



Oxford- Milton Keynes Connectivity Study

Prepared in partnership with EEH by Steer and WSP

England's Economic Heartland (EEH) is the sub-national transport body responsible for bringing together local transport authorities in a strategic partnership for the region extending from Swindon to Cambridgeshire and Peterborough and Northamptonshire to Hertfordshire. We advise the government on the region's transport infrastructure priorities.

Our 2021 transport strategy, *Connecting People, Transforming Journeys*, set an ambitious policy framework with the vision for our transport system:

“To support sustainable growth and improve quality of life and wellbeing through a world-class, decarbonised transport system which harnesses the region's global expertise in technology and innovation to unlock new opportunities for residents and businesses, in a way that benefits the UK as a whole.”

Our strategy highlights **the region's economic importance to the UK**, with its success founded on science and technology innovation, powered by a network of world-leading universities and research centres.

Based on the **requirement to achieve net zero by 2050 at the latest**, our strategy sets out that we will work with infrastructure owners and operators to ensure that proposals brought forward for the development of the transport system reduce reliance on the private car.

At its heart, our transport strategy is the catalyst for addressing the challenges our transport system already faces and enable economic growth while reducing emissions.

The transport strategy commits EEH to a **programme of connectivity studies that examine key study areas across the region in detail**. Their aim is to identify a preferred package of multimodal infrastructure, service, or policy interventions to help achieve the transport strategy's objectives.

This study, shown on the map in figure 1 covers local authorities within Oxfordshire, Buckinghamshire, Milton Keynes, Central Bedfordshire and West Northamptonshire.

Each of EEH's connectivity study areas were decided based on an evidence based assessment of the connectivity challenges and opportunities against our transport strategy principles in defined areas suggested during stakeholder engagement as part of our Outline Transport Strategy consultation

In addition to the evidence based approach to corridor identification, following the formal cancellation of the Expressway the government committed to work to identify more targeted localised road investment. Alongside, EEH has been undertaking this multi modal study to identify connectivity opportunities across the study area.

Projects already underway or committed (such as East West Rail) are factored into the study, with the assessment process and final recommended packages of interventions focused on what further interventions may be needed.

The *“Oxford – Milton Keynes Connectivity Study”* is led by EEH, supported by the consultancy team led by Steer, supported by WSP, 5th Studio and DMS Research and Consulting.

Study aims

The policy framework set out in the transport strategy is guided by four key principles that form part of how interventions were assessed and packaged as part of this connectivity study:

1. Achieving net zero no later than 2050, with an ambition to reach this by 2040.
2. Improving quality of life and wellbeing through a safe and inclusive transport system accessible to all which emphasises sustainable and active travel.
3. Supporting the regional economy by connecting people and businesses to markets and opportunities.
4. Efficient movement of people and goods through the region and to international gateways.

This report sets out the rationale for packages of interventions which will address the objectives and critical success factors developed for the study area. It's two key sections combine to form a pre-strategic programme outline case (SPOC):

Options Appraisal Process: This aligns with the strategic and economic dimensions within the Treasury's 'five case model' and Department for Transport's (DfT's) transport analysis guidance (TAG). This considered the context, current and future situation, a long list of interventions, and the development of packages aligned with the strategy.

Recommended Connectivity Plan: This consists of the combined packages of interventions and initial consideration at a strategic level how they could be implemented in terms of rationale for delivery (via a theory of change framework) and finance.

The overall method is summarised overleaf.

Stakeholder engagement

Development of the transport strategy involved comprehensive engagement, including two rounds of public consultation, capturing the views of our partners, stakeholders, interest groups, businesses and residents.

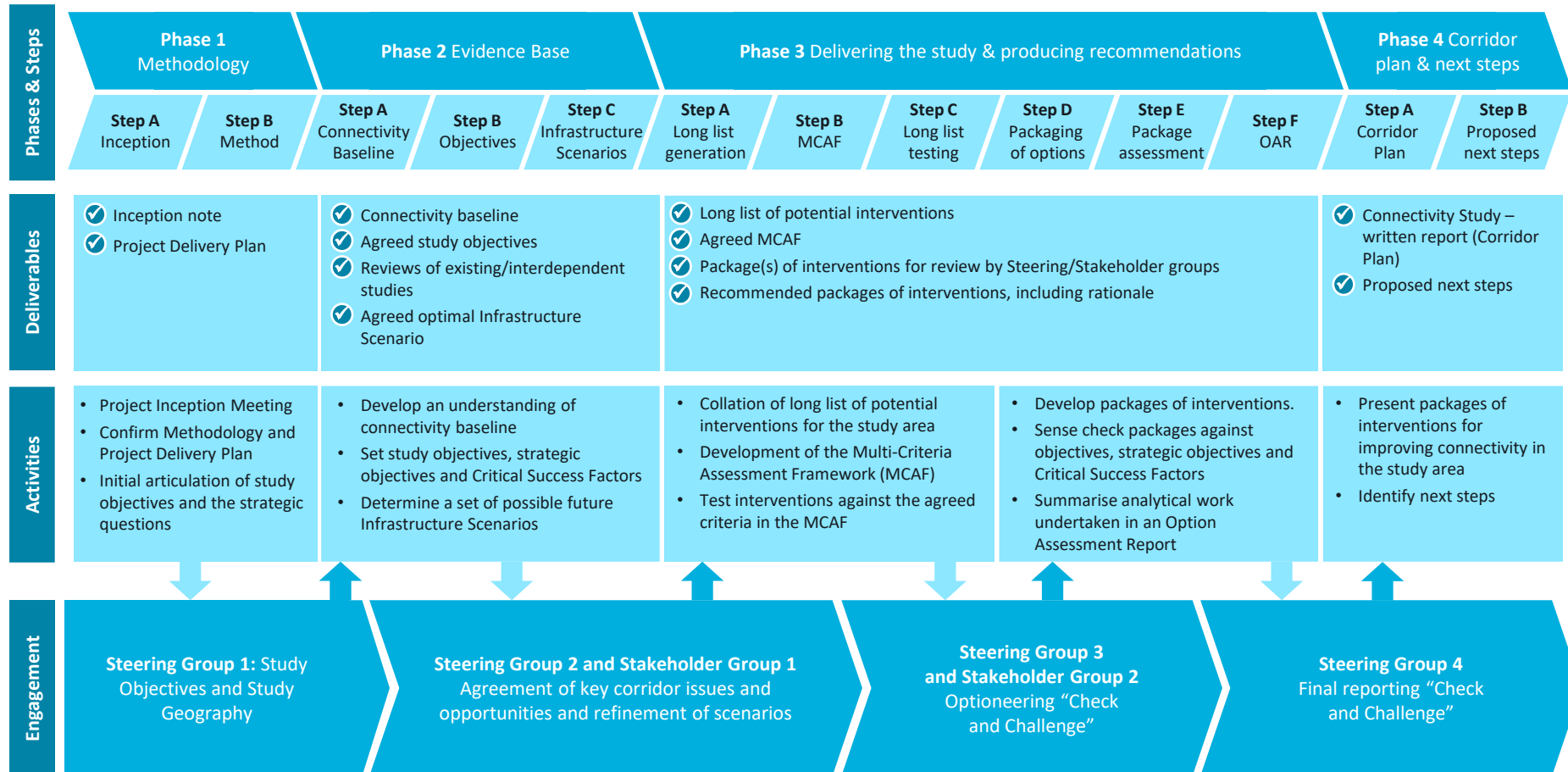
For this connectivity study, the project team worked collaboratively with stakeholders to develop the evidence base, identify possible interventions, and assess their likely impact and form them into packages.

In particular, the process highlighted increased acceptance of the need for change and the need to do so at pace, particularly with regards to decarbonisation.

Within this connectivity study, stakeholder engagement and connectivity evidence was gathered through the following forums:

- **Steering group:** Virtual workshops with local authority planning, local enterprise partnerships and transport officers to gain local insights into connectivity issues and opportunities.
- **Stakeholder group:** Virtual workshops were undertaken with transport, place and environmental stakeholder groups to gather insights on issues and opportunities and potential solutions. Topic specific one-to-one discussions were also held.
- **Call for evidence:** Call for evidence via an online survey, providing the opportunity for wider participation from members of the public, businesses and interest groups in identifying the key connectivity issues in the study area and potential interventions.
- **Expert panel:** An expert panel of public transport, active travel, road and freight experts were engaged to capture any additional connectivity opportunities.

