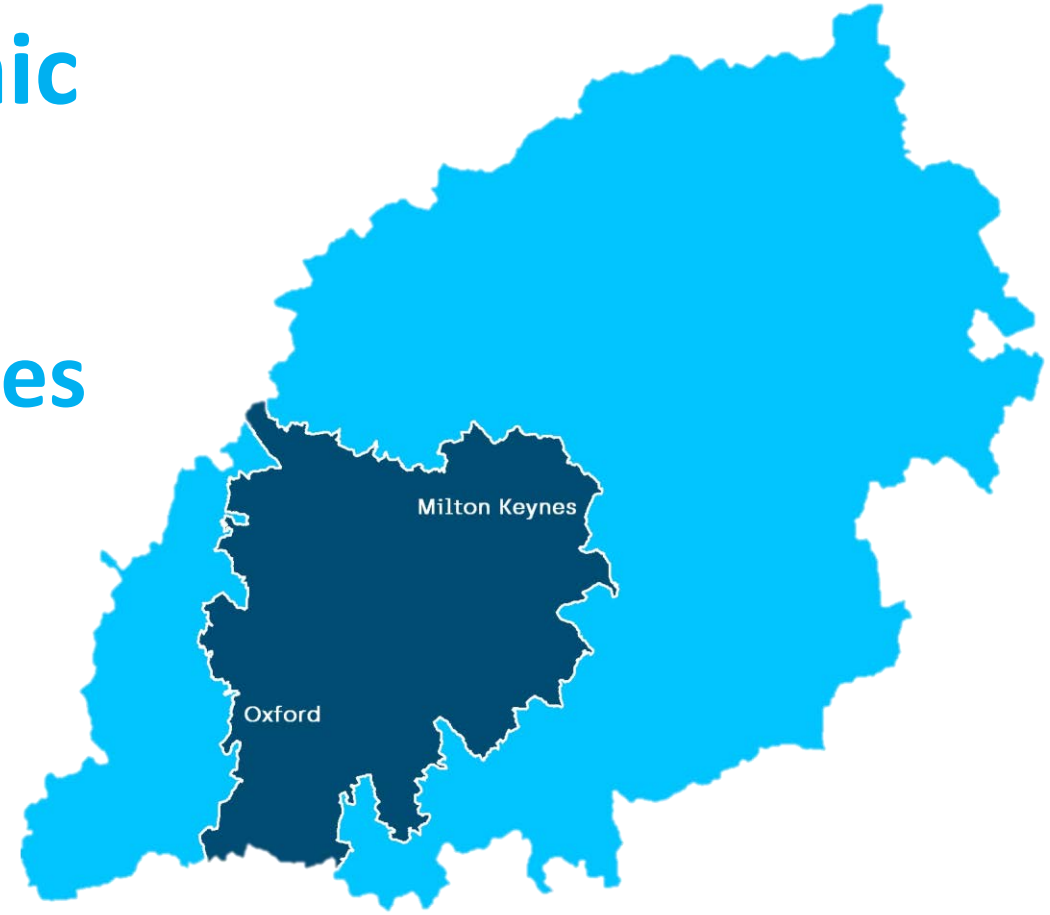
England's Economic Heartland

Oxford-Milton Keynes Connectivity Study



Phase 2 Report

Version 3.0

November 2021

steer wsp

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Introduction

Context & Background

The Ambition

England's Economic Heartland (EEH) is an economic powerhouse, home to world-leading universities and innovators. It is blessed with a **natural, historic and built environment that makes it an attractive place to live and work.** EEH aims to harness these attributes to the benefit of both the existing communities and future generations.

***Connecting People, Transforming Journeys* - EEH's Transport Strategy - emphasises that investment in the transport system will continue to be essential in order to enable economic growth.** At the same time, changes must be made to the way in which investments are planned, developed and delivered.

Network capacity acts as a constraint to growth and reduces resilience and reliability, all of which impacts productivity. Lack of choice in travel options also act as a constraint for those seeking to access jobs, homes, services and amenities. *Connecting People, Transforming Journeys* also acknowledges that the environmental impact of the transport system is unacceptable, with carbon emissions significantly above the national average.

The Vision

Connecting People, Transforming Journeys provides the step-change in approach required to seize the opportunity to deliver a transport system that supports a green economic recovery and enables growth, whilst preserving and enhancing the natural, historic and built environment.

The overarching vision is: ***"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."***

This ambition requires a shared commitment between the partners in the region and national government, and bold decision making that puts people and the environment at its centre. It looks to realise synergies with other policy areas which have a major impact on the way people travel, including spatial planning and the provision of wider infrastructure and services such as digital, utilities, education and health.

The Key Principles

Connecting People, Transforming Journeys sets the policy framework, supported by an initial investment pipeline, that will deliver the ambition. It is guided by four key principles:

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

Context & Background

Project Aims

Steer and WSP have been commissioned by EEH to **undertake a *Connectivity Study* of the Oxford to Milton Keynes Corridor**. The *Connectivity Study* aims to identify a preferred package of multi-modal interventions that deliver the required connectivity outcomes that help achieve EEH's objectives identified within the *Connecting People, Transforming Journeys* - EEH's Transport Strategy.

Methodology

This study is being undertaken in four phases:

- Phase 1: Methodology Development
- Phase 2: Setting the Scene
- Phase 3: Producing Recommendations
- Phase 4: Final Package of Interventions

This report focuses on Phase 2 which includes a summary of the findings of the first four steps of the Department for Transports (DfT's) *Transport Appraisal Process*, shown below.

Understanding the policy context, the current and future community and connectivity issues and opportunities within the study area is a vital first step. This information will assist in the **identification of multi-modal intervention packages which seek to address the underlying causes of the identified challenges**, whilst also providing opportunities for existing and future communities.

Our approach to gathering evidence to establish the need for intervention, identify study objectives and critical success factors has been guided by the key principles identified within the EEH's Transport Strategy - net zero carbon, economic, quality of life, wellbeing, inclusive access, sustainable and active travel connectivity and freight.

Consistent with *Connecting People, Transforming Journeys* 'whole system approach', this Phase 2 report summarises our **people, place** and **connectivity** evidence base to demonstrate the existing and growing complex challenges facing the corridor along with a clear set of critical success factors and objectives to address the identified problems.

The study recognises that strategic infrastructure issues (and solutions) extend beyond a single area and adopts a cross-boarder, strategic approach to assessing connectivity and movement. The study goes beyond more localised approaches to addressing transport issues, like Local Transport Plans, to identify strategic interventions that meet the ambitions of the study area. This reflects EEH's function as a Strategic Transport Body which has the aim of ensuring that regional investment in transport is 'joined up'.

Step 1: Understanding the Current Situation	Step 2: Understanding the Future Situation	Step 3: Establishing the Need for Intervention	Step 4a: Identify Intervention Specific Objectives
•Policy context •People •Place •Connectivity •Movement patterns •Issues and opportunities	•Planned growth •Committed transport improvements •Forecast changes in travel demand	•Key issues and opportunities •Underlying causes and drivers •The case for intervention •Critical success factors	•Objectives

Overview

The Oxford to Milton Keynes corridor study area, as presented on page 7, it extends from Didcot (south) to Banbury (north) and across to Milton Keynes (east). The corridor is strategically located to the north-west of London and is an important contributor to the success of the sub-region.

The study area **includes the primary urban conurbations** of Didcot, Oxford, Bicester, Banbury, Brackley, Buckingham, Newport Pagnell, Milton Keynes, Bletchley, Leighton Buzzard, Aylesbury and Thame, **spanning multiple local authorities**.

The study area also **encompasses regional and national significant road and rail links**, including the M1, M40, A5, A421, A41, A418, and A34 and the Aylesbury to London Line, Princes-Risborough to Aylesbury Line, Oxford to Bicester Line, Marston Vale Line, Cherwell Valley Line, West Coast Mainline, Chiltern Mainline, Cotswold Line, East West Rail and the Former Great Central Railway.

It is noted that the wider area, including Luton and the key international gateway at London Luton Airport, may influence future decision-making on the extent of the transport interventions.

The Oxford to Milton Keynes corridor is an attractive place to live, **exhibiting diverse social characteristics, a strong economy and with relatively good transport connectivity**.

However, the nature of the corridor results in complex social, economic and connectivity challenges to be addressed and opportunities to be maximised:

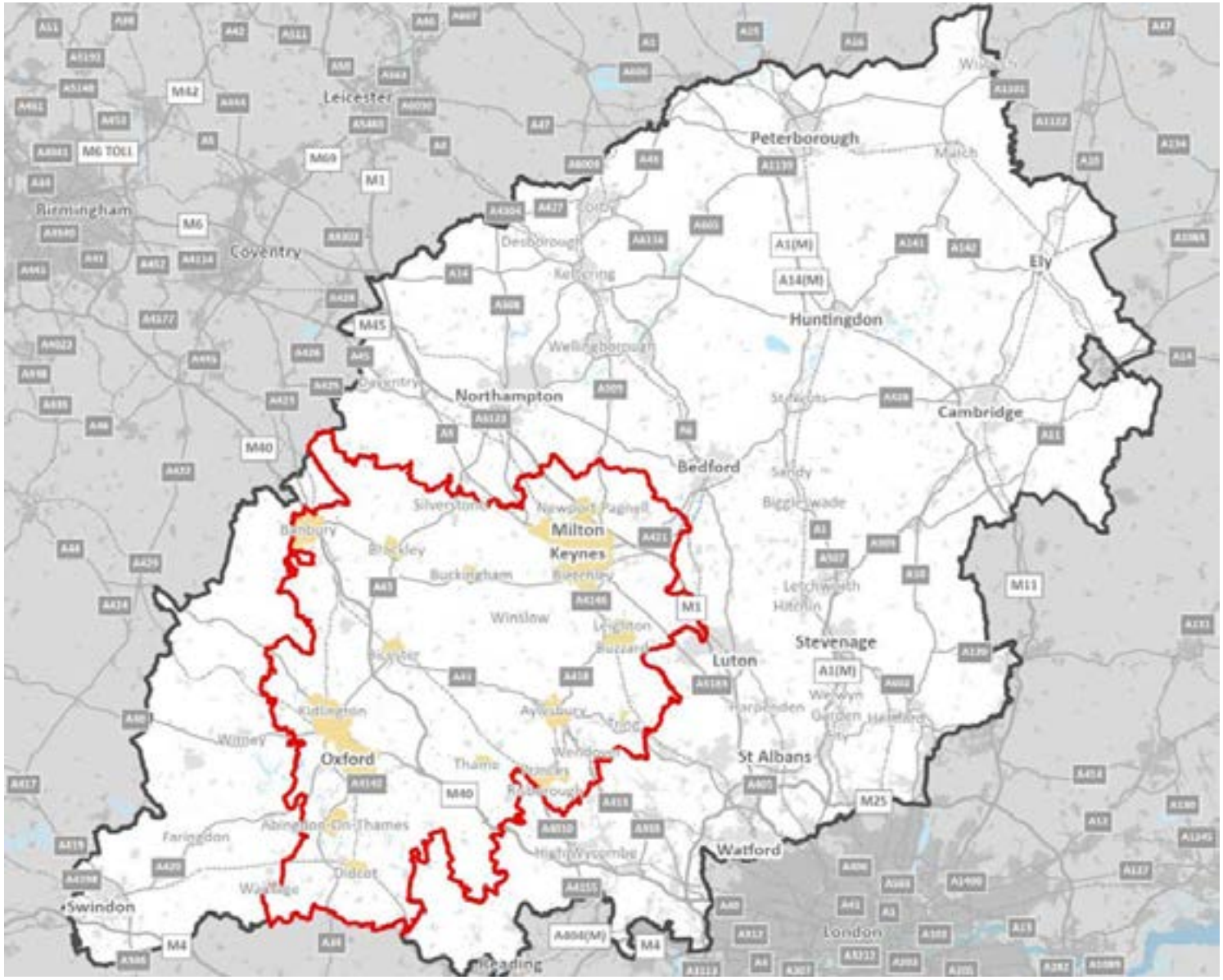
Leveling Up: the study area has varying levels of deprivation, which result in a complex mix of differing needs and challenges. Packages of multi-modal interventions can play a vital role in delivering an affordable and accessible transport network that reduces barriers to employment, education and training, healthcare, social, leisure, physical and cultural activities.

Decarbonisation: EEH are committed to tackling the climate change emergency by bringing all greenhouse gas emission to net zero by 2050, with an ambition to reach this by 2040. The study area exhibits a complex pattern of intra- and inter-urban movements dominated by private vehicle, thereby to achieve this target a substantial behavioural shift in the way existing residents in the study area access jobs, services and amenities is required.

Connectivity: despite a good network of road and rail links, rural areas in the centre of the corridor cannot access key services and facilities within 30-minutes travel by foot and public transport. Improvements would improve the connectivity of key services for current and planned future residents.

Housing and employment growth forecast based on data provided by local authorities.

Study Area


Peterborough
Leicester
Birmingham
Coventry
Northampton
Huntingdon
Ely
Cambridge
Bedford
Milton
Keynes
Luton
Stevenage
Oxford
St Albans
Watford
Swindon
London
Reading
Banbury
Buckingham
Winslow
Wantage
Didcot
Faringdon
Abingdon-On-Thames
Wellingborough
Kettering
Desborough
Biggleswade
Sandy
Hitchin
Letchworth
Harpenden
Wheathampstead
Hemel Hempstead
Aylesbury
Thame
Wendover
High Wycombe
Princes Risborough
Kidlington
Witney
Bicester
Brackley
Towcester
Daventry
Silverstone
Newport Pagnell
Leighton Buzzard
M1
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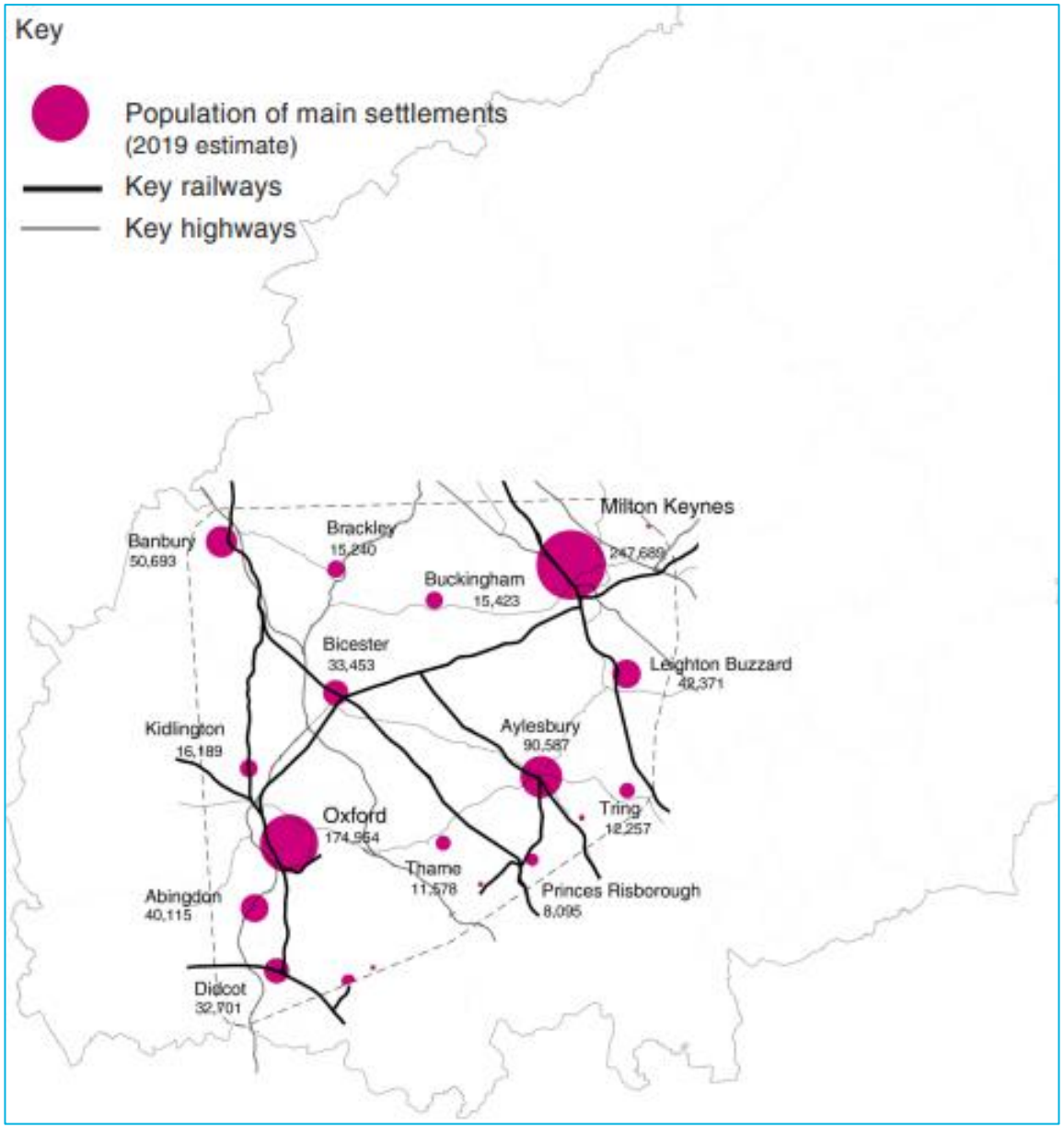
M6 TOLL
M69
M42
M45
M40
M4
M25
M11
A1(M)
A14(M)
A14
A43
A34
A4(M)
M4

Where people live

The map alongside shows the distribution of population across the study area for all settlements with at least 5,000 inhabitants. Across the wider EEH area around 80% of residents live within settlements of at least 5000 people - and this pattern is broadly reflected within this corridor.

Of this population over half live in city-scaled settlements of Milton Keynes and Oxford, with access to a full-range of services within the urban area, a further third in the larger, towns with populations of over 30,000, where most day-to-day needs can be facilitated locally, leaving around 10% in smaller settlements that – with the exception of Kidlington, which is closely associated with Oxford – are generally relatively isolated, and may require travel to nearby towns for certain higher-order services, or job opportunities.

