forward so that service level aspirations could be assigned to them are as follows:

Table 11 Internal EEH High and Medium Value Flows taken forward to Service Level Package Stage

Internal EEH Flows	
High Value Flows	**Medium Value Flows**
Cambridge – Peterborough	Milton Keynes – Bedford
Milton Keynes – Northampton	Watford Junction – Hemel Hempstead
Oxford – High Wycombe	Aylesbury – Luton
St Albans – Luton	Cambridge – St Albans
Oxford – Swindon	Oxford – St Albans
Cambridge – Stevenage	Northampton – Oxford
Aylesbury – High Wycombe	
Bedford – Luton	
St Albans – Stevenage	

Table 12 Internal EEH x Core Cities High and Medium Value Flows taken forward to Service Level Package Stage

Internal EEH x Core Cities Flows	
High Value Flows	**Medium Value Flows**
Swindon – Bristol	Cambridge – Birmingham
Northampton – Birmingham	Peterborough – Manchester
Milton Keynes – Birmingham	Peterborough – Birmingham
Oxford – Manchester	
Cambridge – Manchester	
Oxford – Bristol	
Cambridge – Bristol	
Stevenage – Leeds	
Oxford – Birmingham	

Table 13 Internal EEH x External Hubs High and Medium Value Flows taken forward to Service Level Package Stage

Internal EEH x External Hubs Flows	
High Value Flows	**Medium Value Flows**
Cambridge – Norwich	Kettering – Leicester
Oxford – Southampton	Cambridge – Southampton
Peterborough – Norwich	Cambridge – Reading
Cambridge – Ipswich	Swindon – Southampton
Peterborough – Leicester	

Forming Service Level Aspirations

3.5.13. A service level aspiration was prescribed for each flow that was not currently achieving the aspirational GJS and in the case of EEH internal flows did not have a GJT which exceeded 106 minutes.

3.5.14. Each flow was prescribed a GJT reduction that it should aim to achieve. This was calculated by the difference in current GJT and the GJT required to achieve the aspirational GJS for the respective market type and flow value. To understand how a journey time reduction could potentially be achieved, three different interventions were tested:

1. Reducing the headline journey time by 10 %
2. Increasing the frequency by 1 train per hour (tph)
3. Reducing the Interchange by 1 (this only applies if the origin and destination are not currently served by a direct service).

3.5.15. The tables below (Tables 14 to 19) set out the Economic Flow Value per 60-year appraisal period. This is the economic benefit (expressed in GVA) over a sixty-year period that would be achieved on a flow-by-flow basis if the aspirational GJS was achieved. They also illustrate the reduction in GJT required to achieve the aspirational GJS, and the percentage reduction in GJT that would be achieved by applying each of the three individual GJT interventions.

3.5.16. It should be noted that a 10 % headline journey time improvement could be achieved through a range of different interventions. Faster rolling stock, signalling improvements, track upgrades and timetable changes are a few examples of how headline journey time improvements could be made.

Table 14 Internal EEH High Value Service Level Interventions

Internal EEH (High Value) Service Level Interventions						
Flow	**Economic Value per year (£m, GVA, 60-year appraisal)**	**Target GJT Reduction (GJS = 32mph)**	**10% Headline Journey Time improvement**		**Frequency uplift +1tph**	**Interchange reduction – 1**
			Minutes	**GJT Reduction**	**GJT Reduction**	**GJT Reduction**
Cambridge – Peterborough	30.5	29 %	5	7 %	6 %	n/a
Oxford – Swindon	26.8	45 %	4	5 %	6 %	24 %
St. Albans – Stevenage	23.6	88 %	7	4 %	1 %	43 %
Aylesbury – High Wycombe	21.4	48 %	3	5 %	8 %	n/a[2]
Milton Keynes – Northampton	17.9	21 %	2	5 %	12 %	n/a
Oxford – High Wycombe	14.0	28 %	4	6 %	8 %	n/a
Cambridge – Stevenage	12.5	22 %	4	7 %	7 %	n/a
Luton – St. Albans	12.2	16 %	1	6 %	4 %	n/a
Luton – Bedford	1.6	3 %	2	6 %	6 %	n/a

[2] A direct service is not available throughout the day.

Table 15 Internal EEH Medium Value Service Level Interventions

Internal EEH (Medium Value) Service Level Interventions						
Flow	**Economic Value per year (£m, GVA, 60-year appraisal)**	**Target GJT Reduction (GJS = 26mph)**	**10% Headline Journey Time improvement**		**Frequency uplift +1tph**	**Interchange reduction – 1**
			Minutes	**GJT Reduction**	**GJT Reduction**	**GJT Reduction**
Aylesbury – Luton	13.9	75%	11	7%	2%	10%
Watford – Hemel Hempstead	7.6	38%	1	4%	9%	n/a
Oxford – St. Albans	3.9	40%	5	3%	3%	18%
Cambridge – St. Albans	3.4	33%	7	6%	2%	31%
Northampton – Oxford	2.2	24%	5	5%	4%	34%
Milton Keynes – Bedford	2.5	15%	2	6%	5%	33%

Table 16 Internal EEH x Core Cities High Value Service Level Intervention

Internal EEH x Core Cities (High Value) Service Level Interventions						
Flow	**Economic Value per year (£m, GVA, 60-year appraisal)**	**Target GJT Reduction (GJS = 39mph)**	**10% Headline Journey Time improvement**		**Frequency uplift +1tph**	**Interchange reduction – 1**
			Minutes	**GJT Reduction**	**GJT Reduction**	**GJT Reduction**
Oxford – Bristol	30.6	35%	9	6%	3%	24%
Cambridge - Bristol	22.9	29%	10	4%	2%	33%
Swindon – Bristol	22.8	11%	3	6%	8%	n/a
Stevenage – Leeds	22.5	14%	18	7%	3%	n/a
Cambridge – Manchester	22.2	24%	14	5%	2%	39%
Northampton – Birmingham	20.8	14%	6	7%	5%	n/a
Oxford – Manchester	6.7	6%	15	8%	4%	n/a
Milton Keynes – Birmingham	5.8	4%	6	7%	6%	n/a
Oxford – Birmingham	3.1	4%	7	8%	5%	n/a

Table 17 Internal EEH x Core Cities Medium Value Service Level Interventions

Internal EEH x Core Cities (Medium Value) Service Level Interventions						
Flow	**Economic Value per year (£m GVA,60-year appraisal)**	**Target GJT Reduction (GJS = 32mph)**	**10% Headline Journey Time improvement**		**Frequency uplift +1tph**	**Interchange reduction – 1**
			Minutes	**GJT Reduction**	**GJT Reduction**	**GJT Reduction**
Cambridge – Birmingham	15.2	23%	16	7%	3%	n/a
Peterborough – Manchester	9.2	14%	17	8%	4%	n/a
Peterborough – Birmingham	3.7	6%	10	7%	6%	n/a

Table 18 Internal EEH x External Locations High Value Service Level Interventions

Internal EEH x External Locations (High Value) Service Level Interventions						
Flow	**Economic Value per year (£m, GVA 60-year appraisal)**	**Target GJT Reduction (GJS = 33mph)**	**10% Headline Journey Time improvement**		**Frequency uplift +1tph**	**Interchange reduction – 1**
			Minutes	**GJT Reduction**	**GJT Reduction**	**GJT Reduction**
Cambridge – Ipswich	14.6	27 %	8	8 %	4 %	n/a
Peterborough – Leicester	10.7	21 %	6	7 %	6 %	n/a
Oxford – Southampton	5.0	6 %	8	7 %	6 %	n/a
Cambridge – Norwich	5.0	4 %	8	8 %	4 %	n/a
Peterborough – Norwich	4.5	7 %	10	8 %	4 %	n/a

Table 19 Internal EEH x External Locations Medium Value Service Level Interventions

Internal EEH x External Locations (Medium Value) Service Level Interventions						
Flow	**Economic Value per year (£m, GVA 60-year appraisal)**	**Target GJT Reduction (GJS = 29mph)**	**10% Headline Journey Time improvement**		**Frequency uplift +1tph**	**Interchange reduction – 1**
			Minutes	**GJT Reduction**	**GJT Reduction**	**GJT Reduction**
Swindon – Southampton	8.6	34 %	9	6 %	3 %	22 %
Cambridge – Reading	6.4	23 %	8	4 %	3 %	24 %
Cambridge – Southampton	4.1	10 %	17	7 %	2 %	21 %
Kettering – Leicester	0.8	2 %	2	5 %	10 %	n/a

3.6. Service Level Aspiration (Stage 2E)

3.6.1. Using the outputs from the economic analysis, specifically the options for GJT explored in Stage 2D, flows which had an interface with other flows were packaged together to achieve mutually beneficial service level packages. Where flows did not overlap or group together to form service packages, individual commentary is given as to how these connectivity improvements could be achieved. The details of these flows and packages can be found in Chapter 4; Service Level Aspirations.