Study method



Milton Keynes Central



BLETCHLEY PARK

ARRIVA



Bus

← Bus stops
Y4 Y5 Y6



About the study area

This study examines the area encompassing strategic corridors that run between Oxford and Milton Keynes. The area is approximately 20% greenbelt and is home to:

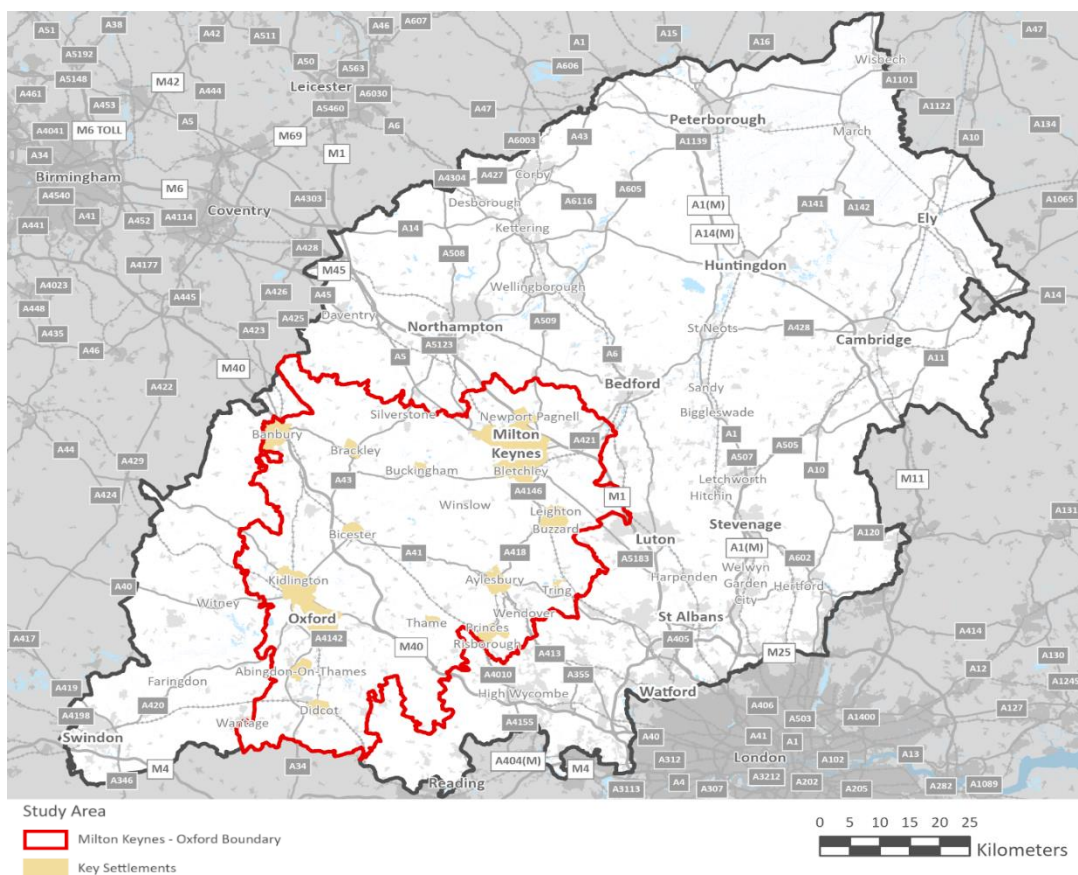
- The University of Oxford, the number one ranked university in the world
- Aylesbury, the spiritual birthplace of the Paralympic Games
- The world-famous Silverstone F1 circuit
- The UK's newest city, Milton Keynes, a major economic and innovation hub.
- Many world class business clusters, science parks and innovation hubs. These include the 'Science Vale' around Didcot, home to Harwell, Culham and Milton Park; the Silverstone tech cluster of advanced engineering, including the majority of Formula One teams; and Westcott Venture Park, a nationally important hub for the space sector

The study area spans across multiple local authorities and encompasses regional and national significant road and rail links including the A34 and M1, and the future East West Rail Link.

The area is served by a transport network that, at present, provides a varied distribution and quality of active travel infrastructure and public transport options and is dominated by the radial links emanating from London.

There are significant opportunities and potential for investment in transport that can not only help support economic growth and levelling-up but also improve air quality, safety, health and wellbeing, support biodiversity net gain and contribute to net zero targets.

Figure 1: Study area



Where people live

The study area is polycentric, with over half the 1.1 million residents living in Milton Keynes and Oxford. Surrounding these two strategic centres are a series of towns and smaller settlements that are more dependent on the larger towns for employment and access to some key services. Between 2011 and 2019 the study area population grew by 8.8%ⁱ. Local plans set out locations for new housing over the next 20 years. The connectivity study does not consider or influence options for future locations of growth – this remains the decision of the local planning authority through the established local plan process. Published local plans and national travel forecasts based on the government’s National Trip End Model are evidence on which demand on the transport system has been mapped to inform this study.

Where people work

Home to a workforce of 577,000ⁱⁱ, the area has a unique combination of scientific and cultural assets, resulting in a highly skilled workforce in the areas of innovation and technology. The biggest employment is in Milton Keynes and Oxford, both of which have large travel to work catchments along north-south corridors. The high growth, high skills employment is focussed around a number of enterprise zones. Some pockets of high employment are within more rural areas. The highest proportion of those in work are in education, health and professional scientific and technical activity sectors (35% in total)ⁱⁱⁱ.

Community diversity

The study area is socially and economically diverse. Areas of lower income are concentrated in Banbury, Bletchley, Aylesbury, Leighton Buzzard, northern and southern parts of Milton Keynes and eastern Oxford. Areas of higher income households are focused around Princes Risborough, eastern parts of Milton Keynes, areas to the west of Oxford, northern parts of Didcot and across the southern rural areas and the Oxford-Bicester-Buckingham spatial geography.

Sustainable and active transport

Rail connectivity is provided by five main rail lines. A direct rail link between Oxford and Milton Keynes will be provided by the Oxford –Bletchley/Milton Keynes stage of East-West Rail, scheduled for completion by 2025. Oxford has high levels of bus and active travel commuting. By comparison, Milton Keynes residents are more car dependent, with lower levels of bus and active travel use. The smaller settlements are not well served by attractive inter-urban bus services. There is a lack of high-quality active travel infrastructure in the study area.

Highway network and travel by car

Highway connectivity in the area comprises nationally significant radial routes. Whilst there is good north-south connectivity, east-west connectivity is more limited with no direct major road link between Oxford and Milton Keynes. Oxford, Aylesbury, Banbury, Thame, Didcot, Bicester and Buckingham experience significant delay and congestion in the peaks. Milton Keynes has over half of electric vehicle charge points (EVCPs) in the area. Smaller settlements have limited provision.

Digital connectivity

Digital connectivity varies across the study area, with the lowest download speeds (less 25 mb/s) within the rural communities. Such inconsistent coverage generates avoidable journeys, with pressure placed on local roads as those in more rural areas travel to access work opportunities and other services.

Landscape and protected areas

The geography and topography varies throughout the area, but its gentle nature presents few barriers to strategic connectivity. Large parts of the area are categorised as either in flood zone 2 or flood zone 3. Approximately 20% of the area is green belt land.

Carbon and air quality

In 2019 the average transport carbon emission per capita in the study area was higher than both the UK and EEH average. The City of Oxford is the largest air quality management area (AQMA) in the area, with smaller, more localised AQMAs being located in and near Bicester, Banbury, Aylesbury, Wallingford and Watlington.

Challenges and opportunities – The need for intervention

The current challenges facing the Oxford-Milton Keynes study area are primarily due to the high levels of car dependency and the relatively high proportion of people living in small and medium sized settlements and rural communities which are harder to serve by active and sustainable travel modes.

Reinforcing the region's role as an economic and innovation powerhouse while also meeting the requirement to reach net zero emissions by 2050 at the latest creates a range of current and future challenges and opportunities. These are summarised below:

Key challenges

- The study area includes a wide range of geodemographics, each of which demonstrate different desirable characteristics of mobility which packages of multimodal transport interventions need to appeal to.
- Car travel within the study area combined with the high levels of HGV movement on the strategic road network (A34, M40 and M1) contribute substantially to carbon emissions and therefore have a huge impact on the study area achieving net zero.
- Accessibility to services and amenities by public transport in central and north-western parts of the study area is challenging. This is likely to be responsible for high levels of car dependency.
- High levels of planned growth (19% within the next 20 years) will result in increases in population, jobs and travel demand. This will place pressure on an already constrained transport system in growth areas such as Oxford, Didcot, Bicester, Banbury, Aylesbury and Milton Keynes.

Key opportunities

- More recently, policy has shifted away from more traditional road-based solutions to focus on sustainable mobility, decarbonising transport and encouraging modal shift to active and sustainable travel options. However, and even with viable sustainable transport options being made available, the region will continue to have a majority of its trips made by road in the future.
- The most common travel to work distance for the study area ranges from 6-10km, which are realistic distances using bicycles and public transport modes thereby representing an opportunity to encourage modal shift. However, improvements to cycling infrastructure and public transport will be essential to facilitate mode shift.
- Implementing measures to support sustainable travel behaviours and hybrid working can help to promote a decarbonised transport network by 2050, thus supporting government objectives, whilst bringing about other benefits.
- Innovation in terms of low/zero emission and shared or autonomous transport modes for private, public and commercial purposes presents opportunities for low carbon, efficient movement.
- The development of East West Rail will provide new rail connectivity for its corridor, notably between Oxford and Milton Keynes. Potential electrification of the railway lines in the study area would help promote sustainable decarbonised transport.

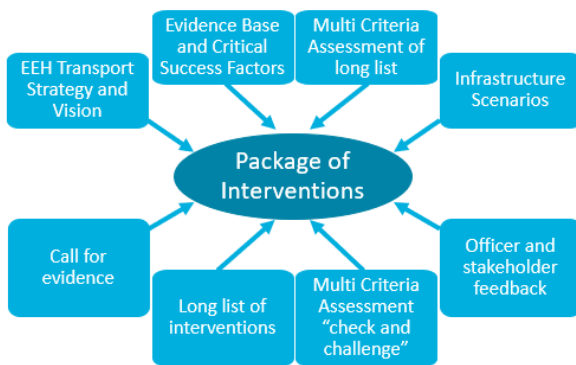
Objectives

19 objectives were established for the Oxford – Milton Keynes study area based on the Evidence Base and issues and opportunities identified. These are centred around the four key strategic principles set out in England’s Economic Heartland’s Transport Strategy.