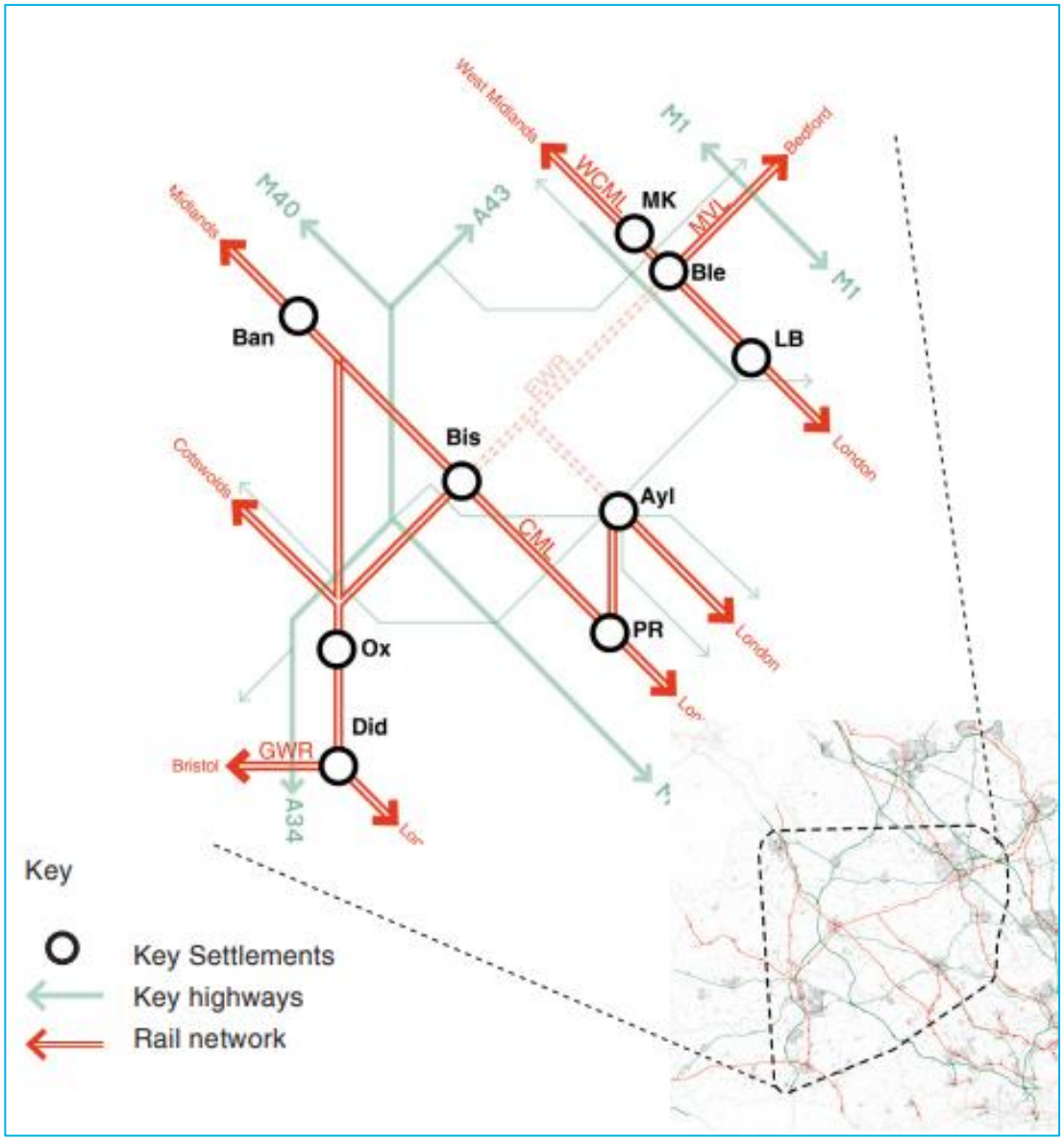


Transport network

At scales larger than an individual experience of a landscape or urban setting many places are defined or given a sense of identify by the form of the transport network that connect them - think of the tube map of London, or the M4 Corridor.

The economic geography of a region will often closely match this transport 'space'. The study area does not currently have a strong singular identity in these terms, and is instead dominated by the radial links emanating from London. However, with the completion of Connection Stage 1 of East West Rail, scheduled for 2025, a new rail spine will link the two main settlements, that together account for around 40% of the population of the area. This linkage would also create a mesh or grid of rail connectivity with the potential to weld together all the larger settlements within this area into a single economic geography.

However, this rail connectivity wont completely join up all of the large settlements in the corridor. For example, Abingdon needs bus and/or cycle links to access rail for longer-distance trips (at Oxford or Didcot stations).



Key Settlements

The corridor includes a number of key settlements that play an important role within both the corridor's and EEH's wider economy by having a significant residential population and / or employment numbers.

Within the Oxford to Milton Keynes corridor there are 13 key settlements. The largest of these settlements is Milton Keynes (247,689 residents and 147,258 jobs). The town has good rail connectivity to London and has a strong sports, cultural and retail offering.

The second largest settlement within the corridor is Oxford (174,954 residents and 120,915 jobs). The settlement is renowned for its educational offering and is home to two universities, University of Oxford and Oxford Brookes University.

Significant growth is forecast in many of the key settlements over the next 20 years (see Part 3). This will provide additional housing and job opportunities within the corridor. It is important that the corridors transport network is designed to accommodate planned growth.

Data Source: 2019 Mid year Population Estimates, 2011 Census - QS601EW Economic Activity, WP101EW Workplace Population

Settlement	Population (2019)	Economically Active (2019)	Total jobs (2019)
Abingdon	40,115	28,004	16,423
Aylesbury	90,587	54,966	39,270
Banbury	50,693	35,397	32,776
Bicester	33,453	24,550	17,187
Brackley	15,240	9,855	6,038
Buckingham	15,423	10,542	5,146
Didcot	32,701	21,268	13,714
Kidlington	16,189	11,280	9,164
Leighton Buzzard	42,371	27,638	12,683
Milton Keynes	247,689	166,167	147,258
Oxford	174,954	133,665	120,915
Princes Risborough	8,095	5,534	3,015
Thame	11,578	8,713	7,717
Tring	12,257	9,483	3,725
Settlement Total	785,803	546,954	435,031
EEH Total	6,009,982	2,593,334	2,354,203
England and Wales Total	59,439,840	28,659,869	36,414,207

**Settlements are defined by All LSOAs within 25% of the given area's Built Urban Area (BUA) Profile. An expansion factor (2011 population by LSOA: 2011 BUA population census data) was applied to Population and Economic Activity to manage discrepancies between LSOA BUA population and actual BUA population.*

Policy Context

Overview

This section sets out the current economic, environmental and transport policy base which is considered pertinent to the context of the Oxford to Milton Keynes corridor.

National Policy

National transport policy has historically been focused on delivering the infrastructure required to meet future travel demands and to enable economic growth. 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.

National Planning Policy Framework (2019) - sets out the Government's planning policies for England and how they should be applied. At the heart of the NPPF is the presumption in favour of sustainable development which needs to be applied in plan-making and decision-taking. The NPFF recognises that there are three separate, but inter-linked, pillars to sustainability – economic, social and environmental.

Clean Air Strategy, DEFRA (2019) - confirms the Government's commitment to encouraging travel by low emission modes of travel, including public transport (bus, light rail, rail) and active modes as these modes are less polluting than private cars.

Transport Decarbonisation Plans, DfT (2021) - sets out the Government's commitments and the actions needed to decarbonise the entire transport system in the UK. It includes our pathway to net zero transport in the UK the wider benefits net zero transport can deliver the principles that underpin our approach to delivering net zero transport.

The document focuses on encouraging mode shift away from cars towards active and public transport. Cars currently make up over 55% of all transport emissions, so in order to achieve net zero it is imperative to transition to the use of zero emission vehicles and increase our use of other more sustainable modes of transport. The plan commits to a review of National Networks' National Policy Statement which may result in future changes to the government's road building plans.

UK National Bus Strategy, DfT (2021) - sets out the vision and opportunity to deliver better bus services for passengers across England, through ambitious and far-reaching reform of how services are planned and delivered. Bus services are to be transformed with simpler fares, thousands of new buses, improved routes and higher frequencies

Gear Change, DfT (2020) - sets out the Government's bold future vision for walking and cycling to become the natural first choice for many journeys, with over half of all journeys in our towns and cities being cycled or walked by 2030. In February 2020, the Transport Secretary announced £5 billion in funding to overhaul bus and cycle links for every region outside London.

The Road to Zero, DfT (2018) - identifies that buses are critical to the Government's objectives to encourage modal shift to more sustainable and less polluting modes of travel and supports and the introduction of zero-emission buses through funding opportunities to improve the efficiency of the UK's bus fleet.

Policy Context

National Policy (cont.)

Route Services Strategic Plan, Network Rail (2018) - plays a vital role in the success of Network Rail achieving its vision for its passengers and freight users. Route Services consists of six primary functions (business services, commercial and procurement, IT services, asset information services, engineering services and supply chain operations) supporting safety, customer and community, customer experience, people, service delivery and sustainable growth objectives.

Rail Network Enhancements Pipeline, DfT (2018) - sets out an approach that applies for rail enhancements within England and Wales. It represents a rolling programme of investment into new or improved infrastructure that enable service changes and other benefits to passengers, freight users and the economy. The investments will enhance the capability of the railway, typically adding increased or new capacity or providing technical improvements to the way the railway runs.

The Road to Zero, DfT (2018) - identifies that buses are critical to the Government's objectives to encourage modal shift to more sustainable and less polluting modes of travel and supports and the introduction of zero-emission buses through funding opportunities to improve the efficiency of the UK's bus fleet.

Road Investment Strategy 2: 2020–2025, DfT, (2020) - This second Road Investment Strategy sets a long-term strategic vision for the network and lists the planned enhancement schemes which are intended to make the network safer, more reliable, and more sensitive to the places through which it runs. Schemes in RIS 2 and relevant to the Oxford Milton Keynes corridor include A34 Newbury to Oxford Enhancements and the A5 Towcester Relief Road.

The Strategic Road Network and the Delivery of Sustainable Development (2013) – This circular explains how the Highways Agency (National Highways) will engage with the planning system. It also gives details on how Highways Agency will fulfill its remit to be a delivery partner for sustainable economic growth whilst maintaining, managing and operating a safe and efficient strategic road network.

The circular covers:

- *Policy aims and application*
- *Plan making*
- *Development management*
- *Access to the strategic road network*
- *Environmental impact*
- *Physical impact of development on the strategic road network.*

Gear Change, DfT (2020) - sets out the Government's bold future vision for walking and cycling to become the natural first choice for many journeys, with over half of all journeys in our towns and cities being cycled or walked by 2030. In February 2020, the Transport Secretary announced £5 billion in funding to overhaul bus and cycle links for every region outside London.

Future of Mobility: Urban Strategy, DfT (2019) - transport interventions in the study area that deliver new modes of transport and or new mobility systems that encourage walking and cycling for short journeys, provide efficient and low emission mass transit, improve public transport reliability, responsiveness, accessibility, affordability and safety, reduce congestion and support the transition to a low carbon future support the principles of the Future of Mobility: Urban Strategy.

Policy Context

Digital

In the digital connectivity arena, the pace of technology development leads to order-of-magnitude changes in broadband speeds and usage over the course of a relatively few years, and there is a fast-changing landscape in EEH as there is in the UK as a whole. Substantial improvements in fixed and mobile connectivity are being driven by a combination of commercial roll-outs and policy action.

In terms of fixed broadband, the coverage of superfast services (offering 30Mbps+ download speeds) is now nearly ubiquitous across the UK. The focus has shifted to the roll-out of gigabit-capable services offering 1,000Mbps+ download speeds.

The largest players in this are BT Openreach which is rolling out Fibre-to-the-Premises (FTTP) services, and Virgin Media which is upgrading its existing cable network to gigabit-capable DOCSIS 3.1 technology and is also using FTTP to extend its footprint.

In addition, there has been a welcome increase in the number of independent fibre network operators over the last few years; in EEH these include CityFibre, Gigaclear, Tove Valley Broadband, Glide, and Hyperoptic.

Recognising that such commercial roll-outs are likely to leave harder-to-reach premises unable to access gigabit services, the Government has established the £5 billion Project Gigabit which plans to subsidise coverage for the 'final 20%' of premises, and its initial procurements for subsidised roll-outs are getting underway.

The EEH area will be addressed through five separate Regional Supplier procurement lots. The Government's aim is to achieve gigabit coverage for 85% of UK premises by 2025 and to push towards 100% nationwide coverage as soon as possible.

For mobile connectivity, the UK's four mobile network operators are currently rolling out 5G services, which offer higher speeds and lower latency and which are expected to have a variety of applications from health care to agriculture to advanced manufacturing.

It is not yet certain how far these commercial roll-outs will extend, but EE has recently stated that it expects their 5G services to cover half of the UK population by early 2023, and 90% of the UK landmass by 2028. In parallel, the publicly-subsidised £1 billion Shared Rural Network initiative between the Government and the mobile operators is seeking to address areas of the UK where 4G coverage is currently non-existent or partial.

Regional Policy

EEH Connectivity Studies, EEH (2022) - the connectivity studies will turn EEH's transport strategy's vision into actions, identifying the investment required to cut emissions while supporting economic growth along this Oxford to Milton Keynes corridor.

Connecting People, Transforming Journeys, EEH (2021) - provides the EEH region and Government with an evidence-based, vision-led framework focused on enabling economic growth in a way that delivers a net zero transport system by as early as 2040. Enabling growth in a way that improves the environment requires a fundamental switch in the way the region's transport system is planned and delivered.

Passenger Rail Study, EEH (2020) – Phase 1 of the study provided a baseline assessment of existing rail networks and levels of service across the EEH region. A number of nodes were identified in the EEH region and generalised journey times were calculated thus highlighting some key connectivity gaps that exist across the Heartland. In response to this, Phase 2 of the study identified aspirational service levels for priority journey pairs where analysis demonstrated stronger connectivity by rail would generate a significant return on investment.

Policy Context

Regional Policy (cont.)

Pathways to Decarbonisation, EEH (2020) - considered the proposed pathway to decarbonisation to help inform the Connecting People, Transforming Journeys Transport Strategy. A total of five pathways (with associated assumptions) were modelled and in consideration of the outcomes, EEH identified two preferred pathways.

The two preferred pathways are:

i) A highly connected future, one that enables our transport system to provide better transport information to the user, better management of the transport network, and the rapid deployment of connected and autonomous vehicles. This pathway will build on a step change in the provision of digital access and services to the home – allowing for a significant increase in home working and a significant change in travel patterns.

ii) A policy-led behavioural shift by which decision makers at all levels agree to deploy policy levers specifically designed to reduce the number of car trips. This will require the application of measures designed to reduce the need to travel.

By primarily reducing the need to travel, focusing on modal shift and supporting the deployment of mass rapid transit and active travel, these scenarios highlights an affordable alternative to traditional, large-scale road projects that take many years to plan, fund and deliver.

EEH Freight Study, EEH (2019) – defines a clear starting point for freight sub-nationally, analyses the implications of future scenario changes and identifies how EEH can capitalise on opportunities and mitigate risk. The study assists in planning the most efficient ways of providing access to goods that unlocks economic potential, protects the environment and communities, and future-proofs networks to accommodate growth and improve efficiency.

Local Policy

SEMLEP Strategic Economic Plan (2017) - The South East Midlands' (SEM) SEP sets out strategic investments and future actions needed to grow SEM's economy to its full potential. To realise this potential the SEM LEP recognises that strategic pieces of transport infrastructure, and transport connections into them, need to be built alongside world-class broadband and wireless networks.

OxLEP Strategic Economic Plan (2016) - the Oxford Local Enterprise Partnership's (LEP) Strategic Economic Plan (SEP) identifies potential opportunities and prospects of Oxfordshire and manages the county's strong economic growth to ensure sustainability and inclusivity. The LEP has three priority areas driving dynamic economic growth: place-making (provide a quality environment), productivity (delivery and attract skills across sectors) and connectivity (allow people to move freely and connect easily).

Buckinghamshire Strategic Economic Plan Refresh (2016-2031)

Buckinghamshire LEP's Strategic Economic Plan secures the commitment of various stakeholders in delivering the future growth agenda to agree a clear vision, mission, strategy and set of objectives. The plan has four strategic priorities: Business Growth & Innovation; Skills and Talent; Connectivity; and Town Centre Regeneration. The plan supports the work of EEH and their proposals for Local Transport Majors funding and advocates a continued requirement for transport improvement.

Policy Context

The Oxford to Milton Keynes corridor encompasses multiple local authorities, all of whom have their own Local Transport Plans (LTP) setting out their transport objectives, policies and strategies.

Furthermore, each district within the study area has a Local Plan which sets out the future land use and planning policies for the area over a set time period.

A number of local authorities in the corridor have, or are the process of developing, Local Cycling and Walking Infrastructure Plans (LCWIP). These are detailed plans that identify where walking and cycling improvements are needed at a local level.

This Connectivity Study will undertake a holistic approach, identifying multi-modal intervention packages that support both strategic and local infrastructure priorities, whilst helping to achieve local objectives.

Local transport policy documents relevant to this study are identified opposite.

- *Milton Keynes Local Transport Plan 4 – 2018 to 2036*
- *Milton Keynes Transport Infrastructure Delivery Plan*
- *Northamptonshire Transportation Plan (2012)*
- *Northamptonshire Bus Strategy (2018)*
- *Northamptonshire Cycling Strategy (2013)*
- *Northamptonshire Highway Management Strategy (2013)*
- *Northamptonshire Rail Strategy (2013)*
- *Northamptonshire Walking Strategy (2013)*
- *Northamptonshire Highway Development Management Strategy (2013)*
- *Northamptonshire Major Roads Strategy (2013)*
- *Northamptonshire Freight Strategy (2013)*
- *Buckinghamshire Local transport Plan 4*
- *Oxfordshire Infrastructure Strategy*
- *Connecting Oxfordshire Volume 1 Local Transport Plan 2015-2031*
- *Connecting Oxfordshire Volume 2 Local Transport Plan 2015-2031 – Bus Strategy*
- *Connecting Oxfordshire Volume 3 Local Transport Plan 2015-2031 – Rail Strategy*
- *Connecting Oxfordshire Volume 2 Local Transport Plan 2015-2031 – Active Healthy Strategy*
- *Connecting Oxfordshire Volume 2 Local Transport Plan 2015-2031 – Freight Strategy*
- *Oxford Local Walking and Cycling Infrastructure Plan*
- *Bicester Local Walking and Cycling Infrastructure Plan*
- *Aylesbury Local Walking and Cycling Infrastructure Plan*
- *Central Bedfordshire Council Local Transport Plan*
- *Oxfordshire Local Transport and Connectivity Plan (published for endorsement for consultation)*
- *Oxfordshire Joint Statutory Spatial Plan (reg 18 consultation just complete)*
- *Overall Oxfordshire Vision, endorsed by the Oxfordshire Future Oxfordshire Partnership*
- *Aylesbury Transport Strategy (2017)*
- *Buckingham Transport Strategy (2017)*

Report Structure

Part 2 Understanding the Study Area

Using the adopted people, place and connectivity approach, this chapter demonstrates the social and economic diversity of the study area and the challenges and opportunities this creates. It also sets out the key environmental issues, the current travel patterns, behaviours and levels of service provided by the existing transport networks.

This chapter seeks to establish the underlying drivers and the scale of the existing issues, in order to identify the key challenges and the opportunities that multi-modal intervention packages could deliver.