3.6.2. Due to the high-level nature of this analysis, the service level aspirations give an indication as to what the service needs to achieve rather than prescribe the precise means of how an output should be delivered. For example, the service level aspiration may note that a 10 % reduction in journey time is needed but may not reference specifically how this journey time reduction can be achieved or what infrastructure it would trigger. This is something for EEH as a scheme promoter to investigate and explore further.

4. Service Level Aspirations

4.1. Overview

4.1.1. Service level aspirations were produced for the 36 flows shortlisted from the economic analysis assessment. Each service level aspiration was graded based on the predicted level of change required to the current service level or infrastructure to deliver the outputs (Table 20).

Table 20 Level of change required to achieve the Service Level Aspirations

Type of Change Required	Grading
Minor Change – *requires changes that could be incorporated into the existing service level.*	1
Incremental Change – *requires changes to existing services which are likely to be achievable on current or enhanced infrastructure.*	2
Transformational Change – *requires significant infrastructure interventions to deliver.*	3

4.1.2. Due to the high-level nature of this analysis, the service level aspirations indicate what the service should achieve rather than prescribe the intervention needed to enable the outputs to be realised. For example, the service level aspirations may note that a 10% reduction in journey time is needed but cannot at this stage be certain on how this can be achieved. Infrastructure identification would require a greater level of detail to understand the localised opportunities and constraints. In developing service level aspirations consideration was given to existing schemes[3] in the Rail Network Enhancement Pipeline (RNEP) to understand if committed improvements have the potential to influence the aspirations sought in this study.

4.1.3. It should be noted that in most cases there is insufficient network capacity and/or capability to realise the service level aspirations identified and therefore infrastructure enhancements will be needed to enable the potential value of the flow to be unlocked. Similarly, there may be additional benefits realised through extending the service levels beyond the flows identified based on further economics not considered in this study, timetable constraints and/ or infrastructure constraints to name a few.

4.1.4. Within this report the flows have been grouped based on their location within EEH. However, it should be noted that some flows interact with more than one geographic group and therefore the groupings in this chapter are for reporting purposes only.

[3] Schemes in RNEP prior to the 2020 Spending Review

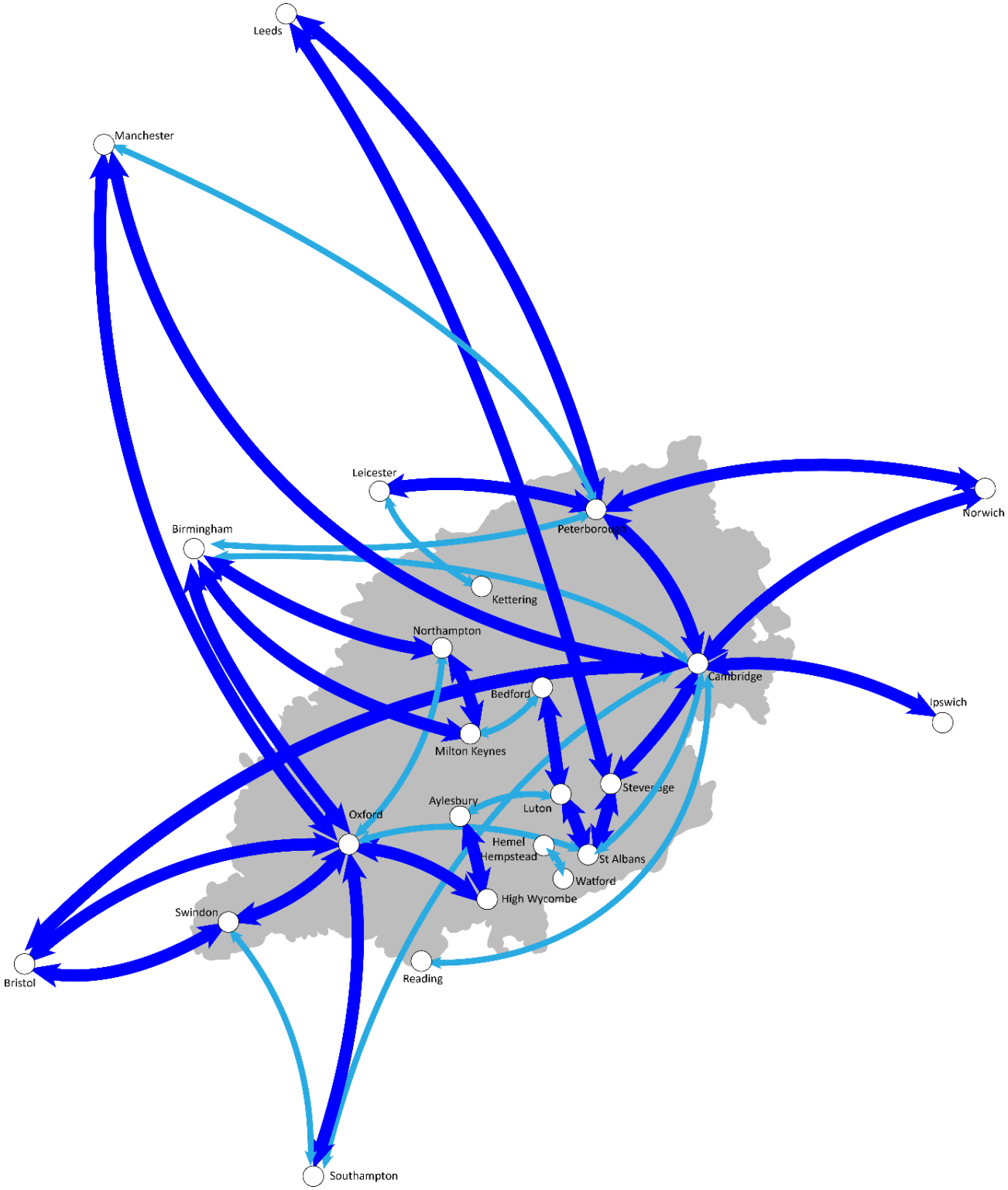


Figure 6 Map of the High and Medium Value Flows Identified. Dark blue denotes high value flows and light blue denotes medium value flows.

4.2. South West Axis

4.2.1. Currently, travel for most locations within EEH (with the exception of those located on the Great Western Main Line (GWML)) to the south-west cities such as Reading and Southampton requires a journey into and out of London with two interchanges. The introduction of East West Rail provides an opportunity to avoid London and instead focuses on Oxford as a key interchange location.

4.2.2. Existing strategies in this area relevant to this study include but are not limited to:

- London Paddington – Reading Corridor Study
- Network Rail's London Rail Strategy
- SWLEP Rail Strategy