Key Principles from England’s Economic Heartland’s Transport Strategy			
<i>Achieving net zero no later than 2050, with ambition to reach this by 2040.</i>	<i>Improving quality of life and wellbeing through a safe and inclusive transport system which emphasises sustainable and active travel.</i>	<i>Supporting the regional economy by connecting people and business to markets and opportunities.</i>	<i>Efficient movement of people and goods through the region and to international gateways.</i>
Objectives for Milton Keynes – Oxford study area			
<p>1a – Reduce the need to travel</p> <p>1b – Deliver a ‘smart’ transport network that uses digital technology alongside other physical measures to manage transport demand.</p> <p>1c – Facilitate a transition to zero-emission transport modes and support greening of the grid to minimise overall carbon impacts of transport.</p> <p>1d – Promote the use of sustainable and active travel modes and improve the users’ travel experience for all sustainable travel modes</p>	<p>2a – Create a transport network that is affordable and accessible for all, supports social inclusion, and improves access to opportunities</p> <p>2b – Minimise the impact of transport-related air and noise pollution on local communities and tackle air pollution in areas impacted by poor air quality</p> <p>2c – Facilitate increased active travel and promote the associated health benefits</p> <p>2d – Support sustainable housing and development to accommodate a growing population and workforce</p> <p>2e – Embed a safe systems approach into all planning and transport operations to achieve Vision Zero – zero fatalities or serious injuries</p>	<p>3a – Enable a boost in productivity through better connecting a skilled workforce with high growth, high value opportunities</p> <p>3b – Create an efficient transport network which reduces transport costs for businesses</p> <p>3c – Improve connectivity by sustainable means to medium sized towns/Market Towns and rural locations.</p> <p>3d – Enable deprived communities to attract investment and achieve more equitable socioeconomic outcomes.</p> <p>3e -Improve sustainable connectivity to sites of health, education, and employment</p>	<p>4a – Develop a transport network which maximises the benefits of East-West rail.</p> <p>4b – Build a resilient and adaptive network improving connectivity and journey time reliability for people and goods</p> <p>4c – Develop a seamless, integrated network with transport users at its heart.</p> <p>4d – Facilitate sustainable first mile/last mile connectivity for people and goods in both urban and rural areas.</p> <p>4e – Enable an increase in sustainable movement of freight.</p>

Package Development

EEH has worked with key stakeholders and technical advisors to develop a set of coherent packages that, together, are designed to deliver EEH's vision and a set of agreed objectives for the connectivity study area. The inputs informing package development are summarised below.



Critical Success Factors

Critical success factors were identified to provide an articulation of the need for intervention informed by a current and future evidence base. They also assisted in providing specificity around outcomes and supported long list assessment and option development. These are listed below:

1. Improved digital infrastructure reduces the need to travel
2. The carbon emissions of transport are reduced to net zero
3. Improved public transport connectivity enables planned development growth to be delivered sustainably
4. The benefits of new technologies are accessible to everybody
5. The area's towns, cities and rural communities are well connected by improved east/west transport corridors
6. There is a step change in public transport connectivity within our urban areas
7. A high quality, sustainable, transport network connects people into the study area's strategic economic assets
8. Rural communities and market towns are well connected to the public transport network
9. The benefits of East West Rail are maximised and widely distributed
10. Rail is fully integrated with the local public transport network with stations developed to facilitate onward public transport connections
11. Active travel mode share within and between our towns and cities increases.

Long List Generation

An initial long list of interventions and options was developed from a wide range of sources, including a review of local transport planning policy documents and of the challenges and opportunities identified in the people, place and connectivity evidence base. In total, **136** interventions were included in the long list. These covered a wide range of topics including highway interventions, mass rapid transit (MRT) including complementary bus and shared mobility options, rail interventions and strategic mobility hubs, active travel including walking/wheeling, cycling and micro-transit, and technology-enabled solutions including alternative fuels, connected and autonomous mobility, shared mobility and new integrated ticketing and business models.

Multi-Criteria Assessment

A multi-criteria assessment framework (MCAF) was developed and used as an early assessment and sifting tool for this study. The MCAF was used to sift out options that perform poorly, and to organise and compare options to help develop coherent packages of interventions. For each option, the following was assessed against of range of **strategic, economic and deliverability criteria**.

In addition to these three assessments above, assessment was made against the **critical success factors** and a set of **alternative futures**, allowing a test for resiliency against plausible futures.

Infrastructure Scenarios

Infrastructure scenarios represent different voices and approaches to infrastructure planning all of which could contribute to realising EEH's transport strategy and addressing the objectives and critical success factors of the connectivity study. The scenarios were used as a framework to guide package development with the infrastructure types replaced with specific interventions from the short list of schemes.

ALLENGE W



NATIONAL
CYCLE
NETWORK

www.sustrans.org.uk



The Connectivity Plan

Delivery of the connectivity plan for the Oxford-Milton Keynes area will enhance the region in its role as an economic and innovation powerhouse, as well as support the move to net zero transport tailpipe emissions.

It represents a comprehensive package of interventions which together meets the specific needs of the area, addressing the objectives and critical success factors identified by key stakeholders.

The connectivity plan is resilient to future changes to travel patterns and is optimised for a desirable 'high tech' future which includes widespread digital connectivity and technical innovation in the transport sector.

Decarbonisation

EEH seeks to achieve net zero carbon no later than 2050, with an ambition to reach this by 2040. This connectivity plan seeks to support these goals by decarbonising existing transport modes, supporting people to shift to more sustainable modes and reducing car use.

We have identified the opportunity for a step change in bus service provision within and between major conurbations within the area. Mass rapid transit in Milton Keynes is an example where road space reallocation will make space for bus segregation and priority infrastructure where appropriate.

The consequent improved journey times and reliability will make bus a more attractive option for many journeys stimulating mode shift, reducing car use and limiting the carbon impact of travel.

Infrastructure enabling a smart and efficient highway network accelerating uptake of alternative fuel vehicles will be delivered. This includes roll out of roadside electric vehicles charging points and connected autonomous vehicles supported by establishment of multimodal mobility hubs and sustainable first mile /last mile urban freight delivery. This will enable smart, efficient, and decarbonised freight and highway trips.

Locally decided measures to manage demand on the transport network are being progressed by partners to reduce the impact of vehicles, and carbon, thereby improving health and wellbeing for their residents, visitors and businesses.

Innovation

Our transport strategy highlights the vital role our region plays for the UK economy, with its success founded on science and technology innovation, powered by a network of world-leading universities and research centres. This includes but is by no means limited to the universities of Oxford and Cambridge.

The study area is home to many of EEH's key innovation assets which can bring even more benefit to the region and wider community when we invest in the transport and digital infrastructure that connects them and upon which they rely. An important part of the solution includes allowing greater opportunities for new mobility and innovative ideas from the public and private sector to come forward, and more quickly.

Oxford and Milton Keynes are regional engines of innovation between which East West Rail will provide a direct sustainable connection. This important project will also better connect the study area to other nationally significant innovation centres such as Cambridge to the east, and Reading and Swindon to the south and west.

This enhanced connectivity as well as improvement on the parallel Varsity Way cycle path increases the potential for interaction and knowledge spill overs, supporting improved innovation outcomes.

The three Buckinghamshire enterprise zone sites have businesses at the cutting edge of innovation across aerospace and advanced manufacturing. Currently public transport connectivity to these sites is poor. This connectivity plan includes delivery of bus infrastructure and new routes bringing frequent, reliable, and sustainable transport options between our major towns, mainline railway stations and the three enterprise zone sites.

Economy






















The connectivity study area is a national driver of economic growth, home to more than 570,000 jobs. Investment in transport infrastructure is required to better connect skilled employees with high value jobs, helping businesses thrive.

