

# M6 to A1(M) Corridor Study

## Summary Report

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# 1 INTRODUCTION

## 1.1 Study Background

Highways England commissioned AECOM to examine the potential for a new strategic highway link across the Pennines, creating an additional link between the M6 and the A1(M). This follows an earlier study in 2018/19, which reviewed the existing Central Pennines Corridor (CPC) conditions and examined the potential for Trans Pennine highway improvements.

The Study is currently at Strategic Outline Business Case (SOBC) stage and aligned with Stage 0 of the Highways England Project Control Framework (PCF).

The scope of this study is focussed on highway connectivity, with rail connectivity out-of-scope, although the interaction between a new highway link and rail network enhancements is considered (including proposals, such as, Northern Powerhouse Rail). The study therefore explores road-based solutions for a new route between the M6 and A1(M). At the outset, it is important to note that the mandate for this study specifically focuses on the development of the case for a new strategic highway route and does not include analysis of strategic alternatives, including full consideration of rail alternatives at this stage.

The evidence collated has demonstrated that in order to meet the study strategic aims and objectives, improvements to the trans-Pennine Strategic Road Network (SRN) are required. The RIS notes that there are limited east-west road links available and the M62 is the only SRN link between the east and west of the country within the CPC. There are also no other dual carriageway east-west links so road capacity in the corridor is very limited.

## 1.2 Study Objectives

The study used a set of scheme objectives to ensure a robust approach can be taken to scheme assessment. The objectives, shown in **Figure 1** were agreed with the Study's sponsors (DfT and Transport for the North, TfN) and the delivery partners which included:

- Lancashire County Council;
- West Yorkshire Combined Authority;
- Bradford Metropolitan District Council;
- Leeds City Council; and
- North Yorkshire County Council.

The objectives have been aligned with Highways England’s stated ambitions and TfN’s Strategic Transport Plan and are identified across four themes: Connectivity, Economic Growth, Network Performance and the Environment.

**Figure 1: Study Objectives**

A. Connectivity	B. Economic Growth	C. Network Performance	D. Environment
A1. Improve connectivity between important economic centres east and west of the Pennines to increase growth and productivity	B1. Support the economic growth of the Northern Powerhouse economy, in particular, the prime and enabling sectors as set out in the North’s Independent Economic Review	C1. Improve journey time reliability for all road users	D1. Minimise adverse impacts on the built and natural environment
A2. Reduce Trans Pennine journey times, including for freight	B2. Support the regional growth aspirations of East Lancashire and North and West Yorkshire by facilitating new economic development opportunities along existing developed corridors where poor connectivity currently impacts on growth and productivity	C2. Improve road safety, including for non-motorised users	D2. Optimise opportunities to enhance the built and natural environment
A3. Maintain and improve access for tourism and local communities in the Yorkshire Dales National Park and the Bowland and Nidderdale Areas of Outstanding Natural Beauty	B3. Improve accessibility from economically deprived areas in the corridor (East Lancashire and West Yorkshire) to centres of employment, education and training	C3. Improve access for non-motorised users and reduce severance for local communities	D3. Reduce the impact of traffic on local communities
A4. Improve access to international transport hubs and gateways such as Leeds Bradford Airport		C4. Reduce congestion on Trans Pennine routes	
		C5. Improve the resilience of strategic Trans Pennine routes to severe weather events and other incidents	

### 1.3 Purpose of Report

The purpose of this document is to summarise the analysis and work that has been undertaken since the previous study; providing details of indicative cost estimates and the potential magnitude of benefits that a scheme in this corridor could produce.

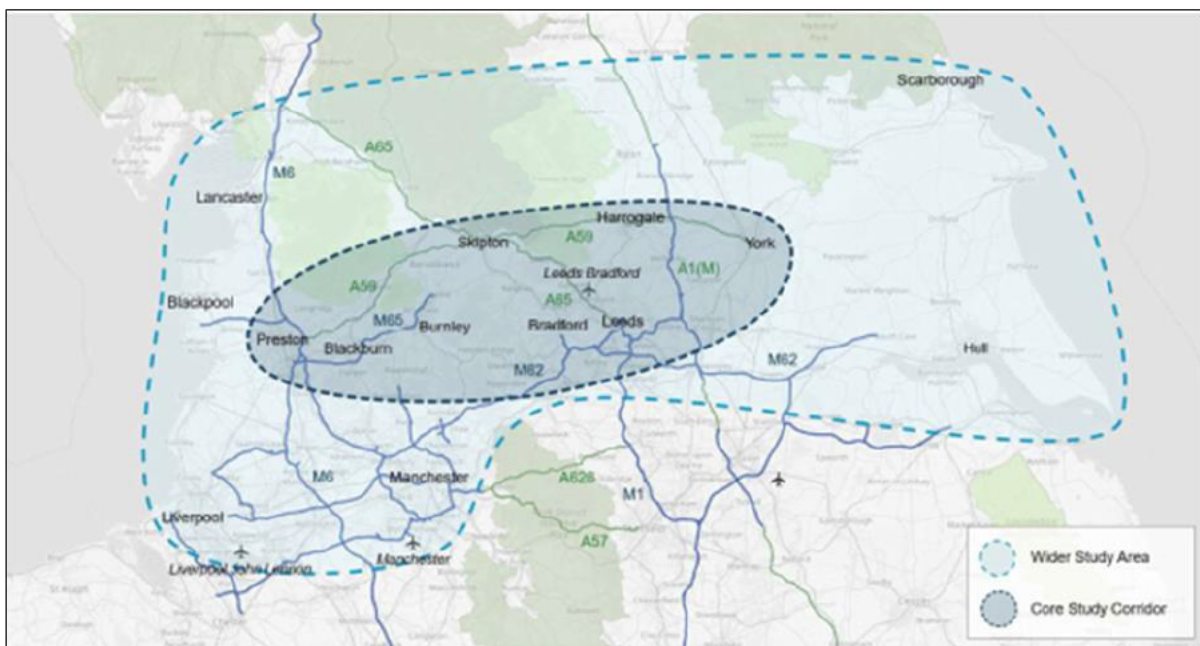
## 2 THE NEED FOR INTERVENTION

### 2.1 Study Area Context

The M6 to A1(M) study area focused on east-west connectivity across the north of England, taking account of the existing SRN and economic centres and assets which would benefit from additional capacity and resilience in the network. **Figure 2** presents the M6 to A1(M) study area which is comprised of two discrete sections:

- **Wider Study Area** - Follows the Transport for the North (TfN) Central Pennines Strategic Development Corridor; and
- **Core Study Corridor** - Focuses on the people, places and businesses between Central and East Lancashire and North and West Yorkshire.

**Figure 2: M6 to A1(M) Study Area**



### 2.2 Existing Provision & Current Problems

This section introduces the existing transport network within the Wider Study Area and Core Study Corridor. With an emphasis on highway movements for this study, **Figure 3** illustrates the existing highway network and the capacity of Trans Pennine connections.

**Figure 3** shows the spatial distribution between existing Trans Pennine routes with many separated by large distances. Although Central and Southern Trans Pennine routes are relatively close in distance, many have lower capacity and are characterised by challenging topography (such as the A59 and A65).

Several routes within the Wider Study Area are part of the SRN, including the A1(M), M6, M61, M62 and M65 (between Preston and Junction 10). The key routes across the M6 to A1(M) corridor are shown in **Figure 3**. The M6 and A1(M) provide north-south connectivity to the west and east of the Wider Study Area respectively, with several east-west routes providing connectivity (of varying extents), but, due to the challenging topography, they are of a low standard, between the M6 and A1(M).

In terms of rail connectivity, an overview of the rail network is provided in **Figure 4**. This highlights there are several large rail stations (e.g. Manchester, Preston, Leeds, Liverpool) providing rail accessibility across the UK via a number of rail lines with varying frequency. It highlights the Core Study Corridor has infrequent services, many have frequent stops which provide a broad passenger catchment but slower journey times. The map demonstrates the connectivity within each region but limited and slow direct rail services between East Lancashire and West Yorkshire which reduces the attractiveness of rail as a viable option to the car.

**Figure 3: Existing Highway Network**





## **Congestion**

Several Trans Pennine routes experience localised congestion around key towns, close to urban areas or interchange locations. Congestion constrains the movement of people and goods and therefore limits the catchment areas for commuters as well as the reliability for business and freight movements, particularly if the latter are dependent on 'just-in-time' deliveries.

## **Resilience**

A resilient highway network is important for ensuring journey times and that journey time reliability are not adversely impacted and therefore provides confidence to those travelling on the network that they will be able to complete their journey time in the expected time frame. As the study area crosses the Pennines, the topography challenges the resilience of several routes.

Meanwhile, severe weather conditions can adversely affect traffic movements and this is exacerbated by the topography. Furthermore, climate change is likely to increase the frequency and severity of severe weather events and the adverse impacts this has on the highway network.

## **Accidents**

It is noted within the Highways England 2018 Regional Safety Reports that for east-west routes, particularly single carriageway roads, accidents often have widespread consequences, with closures leading to heavy congestion, increased journey times and distances, and localised worsening of pollution levels due to the build-up of stationary traffic. Also, in the event of an accident closure on the M62, this can lead to critical delays and force high volumes of traffic onto the lower capacity alternatives or local roads. This can have a particular impact on freight movements which may have more limited alternative routes suitable for the height, width and length of vehicles, and are often opening on 'just-in-time' delivery schedules which are sensitive to delays.

Accidents on the M62, and resulting closures, lead to critical delays and high volumes of traffic needing to use lower capacity alternative routes. This demonstrates the limited resilience of the existing east-west movements to cope with unexpected events. These low levels of resilience can have a particular impact on freight, with more limited suitable alternative routes for some vehicles, and the importance of timely movements for the economy.

## **Growth & Connectivity**

Transport improvements can ensure there is suitable accessibility in areas of growth, whilst also providing the necessary connectivity to facilitate growth elsewhere. With areas within the study area amongst some of the most deprived nationally, this presents an opportunity to drive economic growth and productivity reduce unemployment and improve skills. Although enhanced connectivity between the M6 and A1(M) is unlikely to solely address the challenges, strategic highways improvements can contribute to reducing deprivation levels and boosting employment.