4.2.3. The flows that were identified as economically valuable in the South West Axis are shown in Figure 7 below.

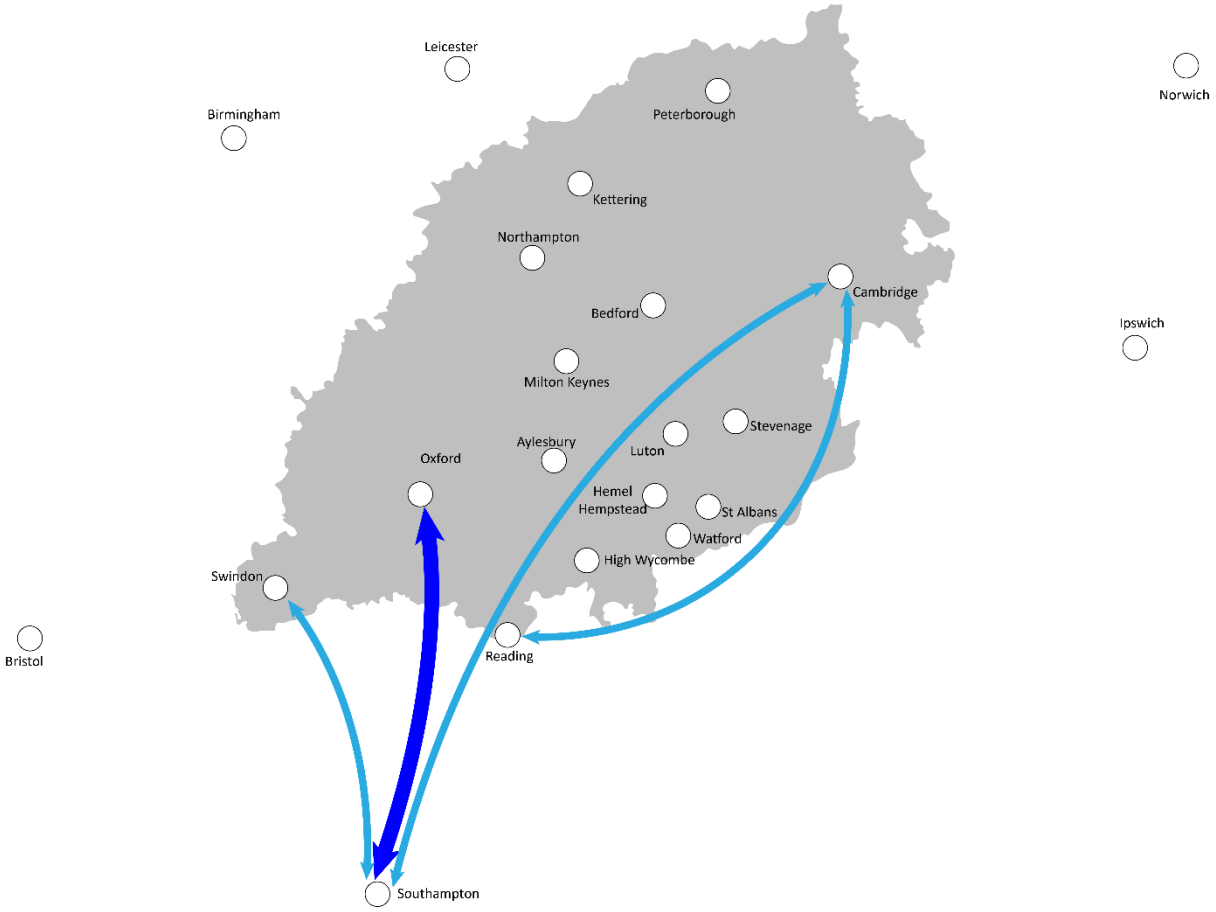


Figure 7 Map of the flows identified for the South- West Axis. Dark blue denotes high value flows and light blue denotes medium value flows.

Service Level Aspirations

4.2.4. To achieve the GJT reduction for flows located along the South-West axis the removal of an interchange and increasing the service frequency is required (Table 21). However, although these two factors combined are not enough to unlock the full value of the Swindon – Southampton flow, they will enable a portion of that value to be unlocked. It is likely that the Swindon – Southampton flow will need a greater improvement which could be supported through the Trans-Wiltshire corridor aspiration

Table 21 Service Level Aspirations for the South- West Axis

Flows	Service Level Aspiration	Type of Change
Oxford – Southampton Cambridge – Southampton Cambridge - Reading	An additional direct service between Oxford and Southampton via Reading	3
Swindon – Southampton	A direct service between Swindon and Southampton with a frequency of at least 1tph. This service does not necessarily need to be routed via Reading*.	2

* *This service level aspiration does not maximise the full value of this specific flow and further development is required to identify what additional enhancement(s) may be needed.*

4.3. Western Axis

4.3.1. As is seen for travel to the south-west, currently most locations within EEH will require the use of London or Oxford (in the future via East West Rail) as interchange locations into and out of the Region.

4.3.2. Existing strategies in this area relevant to this study include but are not limited to:

- East West Main Line Strategic Statement
- London Paddington – Reading Corridor Study
- Network Rail's London Rail Strategy
- The Oxfordshire Rail Corridor Study
- Oxfordshire Connect Programme
- SWLEP Rail Strategy

4.3.3. The flows that were identified as economically valuable in the Western Axis are shown in Figure 8 below.

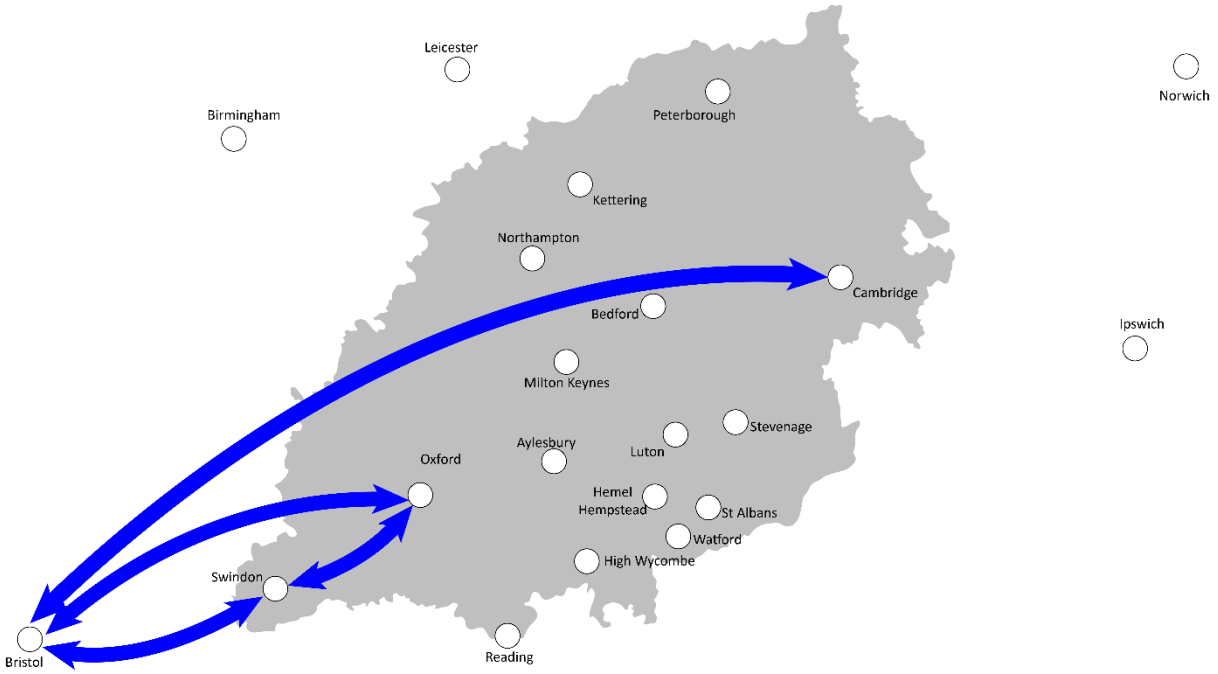


Figure 8 Map of the flows identified for the Western Axis. Dark blue denotes high value flows.

Service Level Aspirations

4.3.4. To achieve the GJT reduction for flows located along the western axis, the removal of an interchange and increasing the service frequency (Table 22) is required.

Table 22 Service Level Aspirations for the West Axis

Flows	Service Level Aspiration	Type of Change
Oxford – Bristol Oxford – Swindon Swindon – Bristol Cambridge – Bristol	An additional direct service between Oxford and Bristol via Swindon	3

4.4. North West Axis

4.4.1. Travel to the north-west from EEH is generally served well via the West Coast Main Line (WCML) but passengers can experience longer journey times with interchanges required elsewhere in the region. The introduction of East West Rail will enable more areas of the region to access the WCML through a single interchange at Bletchley or Milton Keynes.