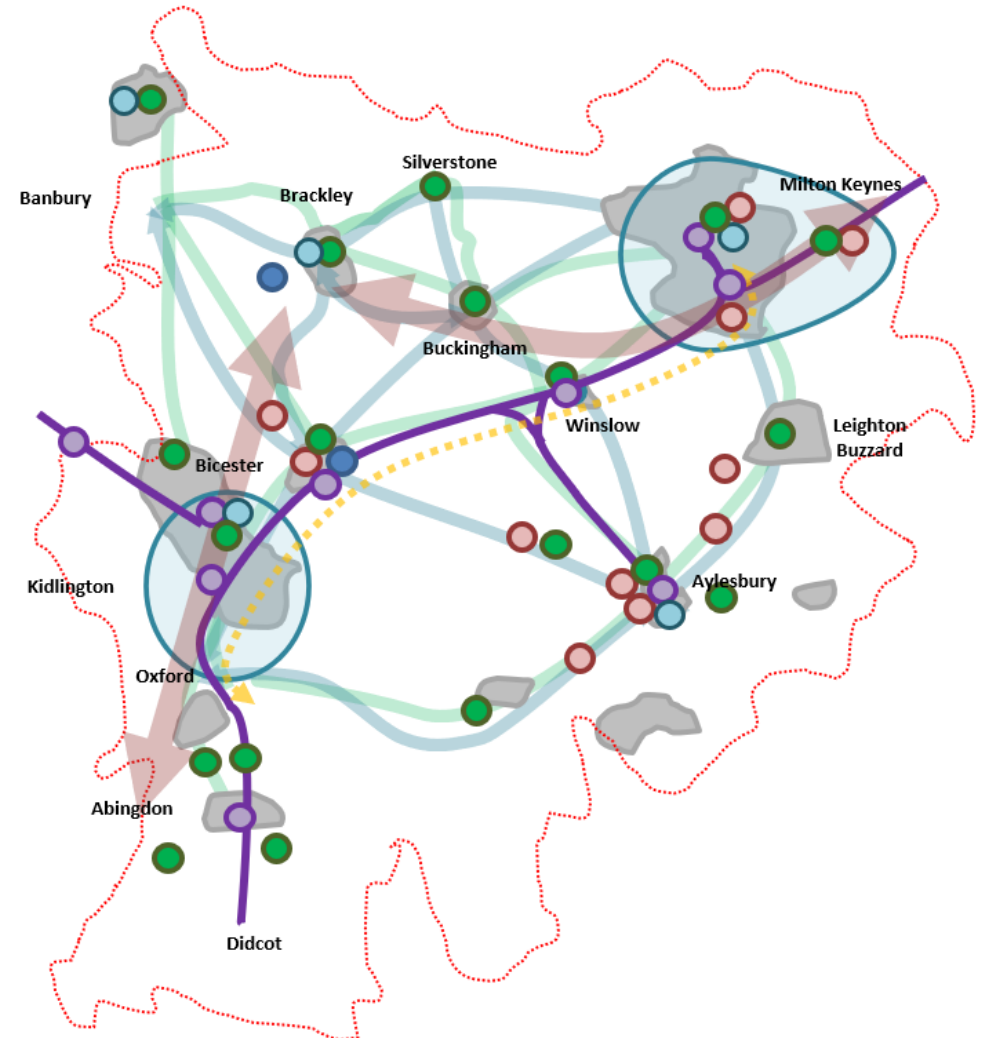
Building on East West Rail, this connectivity plan includes interventions on the wider rail network such as the Aylesbury link and double tracking of the Cotswold Line to Hanborough to optimise the benefits of East West Rail, widening the labour market catchment of Oxford and Milton Keynes and facilitating economic growth.

Highways that facilitate 'east-west' travel in the area currently encounter unreliable journey times and present safety concerns particularly at pinch points within market towns. This connectivity plan identifies opportunities for improved place making with targeted improvements to improve connectivity and to move traffic away from pinch points and town centres such as Aylesbury.

These types of interventions will 'deconflict' strategic and local traffic and enable a more people-friendly urban realm to be created stimulating a step change in the quality of place and active travel, bringing forward planned local economic growth and prosperity.

Map key

-  Connectivity study boundary
-  Key urban areas
- Package 1 - Making Best Use of Roads**
 -  Bus-based MRT
 -  Road space reallocation to Public Transport
 -  Inter-urban bus priority measures in targeted locations
 -  Additional area wide interventions (not mapped)
- Package 2 - Supporting rail to provide reliable strategic connectivity**
 -  Intervention to optimise the benefits of East West Rail
 -  Integration of East West Rail with local transport network
- Package 3 – Supporting mode shift to active and sustainable modes**
 -  Network of multimodal mobility hubs
 -  Inter-urban active travel network
 -  Support delivery of MaaS (not mapped)
 -  Increased adoption of shared transport (not mapped)
 -  Digital connectivity on public transport (not mapped)
- Package 4 – Enabling sustainable, planned development and a decarbonised fleet**
 -  Strategic Highway Safety & Resilience
 -  Highway improvements on key east-west links
 -  Smart & efficient highway network accelerating uptake of alternative fuel vehicles through infrastructure (not mapped)
 -  Support digital hubs in rural areas (not mapped)
 -  Residential & Workplace Parking Standards (not mapped)
- Package 5 - Sustainable and efficient freight solution**
 -  RFI proposals
 -  Freight on rail optimisation
 -  Sustainable urban goods transport (not mapped)
 -  Freight friendly highway interventions on strategic links (not mapped)



Package 1: Making best use of roads

This package will allow more people to move more efficiently through and within the region without the need for significant new infrastructure, maximising the highway asset for all road users, including public transport.

This is achieved through improved journey times and reliability for bus services within major conurbations with new MRT networks proposed for both Oxford and Milton Keynes. Market towns will also benefit from improved bus connectivity to centres of employment and into East West Rail stations enabling more seamless public transport journeys.

Efficiencies of scale will help to reduce cost of bus travel, increasing its appeal relative to private car use while also encouraging more people to walk or cycle as part of their journey (such as to or from a local mobility hub). This shift will see this package to support growth in economic activity while reducing carbon, nitrogen oxide (NOx) and particulate matter (PMx) emissions.

Overview

This package is based on moving more people, more reliably and more quickly by making better use of existing road infrastructure with higher capacity vehicles:

- bus based mass rapid transit (MRT) within major conurbations;
- arterial corridor bus priority on key routes and improvements in bus frequency; and
- enhanced inter-urban transit network.

Interventions include:

- bus-based mass rapid transit systems in Oxford and Milton Keynes combined with;
- inter-urban bus priority measures in targeted locations connecting both cities and market towns such as Aylesbury, Banbury, Bicester, Brackley, Buckingham, Silverstone, and Winslow.

Benefits for the study area

Highlights of the package benefits (as shown as an output through the EEHLEUM model) by 2050 include:

- £60 million GVA uplift per annum (by 2050, 2018 prices)
- ~5,000 tonnes less vehicle CO_{2e} emissions

Key links to other packages

Local and regional benefits from improved bus services will be far greater where integrated with other modes. For example, Aylesbury railway station sits at the intersection of many bus routes.

Integration of bus stops with walking and cycling networks (including effective use of wayfinding signage) will allow this package to support interventions in package 3, aimed at supporting a greater shifting to more sustainable modes.

Encouraging development close to mobility hubs, combined with the use of a decarbonised bus fleet as detailed in package 4 will further improve the value of this package to the community.

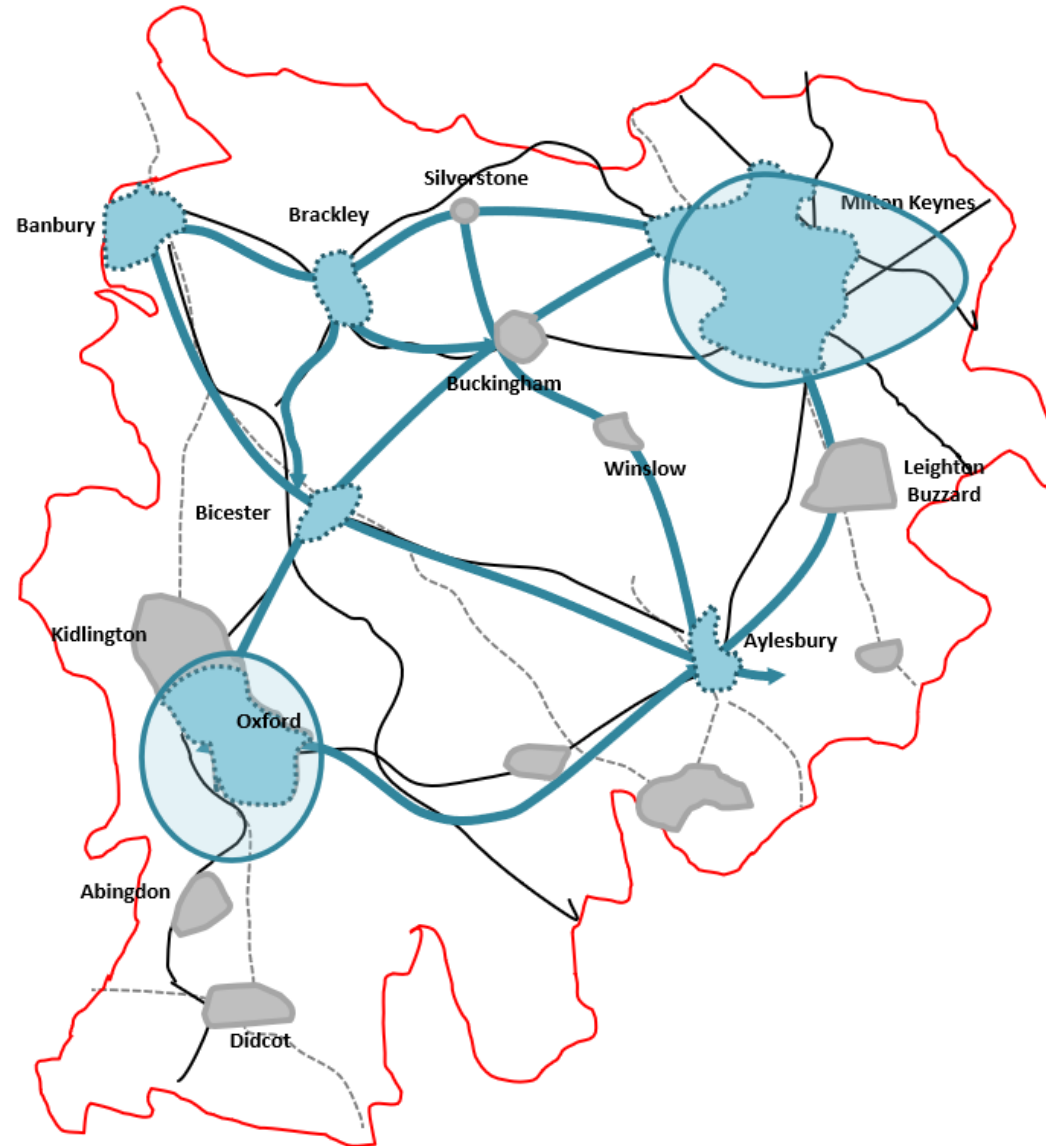
Enabling actions support achievement of net zero carbon

To ensure delivery of interventions is aligned with EEH's transport strategy vision of net zero carbon by 2050 at the latest, consideration needs to be given to:

1. making sure alternatives are in place before road space is reallocated to allow road users to shift modes and or routes where possible;
2. making sure alternatives are understood to ensure road users understand the benefits of changes being made addressing any objections; and
3. continual improvement to understand how things like bus rapid transit can best meet the needs of local users.