Part 3 Future Context

This chapter sets out the scale of the growth challenge within the study area. It sets out the potential implications of planned growth if transport interventions are not provided that address the existing issues identified in Part 2, that will undermine the ability for the study area to deliver the required connectivity outcomes that help achieve EEH's objectives, identified within *Connecting People, Transforming Journeys.*

Part 4 Need for Intervention

This chapter summarises the case for intervention based upon an understanding of the aforementioned policy context, the study area today (Part 2), the scale of the growth challenge (Part 3) and the underlying drivers and causes of the identified issues. It provides a Strengths, Weaknesses, Opportunities and Constraints (SWOC) analysis of the study area before outlining the Critical Success Factors (CSF) that will be used to determine the success of potential intervention packages.

Part 5 Infrastructure Scenarios

This chapter sets out the approach to scenario planning in this study and details the different infrastructure planning scenarios that have been identified as options for addressing the need for intervention. It then outlines how elements of each of these infrastructure planning scenarios have been brought together to develop an optimal scenario to guide long list development.

Part 6 Next Steps

This section sets out the next steps with the study.

Part 2
Understanding the Study Area

Overview

Background

In order to understand to study area, a 'whole system approach' has been adopted to gain an understanding of the existing communities and businesses, the natural and historic environment and the levels of connectivity provided by the existing transport and digital infrastructure assets.

This section summarises the existing **people, place and connectivity** evidence base. It demonstrates the social and economic diversity and the existing connectivity levels of service of the study area and the challenges and opportunities this creates.

This section seeks to establish the **underlying drivers** and **the scale** of the existing issues, in order to establish the need for intervention, study objectives and critical success factors.

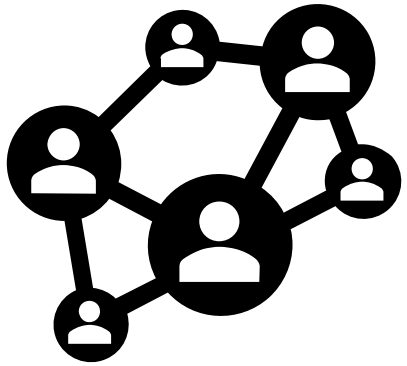
People

The people evidence base presents a set of demographic data to gain an insight into the existing community characteristics of the study area, their needs, and how these can be supported through enhanced connectivity.

Place

The place-based evidence provides an insight into to the existing environmental and settlement characteristics of the study area. By identifying existing environmental constraints and opportunities the location and scale of issues including air quality, safety and carbon emissions are better understood.

Connectivity



The connectivity evidence presents a set of transport network, modal and movement data to gain an insight into to the current pattern of travel, connectivity challenges and opportunities within the study area.

Part 2a
People

Population

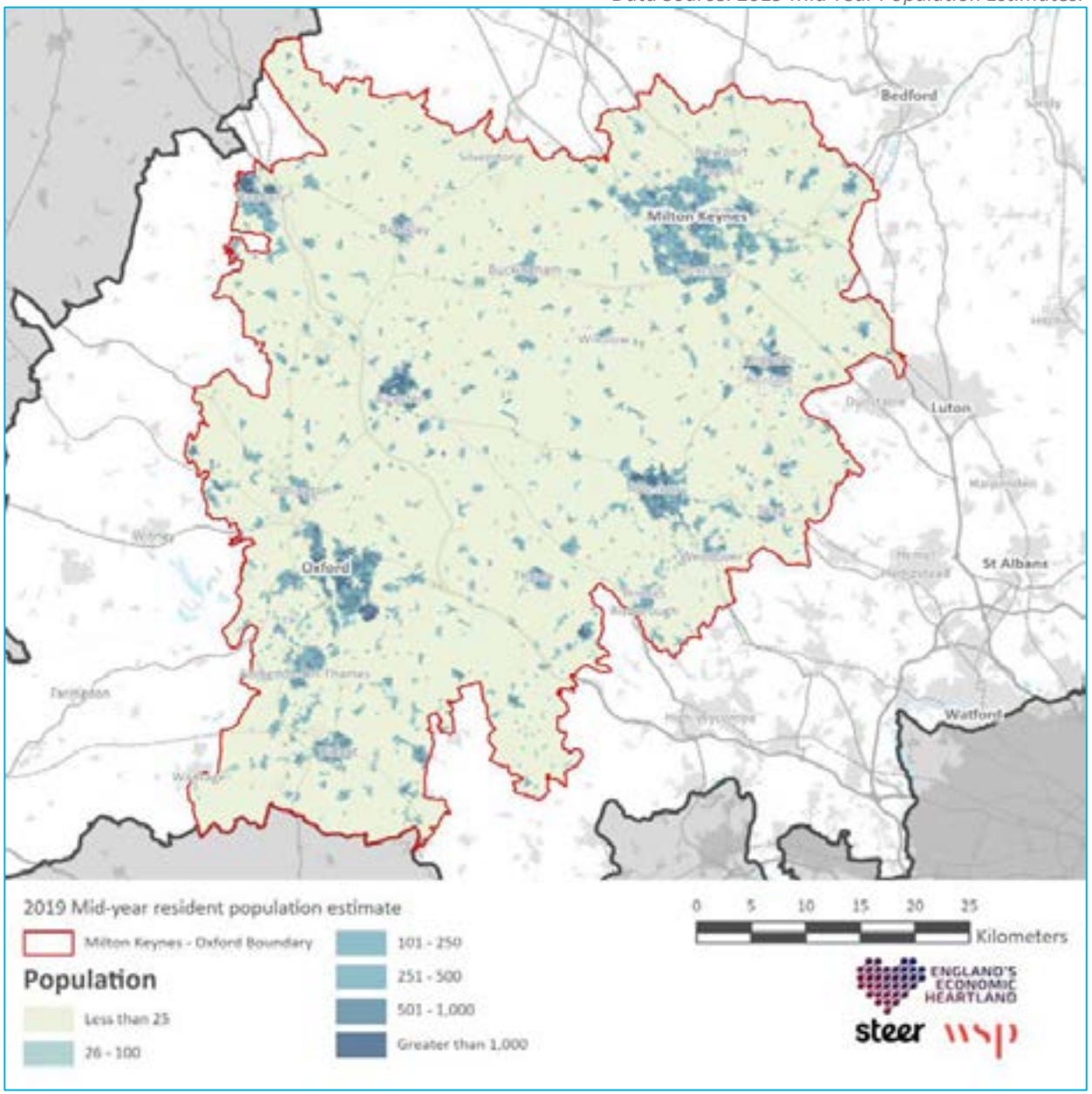
Resident Population

The population of the Oxford to Milton Keynes corridor was approximately 1.1 million in 2019 (ONS). The population of the study area is predominately located in a series of large and medium-sized cities / towns, each of which is distinctive and contributes independently and collectively to the corridors economy and movement patterns.

The most significant population centres (Hexcells with greater than 1,000 residents) are Oxford and Milton Keynes, with large clusters also present in Aylesbury, Banbury, Bicester and Bletchley. Smaller clusters include Didcot, Leighton Buzzard, Brackley, Buckingham, Abingdon-On-Thames and Newport Pagnell. There are also small clusters in Winslow, Thame, Prices Risborough, Wendover and Tring. The population clusters are dispersed widely across the corridor, with central areas being generally sparsely populated (Hexcells with less than 25 residents).

To maximise the societal benefits to the existing residential population, interventions will need to deliver connectivity between the population centres as well as support the surrounding rural communities.

Data Source: 2019 Mid Year Population Estimates.



Population

Population Growth (Historic)

The resident population of the corridor grew by 8.8% between 2011 and 2019, from 1.017 million to 1.107 million residents (ONS).

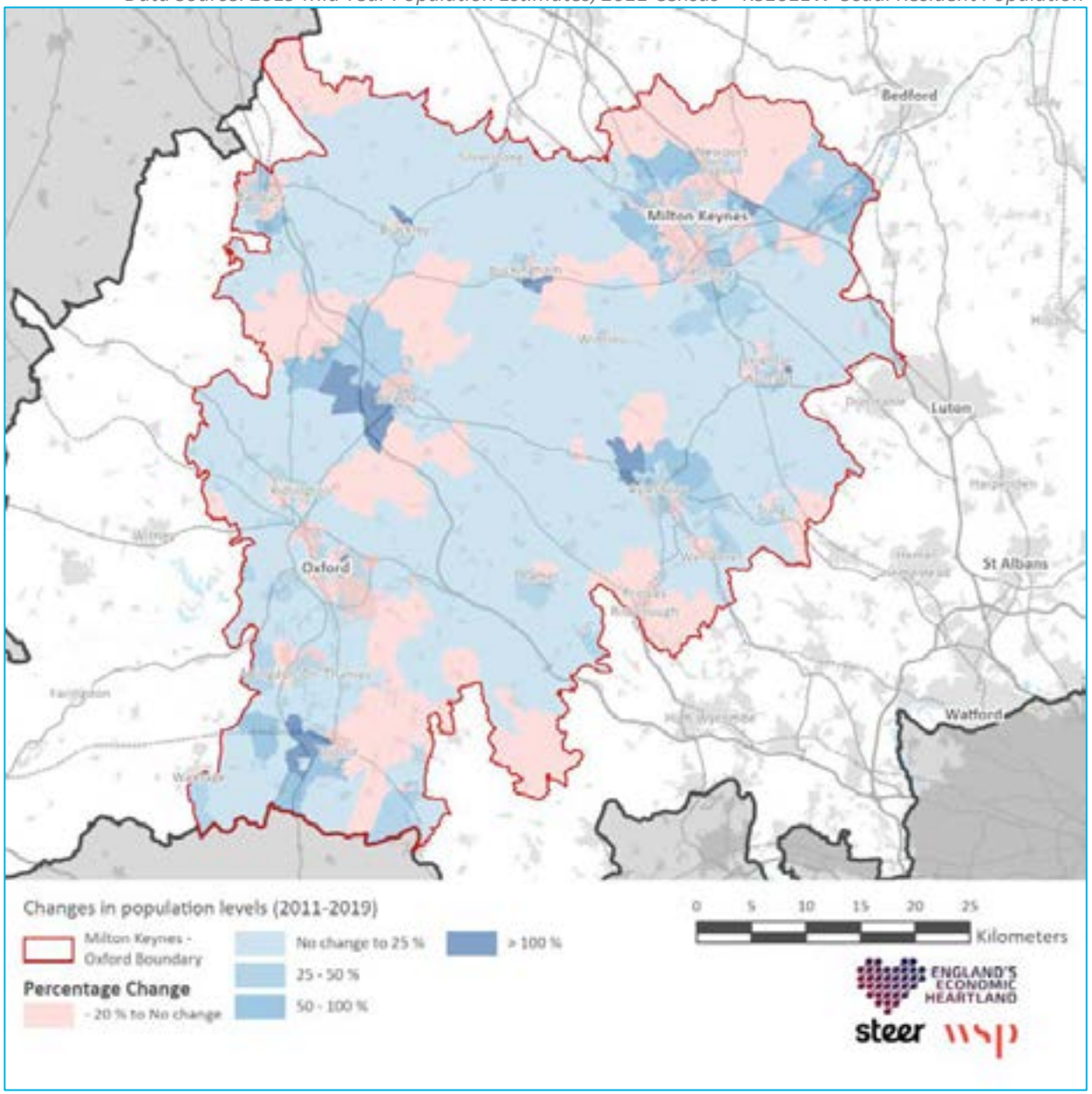
The largest growth in the corridor has been in and around the market towns of Leighton Buzzard and Brackley with the resident population of these settlements growing by 17% and 13% respectively.

In the corridor's two largest settlements, Milton Keynes and Oxford, population growth between 2011 and 2019 has been much smaller, with the resident population growing by 7% and 1% respectively.

In a number of areas the resident population fell between 2011 and 2019. In particular, parts of Oxford and Milton Keynes and the market towns of Bicester (1% reduction) and Princess Risborough (2% reduction).

The study area is growing with over 1 million people living within the corridor. A substantial proportion of growth is focused around urban extensions creating challenges in delivering sustainable development, well served by public transport and active travel infrastructure.

Data Source: 2019 Mid Year Population Estimates, 2011 Census – KS101EW Usual Resident Population



Community Characteristics

Mosaic Groups

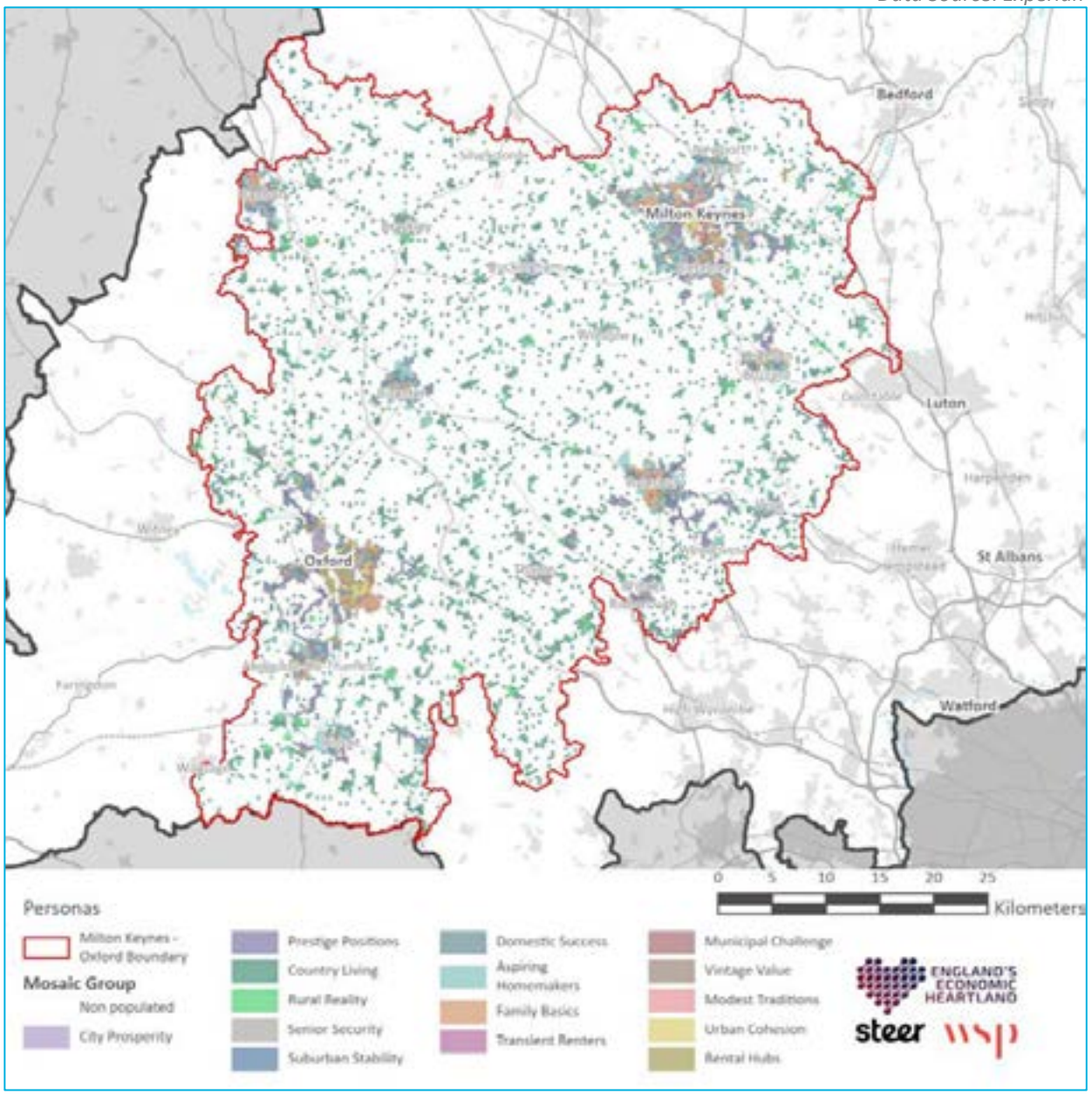
Populations across any given area can vary significantly in terms of the socio-economic attributes. Experian's Mosaic Data has been used to demonstrate the dominant types of people who live in the corridor. The data segments the population into 15 broad persona groups (detailed in Appendix A), which can subsequently provide valuable insights into how certain types of people may relate to transport interventions.

Milton Keynes is characterised by a mix of urban cohesion, transient renters and rental hubs in the core, with aspiring homemakers, family basics and prestige positions further afield. Oxford is characterised by city prosperity in the north, and a mix of rental hubs and urban cohesion to the east.

The wider corridor is comprised of small clusters of family basics, aspiring homemakers, and suburban stability. Sparsely populated rural areas of the corridor are predominantly characterised by country living and rural reality.

The study area has a diverse mix of socio-economic attributes, with notable contrasts between the urban, semi-urban and rural areas across the corridor.

Data Source: Experian



Community Characteristics

Propensity to Travel (By Mode)

As a part of EEH's First Mile Last Mile Strategy a propensity framework was developed using Experian Mosaic data. Using this framework a number of key desirable characteristics of mobility have been associated with each persona group. For instance, 'Family Basics' place a high value on cost, and as such, are likely to have a higher propensity to take-up lower cost modes. Alternatively, individuals in areas characterised by 'Prestige Positions' and 'City Prosperity' tend to place a higher value on comfort, as such, these groups tend to have a lower propensity to cycle or use bus services.

These characteristics have been used to establish the propensity of each persona to use different modes of transport, as shown in the table opposite (a score of 1 indicates a low propensity to use that mode of transport and a score of 5 indicates a high propensity).The propensity scoring is informed by the project teams' professional judgement and interpretation of the Mosaic Data at the time of writing this report.

The evidence provided demonstrates there are a wide range of communities living across the study area. Therefore, to maximise the societal benefits, transport investments need to be inclusive and attractive to a wide range of people.

Data Source: WSP

	Mode	City Prosperity	Prestige Positions	Country Living	Rural Reality	Senior Security	Suburban Stability	Domestic Success	Aspiring Homemakers	Family Basics	Transient Renters	Municipal Challenge	Vintage Value	Modest Traditions	Urban Cohesion	Rental Hubs
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
On foot	On foot	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Cycling	Cycling (SP & O)	3	4	5	4	4	5	4	5	5	4	4	4	4	4	4
	Cycling (P & O)	2	2	4	2	2	3	3	3	3	3	2	2	2	2	2
	Cycling (SP & S)	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1
	Cycling (P & S)	2	2	3	4	2	2	3	2	2	2	2	2	3	2	2
E-Scooter* (kick-scooter)	E-Scooter (P & O)	2	3	4	4	3	4	3	4	4	3	3	3	2	2	3
	E-Scooter (P & S)	1	2	3	3	1	2	2	1	2	1	2	1	3	1	1
Motorcycle	Motorcycle (PTW - O)	2	1	1	1	1	3	2	3	3	2	2	1	1	2	2
	Motorcycle (PTW - S)	1	1	2	2	1	1	2	1	1	1	1	1	2	1	1
	Motorcycle (PTW - Taxi)	1	1	2	2	1	2	1	1	2	1	2	1	2	1	1
Car	Car (Sole Use)	5	3	1	1	3	3	2	3	3	3	3	3	1	4	3
	Car (Sole Use & S - P2P)	3	3	2	4	4	1	3	2	1	2	4	4	4	3	3
	Car (Sole Use & S - Ride Share)	4	4	4	4	4	4	5	4	4	4	4	4	5	4	4
	Car (S - Car Club)	3	3	2	4	4	2	3	2	2	3	3	4	4	3	2
Traditional & Emerging Taxi	Traditional and Emerging Taxi	4	4	3	3	3	3	4	4	3	4	4	3	3	3	4
Ride-hailing (sole use)	Ride-Hailing (Sole Use)	3	2	1	1	2	2	2	2	2	3	3	2	1	3	3
Ride-hailing (shared use) – shared taxi	Ride Hailing (S - Taxi)	4	4	3	4	4	4	4	4	4	4	4	3	4	4	4
Ride-hailing (shared use) – DDRT	Ride Hailing (S - DDRT)	4	5	4	5	5	4	5	5	4	5	5	5	5	5	5
Traditional Bus	Traditional Bus	1	1	1	1	2	1	1	1	1	1	1	2	1	1	1
Bus Rapid Transit	Bus Rapid Transit	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Light Rail	Light Rail	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

SP – Self Powered
P – Powered
O - Owned

S - Shared
PTW – Powered Two Wheeler
DDRT – Digital / Dynamic Demand Responsive Transport

Employment

Workplace Population

The workplace population of the Oxford to Milton Keynes corridor was approximately 617,979 in 2019 (ONS).