Table 1: Challenges & Opportunities Summary

Factor	Assessment
<p>Delays and network stress on existing routes</p>	<p>The M62 is the only Trans Pennine route that is dual carriageway across its entirety. Consequently, it attracts greater traffic volumes and there is a reliance on this route which can lead to delays during peak periods. Meanwhile, alternative routes often have a single carriageway and this limited capacity exacerbates congestion, increases in journey times and reduces journey time reliability.</p> <p>With regards to the study area, with the exception to sections of A650 and A629, the network is typically comprised of lower standard roads which lack coherence and capacity, resulting in journey times to key centres being much greater despite the short distances. Whilst these routes provide local accessibility with fronting properties and multiple junctions, this results in lower speed limits which impacts the journey time and can create congestion pinch-points as vehicles make turning movements at key junctions.</p>
<p>Accidents</p>	<p>Accident rates are relatively high. The locations with the greatest number of accidents within the study area were along the M62 corridor across the Pennines up to Leeds. Other accident hotspots include the A660/A61 area to the north of Leeds, the eastern end of the M65 (where it is met by the A6068 and A56), and around Preston where the M6, M61 and M65 converge.</p> <p>The results show that the proportion of Serious accidents on the M1 (19.8%) was notably higher than the average for Great Britain motorways (15.1%). The proportion of Serious accidents on the M62 (11.3%) was lower than the average, but the Fatal accident proportion was higher than average (3.4% compared with 2.0%). The proportion of Fatal accidents on the A56 and A59 (2.7% and 3.1%) were higher than the average for Great Britain A roads (1.8%). The proportion of Serious accidents on the A59 was also higher than the average (22.0% compared with 19.0%).</p> <p>High accident rates also have a second-order impact on journey-time reliability.</p>
<p>Frequency of road closures</p>	<p>Routes suffer road closures due to poor weather and accidents. Due to the topography of the Pennines, the M62, and A66 route are particularly susceptible to weather-related incidents.</p> <p>Routes crossing at high altitudes are more vulnerable to strong winds, fog, heavy snowfall and sub-zero temperatures, particularly during winter months. This can lead to poor driving conditions and the frequent closure of routes, diverting traffic onto alternatives which can add significant time and mileage to journeys. Adverse weather can also increase safety concerns, with a higher rate of casualties in the darker, winter months of the year (October-March). The Transport Resilience Review in 2014/15 referred to a total of 12 weather related critical incidents as a result of storms on 5th December 2013 including overturned vehicles on the M62 in Humberside, M6 in Cheshire, M60 in Greater Manchester and A1 in West Yorkshire.</p>

Factor	Assessment
Operational Challenges	Poor road conditions, a lack of application of technology, a lack of information provided to travellers and operational issues specific to single carriageway roads carrying relatively high volumes of HGVs.
Noise and Air Quality / Quality of Life	<p>The study area corridor passes through the centre of a number of communities which experience traffic-related noise and poor air quality that have a negative impact on quality of life.</p> <p>With growing recognition of the Climate Emergency and a need to reduce transport emissions, the creation of a new strategic highway link is potentially a contentious scheme which will need to have strategic justification. In June 2019, the government set an ambitious target of reaching net zero carbon emissions by 2050 and in February 2020 the government announced a ban on the sale of new petrol, diesel or hybrid cars from 2035 (proposed). Whilst in March 2020, DfT published the Decarbonising Transport: Setting the Challenge document which stated a TDP would be produced in 2020.</p>
Protected Landscapes and Environmental Designations	<p>The study area corridor passes through national parks and areas of outstanding natural beauty (AONB), Sites of Special Scientific Interest (SSSIs), historic and cultural locations, and internationally recognised museums, with traffic having an adverse visual impact on the environment, as well as adversely affecting its tranquillity.</p> <p>Designations such as National Parks, Areas of Outstanding Natural Beauty (AONBs), and Sites of Special Scientific Interest (SSSIs) pose a constraint to improvements due to the tighter planning regulations. Excluding the M62, many existing routes travel within close proximity to the designations (e.g. the A59 and A65 and the Yorkshire Dales). A large greenbelt area that lies between the M65 and Bradford and includes multiple Special Areas of Conservation and Special Protection Areas is likely to be affected by a scheme through the Core Study Corridor. In addition, there are a number of SSSIs to the north of Leeds, including Eccup Reservoir.</p>

## 2.4 The Case for Intervention

The challenges and opportunities presented above suggest a strategic highway improvement between the M6 and A1(M), across the study area is needed, to create a viable alternative to the M62 for a variety of journey purposes, including local, commuter and freight traffic.

The Wider Study Area displays a number of strengths with population growth across much of the area, high-quality education and training offerings and growth in key economic sectors, such as, advanced manufacturing. However, it is considered that these strengths are not being fully harnessed across the whole area, particularly in many parts of East Lancashire. Limited transport connectivity (particularly Trans Pennine cross-boundary between East Lancashire and West Yorkshire) can contribute to this inability to maximise the strengths identified, although it cannot be attributed to transport alone.

Delivering strategic highway improvements across the Core Study Corridor has the potential to enhance connectivity to improve the directness, journey time and resilience of journeys. This could broaden the travel horizons for people to access greater economic and education opportunities. Improvements could also promote greater cross-boundary movements, which could strengthen agglomeration effects and therefore unlock the area's economic, business and innovation potential as well as the appeal as a place to live. This is also recognised in the CPC SDC reporting which identifies improvements in connectivity between the M6 and A1(M).

As identified in this section, there are notable pressures in terms of capacity, journey times, reliability and resilience across the Core Study Corridor highway network, particularly on Trans Pennine routes.

**Capacity:** The M62 is the only Trans Pennine route that is dual carriageway across its entirety. Consequently, it attracts greater traffic volumes and there is a reliance on this route which can lead to delays during peak periods. Meanwhile, alternative routes often have a single carriageway and this limited capacity exacerbates congestion, increases in journey times and reduces journey time reliability. With regards to the Core Study Corridor, with the exception of sections of A650 and A629, the network is typically comprised of lower standard roads which lack coherence and capacity, resulting in the journey times to key centres being much greater despite the short distances. Whilst these routes provide local accessibility with fronting properties and multiple junctions, this results in lower speed limits which impacts the journey time and can create congestion pinch-points as vehicles make turning movements at key junctions.