Map of package

-  **Connectivity study boundary**
-  **Key urban areas**
-  **Existing rail network**
-  **Existing key road network**
-  **Bus-based MRT**
 - Oxford Bus Based Rapid Transit
 - Milton Keynes MRT Network
-  **Roadspace reallocation to public transport**
 - Urban road space reallocation
-  **Inter-urban bus priority measures in targeted locations**
 - Milton Keynes to Aylesbury to Oxford
 - Milton Keynes – Buckingham – Bicester – Oxford
 - Milton Keynes to Banbury (Via AVEZ - Silverstone)
 - Milton Keynes to Banbury (Via Brackley and Buckingham)
 - Banbury to Bicester to Aylesbury
 - Aylesbury to AVEZ - Silverstone via Winslow and Buckingham
- Additional area-wide interventions (not mapped)**
 - Local free public transport schemes



Package 2: Supporting rail to provide fast, reliable strategic connectivity

Rail is the most efficient way to move large numbers of people longer distances. This package is expected to increase daily return trips by 30%. Interventions such as Aylesbury link, double tracking the Cotswold Line from Oxford to Hanborough and a Bletchley northeast chord will help to optimise and distribute the benefits of East West Rail throughout the connectivity study area and beyond.

Improving and expanding the rail network stimulates mode shift particularly for more strategic trips and a reduction in car use, supporting a reduction in transport's carbon impact. Improvements in journey times and reliability for all rail users reduces barriers to interurban connectivity supporting increased business to business interaction, knowledge spillovers and potential for agglomeration.

Overview

This package is based on making the most of the existing rail network while also creating new capacity due to:

- station improvements to improve rail/bus/active travel integration;
- optimising the opportunities that East West Rail provides; and
- line enhancements and rail-based MRT system in major settlements.

Interventions include:

- infrastructure to realise the full potential of East West Rail such as the Aylesbury link and Oxford North Junction upgrade; and
- investment in strategic transport interchanges in Aylesbury, Bletchley, Bicester, Milton Keynes, Oxford, Oxford Parkway, and Winslow.

Benefits for the study area

Highlights of the package benefits (as shown as an output through the EEHLEUM model):

- £30 million GVA uplift per annum (by 2050, 2018 prices)
- 20,000 more rail journeys each weekday

Key links to other packages

Where integrated with the road space reallocation and bus services improvements in package 1, the interventions in this package will help create an integrated network that stretches far beyond any individual railway station.

Supporting sustainable development close to transport hubs as we are already seeing at Oxford station can help to fund the transport improvements in this package.







Development around an emerging mobility hub will also reduce the need for new residents to use private cars, further supporting the goals of package 1.

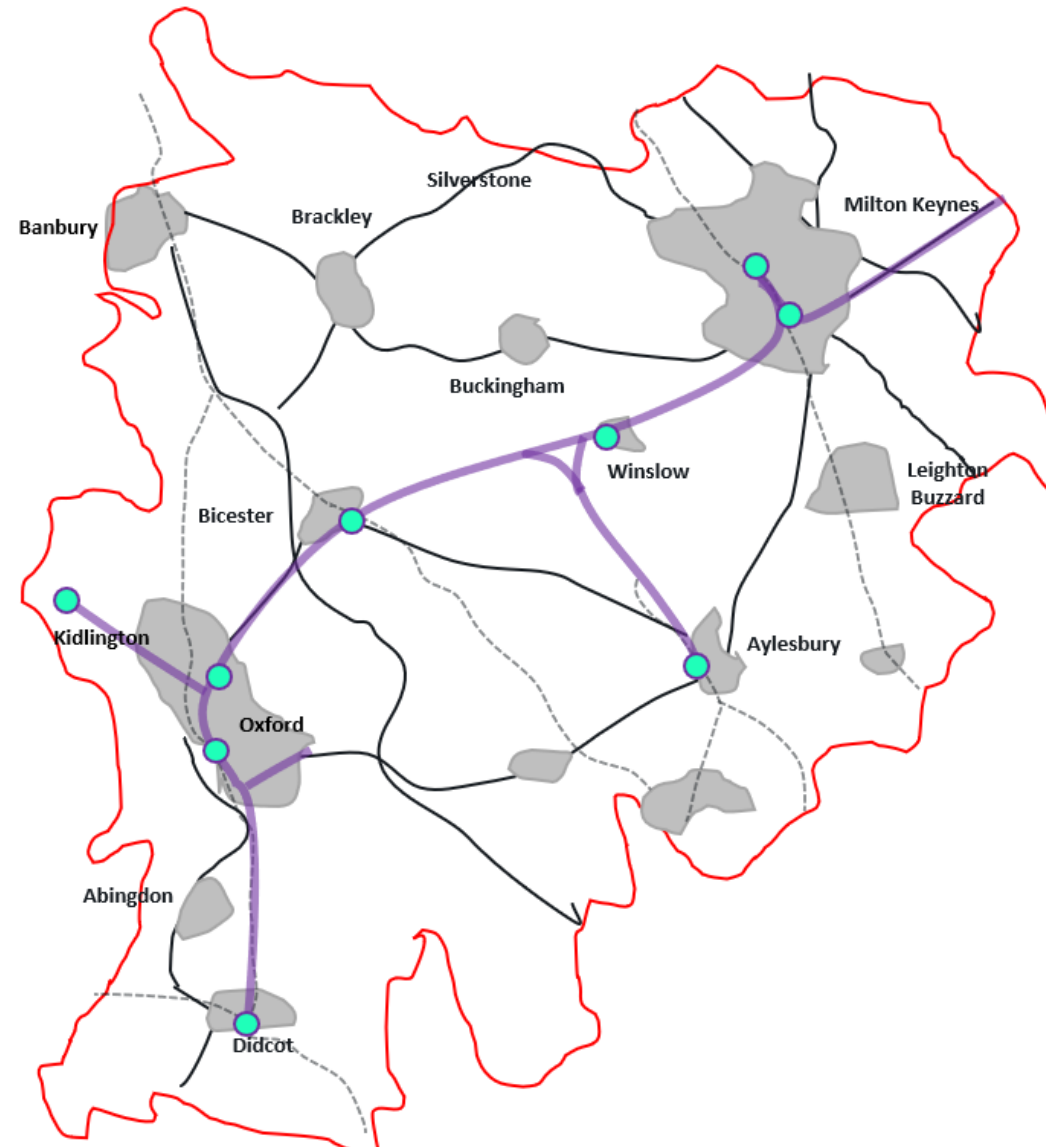
Enabling actions to support achievement of net zero carbon

To ensure delivery of interventions is aligned with EEH's transport strategy vision of net zero carbon by 2050 at the latest, consideration needs to be given to:

1. improving station connectivity ahead of services to maximise use of local walking, cycling and public transport connections by new and existing travellers;
2. investing in energy production from renewable sources to full decarbonise transport operations; and
3. integrating/simplifying ticketing to reduce barriers for using new and existing rail service.

Map of package

-  Connectivity study boundary
-  Key urban areas
-  Existing rail network
-  Existing key road network
-  Intervention to optimise the benefits of East West Rail
 - East West Rail Aylesbury Link
 - East West Rail Aylesbury Link (west)
 - East West Rail Bletchley northeast chord
 - East West Rail Electrification
 - Oxford North Junction upgrade
 - Double tracking Oxford to Hanborough
 - Cowley Branch Line upgrades
-  Integration of East West Rail with local transport network
 - East West Rail Strategic Transport interchanges
 - a) Winslow
 - b) Bicester
 - c) Oxford
 - d) Oxford Parkway
 - e) Aylesbury
 - f) Bletchley
 - g) Milton Keynes
 - Hanborough Station additional platform and crossovers
 - Wolvercote rail Junction – Capacity Upgrades



Package 3: Supporting mode shift to active and sustainable modes

The personal wellbeing and public health benefits from more people choosing to walk or cycle more often can be substantial. When delivered in an accessible way, the benefits of the interventions in this package will allow all those living in and visiting the study area to obtain the various physical and mental health benefits from choosing these active travel options. The package also includes interventions which will make active travel modes a competitive option for travel to work into Milton Keynes and Oxford increasing the efficiency of and improving commute journey times

Reducing car use will be a key benefit of this package, especially for shorter trips, achieving significant reductions in associated carbon and NOx and PMx air quality emissions. This package will also improve the resilience, safety and comfort of the overall transport network for existing active travel users.