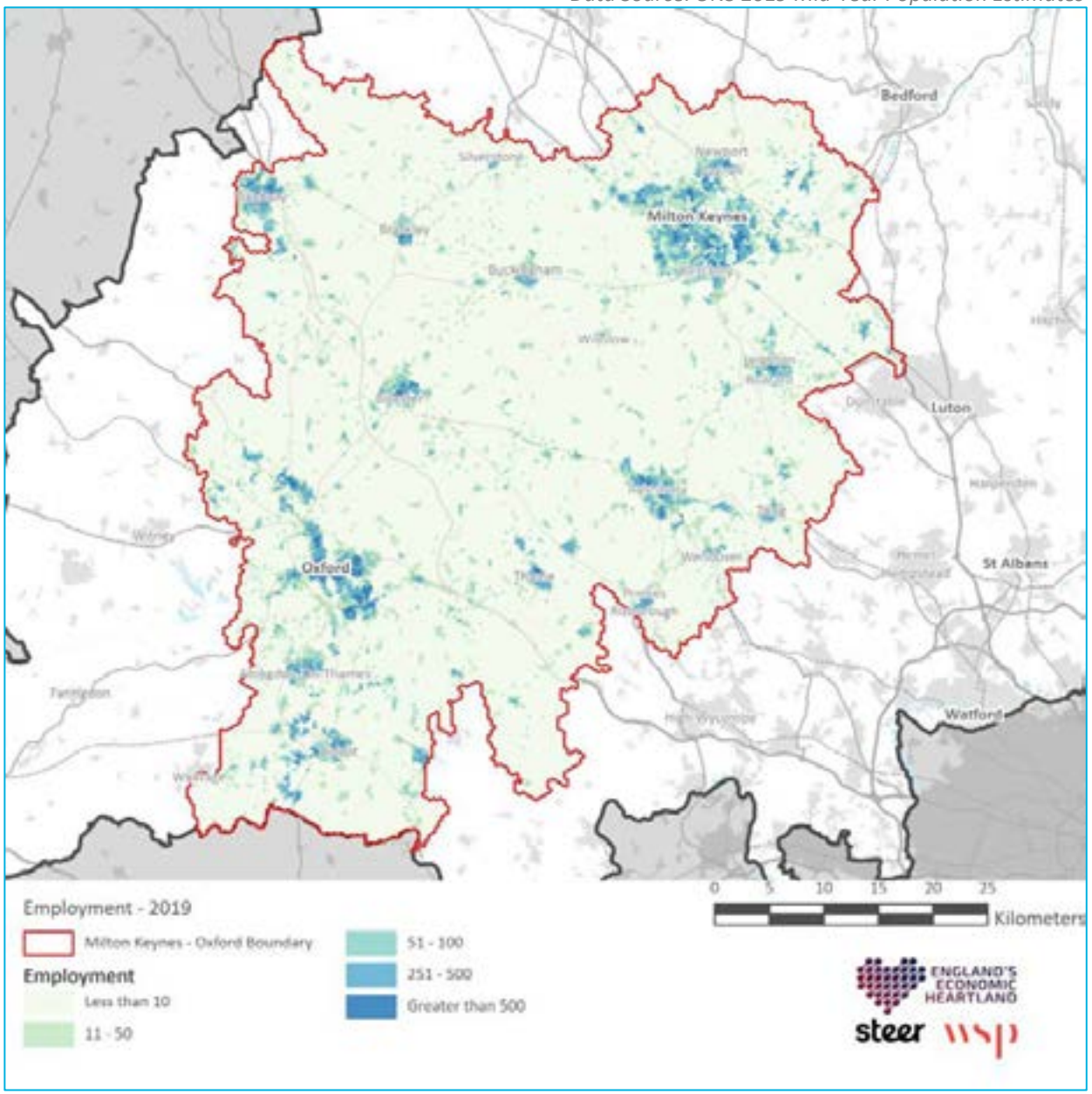
The workplace population is concentrated around Milton Keynes (163,637 jobs) and Oxford (114,411 jobs), which benefit from large retail centres, commercial high streets, hospitals and healthcare provision. Milton Keynes hosts several large distribution facilities, while Oxford's two universities and two business parks are major sources of employment.

The market towns of Aylesbury (34,495 jobs) and Banbury (33,876 jobs) also provide relatively high levels of employment, alongside small and medium-sized settlements within the corridor such as; Bicester (17,722 jobs) and Abingdon (16,179 jobs).

There are pockets of high employment within more rural areas of the corridor, including Silverstone Park, Wendover town centre and Winslow Business Park.

The evidence demonstrates that transport interventions could play an important role in better connecting workers with the full range of employment opportunities across the corridor.

Data Source: ONS 2019 Mid-Year Population Estimates



Employment

Average Earnings

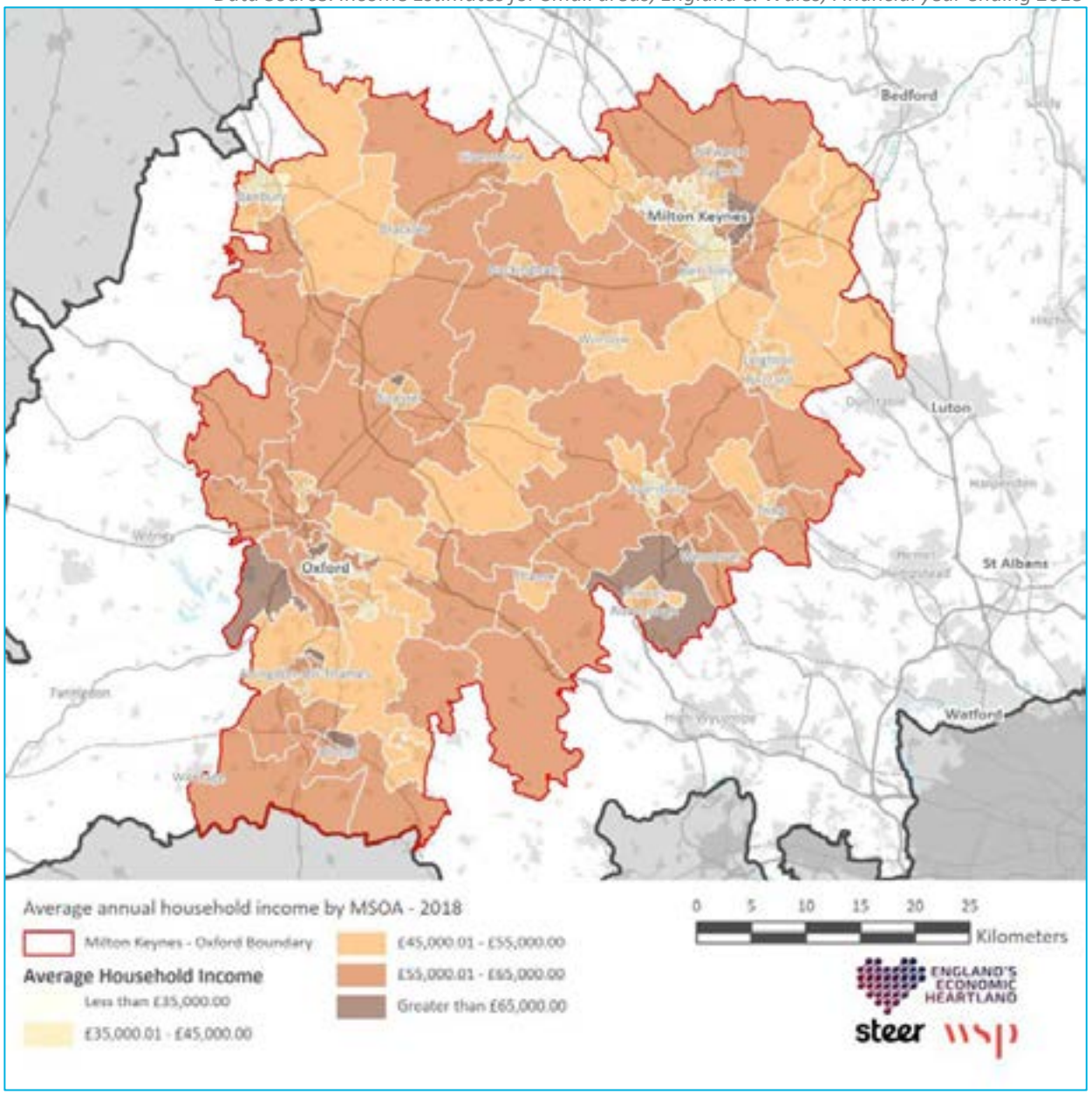
In 2018 the average household income of the Oxford to Milton Keynes corridor was £52,755, with the average yearly household income for most of the corridor to be between £45,001 and £65,000.

The areas with the highest average yearly household income (greater than £65,000) include villages to the west of Oxford, east Milton Keynes, north Bicester, Didcot and the villages of Longwick, Meadle, Great Kimble and Dunsmore.

Most of the large and medium sized settlements in the corridor have areas where average earnings are less than £35,000 per year. The largest cluster of households earning less than £35,000 per year are in Milton Keynes, Bletchley, Oxford, Aylesbury, Leighton Buzzard and Banbury.

Transport interventions should connect areas of high and low prosperity, providing new opportunities for lower income groups to access jobs, education and key services both within settlements and across the corridor.

Data Source: Income Estimates for Small areas, England & Wales, Financial year ending 2018



Deprivation

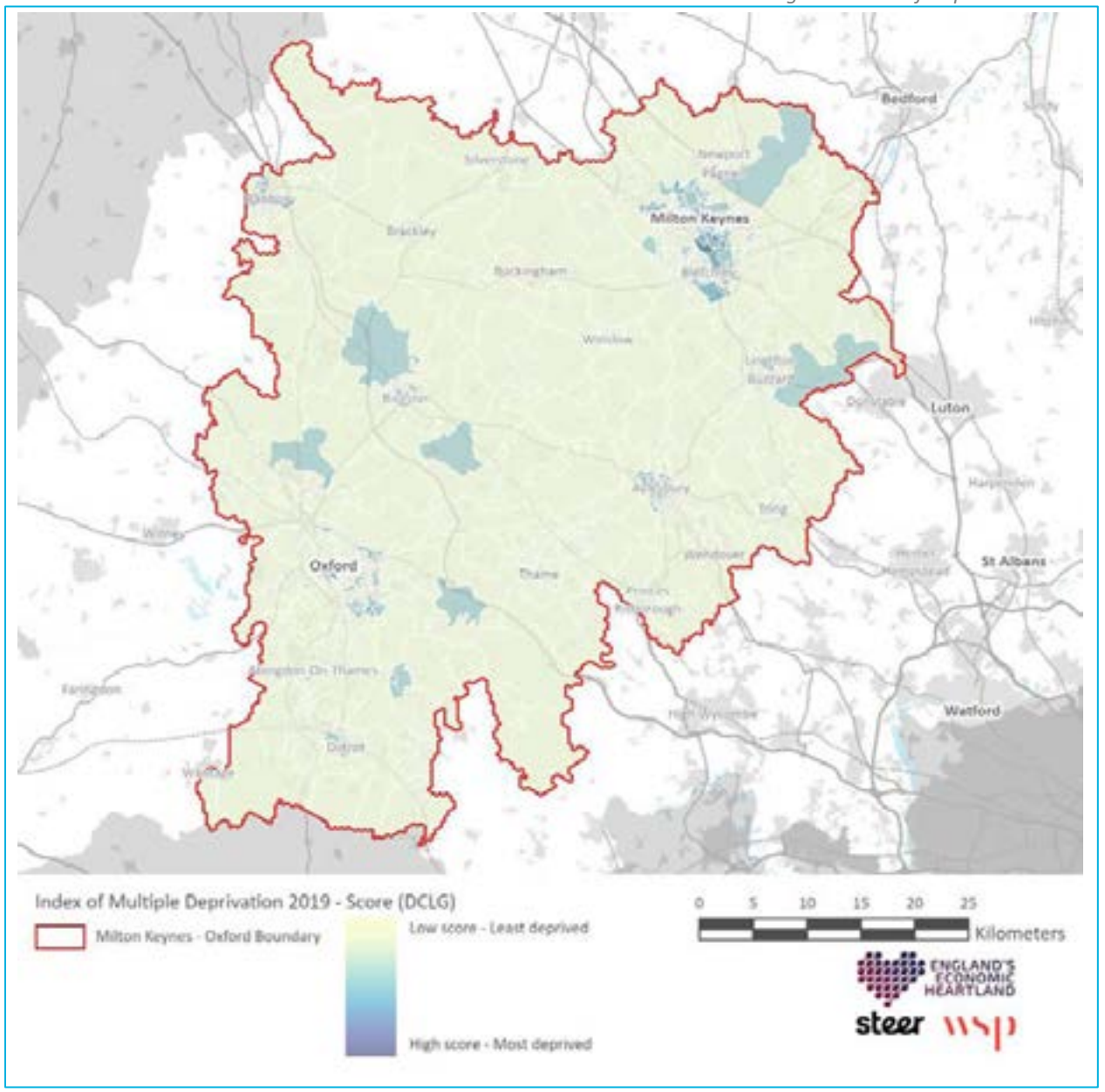
Indices of Multiple Deprivation (IMD)

The IMD includes various factors influencing the level of affluence in an area, including income, employment, education, health, and the living environment. Deciles are calculated by ranking the 32,844 neighbourhoods in England from most deprived to least deprived and dividing them into 10 equal groups.

The corridor includes areas that fall into the top 10% most deprived areas of the country, although there are varying levels of deprivation, which results in a complex mix of differing needs and challenges. Urban settlements, including parts of Milton Keynes, Aylesbury, Oxford and Banbury all have areas of high deprivation.

It is evident that the social geography of the corridor is diverse with the highest levels of deprivation predominately occurring in the largest urban settlements. This pattern aligns with areas of low annual income and car ownership, which places higher importance on the need to access good quality public transport services in order to access opportunities across the study area.

Data Source: English Indices of Deprivation 2019



Car Ownership

Car Availability

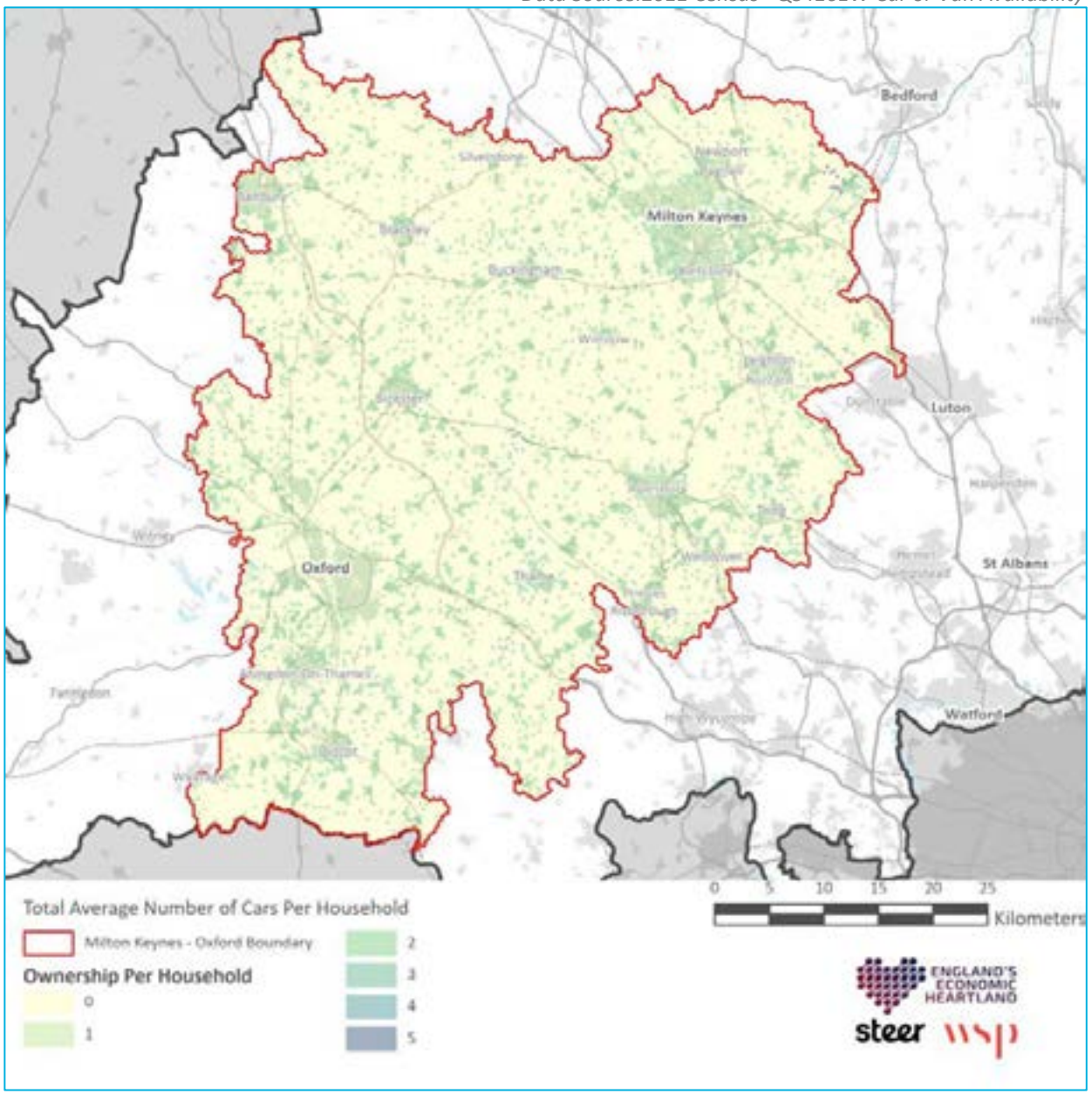
Vehicle availability provides an indication of personal perception of the quality and availability of other modes and the socio-economic status of an area. **In 2011, households across the corridor had access to an average of 1.4 cars or vans per household.**

Across all of the main urban settlements in the corridor, households had access to an average of 1.2 cars or vans**.** Outside of the main urban settlements, households had access to an average of 1.6 cars or vans.