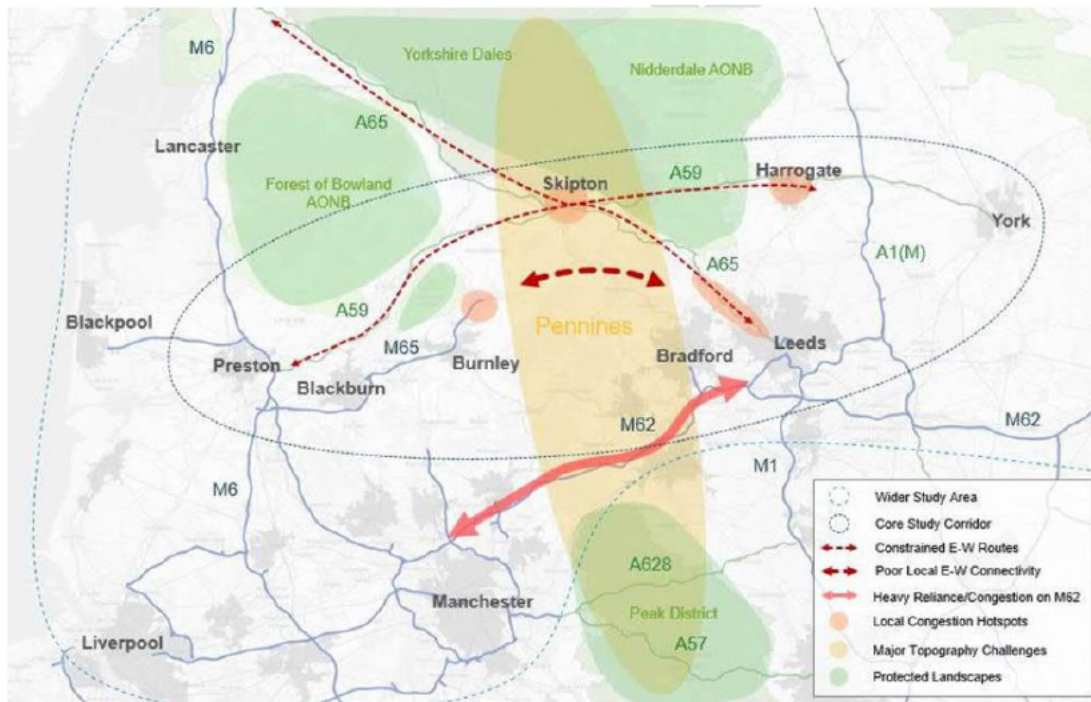
**Journey Times:** It is evident that there are poor journey times / slow speeds on sections of the highway network between the M6 and A1(M). This affects all movements, including commuters, freight and those visiting in the Core Study Corridor, and consequently has adverse economic and social impacts as a result of the impact on connectivity. Slow journey times is a barrier to connectivity as the decision to travel in the Core Study Corridor may be constrained by the available catchment within the travel time an individual is willing to accept; this can impact access to employment for residents as well as the pool of potential employees for businesses

**Reliability:** The evidence has shown congestion on the network, particularly the M62 between Manchester and Leeds and localised congestion on alternative Trans Pennine routes around key towns and interchange between junctions. Congestion causes delays resulting in slower journey times and greater variation in journey times reducing the reliability, which can be compounded by the topography and vulnerability to severe weather. This disruption and unreliability is likely to have an adverse impact on the Northern economy as the commuters, business travellers and freight (particularly for just-in-time deliveries) movements are affected.

**Resilience:** There is a need to improve resilience of the highway network across the Core Study Corridor to enable the network to better cope with increases in demand and the response to accidents / incidents on the network which cause delays and diversions. As there are limited east-west routes north of the M62 between the M6 and A1(M), with 22 miles to the next alternative route (A59 / A65) compared with just 12 miles to the south of the M62 (A682), this limits the alternative options available, particularly for relatively localised movements.

**Figure 5** summarises the key challenges resulting in the need for highways improvements between the M6 and A1(M).

Figure 5: Summary of strategic highway challenges



N.B. The map shows indicative examples of local congestion hotspots and excludes urban areas.

## Opportunities

The analysis has also highlighted a number of opportunities which an intervention between the M6 and A1(M) could harness, including:

**Transport Hubs:** Accessibility to key transport hubs, for example LBA and onward connectivity to ports, could be improved which would enable greater demand to be accommodated with improvements in journey quality. This would broaden the catchment of transport hubs within a defined journey time and make it quicker / more convenient for all journey purposes. For example, surface access to LBA is considered to be limited and risks impeding growth aspirations for the airport so improving accessibility could broaden LBA's catchment area. This highlights how enhancing highway connectivity between the M6 and A1(M) can have synergies with wider transport network improvements and deliver benefits across the region as well as supporting modal shift to public transport.

**Regional Growth:** Enhanced connectivity between IECs provides the infrastructure to support economic growth and contributes to local and regional growth as part of the Northern Powerhouse. Transport can unlock increased productivity and improve inter-regional flows as businesses are able to benefit from quicker and more reliable journeys. This can help to stimulate agglomeration of particular sectors and unlock development site potential to further harness the economic benefits of an improved Trans Pennine highway network. Addressing the transport constraint will support the 'levelling-up' between the north and south by contributing to the unlocking of economic potential in the Core Study Corridor.

**Leisure and Tourism:** Investment in the M6 to A1(M) Corridor has the potential to support future growth in the leisure and tourism sector and mitigate existing challenges. A new route could accommodate the high car dependency evident to access these sites and seek to reduce the conflict between visitor, local and Trans Pennine traffic. This increase in leisure and tourism would support the local economy and regional growth described above; however, there is a need to be mindful of the potential adverse impacts associated with new infrastructure in proximity to environmentally sensitive areas (which may be a leisure and tourism attraction).

### **Impact of not changing**

The decision to progress with a project should also consider any impacts if the project did not take place. This involves assessing the current future situation and four key impact areas have been identified below:

#### **Transport**

1. Existing congestion issues, with slower journey times and poor journey time reliability, are likely to worsen without an intervention and with expected increases in travel demand, this will make it difficult to accommodate this increase without exacerbating congestion.
2. Limited east-west connectivity across the Pennines will persist without an intervention and this constrains the capacity of the highway network with many routes of a lower standard which support local movements but impede efficient strategic movements.
3. Resilience of the network is limited by the lack of alternative routes to lower standard routes which results in delays or a need to use often lengthy diversion routes.
4. The transport network within the Core Study Corridor provides accessibility to the wider strategic network, for example, the SRN, airports and ports. Growth in travel demand, for a variety of journey purposes (e.g. commuting, freight and leisure), will need to ensure sufficient accessibility to facilitate these movements reliably and effectively.