4.4.2. Existing strategies in this area relevant to this study include but are not limited to:

- East West Main Line Strategic Statement
- Network Rail's London Rail Strategy
- The Oxfordshire Rail Corridor Study
- Oxfordshire Connect Programme

4.4.3. The flows that were identified as economically valuable in the North West Axis are shown in Figure 9 below.

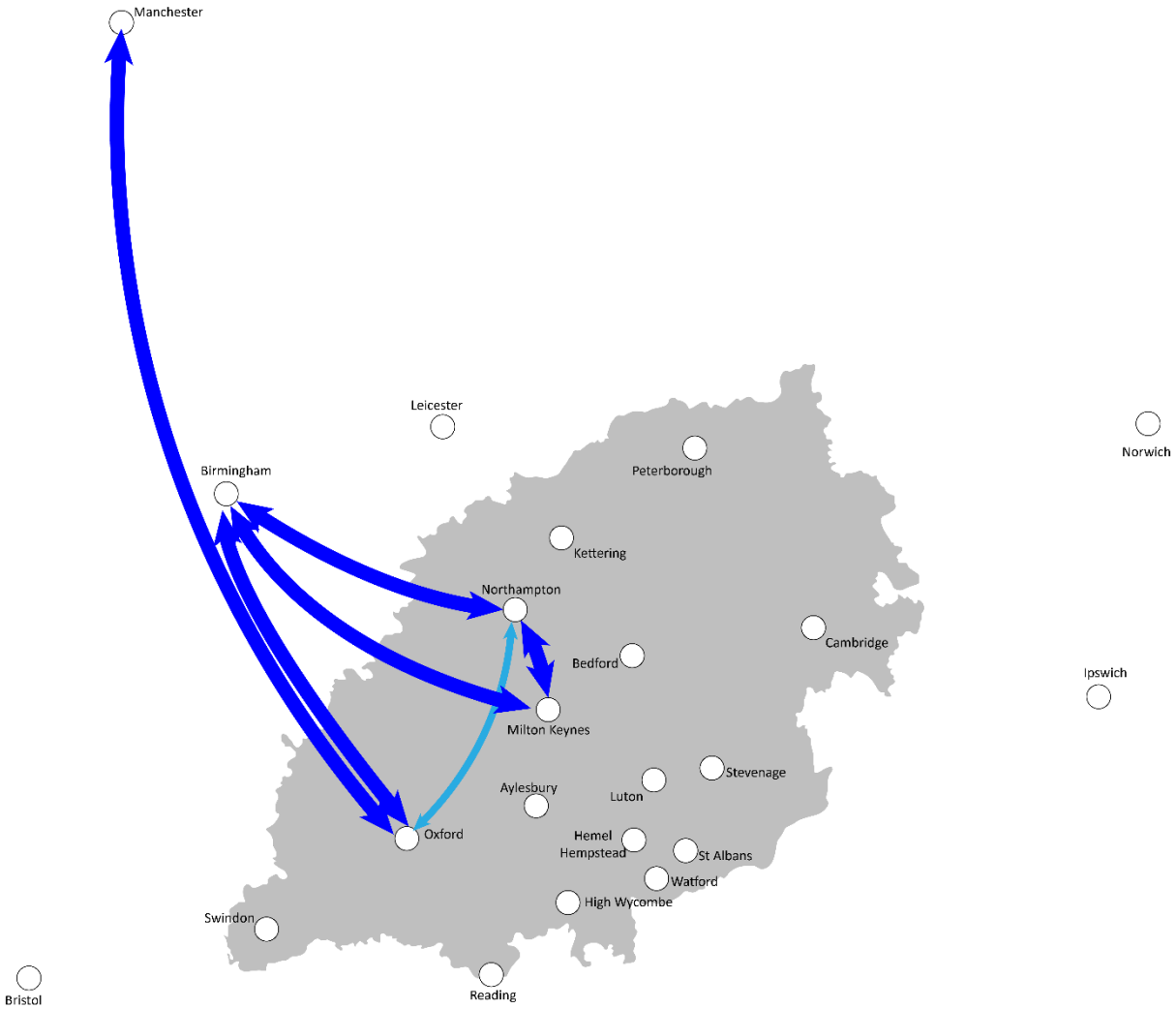


Figure 9 Map of the flows identified for the North- West Axis. Dark blue denotes high value flows and light blue denotes medium value flows.

Service Level Aspirations

4.4.4. To achieve the GJT reduction for flows located along the North-West axis a frequency uplift is typically required (Table 23). The introduction of High Speed 2 (HS2) also provides the opportunity to recast the WCML timetable which could enable connectivity to be improved between locations along the main line.

Table 23 Service Level Aspirations for the North-West Axis

Flows	Service Level Aspiration	Type of Change
Milton Keynes - Birmingham	A reduction in journey time of 10% (~6 minutes) **OR** An additional direct train between Milton Keynes and Birmingham via Northampton to address Milton Keynes – Northampton and Northampton – Birmingham connectivity aspirations.	2
Northampton - Birmingham	A reduction in journey time of ~20% (~12mins). This service could be combined by introducing the additional direct train between Milton Keynes and Birmingham.	2
Milton Keynes - Northampton	Two additional trains per hour between Milton Keynes and Northampton. These services could be split by: 1. One Milton Keynes- Birmingham service running via Northampton. 2. One Oxford – Northampton service.	1
Oxford - Northampton	A direct service between Oxford – Northampton which could be achieved, for example, through an extension of an East West Rail Oxford – Milton Keynes service. This could serve as one of the additional trains required for the Milton Keynes – Northampton flow.	1
Oxford - Birmingham	A reduction in journey time of 10% (~7 minutes) **OR** An additional direct train between Oxford and Birmingham. Improving this service will also support Oxford – Manchester connectivity aspirations	2
Oxford - Manchester	A reduction in journey time of 10% (~15 minutes). An alternative yet indirect option could be to provide a good service interchange onto HS2 at Birmingham Curzon Street	2

4.5. Northern Axis

4.5.1. Travel to the north from EEH is generally served well via the Midland Main Line (MML) for locations along this railway but there are longer journey times with indirect routings from elsewhere in the region. As with the North-West axis, the introduction of East West Rail will provide faster routings for locations on the WCML and more direct routings to locations on the East Coast Main Line (ECML) and GWML via Bedford without having to interchange at London or Leicester.

4.5.2. Existing strategies in this area include but are not limited to:

- Ely Area Capacity Enhancement Scheme
- Ely Area OBC

4.5.3. The flows that were identified as economically valuable in the Northern Axis can be seen in Figure 10 below.

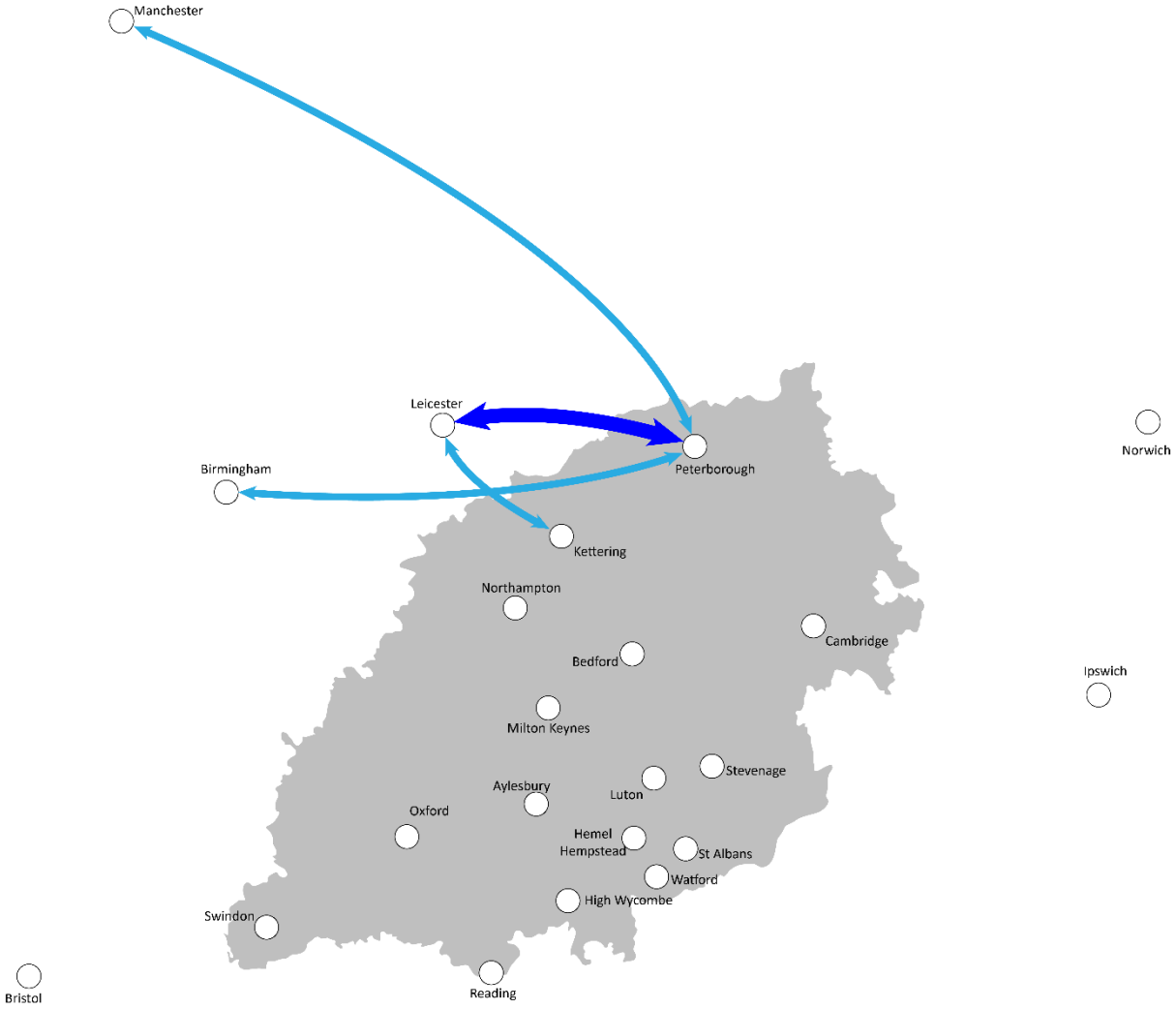


Figure 10 Map of the flows identified for the Northern Axis. Dark blue denotes high value flows and light blue denotes medium value flows.