The highest availability of cars and vans per household was recorded in Brackley (access to 1.5 cars or vans), whereas Oxford had the lowest availability with households having access to 0.9 cars or vans (on average). Households in a small area within Marston Vale to the east of Milton Keynes had access to an average of five cars per household.

The evidence demonstrates that there are high levels of multiple car ownership per household across the study area. Therefore, there are opportunities to reduce second car ownership, particularly where attractive public and active transport options and fast digital infrastructure already exist.

Data Source:2011 Census - QS416EW Car or Van Availability



Health & Wellbeing

Health & Disability Decile

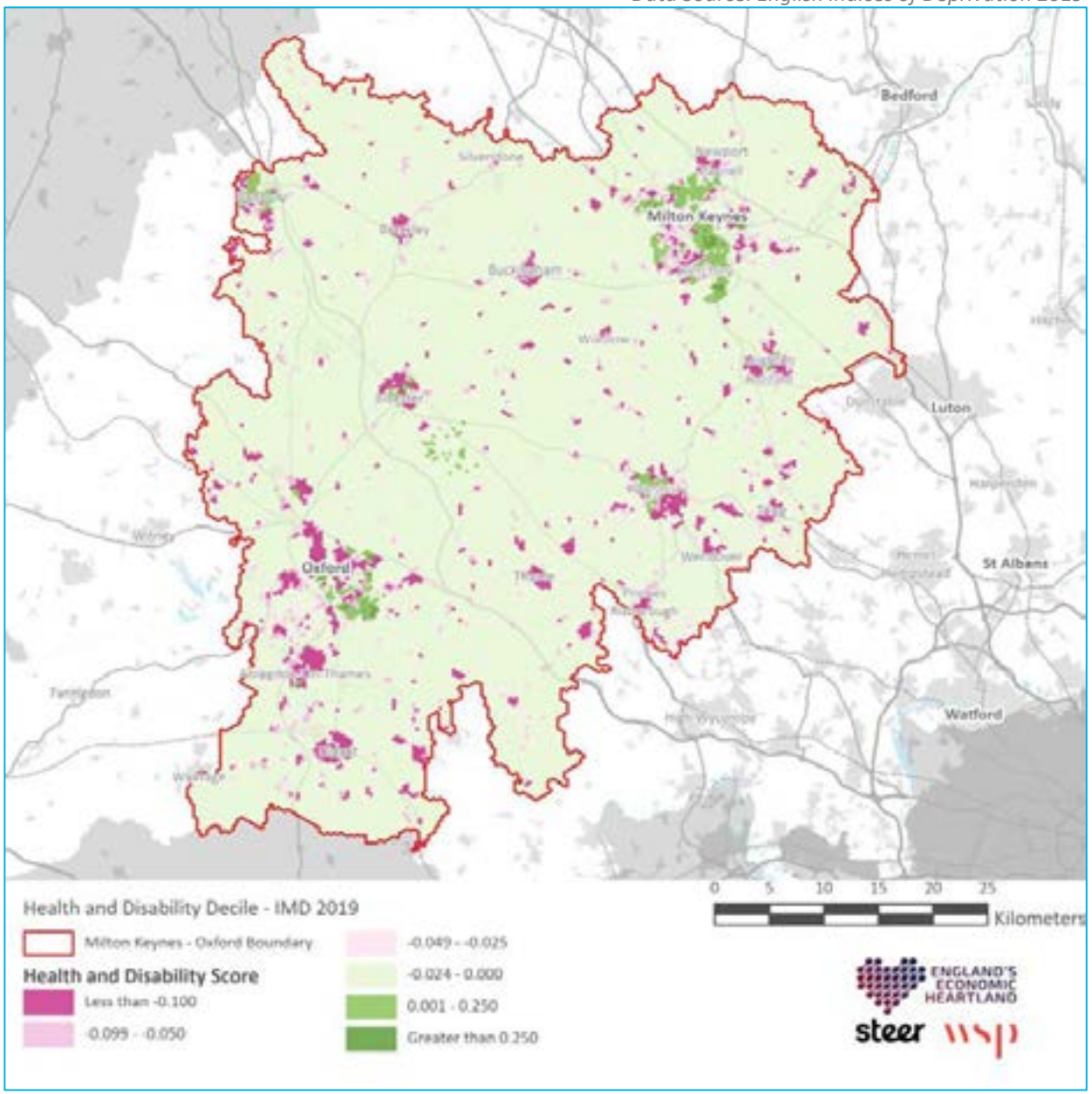
The UK is currently facing several public health issues, including growing rates of obesity, diabetes and heart disease that are all linked to physical inactivity.

Health deprivation is low in various clusters, including Didcot and Abingdon-on-Thames, where the majority of the area scores less than -0.100. Numerous other small and medium-sized settlements such as Brackley, Buckingham and Leighton Buzzard present low scores, with the majority below 0.050.

Oxford and Milton Keynes show stark contrasts in deprivation. Milton Keynes has the largest cluster of high health deprivation, with the majority of the area scoring greater than 0.001; despite this, surrounding areas such as Tattenhoe, Westcroft and Newport Pagnell are low scoring clusters.

Transport interventions in walking, cycling and passenger transport provide the opportunity to increase levels of active travel for end-to-end journeys or part of a longer trip by public transport. Active and sustainable transport investments provide the opportunity to improve the health and wellbeing of residents, whilst also addressing health inequalities across the study area.

Data Source: English Indices of Deprivation 2019



Health & Wellbeing

Road Safety

Between January 2012 and December 2018 there have been a substantial number of Personal Injury Accidents (PIA) recorded on the corridor's key highway links.

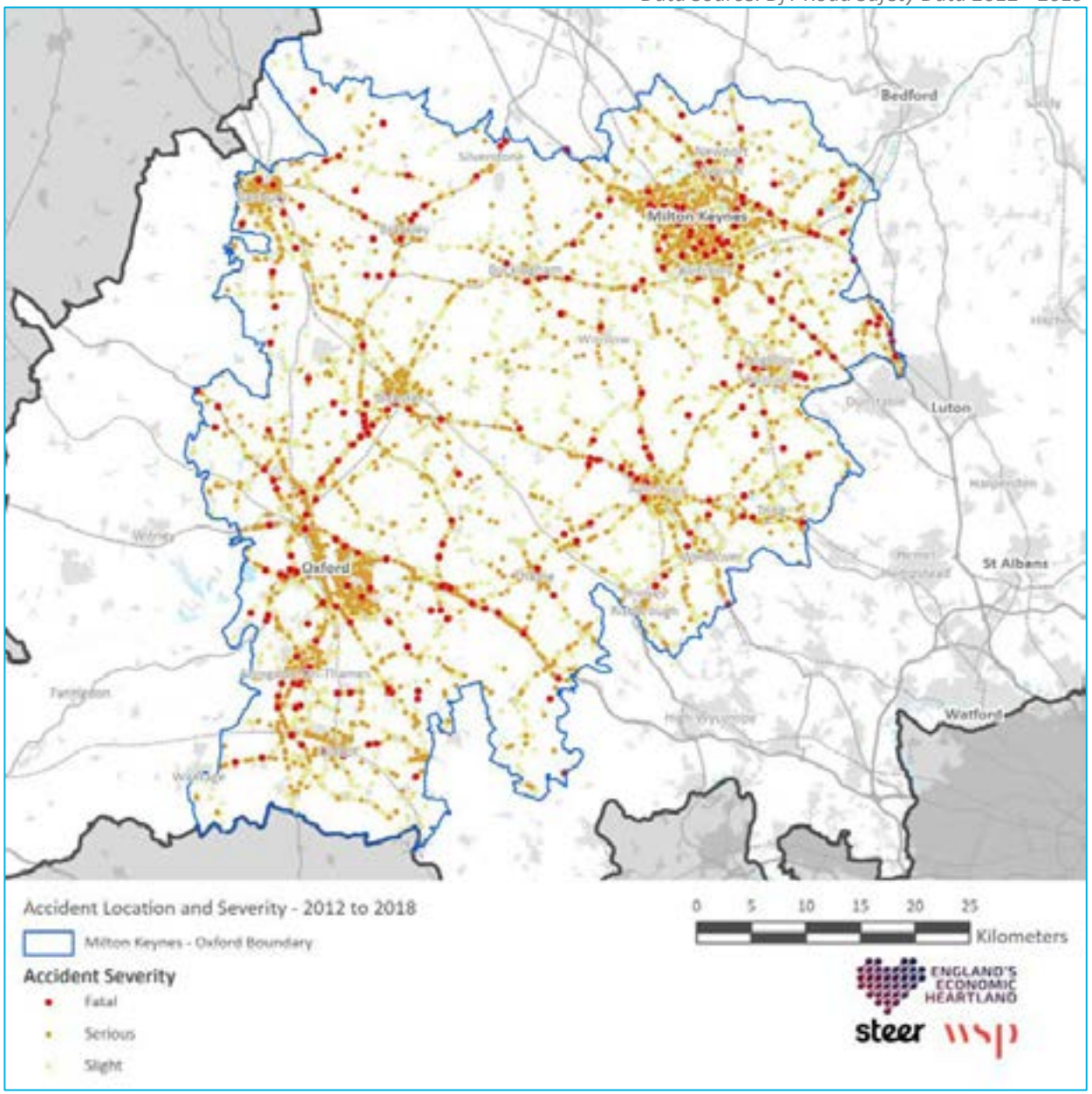
The volume of PIA generally increases in urban areas, with the highest concentration of PIAs occurring in settlements such as Milton Keynes, Oxford, Aylesbury, Bicester and Banbury. This increased concentration of accidents in urban areas is likely to reflect the presence of more junctions and intersections and a higher number of vulnerable road users.

Outside the main urban settlements there are several locations where a high number of fatal accidents have occurred. This includes:

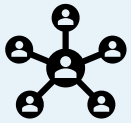
- A34 between Oxford and Bicester on approach to the junction with the M40;
- A41 west of Aylesbury; and
- M40 south of Thame, particularly at Junction 8a with the A40.

A future increase in traffic is likely to have an adverse impact on the number of road accidents and casualties in the study area. Corridor improvement packages for specific roads could help reduce the number of road accidents and casualties.

Data Source: DfT Road Safety Data 2012 - 2019



Summary

Theme	Issues & Opportunities
 POPULATION	**Issues** • **Spatial Distribution -** the existing population is predominately located in a series of large and medium-sized cities / towns dispersed across the corridor – the largest population clusters are Milton Keynes and Oxford. **Opportunities** • **Population Levels -** the study area is home to over 1 million people and is generally growing, resulting in a substantial 'addressable market' that will directly benefit from enhanced intra-urban and inter-urban connectivity.
 COMMUNITY	**Issues** • **Social Diversity -** the study area includes a wide range of geodemographics (from successful affluent groups to more economically disadvantaged groups), each of which demonstrate different desirable characteristics of mobility. **Opportunities** • **Inclusive Transport -** the evidence demonstrates that there is an opportunity to implement packages of multi-modal transport interventions that appeal across socio-demographic profiles.
 EMPLOYMENT	**Issues** • **Economic Variance -** the economic profile of residents living and working in a particular area is variable. In general residents living within built up areas have lower average earnings than residents living in more rural locations. **Opportunities** • **Inclusive Transport -** the evidence demonstrates that transport interventions should provide opportunities for lower income groups to access the full range of jobs, education and key services across the corridor.
 DEPRIVATION	**Issues** • **Deprivation –** High levels of social deprivation is occurring in some urban areas including parts of Milton Keynes, Aylesbury, Oxford and Banbury resulting in the need for good access to public transport, walking and cycling infrastructure to access jobs and facilities. **Opportunities** • **Levelling up -** inclusive transport connectivity can be provided between homes, jobs and services to enable all members of society to access the full range of opportunities provided in the study area.
 HEALTH & WELLBEING	**Issues** • **Deprivation -** the study area has a diverse range of health deprivation, with high levels of health and disability deprivation in areas of Didcot, Abingdon-on-Thames, Milton Keynes and Oxford which contributes to national public health issues. **Opportunities** • **Healthy Movement -** the evidence supports the need to invest in improved active and sustainable transport infrastructure to increase physical activity levels, improve health and mental health and reduce social isolation and loneliness.

Part 2b

Place

Carbon Emissions

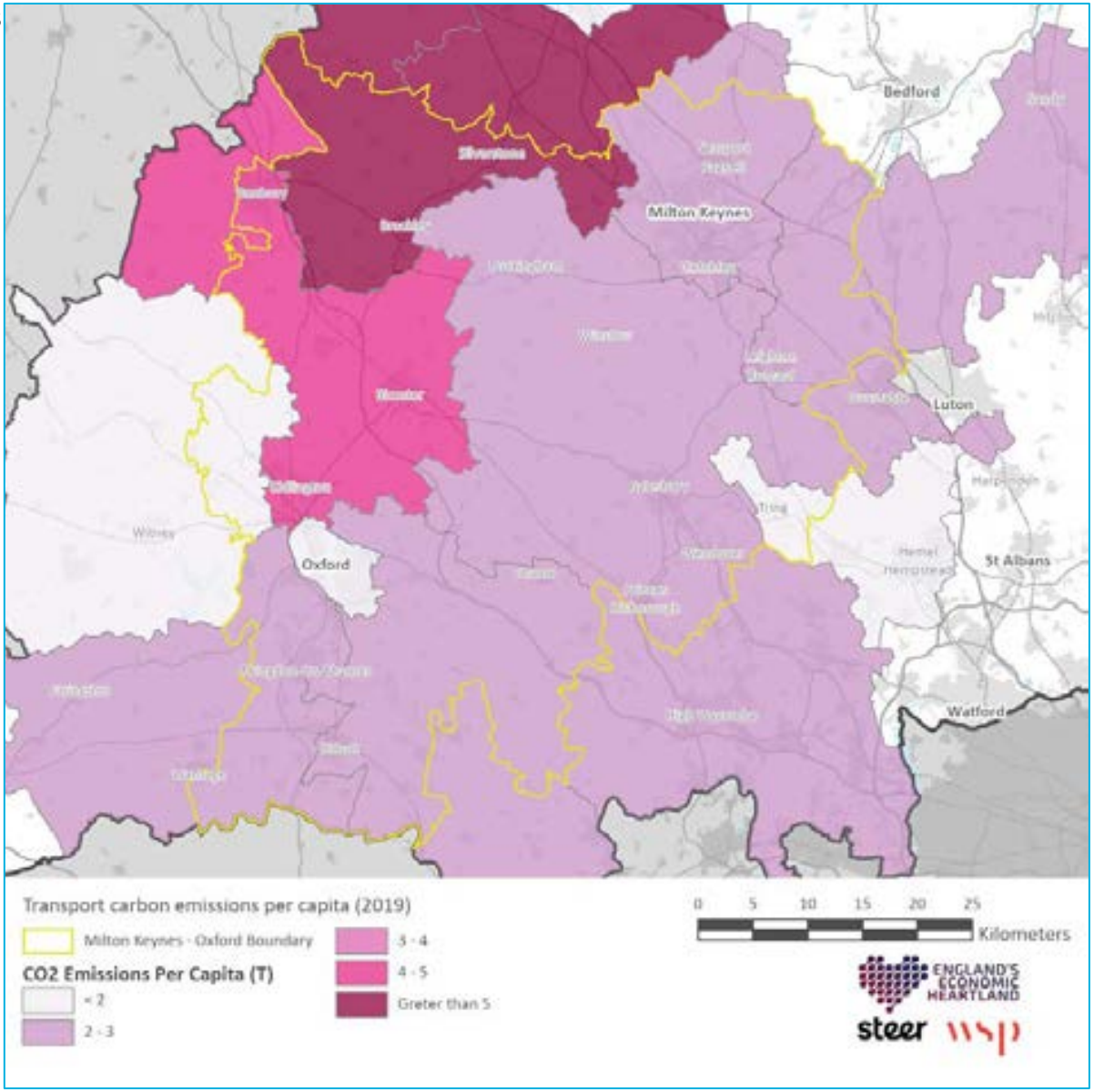
Data Source: UK Local Authority and Regional Carbon Dioxide Emissions 2019

To address the UK's GHG emissions, the Government has set a legally binding target of reaching net zero carbon emissions by 2050. There is also an interim target of reducing emissions by 78% by 2035. To assess progress against this, it is important to understand the total carbon emissions of the corridor. **In 2019, the total amount of CO_2 emissions from transport[1] by districts in the study area was 6,120 kT. This makes up roughly 49% of all the CO_2 emissions within the EEH region.**

In 2019 the average transport carbon emission per capita within the corridor was 2.32 Tonnes. This compares with an average of 1.66 Tonnes for the UK as a whole and an average of 2.16 Tonnes for the EEH region as a whole. Several Local Authorities recorded carbon emissions per capital above the average for the corridor, such as Central Bedfordshire and Daventry. Both major urban areas of Oxford and Milton Keynes have lower than average carbon emissions per capita, with Oxford having the lowest in the corridor at 0.76 Tonnes. This is likely to be due to high levels of active travel and public transport coupled with lower average trip distances.

This data does not include through trips on the Strategic Road Network, but these do contribute materially to carbon emissions of the area.

The evidence presented and the supporting EEH documentation (*Pathways to Decarbonisation*) indicates an opportunity to support behavioural shift towards sustainable modes, combined with a stronger / more reliable digital future to reduce the need to travel and create a cleaner vehicle fleet.