#### **Economy**

1. The Core Study Corridor contains a number of economic centres and assets which rely on the transport network to facilitate commuting, business and freight movements, as well as the access for customers and visitors.
2. The NPIER highlights the existing performance gap with regards to productivity in the North, and investment in the transport network can support an increase in productivity and mitigate the widening of this gap.
3. The full potential of planned, proposed and potential developments may not be realised without sufficient transport accessibility to facilitate the connectivity as well as the likely growth of existing sites (such as LBA).
4. Increased economic growth and prosperity in the CPC is critical to unlocking the potential of North, and in supporting the levelling up of the UK economy.

#### **Social and Wellbeing**

1. Without intervention, existing areas suffering from deprivation and the disparity in deprivation levels are likely to persist. Improving access to employment and education opportunities can help to reduce the number of areas experiencing deprivation.

2. The transport network provides access to employment and education so improving connectivity can broaden the potential catchment area and therefore the opportunities to improve economic activity, which would not necessarily be facilitated without an intervention in the network.
3. Ensuring the transport network can support the movement and address severance barriers of active travel is also important for contributing to the levels of physical activity and without intervention this would be constrained.

### **Environment**

1. High car dependency and congestion on the network contributes to air quality and localised noise issues along the corridor so will be exacerbated without an intervention to better manage traffic flows.
2. The impact of climate change and severe weather will exacerbate existing issues on the highway network without an intervention to better manage traffic flows.

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### 3 OPTION DEVELOPMENT

#### 3.1 Study Timeline

The process for identifying potential routes began with the identification of three strategic corridors and options for each of these. Route options were identified from an original long list of components and then assessed against a combination of transport and economic objectives. This resulted in the definition of three strategic corridors. The corridors were split into the following:

- **Skipton-Harrogate:** Extending from the North-West of Blackburn to the West of York broadly following the A59, capturing Clitheroe, Skipton and Harrogate and the A1(M). This corridor serves the Lancashire and York, East Yorkshire and East Riding Strategic Economic Plans (SEPs).
- **Leeds-Bradford:** A central corridor that stems from the Eastern point of the M65, in Colne, to York, serving the conurbations of Leeds and Bradford, Leeds-Bradford International Airport, the M1 and the A1(M). This corridor also serves the Lancashire and York, East Yorkshire and East Riding SEPs.
- **Bradford-Halifax:** Runs South of the M65 and primarily serves Halifax, Bradford and the M62. This corridor includes parts of Lancashire and Leeds City Region SEPs.

Individual route components were considered against the strategic need for an intervention, specifically:

- Improve east-west connectivity;
- Improve network resilience and reliability;
- Improve local connectivity;
- Integration with other modes;
- Support economic growth for the North; and
- Support Corridor economic growth.

This sifting resulted in seven scenarios being identified:

- Option 1: Colne (M65), Skipton, Harrogate, A1(M) and York (A59 Corridor);
- Option 2: Colne (M65), Keighley, LBA, Harrogate/A1(M) and York (A59 Corridor);
- Option 3: Colne (M65), LBA and A1(M) and York (A64 Corridor);
- Option 4: Colne (M65), LBA and M1 east of Leeds;
- Option 5: Colne (M65), LBA and M62 between Leeds and Bradford;
- Option 6: Colne (M65), LBA and outer ring road of Leeds connecting M1 and M62; and
- Option 7: Burnley (M65) to the M62.

This highlights several of the components did not demonstrate sufficient alignment with the criteria and were not included within a long list option.

A second sifting exercise was then conducted reviewing against the strategic objectives and undertaking a demand impact assessment of the seven routes using Highways England's Regional Transport Model (RTM). The four better performing scenarios were recommended to be taken forward for preliminary economic assessment. The four were:

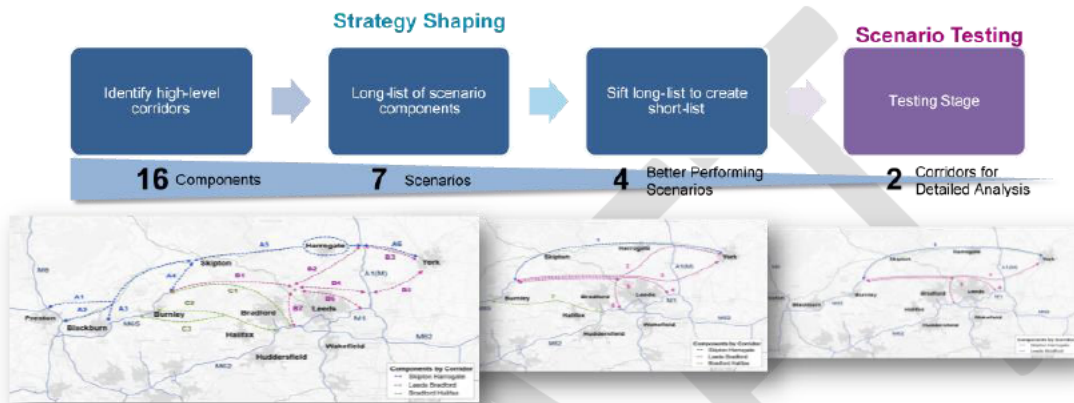
- Orange: Colne (M65) – Skipton – LBA – A1(M) – York (A64);
- Pink: Colne (M65) – Skipton – Harrogate – A1(M) – York (A59);

- Purple: Colne (M65) – Skipton - LBA – M1 east of Leeds; and
- Red: Colne (M65) – Skipton - LBA – Leeds outer ring road – M62.