Service Level Aspirations

4.5.4. To achieve the GJT reduction for flows located along the Northern axis a reduction in journey time is typically required (Table 24). The analysis identified that additional enhancements are required to maximise the full value of flows along the northern axis to cities in the north such as Leicester, Birmingham, and Manchester.

Table 24 Service Level Aspirations for the North Axis

Flows	Service Level Aspiration	Type of Change
Kettering - Leicester	A reduction in journey time of 10 % (~2 minutes). This is likely to be achieved by the Midland Main Line electrification programme.	1
Peterborough - Birmingham Peterborough - Leicester	A reduction in journey time of 10 % (~10 minutes) **OR** An additional direct train between Peterborough and Birmingham via Leicester*.	3
Peterborough - Manchester	A reduction in journey time of 10 % (~17 minutes) plus an additional direct service between Peterborough and Manchester.	3

* *This service level aspiration does not maximise the full value of this specific flow and further development is required to identify what additional enhancement(s) may be needed.*

4.6. Eastern Axis

4.6.1. Currently, travel for most locations within EEH (with the exception of those located on the MML) to the cities and towns in the east such as Norwich and Ipswich require travelling into and out of London or interchanging at Cambridge or Peterborough. The introduction of East West Rail provides an opportunity to avoid London and instead focuses on Cambridge as a key interchange location for EEH to access East Anglia.

4.6.2. Existing strategies in this area relevant to this study include but are not limited to:

- Cambridge Station
- Eastern Section EWR- Interim SOBC
- Ely Area Capacity Enhancement Scheme
- Ely OBC
- Ely Soham Doubling
- Great Eastern Main Line SOBC
- Haughley Junction OBC
- Soham Station
- West Anglia Main Line Study

4.6.3. The flows that were identified as economically valuable in the Eastern Axis are shown in Figure 11 below.

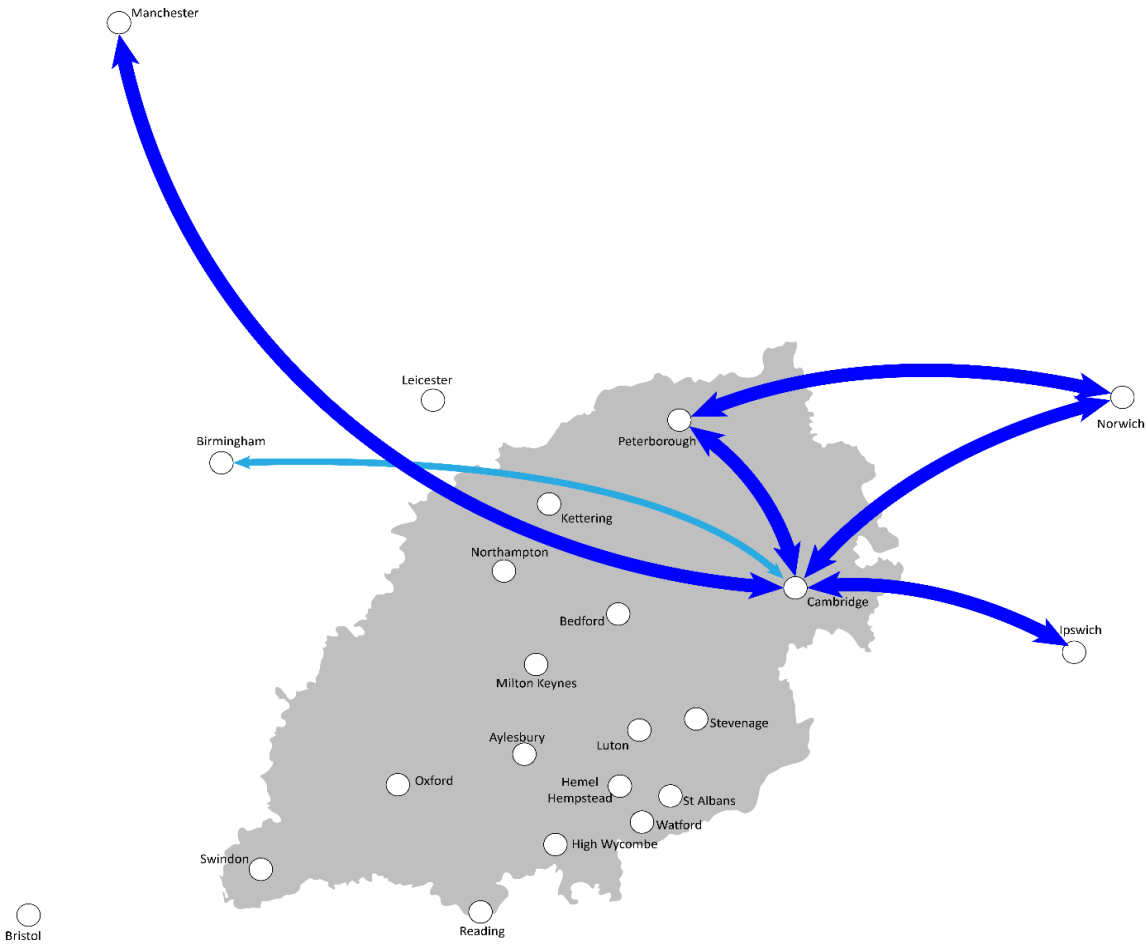


Figure 11 Map of the flows identified for the Eastern Axis. Dark blue denotes high value flows and light blue denotes medium value flows

Service Level Aspirations

4.6.4. To achieve the GJT reduction for flows located along the Eastern Axis a reduction in journey time and an increase is service frequency is typically required to connect EEH to East Anglia. The analysis identified that greater enhancements are required to unlock the full value of flows from the eastern-axis of EEH to cities in the North-West such as Birmingham and Manchester (Table 25).

Table 25 Service Level Recommendations for the East Axis

Flows	Service Level Aspiration	Type of Change
Cambridge - Norwich	An additional direct train between Cambridge and Norwich **OR** A reduction in journey time of 10 % (~8 minutes) between Cambridge and Norwich.	2
Peterborough - Norwich	A reduction in journey time of 10 % (~10 minutes) between Peterborough and Norwich.	2
Peterborough - Cambridge	A reduction in journey time of 10 % (~5 minutes) and an additional direct service between Peterborough and Cambridge*. Improving this service will also support Peterborough – Norwich, Cambridge – Manchester and Cambridge – Birmingham connectivity aspirations.	3
Cambridge - Ipswich	A reduction in journey time of 10 % (~8 minutes) and an additional direct service between Cambridge and Ipswich*.	3
Cambridge - Manchester	A reduction in journey time of 10 % (~14 minutes) and an additional direct service between Cambridge and Manchester*. Improving this service will also support Peterborough – Cambridge, Peterborough – Manchester and the Cambridge – Birmingham connectivity aspirations.	3
Cambridge - Birmingham	A reduction in journey time of 10 % (~16 minutes) and an additional direct service between Cambridge and Birmingham. An improvement in this service will support Peterborough – Cambridge, Peterborough – Birmingham and the Cambridge – Manchester connectivity aspirations.	3

* *This service level aspiration does not maximise the full value of this specific flow and further development is required to identify what additional enhancement(s) may be needed.*

4.7. Central Axis

4.7.1. Travel for most locations within EEH which are not situated on the same main line are often long and complicated resulting in travellers opting to use personal transport for a more direct journey. The introduction of East West Rail begins to address this need for those travelling through the region's centre but doesn't provide a solution for those travelling east-west in the northern or southern periphery of the Heartland.