Overview

This package is based on reducing barriers to more people more frequently choosing to walk, cycle, etc. through:

- improved walking and cycling infrastructure as part of an integrated inter-urban active travel network;
- network of multimodal mobility hubs; and
- demand responsive transport (DRT) in rural areas.

Interventions include:

- creating a network of multimodal mobility hubs connected by an improved inter-urban active travel network; and
- supporting increased adoption of shared mobility solutions.

Benefits for the study area

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Benefits for the study area

Highlights of the package benefits (as shown as an output through the EEHLEUM model):

- 150,000 additional active mode return trips each weekday
- 100,000 fewer return car journeys each weekday
- £40 million GVA uplift per annum (by 2050, 2018 prices)

Key links to other packages

Improved active travel routes, such as Varsity Way linking Oxford and Milton Keynes, will make it easier for more people to access the bus interventions detailed in package 1 and rail projects in package 2 without also increasing private car use.

Reducing private car use for shorter trips will also reduce demand for car parking in urban areas, supporting package 4 in delivering more sustainable, planned developments by allowing space to be used for more productive purposes.







Highways interventions in package 4 'deconflicting' strategic and local traffic will support realisation of improved safety for active mode users.

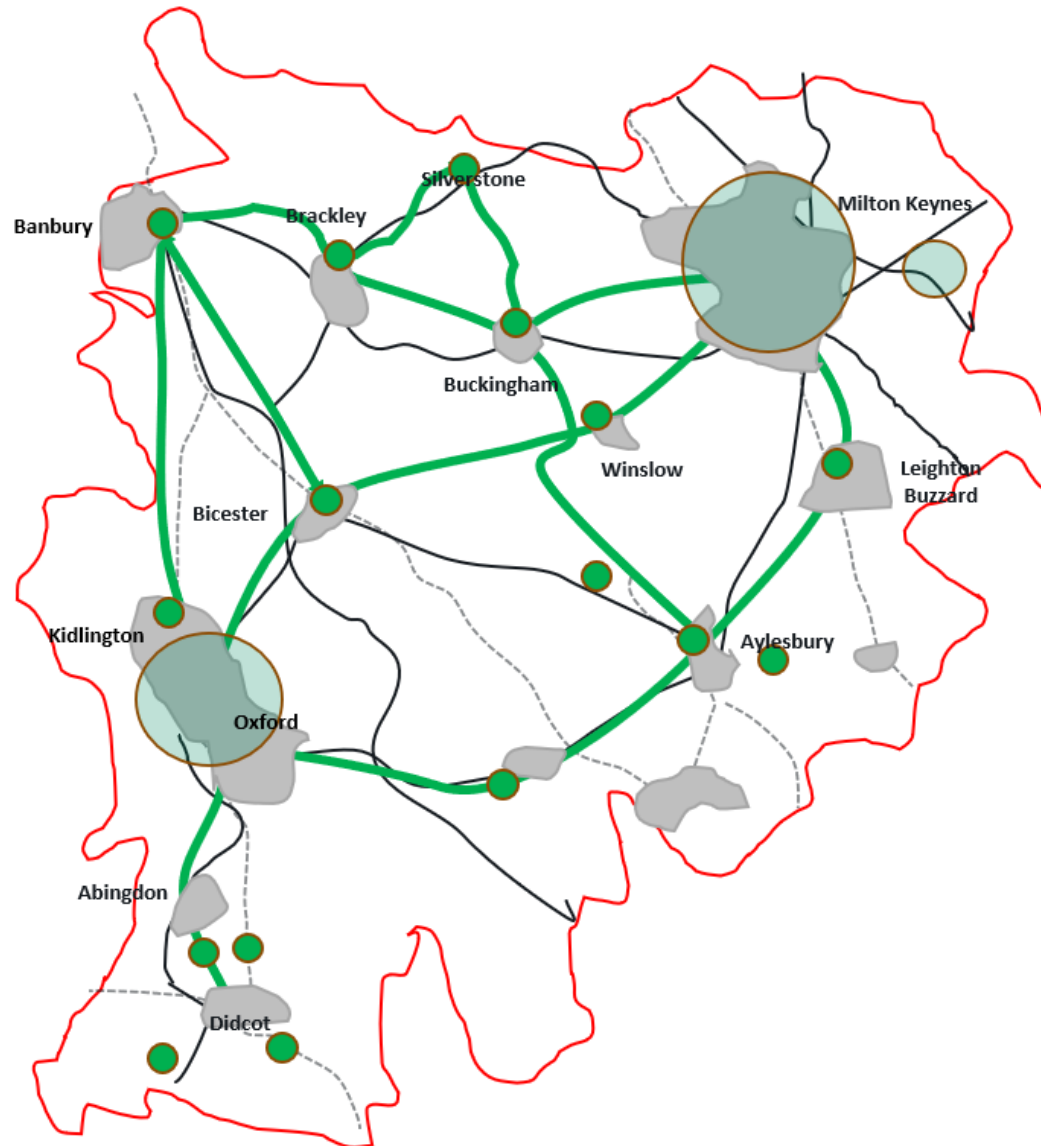
Enabling actions to support achievement of net zero carbon

To ensure delivery of interventions is aligned with EEH's transport strategy vision of net zero carbon by 2050 at the latest, consideration needs to be given to:

1. effectively managing existing walking and cycling routes, by ensuring enforcement action against illegal pavement parking;
2. ensuring schemes are integrated into existing networks, especially at either end of new interurban walking and cycling routes delivered in a phased approach; and
3. embedding mobility hub principles into local policies to ensure development is sustainable.

Map of package

-  Connectivity study boundary
-  Key urban areas
-  Existing rail network
-  Existing key road network
-  Network of multimodal mobility hubs
 - Oxford outer P&R sites
 - Milton Keynes P&R sites
 - Ridgmont Strategic Mobility Hub
 - Strategic network of mobility hubs
-  Inter-urban active travel network
 - Buckinghamshire Greenway to Brackley
 - Brackley to Banbury
 - Brackley to Milton Keynes
 - New cycle route between Banbury and Bicester
 - Missing link between NCN 57 at Thame and NCN 6 at Leighton Buzzard
 - Upgrade NCN 5 (Didcot to Banbury)
 - Upgrade NCN 51 (Oxford to Milton Keynes)
- Support delivery of MaaS (not mapped)**
 - Multi modal, integrated, consistent fares/ticketing Mobility as a Service (MaaS)
- Increase adoption of shared transport (not mapped)**
 - Rural mobility hubs
 - Rural DRT
 - Cycle hire schemes
 - Expansion of car clubs
 - Micro-mobility
 - Development of rural car clubs
 - Mobility Management Plans
 - Behaviour Change Campaigns
 - Digital connectivity on public transport



Package 4: Enabling sustainable, planned development and a decarbonised fleet

Key benefits of this package are safer highways, notably in urban areas and more reliable strategic highway journey times. Deconflicting of strategic and local trips will also improve air quality in urban areas, stimulate placemaking and present the opportunity to reallocate road-space to active travel and public transport. The Bicester South East Perimeter Road for example removes strategic traffic from the town centre allowing an enhanced quality of place encouraging regeneration and development.

'Placemaking' identifies locations where there is a need to reduce the impact of an existing road on the quality of life for communities near it. It is likely that solutions will be targeted, community-focused interventions which can potentially be delivered within shorter timescales than schemes of a bigger scale. The nature of the intervention/s required are still to be determined and will be developed in collaboration with partners in all cases.

The package also deploys charging (and or refuelling) infrastructure for zero emissions vehicles enabling those who still choose to drive to do so with reduced environmental impact.

Overview

This package is based on increasing access to housing and facilitating shift to zero emissions vehicles by:

- enabling highway access to development for all modes (car, bus, etc);
- provide infrastructure for alternative fuel vehicles (e.g. electric charge points); and
- further integrating land use and transport planning.

Interventions include:

- work to improve safety and resilience on strategic highways;

- Targeted improvements on key east-west links
- accelerating uptake of alternative fuel vehicles through improved roadside infrastructure, smart parking, etc.

Benefits for the study area

Highlights of the package benefits (as shown as an output through the EEHLEUM model):

- £30 million GVA uplift per annum (by 2050, 2018 prices)
- ~25,000 tonnes less vehicle CO_{2e} emissions

Key links to other packages

Deconflicting strategic and local traffic in urban centres such as Aylesbury will be critical to realising the environmental benefits from bus improvements in package 1. It allows the opening up of road space for reallocation to bus and active modes supporting better bus journey times, reliability and encouraging mode shift, as per EEH's transport hierarchy.









Integrated land use and transport planning will also support realising the benefits of rail interventions in package 2, as well as the shift to more sustainable active travel modes like walking and cycling in package 3 presenting opportunities for transport-led development.