The four listed options were assessed using standard transport scheme appraisal techniques as recommended by DfT which considered user and non-user travel time savings as well as wider economic benefits. The Orange and Purple routes generated the most benefit from the four schemes assessed.

The overall option development process is illustrated in **Figure 6**.

**Figure 6 Option Development Process**

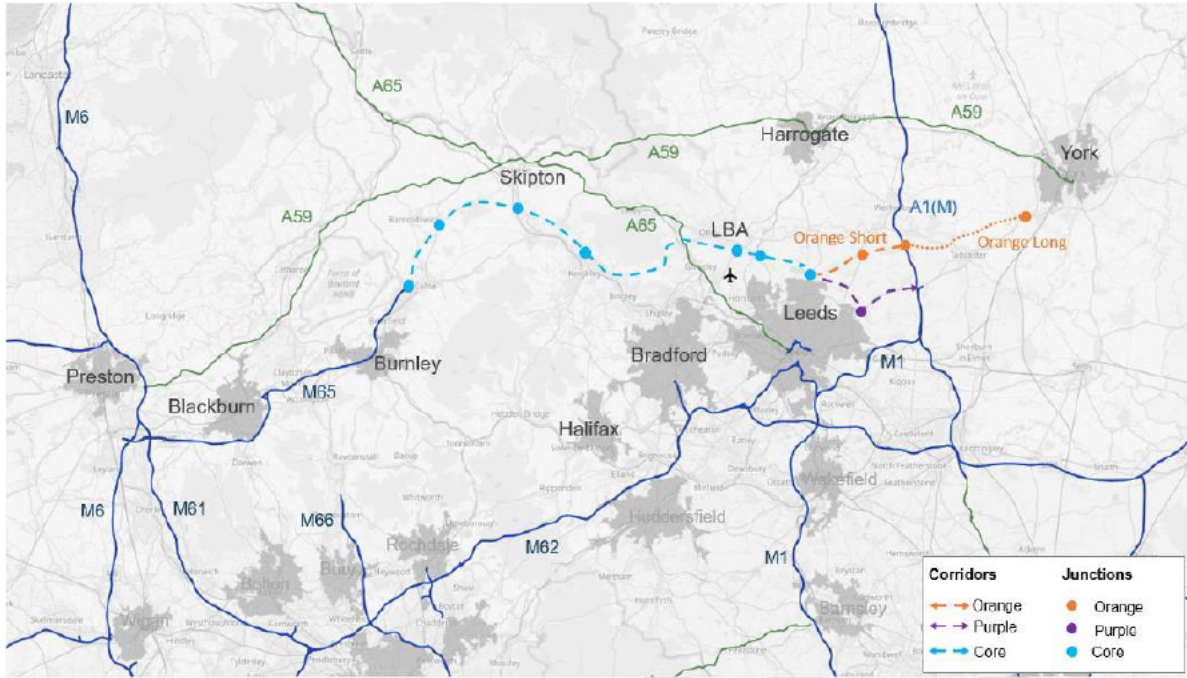


### 3.2 Proposed Package

The options progressed to a detailed testing stage which has resulted in three preferred options. The three options, shown in **Figure 7**, share a consistent routing between the M65 and North of Leeds (Blue Core) before splitting and linking up to the A1(M).

- **Blue Core:** This core section provides the connection with the M6 via the existing M65. From the eastern end of the M65, near Colne, the route passes through Skipton, Keighley to LBA and north Leeds;
- **Orange Short Variant:** This variant includes a junction with the A1(M);
- **Orange Long Variant:** This variant includes a junction with the A1(M) and A64 (near York); and
- **Purple Variant:** This variant includes a junction with the East Leeds Orbital Route (ELOR) and dualling of the existing A64 to the A1(M).

Figure 7: Option Corridors for Detailed Testing



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## 4 STUDY APPROACH

### 4.1 Traffic Modelling

The transport model used to undertake the assessment is the Trans Pennine South (TPS) Regional Transport Model (RTM). This model was developed by Highways England as one of a suite of five covering the entire country. It has been widely used in the appraisal of SRN schemes in the region.

The model can forecast the volume of traffic that will use a particular route at different times of the day and for different future years. The model outputs include estimates of traffic flows and journey times on highway routes across the study area.

The traffic modelling approach has followed DfT Transport Appraisal Guidance (TAG) and been informed and assured by Highways England Transport Planning Group, Economics and Environmental Assurance teams.

### 4.2 Economic Appraisal

An economic appraisal has been compiled based on comparing the level of benefits expected to be generated from the scheme and the project costs. Transport user benefits were calculated using TUBA and wider economic impacts calculated using WITA.

The benefits are driven primarily by journey time savings which are experienced by people who can now use the new route to reach their destination. The impact of a reduction in traffic on existing routes is also accounted for within the process.

Standard DfT approved economic methods are then used to estimate the value of these benefits over the life of the scheme.

Detailed project costs have been calculated and verified by Highways England's commercial team. The costs are based on assumed alignments for each corridor taking account of the nature of the terrain, the nature of construction required and the number and type of new structures such as bridges and tunnels that would be required

### 4.3 Environmental Analysis

The environmental considerations for the scheme used Highway's England's environmental reporting format, the Preliminary Environment Risk Assessment or PERA. The following environmental topics were included:

- Air Quality;
- Cultural Heritage;
- Landscape;
- Biodiversity;
- Geology and Soils;
- Materials and Waste;
- Noise and Vibration;
- People and Communities;
- Road Drainage; and
- Climate Change.

RAG (Red/Amber/Green) ratings were applied for each environmental topic to demonstrate the anticipated level of issues which may affect the programme and delivery of improvements

to the route. The Appraisal Results section capture environmental considerations which have undergone a high-level assessment at this early stage.