[1] *Transport refers to the transport system as a whole and includes carbon emissions from diesel railways, road transport (A roads), road transport (minor roads), road transport (motorways) and transport other. It should be noted carbon emissions from international aviation and shipping are not included. However domestic aviation (i.e. flights taking off and landing within the UK) and shipping are included.*

Flood Risk

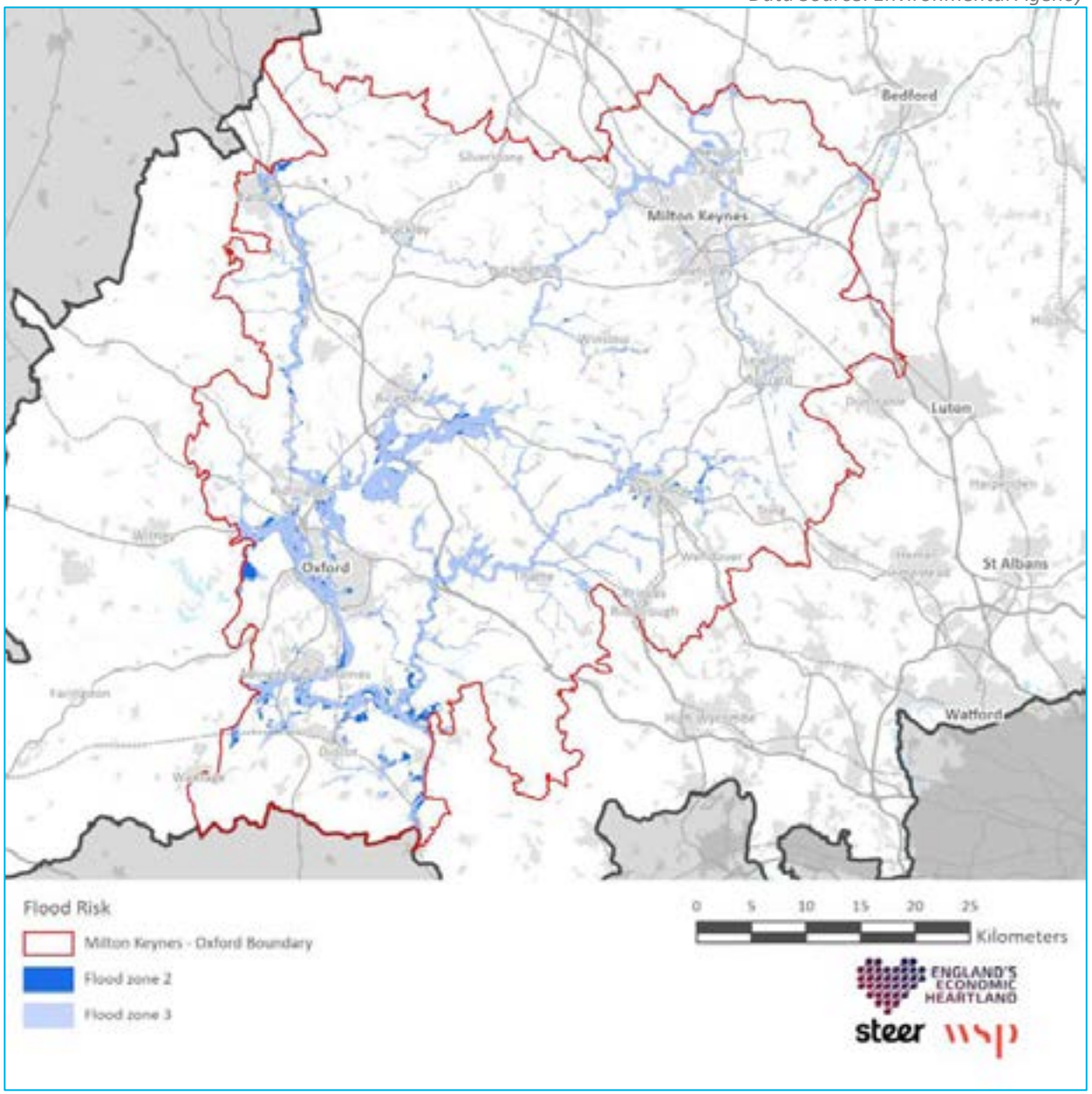
Areas of the corridor fall into Flood Zone 2 (1 in 1000 or greater annual probability of flooding) or Flood Zone 3 (1 in 100 or greater annual probability of flooding).

The southern portion of the corridor is more susceptible to flooding due to the presence of both the River Thames and the River Thame. The River Thames poses flood risks to areas north of Didcot (Dorchester, Shillingford, and Long Wittenham), as well as the south-eastern portion of Abingdon and West Oxford. North of Oxford is also prone to flooding due to the River Cherwell. Other settlements with a higher risk of flooding include Banbury, Thame, Aylesbury and north-west Milton Keynes.

Recent severe weather has increased the likelihood of flooding, and there is a consensus in the scientific community that climate change will only increase incidents of extreme weather, further worsening the problem. Key actions, such as the Oxford Flood Scheme (an £150 million scheme to reduce flood risk in the city), are imperative.

The delivery of large scale transport infrastructure, such as new mass rapid transit schemes, may be challenging due to the inherent flood risk in many parts of the corridor.

Data Source: Environmental Agency

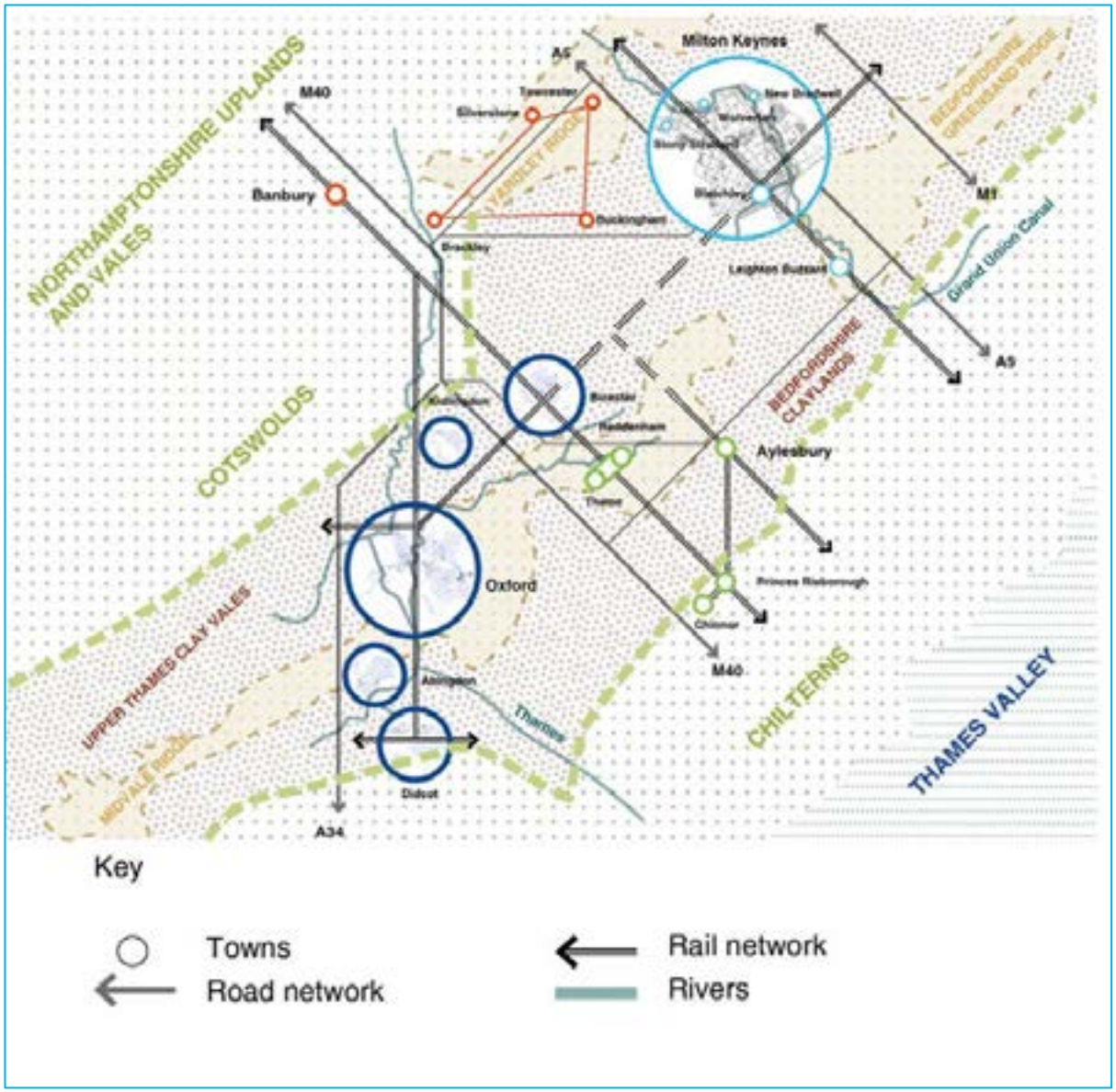


Landscape

The study area comprises a broad clay vale running SW to NE, bracketed by the less developed, higher ground of the Chilterns to the SE and the Cotswolds/Northamptonshire Heights to the NW.

Accommodating the major settlements within this study area this central vale is characterised by its slow meandering rivers: the Thames and it's tributaries in the SW, which are so fundamental to the sense of place of Oxford and its pattern of development, while in the NE Milton Keynes is bound on its northern edge by the Ouse, but is conceived as a city in a forest, a 'lazy' landscape grid on the plateau above the river, with its central grid oriented to sunrise on the summer solstice.

The central portion of the study area, on the upper reaches of these two river systems was traditionally less accessible and less inhabited and remains, in relative terms, a kind of 'deep countryside'. Despite the relatively 'gentle' nature of the topography, which presents no major obstacles to connectivity, the presence of the mid-vale ridge, also running SW to NE and the way it is broken only in a narrow corridor by the Thames at Oxford, underpins the linear pattern of river, road and rail links, and urban development between Didcot and Bicester. It also frames Aylesbury Vale, sitting between the mid-vale ridge and the Chilterns, with Aylesbury itself at its centre.



Protected Areas

There are numerous protected areas and other heritage and ecological constraints in the corridor. Whilst these protected areas present a constraint to the delivery of new transport infrastructure, there is also an opportunity to improve the sustainable transport connectivity of parks, gardens and nature reserves. This will create new opportunities for recreation and exercise by residents living in the study area.

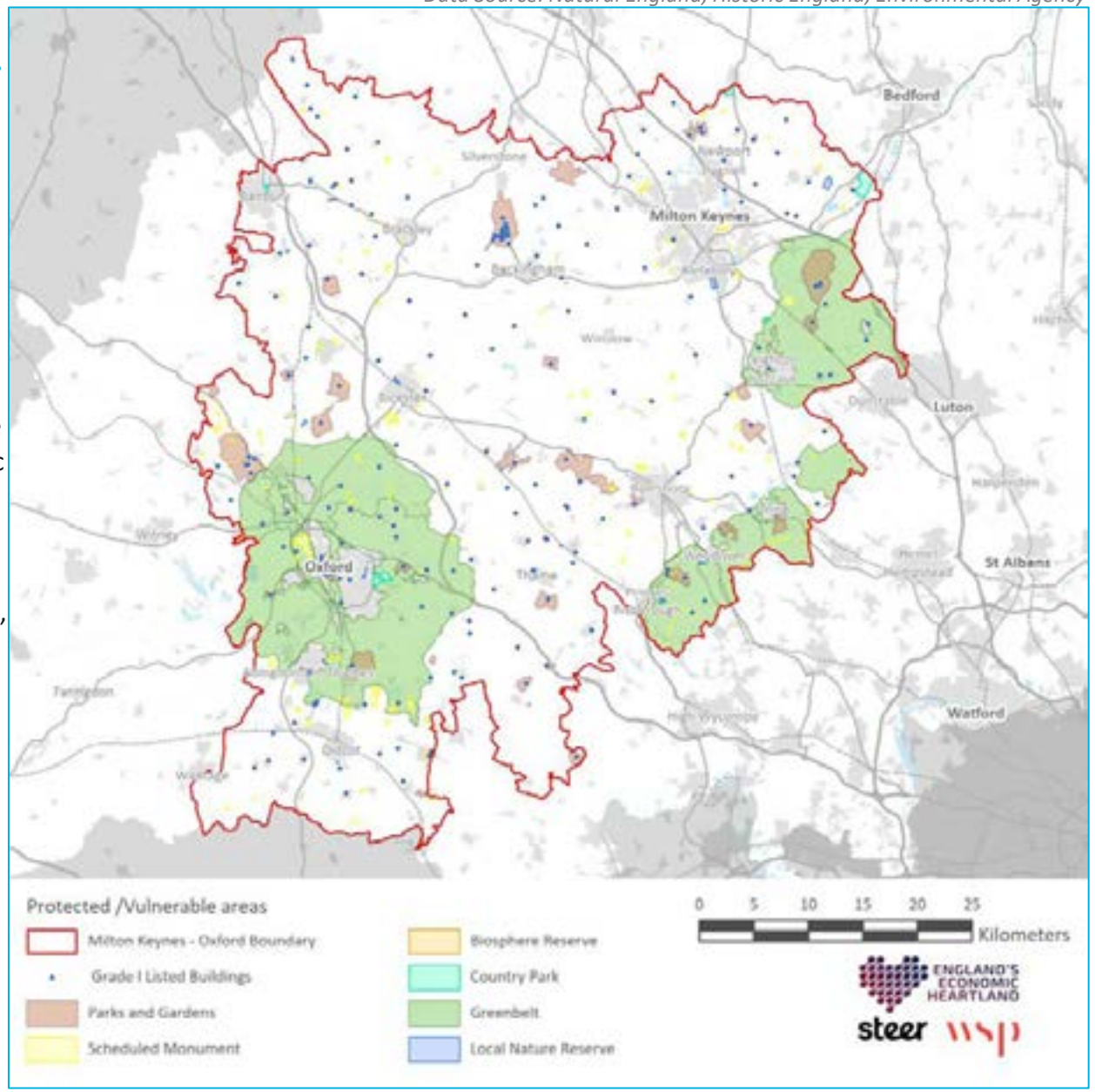
Heritage: There are a total **452 Grade I Listed Buildings in the corridor.** The majority of listed buildings are situated in rural areas, although there are also a high number of listed buildings in historic settlements such Oxford.

The most notable cluster can be found north of Buckingham. The former Village of Stowe now resides on a protected area, home to Stowe School, on the original Stowe House. The area is also a protected country park.

Ecology: Roughly **20% of the land area in the Corridor is Greenbelt land**. Greenbelts are designated areas to stop urban sprawl. The largest area of Green Belt is surrounding Oxford and the Chiltern Hills Downs. The latter includes the settlements of Princes Risborough, Wendover, Tring, Leighton Buzzard and a small part of Milton Keynes.

The corridor has a significant greenbelt coverage and parks and gardens, along with notable grade one listed buildings in rural areas.

Data Source: Natural England, Historic England, Environmental Agency



Housing Affordability

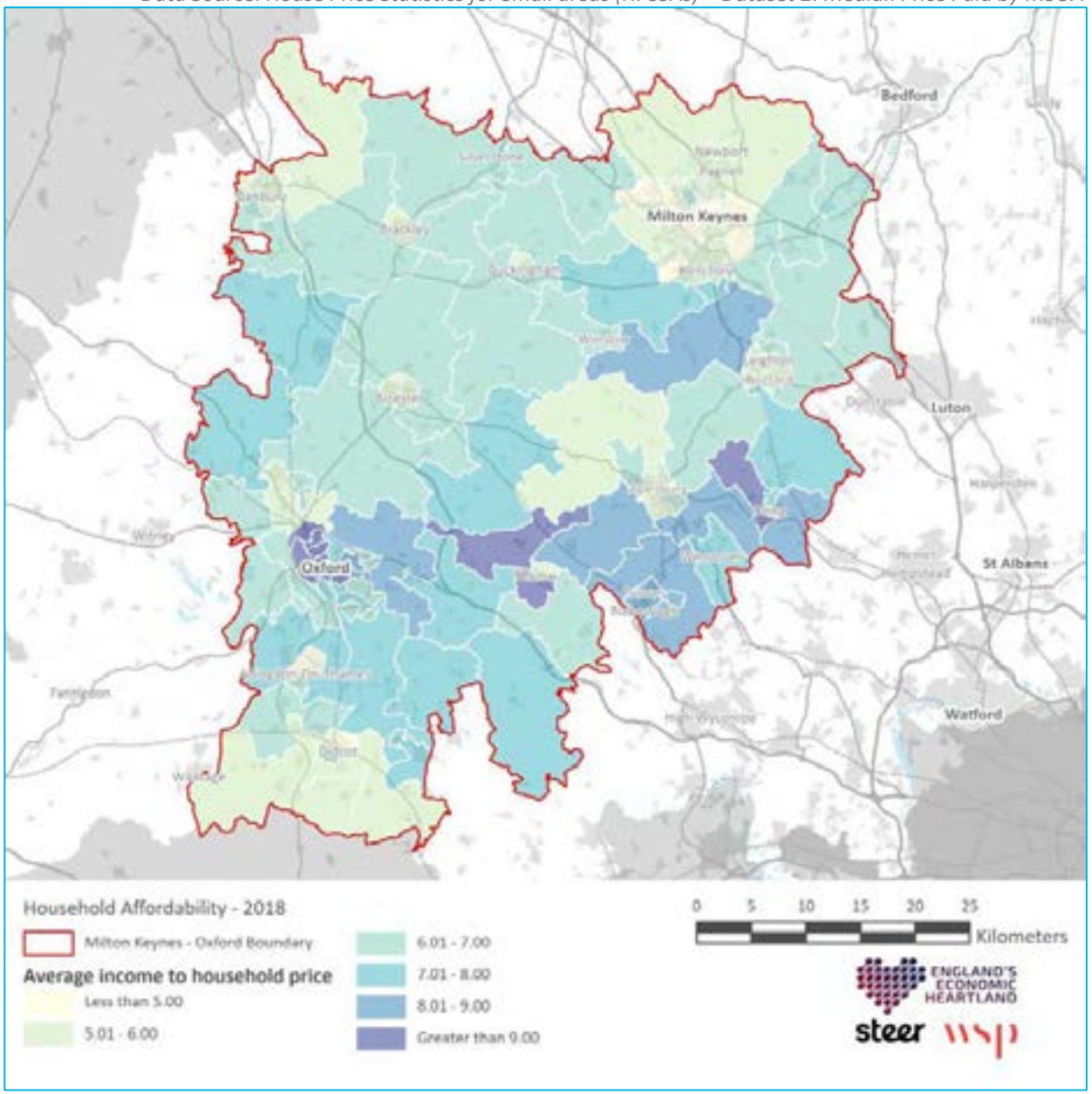
In 2018, the average house price in the Oxford Milton Keynes corridor was £332,500 while the average household income was £59,600; equating to a corridor-wide affordability ratio of 5.58.

Oxford, Thame and Tring are the least affordable settlements in the corridor with part or all of these settlements having a housing affordability ratios greater than 9.00. The most affordable settlements in the corridor are Banbury to the northwest, Milton Keynes to the northeast, Aylesbury to the east and Didcot to the south with affordability ratios of less than 6.00.

There is a significant difference in the affordability of housing in the corridors two largest settlements. Milton Keynes has an affordability ratio of 5.34 whereas Oxford has an affordability ratio of 8.60.

It is important that high quality transport connections are provided between areas of high and low affordability, as well providing affordable housing in low affordability areas. This is to ensure that income does not restrict residents from accessing services, facilities and employment opportunities that may otherwise only be available to those living in areas of low affordability. More affordable housing in low affordability areas has transport benefits through reducing the need for longer journeys and supports potential uptake of active travel.