4.7.2. Existing strategies in this area relevant to this study include but are not limited to:

- A414 Corridor Mass Rapid Transit System
- Abbey Line SOBC
- Bedford Rail Strategy
- East West Main Line Strategic Statement
- Hertfordshire County Council Rail Strategy
- Network Rail's London Rail Strategy

4.7.3. The flows that were identified as economically valuable in the Central Axis can be seen in Figure 12 below.

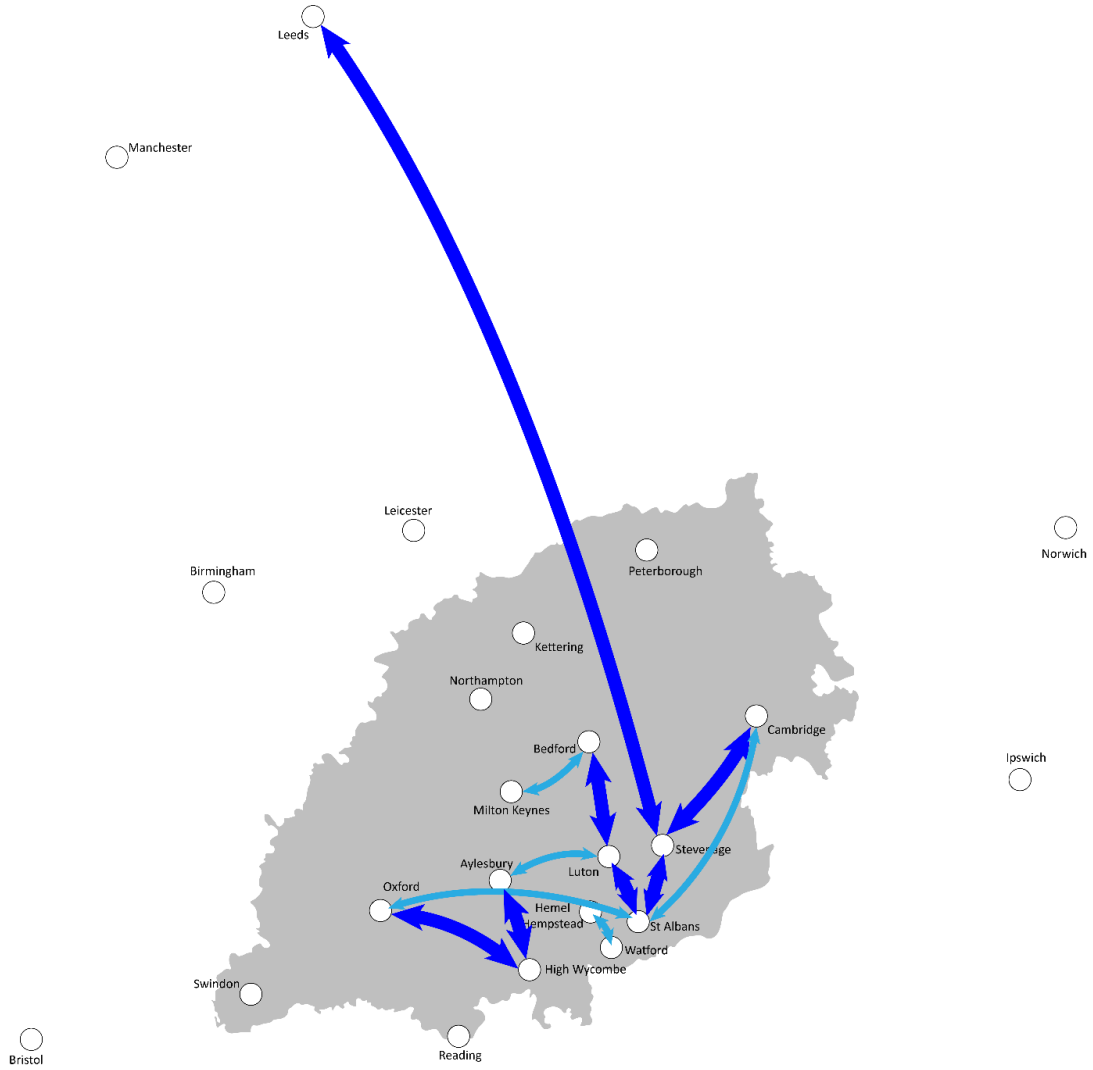


Figure 12 Map of the flows identified for the Central Axis. Dark blue denotes high value flows and light blue denotes medium value flows.

Service Level Aspirations

4.7.4. To achieve the GJT reduction for the Central Axis a direct service is often required between locations, removing the need to interchange in London. However, to reduce the need to interchange usually requires a significant intervention such as a new railway line to unlock the value (Table 26).

Table 26 Service Level Recommendations for the Central Axis

Flows	Service Level Aspiration	Type of Change
St. Albans - Stevenage St. Albans - Cambridge	A direct service between St. Albans and Cambridge via Stevenage. It should be noted that to achieve a direct service a new line would be required between St. Albans and Stevenage*.	3
Stevenage - Cambridge	A journey time improvement of 10 % (~4 minutes) and an additional direct service between Stevenage and Cambridge*.	3
Stevenage - Leeds	A journey time improvement of ~20 % (~36 minutes) between Stevenage and Leeds.	2
St. Albans - Oxford	A direct service connecting St. Albans and Oxford, with no interchange*.	3
St. Albans - Luton	A journey time improvement of 10 % (~1 minute) and an additional direct service between St. Albans and Luton*.	3
Luton - Bedford	A journey time improvement of 10 % (~2 minutes) **OR** An additional direct service between Luton and Bedford. This additional service could be extended onto Kettering and cities further north (Leicester/Nottingham/Derby) to address the removal of direct services from May 2021.	1
Milton Keynes - Bedford	A direct service between Bedford and Milton Keynes. This could be achieved by extending a Bedford – Bletchley service onto Milton Keynes, noting the requirement for additional infrastructure or a reversal move at Bletchley.	3
Watford - Hemel Hempstead	An improvement in journey time of 10 % (~1 minute) and an additional direct service. This could be explored through the capacity released on the WCML from HS2*.	2
Aylesbury - Luton	A direct service between Aylesbury and Luton. To achieve this a new line or new infrastructure connections to existing lines would be required to connect the two towns.	3
High Wycombe - Aylesbury	An improvement in journey time of 10 % (~3 minutes) and an additional direct service. This could be explored further through the Chiltern Route Upgrade programme*.	3
High Wycombe - Oxford	An improvement in journey time of 10 % (~4 minutes) and an additional direct service. This could be explored further through the Chiltern Route Upgrade programme*.	2

* *This service level aspiration does not maximise the full value of this specific flow and further development is required to identify what additional enhancement(s) may be needed.*

5. Conclusion

5.1.1. The Phase 2 study has applied multiple levels of economic analysis to identify the most economically valuable strategic flows both internally and externally that connect EEH key locations. The analysis has reinforced the findings of Phase 1, observing the strengths of the EEH rail network in connecting locations along main lines but falling short of encouraging east to west travel unless via interchange at London termini.

5.1.2. The delivery of East West Rail will begin to address the demand for cross-region travel by connecting Oxford, Milton Keynes, Bedford, and Cambridge, and could do more by expanding the services to new locations beyond the existing planned geography. The analysis has indicated that extension of East West Rail services west of Oxford could deliver some of the service level priorities identified in this report. Notwithstanding this, the modelling in this study has confirmed east – west connectivity for the town and cities to the north and south of the new East West Main Line will remain largely unchanged. It is recognised that opportunities will arise to improve rail connectivity in EEH through future schemes such as the capacity that is released on the West Coast Main Line from HS2, electrification of the Midland Main Line, the Chiltern Route Upgrade programme and the Eastern section of East West Rail.

5.1.3. Phase 2 has demonstrated unequivocally that a significant market exists to justify enhancements to regional and intercity travel by rail in this region. The economically valuable flows identified in this study are on all sides of the compass and are agnostic to the infrastructure that improved connectivity may trigger. The spatial spread of the region's most economically sensitive services showcases the economic value of EEH's regional centres which can be overlooked in franchise specifications. Further, it identifies empirically that many of these flows are performing below average when compared with neighbours outside the region.

5.1.4. 36 flows were identified as having the potential to generate a significant return on investment as a result of improved rail connectivity. These flows were converted into service level aspirations to identify what is required to unlock the value of the flows. Where there was a logical interface with more than one flow the service level aspirations were aggregated to form service packages which would contribute to realising the value of multiple flows. Table 27 below summarises the extent of change required to improve connectivity and therefore unlock economic, social, and environmental benefits across the EEH region.