#### **4.4 Package Cost**

In order to appraise transport schemes an estimate of scheme cost is required in addition to an estimate of scheme benefits. At this high-level stage, costs have been produced by Highways England's Commercial Team. The capital costs included a risk value and the risk value for the options is 20.7% of the cost (exc. inflation). No optimism bias has been included because the costing has taken a bottom-up approach with allowances for project and portfolio risk – this is in line with current Highways England practice for schemes using costs prepared by Highways England Commercial.

Based on uncertainties associated with the early stage of the study, i.e. without any scheme design detail, cost estimates have been developed at a range of levels. The development of scheme costs are strategic estimates at the early stages based on the level of scheme design and high-level understanding of constraints. No detailed Quantitative Risk Assessment (QRA) has been undertaken.

#### **4.5 Stakeholder Engagement**

A key input to the study has been Stakeholder Engagement. The Project Board is represented by the key delivery partners; Department for Transport, Highways England, Transport for the North, and a number of Local Transport Highway Authorities within the Core Study Area.

At this stage, it is not envisaged that there would be much external stakeholder engagement at this stage of the study until an agreement is reached on whether the study should progress to the next stage of development.

#### **4.6 Options for Delivery**

Due to the magnitude of the proposals and the substantial costs, an approach to phased delivery has been considered:

- All options were assumed to have an opening year of 2041 and this is the only modelled year;
- It was assumed the route would be split into four or five sections which would be constructed sequentially between 2029 and 2043 with route sections open to traffic as they were completed. Therefore, benefits on completed sections would be realised prior to the assumed 2041 opening year but the benefits from this construction profile could not be captured; and
- The costs were assumed to be incurred over a 17-year construction period between 2028 and 2046. This length of construction period was assumed based on the length of the route and extent of transformation.

#### **4.7 Business Case**

A Strategic Outline Business Case (SOBC) has been produced for this study. The SOBC is to inform a decision on whether to take forward the proposed interventions to the next stages of the PCF process.

## 5 LIKELY BENEFITS AND OPPORTUNITIES

### 5.1 Introduction

Traffic model results have been compiled based upon a series of metrics which reflect the study objectives set out in the strategy shaping study. These are:

- Journey time differences between key economic centres east and west of the Pennines;
- The journey time and delay impact on the existing major Trans Pennine corridor, the M62 motorway;
- The level of flow in the new corridor by scenario; and
- Impact on flows on the existing M65 and M62 corridors.

These metrics have been assessed for the notional opening year of 2041. The metrics will form evidence to evaluate the level of benefit from each of the three route variations considered at this stage.

### 5.2 Economic

The corridor is expected to generate the majority of its user benefits through savings made in travel time and operating costs for transport users. Of these benefits, most are experienced by users making business related trips. All routes offer large time savings for particular journeys. As an example, the transport model forecasts that travel between Preston and York would be 30 minutes quicker were the route to be in place. There were more marginal improvements for other journeys such as Leeds to Preston and Harrogate to Liverpool.

The results show that the larger proportion of benefits accrue to the trips in the 50-200km trip length bands suggesting that the scheme is benefiting longer distance movements as would be expected for a route of this nature.

Journey time reliability is particularly important for business and freight deliveries operating with just-in-time productions. With the increased capacity on the network, all options are expected to improve journey time reliability along the Core Study Corridor. The additional capacity will support the mitigation of congestion and delays associated with traffic growth due to economic activity along the corridor. It will also provide greater resilience for east-west movements along the Core Study Corridor because accidents, incidents and severe weather (particularly in areas of high topography) can have considerable impact on journey time reliability.

### 5.3 Value for Money

The Value for Money (VfM) is assessed using the Benefit to Cost Ratio (BCR). The BCR indicates how much benefit is obtained from one unit of cost, with a BCR greater than one demonstrating that the benefits outweigh the costs. The VfM category is determined by the BCR, but it is important to note this excludes non-monetised benefits. The BCR compares the forecast monetary value of benefits from the scheme over its life against the estimated costs.

All options achieve a BCR of 1 or lower, which represents a 'Poor' value for money using DfT's Transport Analysis Guidance (TAG). This is despite the significant journey time savings mentioned previously as the scheme has a very high construction cost reflecting the length of the route and the challenging terrain.

In addition to the monetised benefits identified, the following non-monetised benefits are also expected:

- Improved journey time reliability;

- Reduction in accidents;
- Greater resilience for east-west movements within the Core Study Corridor;
- Improved journey quality;
- Regeneration at locations along the Core Study Corridor;
- Enhanced accessibility to key transport hubs;
- Improved access to leisure and tourism facilities (e.g. Yorkshire Dales National Park, Bowland and Nidderdale AONB); and
- Mitigation of deprivation along the Core Study Corridor.

#### **5.4 Environmental**

As the options extend across a significant distance, the corridor traverses challenging terrain which is expected to have significant adverse environmental impacts.

The options pass through a predominately rural area, with some residential areas and there may be sensitive receptors, such as, educational, medical and community facilities. In addition, a new route is proposed to be in close proximity to a number of designated sites which are likely to be noise sensitive that are valued for tranquilly or acoustic environment is also affecting all options. There is the potential for significant changes in night time noise particularly in rural areas also.

As all options share a core section for the majority of the new link road, the impact on local air quality is expected to be similar in these locations. The options run through predominantly rural small-to-medium sized villages and market towns and two local authorities have declared Air Quality Management Areas (AQMAs) within the corridor. The expected re-routing of traffic is likely to dissipate pollutant concentrations from existing locations to other areas resulting in localised benefits and disbenefits.

All options may lead to an increase in traffic across rural areas which could lead to an increase in emissions and adverse contribution to greenhouse gas levels and Climate Change.

It is too early to fully understand the impact on landscape but there will be a potential large adverse impact that will likely outweigh mitigation measures. Large adverse effects are likely at a local scale for each option. As well as the visual impact on footpaths and green open spaces, there is Green Belt land within the Purple variant. A large adverse impact on cultural heritage is anticipated for all options, with numerous scheduled monuments, parks and gardens and listed buildings in the corridor.