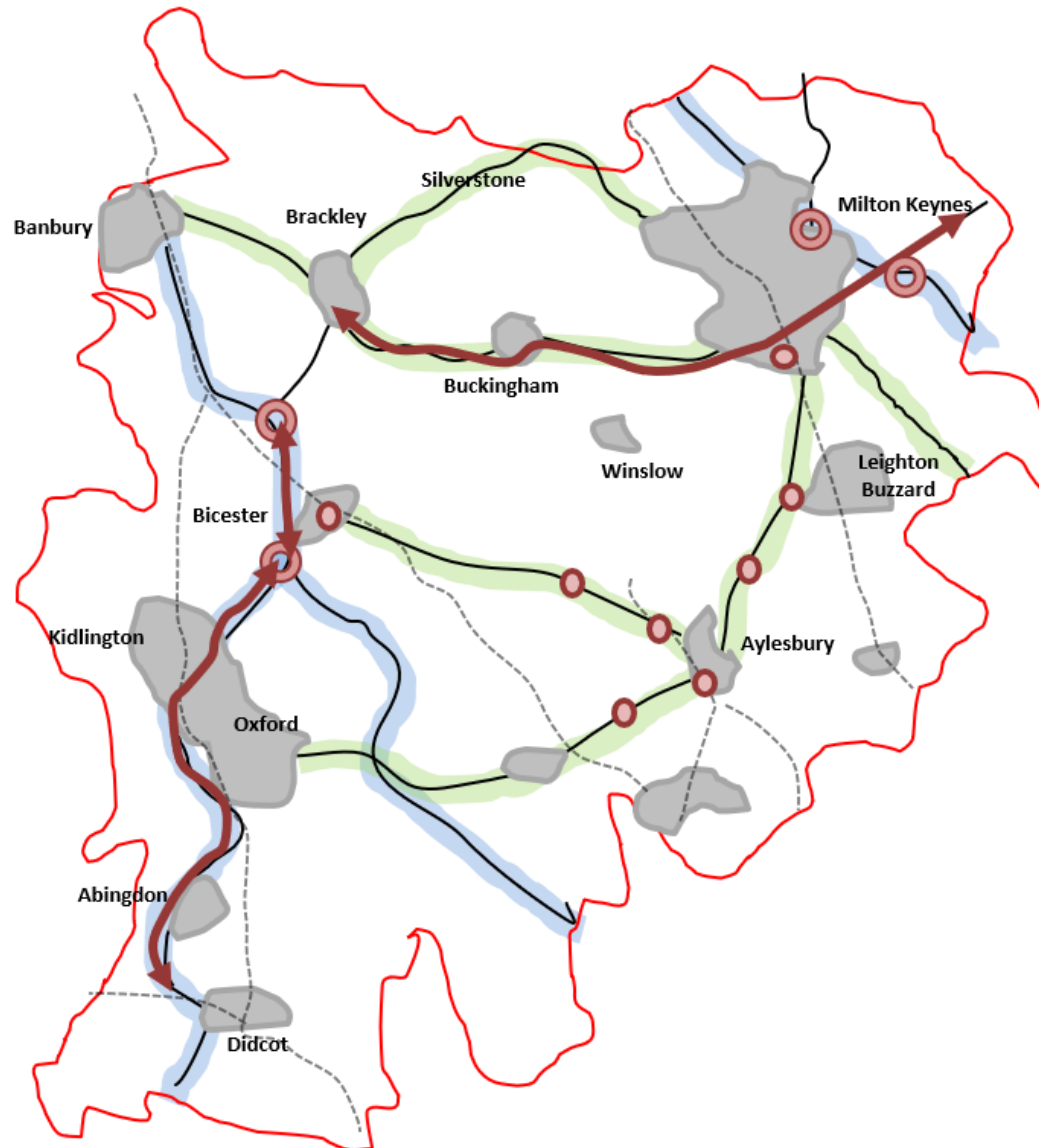
Enabling actions to support achievement of net zero carbon

To ensure delivery of interventions is aligned with EEH's transport strategy vision of net zero carbon by 2050 at the latest, consideration needs to be given to:

1. Ensuring charging infrastructure is in place across all areas to facilitate decarbonised journeys to, from and within the region;
2. Proactively communicating the benefits of integrated land use and transport planning from similar and or nearby areas before initiating local projects; and
3. Using events and temporary interventions to gain local buy in ahead of permanent changes.

Map of package

-  Connectivity study boundary
-  Key urban areas
-  Existing rail network
-  Existing key road network
- Strategic Road Links**
 -  North South
 -  East West
-  **Strategic highways safety and resilience**
 - M1 Junction 13 and 14
 - Reliability and Safety Improvements for bus and active travel along the A34
 - M40 Junction 9-10 junction and safety improvements
-  **Highway improvements on key east-west links**
 - A421: Journey time reliability and future resilience
 - Bletchley Placemaking
 - A41: Bicester South East Perimeter Road
 - A41: Waddesdon Placemaking
 - A418: Dinton, Stone, Upton, Hartwell Placemaking
 - A418: Aylesbury Northern and Southern Ring Roads
 - A418: Rowsham Placemaking
 - A418: Wing Placemaking
- Smart & efficient highway network accelerating uptake of alternative fuel vehicles through infrastructure (not mapped)**
 - Traffic Management
 - CAV Roadside Infrastructure
 - Smart parking
 - AI-assisted road condition monitoring
 - Electrical Vehicle Charging infrastructure
 - Support digital hubs in rural areas
 - Residential & Workplace Parking Standards
- Additional measures (not mapped)**
 - Support digital hubs in rural areas
 - Residential & Workplace Parking Standards



Package 5: Sustainable and efficient freight solution

Moving more freight by rail will reduce the number of HGV trips to, from and across the study area, reducing both emissions and highway congestion. Removing such traffic in this way will create capacity on existing infrastructure for trips that have greater benefit for the local area, such as those provided by the expanded bus network detailed in package 1.

This package will also help to reduce carbon emissions by increasing the number of trips taken by zero-emission vehicles, such as e-cargo bikes facilitating first/last mile delivery from freight consolidation centres.

Overview

This package is based on improving capacity for freight movements with reduced environmental impact through:

- greater use of sustainable urban goods transport for first and last mile; and
- improvements to both road and rail based strategic freight corridors.

Interventions include:

- providing more sustainable first/last mile freight delivery options, including freight consolidation centres on the outskirts of towns;
- freight-friendly highway interventions on strategic links; and
- optimising rail freight.

Benefits for the study area

Highlights of the package benefits (as shown as an output through the EEHLEUM model):

- £80 million GVA uplift per annum (by 2050, 2018 prices)
- Reduced congestion on local roads from better coordination of deliveries

Key links to other packages

Increasing usage of rail for long distance freight through introduction of passing loops on East West Rail and expanding local consolidation and sustainable first/last mile delivery will particularly support package 1 by reducing demand for existing road space. It will also support package 3 by increasing the demand and value of improved local and inter-urban cycling infrastructure.








Improvements in digital connectivity and increased levels of automation as detailed in package 6 will also improve the efficiency and capacity of local, national and international freight networks.

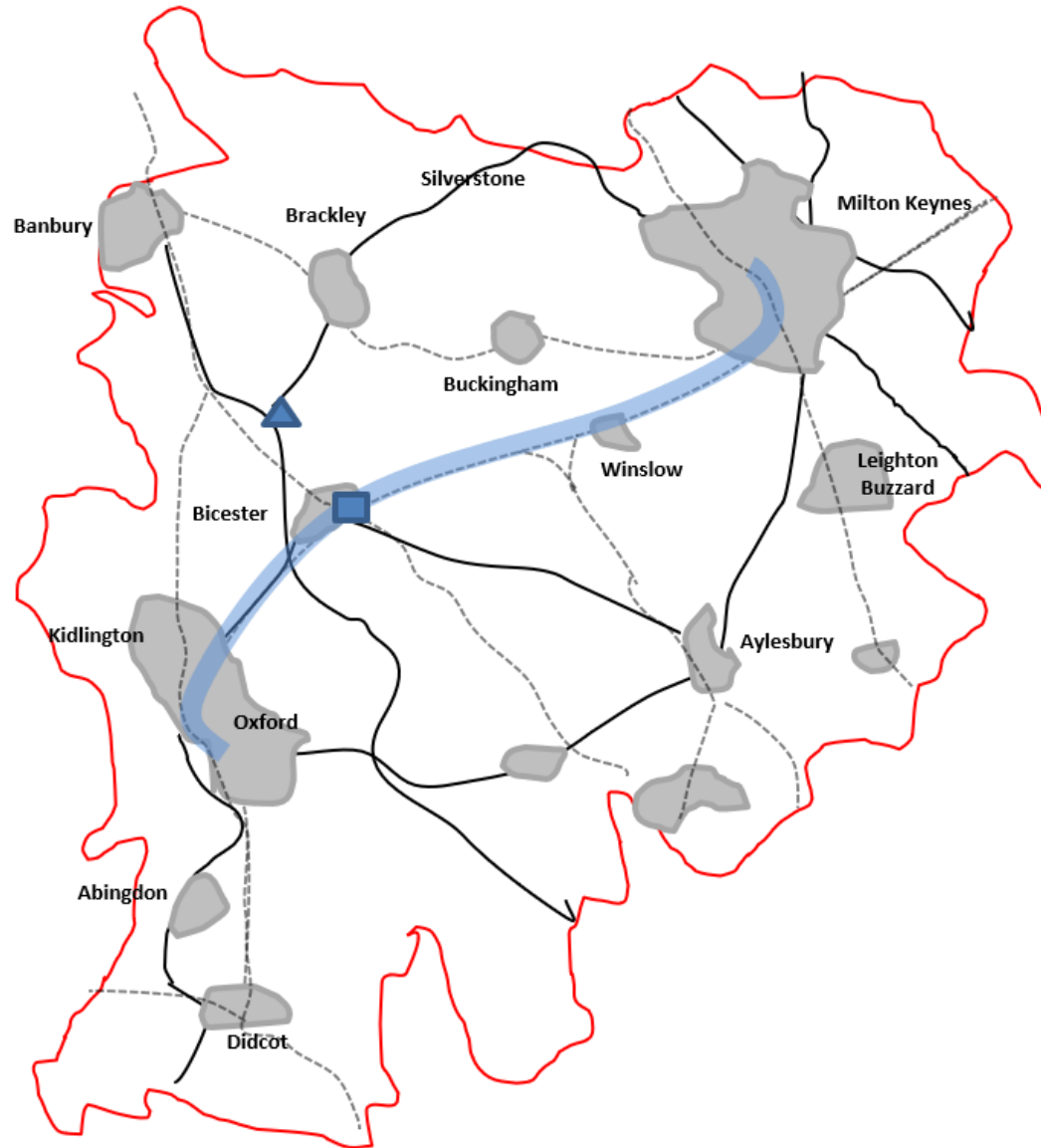
Enabling actions to support achievement of net zero carbon