Table 27 Summary of changes required to achieve the flow potential.

Type of Change Required	Number of Flows
Minor Change – *requires changes that could be incorporated into the existing service level.*	4
Incremental Change – *requires changes to existing services which are likely to be achievable on current or enhanced infrastructure.*	10
Transformational Change – *requires significant infrastructure interventions to deliver.*	22

5.1.5. The service level aspirations identified in this study will be prioritised by EEH depending on their existing development states. Those which are at an early stage of development or do not currently have any development work underway will be considered further by EEH. EEH on behalf of its partners will consider which flows to take forward as a programme of feasibility studies and business cases to understand how best to realise the value of the service level aspirations set out in in this report.

6. Appendices

Appendix A: Existing Strategies Across EEH

6.1.1. Existing strategies identified by the EEH Passenger Rail Study Phase 2 Steering Group which may, in places, overlap with this study and its output are listed below. This is not an exhaustive list and studies or strategies may exist in addition to those mentioned here.

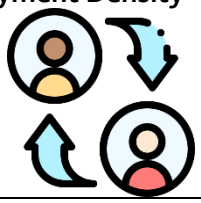
A414 Corridor Mass Rapid Transit System	Great Eastern Main Line SOBC
Abbey Line SOBC (RYR)	Haughley Junction OBC
Bedford Rail Strategy	Hertfordshire County Council Rail Strategy
Cambridge Station	London Paddington – Reading Corridor Study
East West Main Line Strategic Statement	Network Rail's London Rail Strategy
Eastern Section EWR- Interim SOBC	Oxfordshire Connect Programme
EEH Transport Strategy	Oxfordshire Rail Corridor Study (ORCS)
Ely Area Capacity Enhancement Scheme	Soham Station
Ely OBC	SWLEP Rail Strategy
Ely Soham Doubling	West Anglia Main Line Study

Appendix B: Multi- Criteria Analysis

Phase 1 of the EEH Rail Corridor Study considered 29 key locations in EEH region. In Phase 2 of this study, priority flows or areas were identified to enable analysis to initially focus on places that generate higher benefits from an improvement in rail connectivity. Places that were not included in the initial list of priority flows can still benefit from conditional output development and packages of options. For example, an improvement in connectivity between two key economic centres can be achieved by providing more frequent services between these places, serving and therefore benefitting, intermediate rail stations between these two places. The identification and shortlist of places enables the efficient management of the economic assessment and interpretation of the results.

A Multi-Criteria Analysis (MCA) was used to select places for further assessment. It is a decision-making tool that evaluates multiple (possibly conflicting) criteria as part of the decision-making process. Similar in purpose to a cost-benefit analysis, but with the notable advantage of not being solely limited to monetary units for its comparisons. It also has the added benefit of judging options against various pre-determined criteria. The criteria used for this MCA to identify a list of prioritised locations for further connectivity analysis are outlined below:

Table 28 MCA Criterion

Criterion	Explanation
Population 	The larger the population of a location, the more passengers that will benefit from a connectivity improvement.
Employment Density 	Previous analysis has indicated that a minimum level of employment density is required before business rail travel starts to accelerate. Before this employment density level, even if large rail improvements are delivered, it will not significantly increase the number of business travellers.
GVA per Worker 	The productivity of workers will affect how much the economy will 'level up' post a rail connectivity intervention.
Rail Service Opportunity 	This criterion examines how the current Generalised Journey Times (GJTs) to other EEH locations compare to the expected GJT for the size of the location against the national average. The expected GJT is determined by the observed average GJT of similar sized employment centres from across the country.

Market Opportunity (to abstract from Car modal share) 	This criterion looks at whether there is a big travel market and the rail modal share. If a location has a large market but a low rail modal share this represents an opportunity for rail to abstract passengers from road. Conversely small markets with low rail modal share are unlikely to see large increases in rail patronage with improvements to the rail service and therefore receive a lower score.

In terms of scoring, each location was scored between 1 and 5 for each criterion, with 5 being the highest score. In this exercise the current state of each of the locations will be assessed on how they meet transport objectives. Previously it was thought it could be useful to test what the future state of the locations might be, but because the scoring has been aligned to national rather than regional comparisons no further insights were gained (no material difference has been identified) in conducting an assessment of the future. The current state of each location is a good indicator of the opportunity to meet transport objectives both now and in the future. Therefore, the analysis has examined just the current state of the EEH locations.

The methodology on how these scores are determined is detailed below:

Criterion 1: Population

The population scoring has been tailored to the size of locations across the UK. Locations with higher populations are scored higher with mainly cities receiving a score of 5.

Score	Score details	Data used to represent the current state
1	<50,000	ONS Population Estimates for local authorities mid-2019.
2	50,001-150,000	
3	150,001-300,000	
4	300,001-450,000	
5	>450,000	

Criterion 2: Employment Density

This scoring is based on a national employment density analysis on UK cities undertaken by Network Rail's Economic Analysis Team. It showed a correlation across cities that once a location reaches 50 workers per hectare rail business travel increased sharply.

Score	Score details	Data used to represent the current state
1	<25 workers per hectare	2018 Business Register and Employment Survey: open access, using the MSOA data where the train station is located.
2	25-50 workers per hectare	
3	50-100 workers per hectare	
4	150-200 workers per hectare	
5	>200 workers per hectare	

Criterion 3: GVA per worker

The GVA scoring has aligned to the GVAs per worker of local authorities from across the country. Generally, the data shows that locations in the South have a higher GVA than locations in the North. Higher GVA areas score higher under this criterion because they are able to generate higher economic returns (e.g. tax revenue and increase in economic output) for the country given an improvement to the transport network.

Score	Score details	Data used to represent the current state
1	<£40,000	Office for National Statistics Gross Value Added (Income Approach) December 2017. GVA per worker (2016) by local authority.
2	£40,001-£50,000	
3	£50,001-£55,000	
4	£55,001-£60,000	
5	>£60,000	

Criterion 4: Rail Service Opportunity

All flows across the UK were examined in this exercise to examine the average rail GJT between locations of a certain size (employment) and distance. The GJT from each key location to the other EEH locations were examined and compared to the expected GJT (the average GJT between locations of a similar job market size based on national UK rail data). If the actual GJTs to EEH locations were higher than the expected GJT this demonstrates that the rail service is underperforming compared to similar locations in the UK, and therefore it scores highly with a score of 4 or 5 depending on how far away the actual GJT is versus the expected GJT. Conversely if the actual GJT is lower than the expected GJT it shows that the rail service is over performing compared to the national average and therefore scores poorly.

Score	Score details	Data used to represent the current state
1	<-40 %	NR National GJT Analysis examining for all flows the total jobs for both the origin and destination and the GJT between them.
2	-40 to -10 %	
3	-10 to +10 %	
4	+10 to +40 %	
5	>40 %	

Criterion 5: Market Opportunity

The market opportunity criterion takes into consideration two factors: the size of the market and the rail modal share. The size of the rail market for this analysis is determined by totalling the business user demand per day to other EEH locations. Only business users have been used, as one of the primary objectives of the EEH phase 2 study is to understand the benefits of improving the B2B (business to business) travel to and from EEH locations. The second factor considered is the rail modal share; this is the percentage of rail business users out of all journeys made between the EEH locations.

Multimodal data is required to undertake this kind of analysis, but unfortunately up to date data with the correct geography and level of detail to cover all the EEH locations is difficult to obtain. Previously it was thought that the study could repurpose data from DfT's WITA model. However, DfT guidance advises that absolute values should not be used for further analysis therefore eliminating this data source for use in the EEH study. The study has therefore decided upon using PLANET data, a model originally used to calculate the benefits of HS2 (NR originally used this data for the long-distance study forecasts in 2011). In PLANET the country is divided into 235 zones (Planet strategic zones), and the model contains the total number of journeys to all other zones by mode type (rail, car and air[4]). For some of the bigger locations in EEH the zones matchup well. However, for some of the small locations they have been grouped into a zone e.g. High Wycombe, Bletchley and Aylesbury are grouped into the Buckinghamshire Zone. In this instance a simplification has been made due to the limitations of the data whereby the demand travelling from this zone to other EEH locations is split according to the population of each location.

Once the data was processed to understand the market size and rail modal share for each location travelling to the other EEH locations the scores for each location were decided upon using the following matrix.