An assessment of the impact the options could have on biodiversity concluded all options would have a large adverse impact with a number of SSSI's within 4km of the corridor. In addition to this, there are several large watercourses within the options. The options also lie within a Surface Water Drinking Water Protected Area and Source Protection Zones 1, 2 and 3. There are multiple Flood Zones 2 and 3 associated with the watercourses in the corridors and the increased impermeable area will need to be attenuated to ensure no detrimental increase in flooding potential.

#### **5.5 Challenges**

The potential options present a number of challenges when considering their suitability for implementation; ranging from scale, environmental concerns, costs etc. in addition to this, there are also a number of challenges relating to the modelling of these options given their early stages of design.

The options were individually assessed using a fixed trip assignment using the TPS-RTM do minimum networks and matrices for 2041. An analysis of benefits was calculated for a 60-year period from an assumed scheme opening year of 2041. Since only a single model year was used it was assumed that there would be no further change in overall demand beyond 2041.

At this stage no assessment of accident and reliability benefits has been made. It might be expected that the scheme would have a small positive impact on both. Replacing existing trans Pennine routes with a higher standard carriageway would be expected to lead to a reduction in numbers of accidents and providing additional high standard route across the Pennines would be expected to reduce demand and hence improve the reliability on the existing routes.

In addition, no assessment of delays during construction and maintenance has been undertaken at this stage, which might be expected to produce a small negative impact. Further detailed analysis of the benefits would be conducted at later Project Control Framework (PCF) stages should the scheme continue.

The development of scheme costs are strategic estimates at the early stages based on the level of scheme design and high-level understanding of constraints. No detailed Quantitative Risk Assessment (QRA) has been undertaken.

The three options explored for the M6 to A1(M) were considered to be within the Poor VfM category. The VfM judgement considers the likelihood of benefits being overestimated, the significant adverse impacts on the environment as well as other uncertainties surrounding the appraisal.

The main benefit of the options is the travel time saving created by the additional east-west route across the Pennines between Preston and York. However, there is significant concern to suggest the travel time benefits may be overestimated due to the appraisal methodology used and the assumption that the D2AP options will generate the same benefits as the D2M options.

The assessment has also shown that the scheme is likely to generate productivity gains from agglomeration; however, there is also significant uncertainty surrounding the true scale of these impacts and how likely these benefits will be realised due to the scheme being in the early stages of development.

Despite the considerable benefits, there are also large disbenefits associated with the scheme, mainly from the environmental impacts which have only been qualitatively assessed. Significant adverse environmental impacts are likely, particularly for air quality, landscape, biodiversity and the historic environment with the route being within a SAC and SPA. The scheme is also likely to route through several Natural Character Areas (NCAs) resulting in a negative impact on landscape. Where possible in future stages, the quantification of environmental impacts is likely to have a downward impact on the BCR and consequently a worsening of the VfM of the scheme.

The VfM statement notes that the benefits from travel time savings are likely to be overestimated, a number of impacts have yet to be assessed (e.g. carbon, delays during construction and accidents) and cost estimations are high level and likely to change should the scheme progress. It is stated that the non-monetised disbenefits arising from the scheme are likely to offset the likely benefits that have yet to be assessed.

There is scope for challenge in the following areas:

- The economic appraisal is based on only one forecast year of 2041, with these results copied across as 2051 to run TUBA. This is not common practice and is likely to overestimate the benefits;
- The benefits for D2AP have been assumed to be the same as D2M, which means the D2AP benefits are overestimated;
- Use of the existing RTM Variable Demand Model may need to be re-assessed, given the very large time savings predicted for some journeys. It is not clear if the existing RTM Variable Demand Model is calibrated to assess the effects of such large time savings; and

The economic analysis undertaken quantifies only the travel time benefits and wider economic impacts and, as such, it is possible that the VfM category could change significantly should the study progress to further PCF stages.

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## 6 CONCLUSION

Highways England have been asked to assess the potential for a new strategic highway link across the Pennines between the M6 and the A1(M).

The study is at Stage 0 of the PCF process which relates to strategy, shaping and prioritisation. The work has identified three possible options, which have subsequently been appraised, which would be developed further during Stage 1 and Stage 2 of the PCF process should the decision be to proceed with the project.

There are notable existing pressures in terms of highway capacity, journey times, reliability and resilience across the Core Study Corridor, particularly on Trans Pennine routes. Challenging topography means there are limited east-west road links available and the M62 is the only SRN link between the east and west of the country within the study area.

The strategic need for an intervention within the corridor is driven by the need to improve connectivity and support economic growth of the Northern Powerhouse economy by:

- Alleviating congestion around key towns and taking pressure off the M62;
- Improving resilience on the network to severe weather events;
- Reducing delay experienced as a result of accidents on the network; and
- Opening up development areas and areas for economic growth.

Delivering a strategic highway improvement across the Core Study Corridor has the potential to enhance connectivity to improve the directness, journey time and resilience of journeys. This could broaden the travel horizons for people to access greater economic and education opportunities. Improvements could also promote greater cross-boundary movements, which could strengthen agglomeration effects and therefore unlock the area's economic, business and innovation potential as well as the appeal as a place to live.

All the options appraised in this study generated similar results, inclusive of wider economic impacts, with a BCR of 1 or lower. Whilst all options are expected to generate economic benefit from improved journey times and wider economic impacts across the Core Study Corridor, the significant cost and environmental impact associated with the options has an adverse impact on the BCR. A VfM statement produced by Highways England concluded all options represent Poor VfM and noted the likelihood for significant adverse non-monetised impacts on the environment, as well as other uncertainties surrounding the appraisal.