Data Source: House Price Statistics for Small areas (HPSSAs) – Dataset 2: Median Price Paid by MSOA



Air Quality

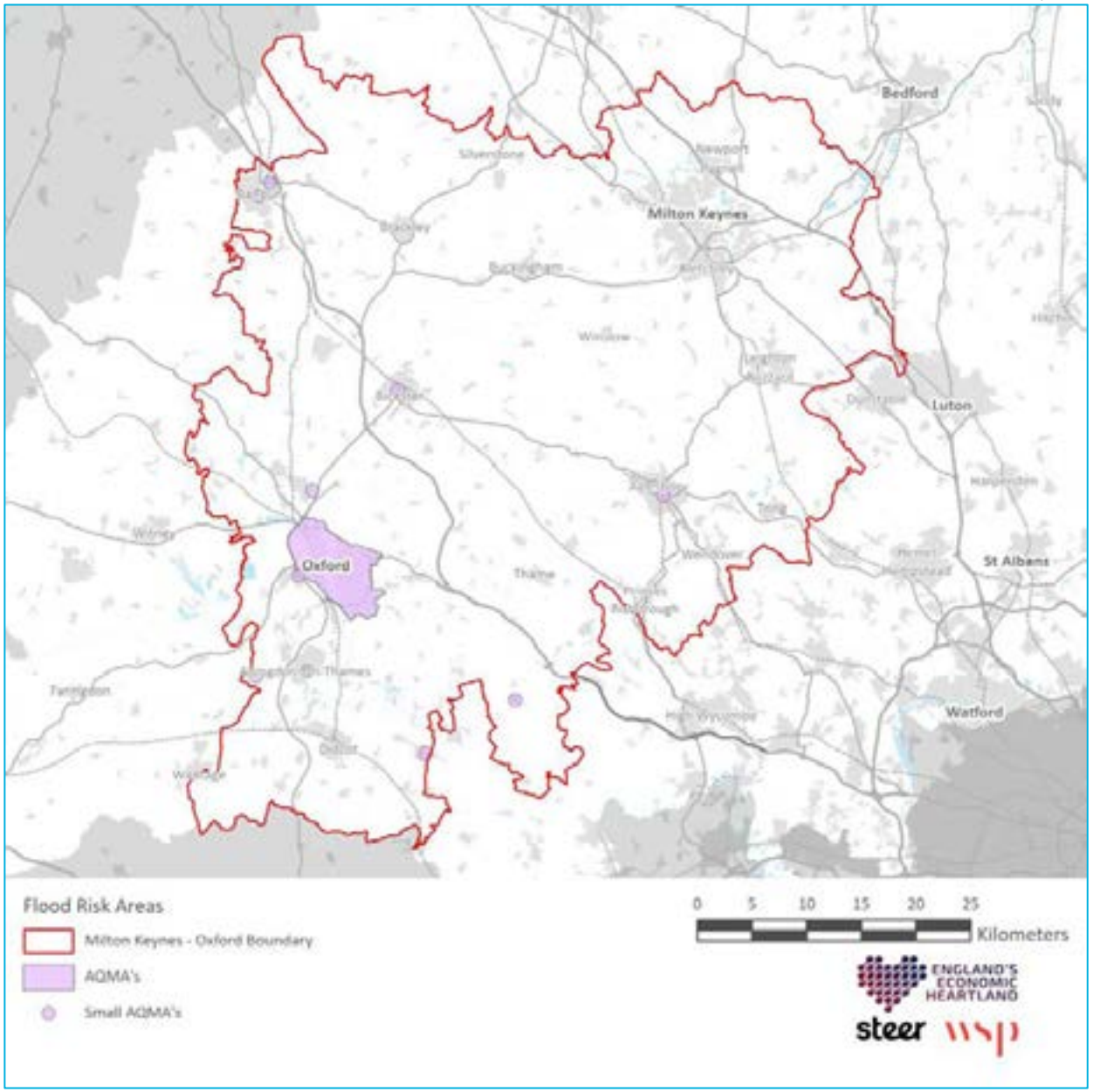
The impact of vehicle emissions on people's health from poor air quality has become a prominent issue in recent years. **Nationally, road transport is the largest emitter of greenhouse gases (GHG), with cars contributing 55% of domestic transport emissions (DfT).**

Areas of poor air quality can be identified from the location of Air Quality Management Area (AQMAs), which are typically located where large inter-urban corridors and strategic roads pass through urban areas (for example, Aylesbury, where the A41 intersects the A418, and Bicester, where the M40 intersects the A41).

The largest AQMA in the corridor is 'The City of Oxford', established in 2010 due to an excessive annual mean of nitrogen dioxide (NO_2). Other, smaller and more localised AQMAs are located in Bicester, Banbury, Aylesbury, Wallingford and Watlington.

The evidence shows that there are opportunities to invest in transport measures that help deliver improved air quality. Ultra-low and zero-emission propulsion technologies have an important role to play in improving air quality.

Data Source: DEFRA AQMAs



Economy

The EEH region is the heart of the UK's academic and commercial research sector. The region is characterised by a unique combination of scientific and cultural assets, resulting in a highly skilled workforce in the areas of innovation and technology.

The industry split across the Oxford to Milton Keynes corridor reflects this, with education, health and professional scientific and technical activities being the most significant sectors and accounting for over 200,000 jobs. Over 35% of jobs within the corridor fall into these industries, higher than the 32% average for the EEH region as a whole.

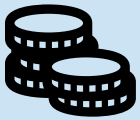
The high growth, high skills employment is particularly focussed around a number of enterprise zones which facilitate industrial clustering and the productivity benefits this generates. Prominent industry hubs within the corridor, include (based in and around):

- **University of Oxford**, one of the world leaders in science and technology;
- **Science Vale**, the largest concentration of research and development activity in Europe;
- **Silverstone**, the heart of the UK's High Performance Technology network;
- **Westcott Innovation Centre**, a new multi-million pound innovation centre for industries in the space and other related sectors; and
- **Aylesbury Woodlands,** this site focuses on food science accommodating over 2,500 jobs.

Data Source: Business Register and Employment Survey

Industry	Study Area		EEH Region		England	
	Number	%	Number	%	Number	%
Education	81,853	*14%*	252,828	*10%*	2,598,000	9%
Health	65,181	*11%*	274,416	*11%*	3,924,000	13%
Professional, Scientific & Technical Activities	59,012	*10%*	275,264	*11%*	2,627,000	9%
Retail	51,356	*9%*	223,791	*9%*	2,771,000	9%
Business Admin & Support Services	49,985	*9%*	271,397	*11%*	2,660,000	9%
Manufacturing	41,676	*7%*	195,814	*8%*	2,400,000	8%
Accommodation & Food Service Activities	36,369	*6%*	157,975	*6%*	2,300,000	8%
Transport & Storage	30,751	*5%*	141,395	*6%*	1,472,000	5%
Information & Communications	29,505	*5%*	111,935	*4%*	1,293,000	4%
Construction	25,537	*4%*	127,617	*5%*	1,466,000	5%
Arts, Entertainment & Recreation	25,190	*4%*	109,810	*4%*	1,351,000	4%
Wholesale	24,704	*4%*	127,742	*5%*	1,160,000	4%
Public Admin & Defence	16,404	*3%*	67,940	*3%*	1,315,000	4%
Motor Trades	13,837	*2%*	52,590	*2%*	569,000	2%
Financial & Insurance	12,812	*2%*	64,263	*3%*	1,049,000	3%
Property	8,609	*1%*	38,698	*2%*	519,000	2%
Mining, Quarrying & Utilities	3,705	*1%*	21,163	*1%*	388,000	1%
Agriculture, Forestry & Fishing	682	*0%*	2,943	*0%*	214,000	1%
TOTAL	**577,168**	***100%***	**2,517,581**	***100%***	**30,076,000**	**100%**

Summary

Theme	Issues & Opportunities
 ECONOMY	**Issues** • **Workforce -** the corridor is characterised by a highly skilled workforce in the areas of innovation and technology. However, housing affordability variation results in an increased need to commute. **Opportunities** • **Economic growth -** the evidence supports the need to invest in transport that enables all local residents to access the full range of jobs, enabling employers to better attract and retain the right skills needed to drive future economic development. • **High tech industries -** as the corridor (along with the rest of the EEH region) is categorised by high-tech industries and world-class educational facilities, there are opportunities for technological transportation solutions to be developed.
 ENVIRONMENT	**Issues** • **Emissions -** car travel makes a substantial contribution to transport sector carbon emissions and therefore has a huge impact on achieving net zero. Achieving net zero in the study area is a significant challenge given the high levels of car ownership. • **Environmental Protections -** 20% of the corridor is greenbelt land, preventing urban expansion in these areas. The diverse environmental constraints may impact upon the deliverability of transport interventions. • **Flood Risk -** many of the waterways within the corridor pose a potential flood risk, with Oxford and the Southern parts of the corridor at most risk. Climate change will increase incidents of extreme weather, worsening the risk of flooding. **Opportunities** • **Decarbonisation –** implementing measures to support sustainable travel behaviours and hybrid working can help to promote a decarbonised transport network by 2050, thus supporting national and regional objectives.
 SOCIAL	**Issues** • **Air Quality -** the study area contains a number of AQMAs along the key transport links and covering the key settlement of Oxford, resulting in negative impacts on the quality of the local environment. • **Housing Affordability:** There is significant variation in the affordability of housing across the corridor. Oxford, Thame and Tring are the least affordable settlements in the corridor, while the most affordable settlements in the corridor are Banbury, Milton Keynes, Aylesbury and Didcot. **Opportunities** • **Active Travel -** the presence of the green belt and other environmental protection areas presents an opportunity to provide attractive walking and cycling routes within the corridor whilst protecting the natural environment.

Part 2c
Connectivity

Networks – Digital Connectivity

Connectivity

The rise of home working has increased the importance of digital connectivity.

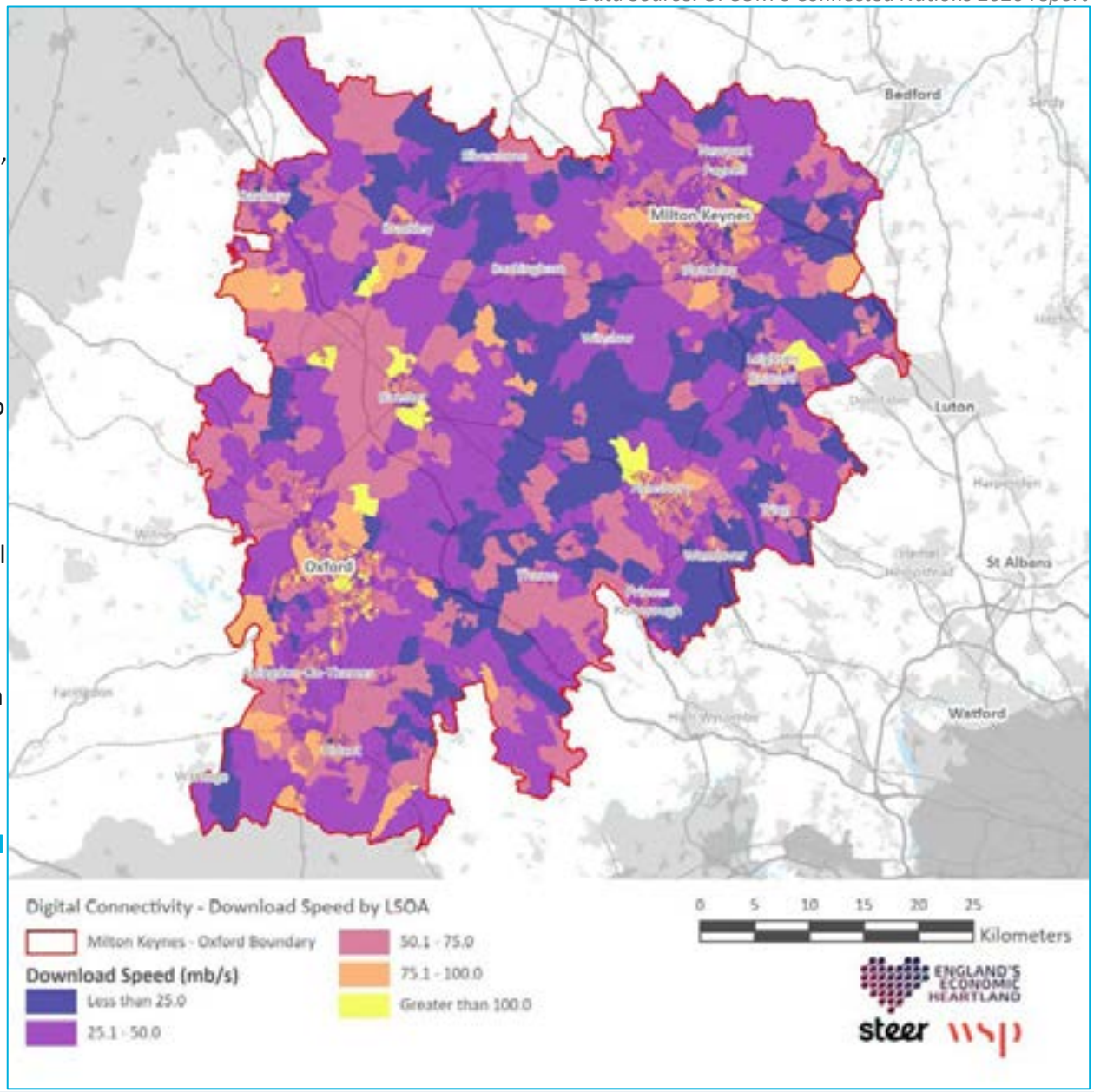
The plan to the right shows that for fixed broadband, the highest average download speeds (greater than 100 mb/s) are mostly found in or around large and medium size settlements in the corridor. Rural areas have the slowest average download speed, with many parts of the corridor having an average download speed of less than 25 mb/s.

Coverage of reliable, high speed mobile internet also varies across the area with gaps on the strategic road and rail network presenting particular issues.

Remote and hybrid working is likely to bring about other benefits, with the EEH Capacity Release Model estimating, in the core scenario, a 10-14% reduction in traffic congestion for the corridor; thereby substantiating the need for improved digital connectivity. However the adoption and success of a hybrid style of working is also dependent upon workplace culture and how open individual businesses are to embracing such a change.

To enable the wider community and environmental benefits of home-working and hybrid working alternatives to be maximized, and to avoid digital severance and divide, the rollout of superfast and ultrafast fixed and mobile internet in areas with lower average download speeds should be investigated.

Data Source: OFCOM's Connected Nations 2020 report



Networks – Mobile Connectivity

The outdoor geographic coverage of 4G mobile (from all 4 operators) is now high across the EEH area, ranging from 90.39% of landmass in South Oxfordshire to 99.98% in Oxford. The £1bn Shared Rural Network initiative will improve this further.

However, indoor coverage is significantly lower than outdoor coverage. The proportion of premises with indoor 4G coverage from all 4 operators ranges from 52.8% in West Oxfordshire to 99.5% in Watford.

5G roll-outs are still at an early stage (see EE example opposite), and indoor coverage for 5G is more challenging than for 4G, because 5G deployments typically use higher frequencies. However, we should see 5G coverage improve substantially over the next few years (e.g. EE is aiming for 90% UK landmass coverage by 2028).

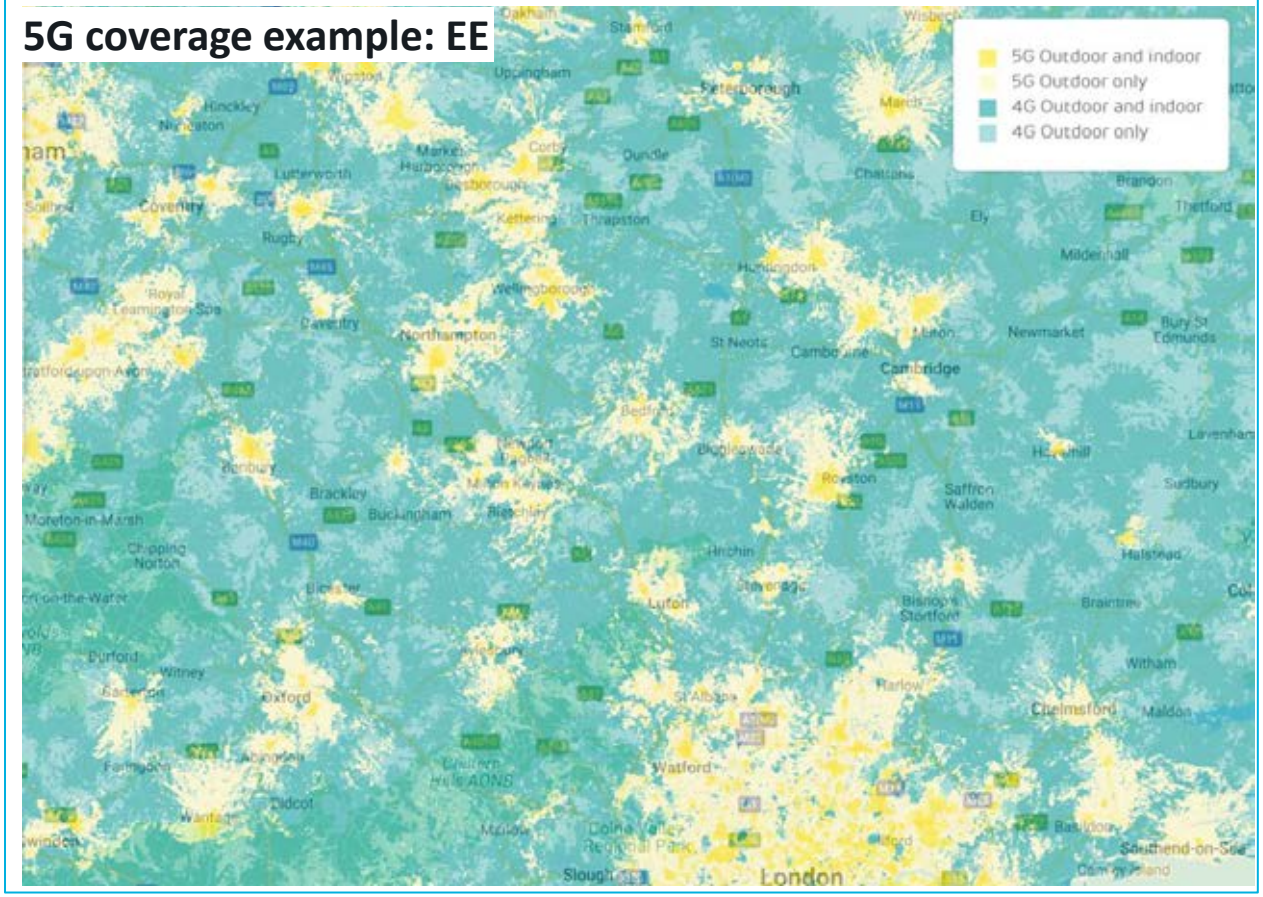
5G offers substantial performance improvements vs 4G (higher speeds, lower latency, handling higher densities of devices, and offering more flexibly tailored services for specific use cases), and is seen as a potentially transformative tech for various industries.

Constraints on 5G availability/quality (which will typically remain much better in dense urban areas) may start to impact business location decisions, and hence commuting patterns, in coming years.