To ensure delivery of interventions is aligned with EEH's transport strategy vision of net zero carbon by 2050 at the latest, consideration needs to be given to:

1. upgrading walking and cycling infrastructure where possible ahead of freight consolidation hubs going live to help ensure their success;
2. providing long term infrastructure pipeline and delivery plan to give certainty and foster private sector investment in freight terminal and other supporting infrastructure; and
3. delivering overhead electrification of freight rail network to further reduce the carbon impact of freight.

Map of package

-  Connectivity study boundary
 -  Key urban areas
 -  Existing & Planned rail network
 -  Existing key road network
- Freight on rail optimisation**
-  East West Rail passing loops
 -  RFI – Private Sector proposal - NW of Bicester
 -  RFI - Public Sector proposal - Bicester MOD
- Sustainable urban goods transport (not mapped)**
- First Mile / Last Mile Sustainable freight delivery
 - Freight consolidation centres on the outskirts of towns
- Freight friendly highway interventions on strategic links (not mapped)**
- HGV parking areas
 - HGV lanes at key junctions and on steep hills
 - HGV signal priority
 - Freight hubs on SRN





Demand Management

Demand management measures, such as behaviour change initiatives and optimisation of assets, seek to promote alternatives where private car (particularly single occupancy car use) is a less efficient use of limited road space and increase the appeal of alternatives such as shared transport, public transport and active modes of travel. The nature of the interventions influence travel patterns, increasing mode shift away from car, reducing carbon emissions and improving quality of life through placemaking and improved health through an increase in active travel and improvements in air quality.

Through the iterative process of the development of this study, the impact of demand management was modelled and highlighted the benefits that demand management could bring to mode shift, providing it was at the right scale. Demand management solutions should be considered either nationally, within the geography of individual local authority areas, or both. A region-wide demand management solution is not currently an aspiration of the EEH Board.

Partners, such as Oxfordshire County Council are seeking to capitalise on the benefits of demand management. Through the Central Oxfordshire Travel Plan, measures such as traffic filters and workplace parking levy are proposed, as well as further roll out of alongside a live trial of a Zero Emission Zone, alongside a comprehensive package of sustainable travel measures.

Funding generated by interventions such as workplace parking levies can be utilised to fund improved public transport measures, a benefit of the approach in a background of funding constraints.

Impact Assessment

Package Modelling

EEH commissioned Steer to develop a model to test the impact of the packages developed within the connectivity studies on transport and socioeconomic outcomes up to the year 2049. This model, known as

the England's Economic Heartland Economy and Land Use Model (EEHELUM), is a transport and land use model that simulates the interaction of transport, people, employers and land use over periods of time. To model each package in EEHELUM, adjustments were primarily made to the generalised journey times (GJTs) within and between each zone (by mode) to reflect the anticipated impact users will get from the proposed interventions identified. The packages were modelled in EEHELUM from a base year of 2022 and run for 28 years to 2049. The results are presented as a comparison to a business-as-usual scenario (BaU), which is based on the national trip end model (NTEM) which also projects employment and population growth to 2050.

Costs

The construction and maintenance cost estimates have been prepared to a level of detail commensurate with the maturity of the design of the interventions and the current level of detail available on the proposals. Items have been priced using either published costs, estimated based on similar known schemes or built up based upon industry standard rates. All estimates have a base year of 2022. To reflect the lack of maturity of the design, risk allowances have been applied to the higher range costs at levels commensurate with SOC estimates, informed by DfT's transport analysis guidance (TAG) as detailed in the table below. Operations cost estimates have been presented as low, medium and high range of costs. This reflects a level of uncertainty in cost estimating accuracy, due to the lack of maturity of the design and available detail for many schemes. The low costs are based on estimated delivery costs in 2022, medium applies a +10/+15% increase and High accounts for additional risk and optimism bias as set out above.

Figure 2: Package modelling outputs and costings

	Change against BAU 2049 in socioeconomic indicators within the study area				Costs (Mid Cost - £m 2022 prices)		
	Population	Jobs	GVA (£m per annum)	Carbon (kTCO ₂ e)	Construction	Maintenance & Renewal	Operations
BAU 2021	1,340,000	560,000	39,000	615			
BAU 2049	1,650,000	650,000	73,000	320			
Package 1 - Making best use of roads	+500	+900	+60	-5	1,480	110	Medium
Package 2 - Supporting rail to provide fast, reliable strategic connectivity	+100	+200	+30	-	1,180	30	High
Package 3 - Supporting mode shift to active modes	+400	+200	+40	-10	490	40	Low
Package 4 - Enabling sustainable, planned development and a decarbonised fleet	+200	+300	+30	-20	820	60	Low
Package 5 - Sustainable and efficient freight solution	+700	+900	+80	-	1,160	45	Low
Combined Impact against BAU 2049/Cost	+1,900 +0.1%	+2,500 +0.4%	+240 +0.3%	-35 -11%	5,130	285	

Next Steps

Funding

There are a number of funding sources to potentially support infrastructure investment and other resource intensive programmes in the Heartland including central government funding, National Roads Fund, third party contribution (such as developer contributions) and local rates/levies. New funding sources may also become available over time which EEH and its partners will work to being primed to secure.

Investment sought within this plan is additional to funding required to invest in local bus services and maintenance of our transport assets.

It is recognised that funding is nationally challenging, and therefore a range of funding and financing models will need to be analysed and considered. In this regard, EEH will identify alternative models for transport investment within the region and seek to produce a prospectus aimed at investors and developers within EEH to attract funding for new schemes.

In addition, some interventions are revenue generating and might only require 'seed-corn' funding to mobilise the intervention. Furthermore, new funding and financing models could include a 'beneficiary pays' approach to reduce reliance on central government grants if the relevant powers are available locally.

As a key function of STBs, EEH we will also determine how regional strategic transport investment schemes are prioritised, drawing from recommendations across our technical work from previous years; and develop a prioritised pipeline.

Governance

The Strategic Transport Leadership Board, transport officers group (TOG), steering groups and stakeholder groups are part of the EEH governance process and are key to the successful development of the connectivity study. The steering group is composed of local transport authorities, local planning authorities and local enterprise partnerships. Stakeholder groups have included infrastructure owners (National Highways and Network Rail), transport operators (e.g. bus operators association, TOGs, Department for Transport (DfT), environment and business groups (including statutory and non-statutory), Homes England, National Trust, Department for Digital, Culture, Media and Sport (DCMS), national interest and mode specific groups (e.g. Sustrans) amongst others. EEH will consider its governance structure for onward delivery of its transport strategy and associated investment pipeline.

Delivery Plan

Planning timescales have been considered as well as the scale and complexity of each scheme, its current stage of scheme development (e.g. pre-feasibility through to construction and evaluation) and what powers and consents are required, along with major considerations such as securing funding and land assemblage.

Based on stakeholder input intervention phasing was considered in the short, medium and long term. Short term schemes were judged to have a construction start date between 2025 and 2032. Medium term schemes were judged to have a construction start date between 2033 and 2040. Long term schemes were judged to have a construction start date 2041 onwards.

Subject to agreement, the assumed scheme promoters include Network Rail, local transport authorities, National Highways and Active Travel England. It should also be noted that there is an important role for the private sector, partnerships, and innovative funding and financing tools.

Wider Next Steps

As the sub-national transport body for the region, EEH will continue to lead on delivery of the investment pipeline, working with officers and the Strategic Transport Leadership Board to scope its onward development. The connectivity studies, alongside other technical work currently being commissioned by EEH, will also inform the investment pipeline. Specifically, EEH will:


- Ensure completion of other connectivity studies currently under development (funding dependent);
- Determine the scope and appoint a team to develop the EEH Investment Pipeline iterations.

ⁱ ONS

ⁱⁱ ONS


ⁱⁱⁱ Business Register and Employment Survey

Get in touch

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