	Rail Modal Share by Business Journeys per day to EEH locations category.			
Score	**<750**	**751-2,000**	**2,001-5,000**	**>5,001**
1	>2 %	>4 %	>5 %	>20 %
2	<2 %	2-4 %	3-5 %	8-12 %
3		<2 %	2-3 %	5-8 %
4			<2 %	2-5 %
5				<2 %

The matrix above was decided upon based on the aspirational rail modal share of a higher performing region, namely the Midlands. Regional centres in the Midlands such as Coventry, Nottingham and Leicester have a rail modal share of 2-8 % travelling to other regional centres in the Midlands and represent a realistic minimum target for EEH locations to aspire to. There are four scoring categories in the matrix above because small locations with fewer business journeys represent a smaller market opportunity and therefore have a maximum score they can achieve. For larger locations, with >5,001 business journeys per day if the mode share is less than 2 %, this represents a larger opportunity to abstract mode share from car onto rail and therefore a score of 5 is awarded. Conversely for large locations if the mode share of rail is already high, it will receive a lower score.

[4] Does not include Bus/Coach

Location Scoring

The performance for the EEH locations under each criterion is displayed below. Locations are currently shown in descending order by population size.

Table 29 EEH Location Multiple Criteria Analysis Results

		1) Population		2) Employment Density		3) GVA per Worker		4) Rail service Opportunity		5) Market Opportunity				
#	Location Name	Population Size	Score	Employment Density (jobs per hectare)	Score	GVA per Worker	Score	Current vs Expected GJT	Score	Estimated Business Journeys per day to EEH Key Stations	Rail Mode Share	Score	Total Score	Rank
1	Milton Keynes	269,457	3	72	3	72,348	5	-40%	2	2,730	0.6%	4	17	1
2	Northampton	224,610	3	102	4	51,534	3	-40%	2	10,676	0.3%	5	17	1
3	Swindon	222,193	3	81	3	74,736	5	-26%	2	218	2.5%	1	14	4
4	Luton	213,052	3	91	3	58,076	4	-48%	1	1,922	0.9%	3	14	4
5	Peterborough	202,259	3	92	3	51,217	3	-37%	2	492	2.9%	1	12	9
6	Bedford	173,292	3	68	3	49,776	2	-47%	1	867	0.8%	3	12	9
7	Oxford	152,457	3	119	4	41,208	2	-31%	2	1,012	3.2%	2	13	6
8	St Albans	148,452	2	109	4	47,703	2	-42%	1	1,134	3.6%	2	11	13
9	Cambridge	124,798	2	57	3	50,639	3	-29%	2	2,952	4.5%	2	12	9
10	High Wycombe	124,073	2	48	2	52,790	3	-30%	2	2,640	0.4%	4	13	6
11	Hemel Hempstead	101,849	2	35	2	54,280	3	-41%	1	882	0.4%	3	11	13
12	Kettering	101,776	2	36	2	42,635	2	-20%	2	1,877	0.1%	3	11	13
13	Watford	96,577	2	333	5	46,956	2	-40%	2	513	0.4%	2	13	6
14	Stevenage	87,845	2	40	2	51,962	3	-36%	2	1,820	2.7%	2	11	13
15	Aylesbury	84,890	2	108	4	46,194	2	5%	3	2,807	0.4%	4	15	3
16	Wellingborough	79,707	2	28	2	46,179	2	-24%	2	298	0.4%	2	10	17
17	Corby	72,218	2	20	1	44,649	2	-10%	2	621	0.4%	2	9	20
18	Welwyn Garden City	51,264	2	86	3	45,366	2	-23%	2	448	2.7%	1	10	17
19	Banbury	47,230	1	28	2	54,023	3	-46%	1	550	0.4%	2	9	20
20	Hatfield	44,821	1	52	3	45,366	2	-21%	2	566	2.7%	1	9	20
21	Leighton Buzzard	41,814	1	28	2	62,686	5	-43%	1	299	3.2%	1	10	17
22	Bishops Stortford	40,423	1	32	2	46,074	2	-29%	2	22	5.7%	1	8	26
23	Bletchley	39,304	1	38	2	72,348	5	-37%	2	649	0.4%	2	12	9
24	St Neots	32,854	1	12	1	52,294	3	-41%	1	766	0.3%	3	9	20
25	Bicester	32,789	1	34	2	54,023	3	-42%	1	423	0.4%	2	9	20
26	Didcot	30,078	1	16	1	57,718	4	-47%	1	379	0.9%	2	9	20
27	Hertford	28,950	1	43	2	46,074	2	6%	3	782	2.7%	2	10	17
28	Huntingdon	25,825	1	28	2	52,294	3	-47%	1	602	0.3%	2	9	20
29	Ely	20,225	1	3	1	51,568	3	-33%	2	944	0.3%	3	10	17

From the table above, a general, but expected trend is that the larger economic centres tend to score higher than the smaller regional centres. Milton Keynes and Northampton are the two largest regional centres in the EEH area and score the highest, and conversely the smallest regional centres Huntingdon and Ely score on the lower end.

However, the MCA does bring some interesting results for medium sized regional centres. According to the criteria, several locations present a development opportunity, the most prominent being Aylesbury & Watford. Ranked 15th and 13th in terms of population, but in the MCA they rank 3rd and 6th overall because they both have a relatively high employment density indicating there is sufficient economic mass to support the business travel and commuter markets, and they both have high GVAs per head. Aylesbury in particular scored highly because an opportunity to improve the rail service offering exists. It was the one of only two locations out of the 29 where the current GJT is worse than the expected GJT, when compared to a place with similar employment size. Additionally, in Aylesbury there appears to be a relatively large business travel market but a very low rail mode share. This therefore suggests there may be a significant opportunity for rail to take away mode share from car.

Conversely medium sized regional centres such as Wellingborough and Corby scored lower because of low employment densities (<50 jobs per hectare) and lower than average GVAs per head.

Finalised List of Priority Locations

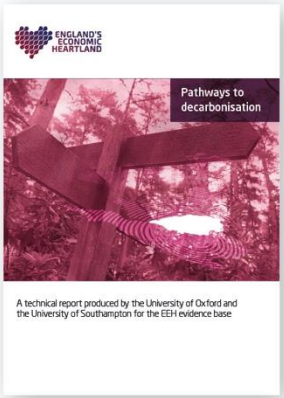
The purpose of the MCA exercise was to help rank and prioritise locations for further investigation. When ranked in order, a list of 15 locations emerged from the analysis, these are highlighted below:

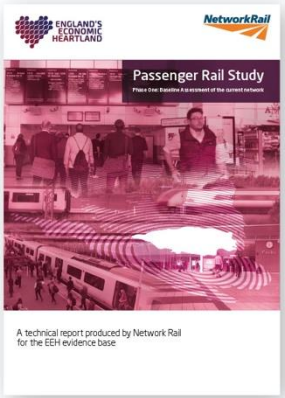
Table 30 List of Prioritised Locations for further analysis

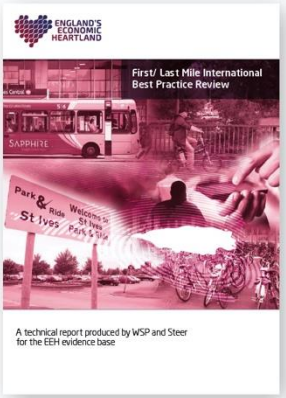
#	Location Name
1	Milton Keynes
2	Northampton
3	Aylesbury
4	Swindon
5	Luton
6	Oxford
7	High Wycombe
8	Watford
9	Peterborough
10	Bedford
11	Cambridge
12	St Albans
13	Hemel Hempstead
14	Kettering
15	Stevenage

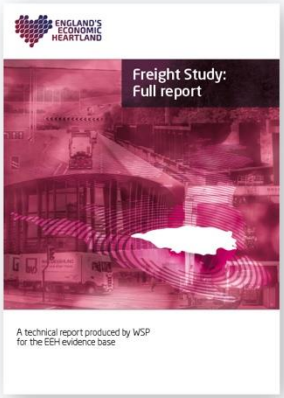
Bletchley has however been removed from the top 16 list as it is believed that the final score for Bletchley may include an overestimation on the size of the opportunity. Bletchley is classified in the same local authority as Milton Keynes and therefore it has inadvertently benefited from the aggregation of data for the GVA per head criteria (it scores a 4, when in all other categories Bletchley scores a 1 or 2). Therefore, it has been removed from the top 16 list due to the limitations in the data overestimating the size of the opportunity.

Englands Economic Heartland has released a number of technical studies and documents which underpin the Transport Strategy.
These are available on our website www.englandseconomicheartland.com









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