Data Sources: Shared Rural Network; EE coverage checker (Feb 2022)

4G geographic outdoor coverage

5G coverage example: EE



Networks – Active Modes

Network Overview

Active travel infrastructure quality and availability differs throughout the corridor but allows for good connectivity between most settlements.

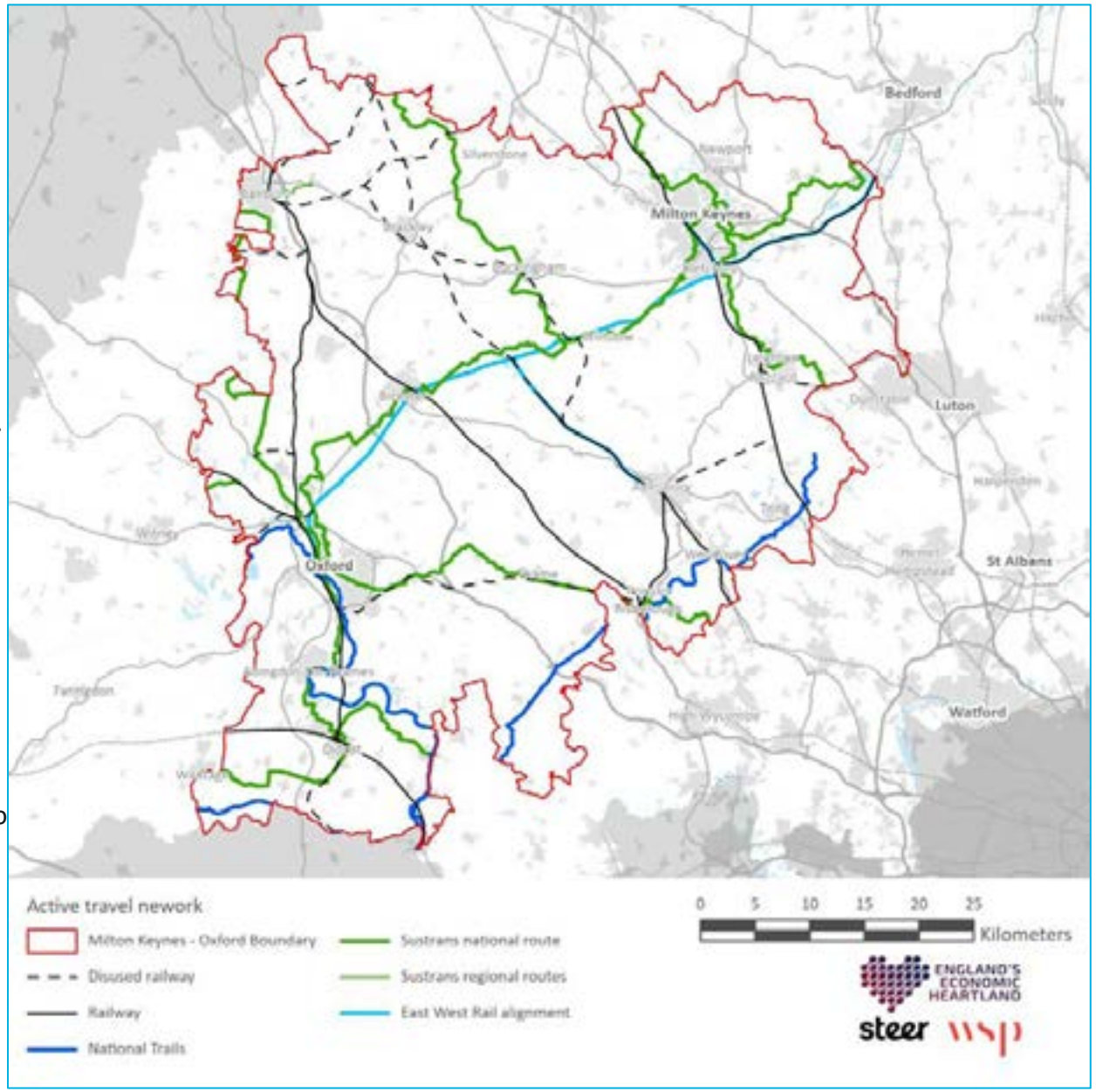
The plan opposite shows the Sustrans National Cycle Routes and nature trails run through the corridor. These routes provide strategic connectivity between settlements on foot and cycle. The routes are comprised of a mix of on-carriageway, segregated and shared-use sections. The plan does not include local routes.

To improve the active travel network, there are opportunities to convert disused rail lines into active travel routes. This could help improve active travel connectivity for Banbury, Brackley, Buckingham and Aylesbury.

The delivery of Local Cycling and Walking Infrastructure Plans (LCWIPs) are a key part of improving active travel networks, which will link to existing Sustrans routes and public transport to make a more integrated transport network.

It is important that active travel networks provide high quality connections between residential areas, employment areas and rail stations to help facilitate multi-modal journeys by public and active transport.

Data Source: SUSTRANS



Cycling Propensity

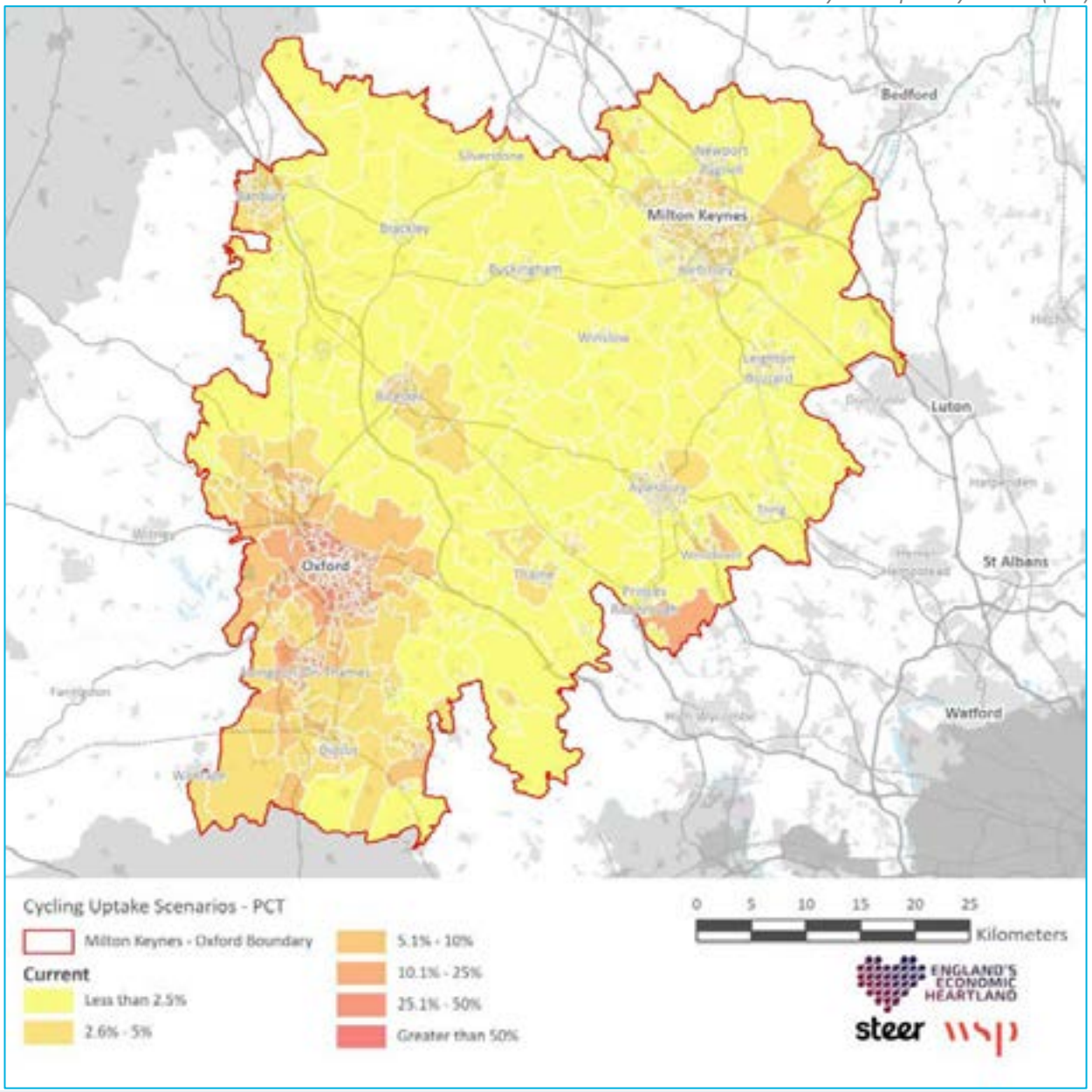
There are a myriad of benefits to using cycling as a mode of travel, including health benefits, reduced pollution and decreased travel times.

The plan opposite shows percentage of all journeys to work (JtW) undertaken by cycle (as per the 2011 Census). This provides an insight into the existing propensity of the population to cycle to work.

The Cycling Propensity Toolkit (CPT) has considered the cycling JtW mode share in a number of future scenarios where the population acquires a difference propensity to travel. One of these scenarios is a Dutch scenario, where the JtW cycle mode share of rural areas would increase to between 10% and 25% in rural areas and greater than 50% in urban areas. The outputs of this analysis and the other scenarios are attached in Appendix D. It should be noted that whilst the CPT focuses on commuting journeys, similar propensities are likely to be observed for other journey purposes.

A high propensity to cycle is unlikely to translate into a high journey to work mode share if there is not the cycling infrastructure to support these trips. As such continuous high quality cycle routes and infrastructure must be provided to connect residential areas to places of employment, leisure and education in urban and rural locations.

Data Source: Cycle Propensity Toolkit (CPT)



Networks – Active Modes

Micro-mobility

Micro-mobility involves transportation using lightweight personal vehicles such as e-bikes and e-scooters. Shared / public micro-mobility schemes have become a new first mile/last mile active travel option. Shared mobility schemes operating across the corridor are listed below:

Milton Keynes: Docked cycle hire scheme operated by Santander Cycles; E-scooter schemes operated by Spin (Trial), Lime (Trial) and Ginger (Trial).

Oxford: Docked cycle hire scheme operated by Donkey Republic; E-scooter schemes operated by Voi (Trial).

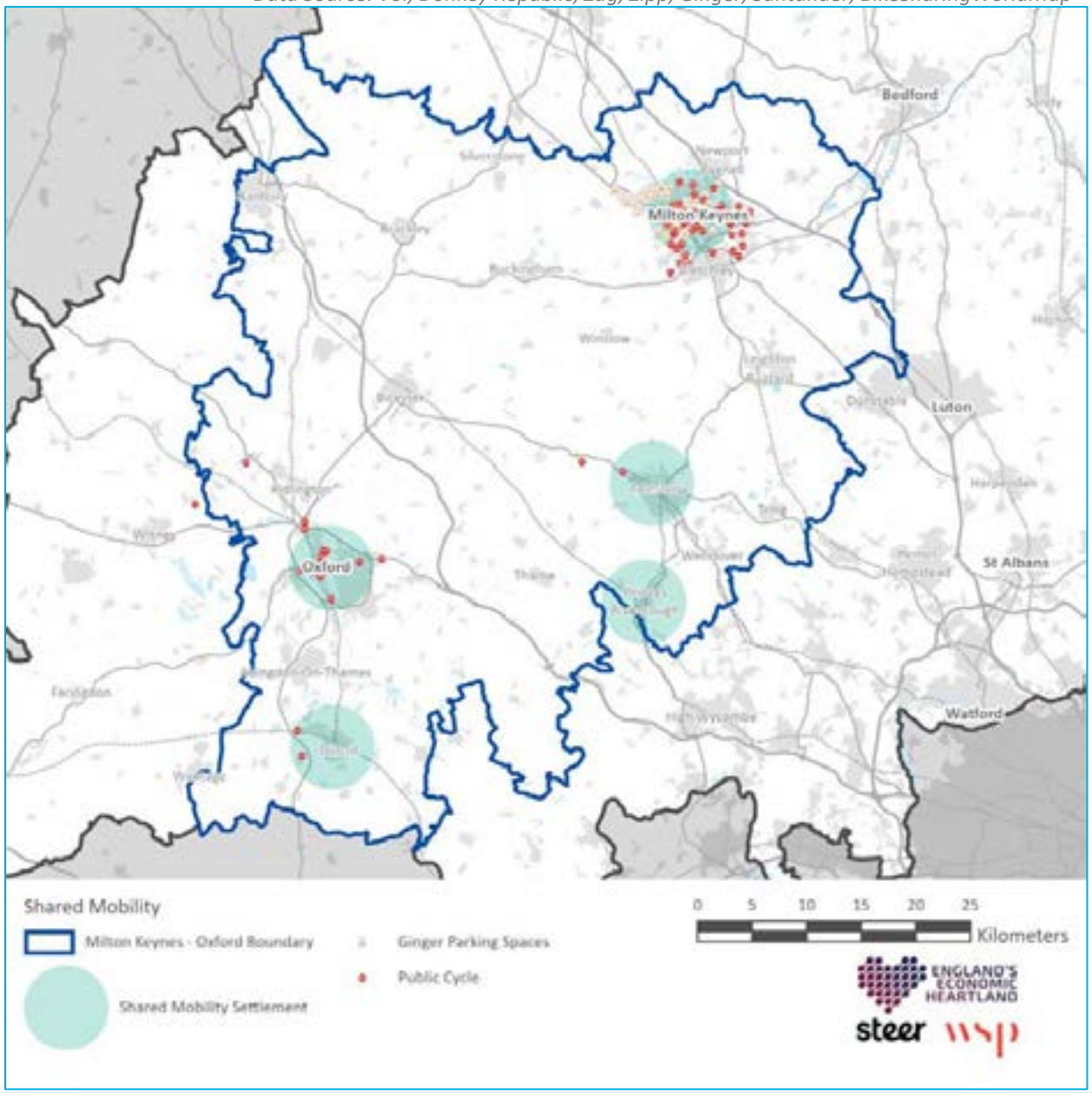
Aylesbury: Docked e-bike scheme operated by MoovBikes; E-scooter schemes operated by Zipp (Trial).

Didcot: Docked cycle hire scheme operated by Donkey Republic.

Princes Risborough: E-Scooter Trial operate by Zipp Mobility

Micro-mobility solutions can form the first / last mile of a longer journey undertaken by passenger transport thereby supporting a holistic transport network. Micro-mobility schemes are more viable in urban areas where there is a critical density that ensures commercial viability.

Data Source: Voi, Donkey Republic, Zag, Zipp, Ginger, Santander, BikeSharingWorldMap



Networks – Active Modes

Catchments (E-Bikes)

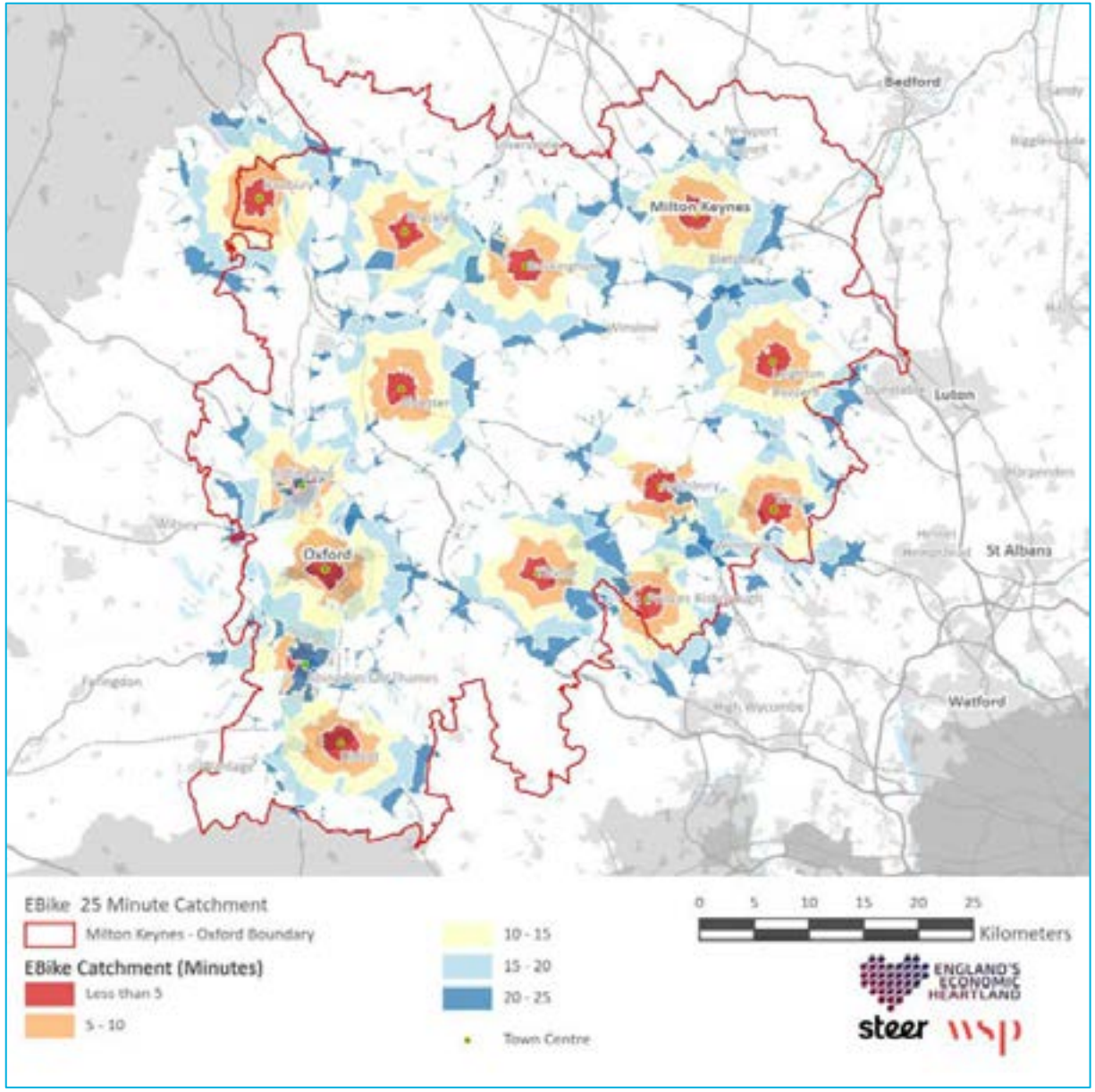
E-bikes - electrically assisted pedal bicycles which can travel up to 25kmh - are an attractive option for commuting over traditional cycling, with the potential to increase active travel mode share in the near future.

The plan opposite shows the potential for E-bikes to support connectivity within urban areas, whilst also providing some opportunity for inter-urban travel. Separate catchments by settlement can be seen in Appendix C.

Notable opportunities for E-bike commuting can be seen between: Thame and Princes Risborough; Oxford and Abingdon; Oxford and Kidlington; Bicester and Kidlington; Aylesbury and Tring, and Brackley and Buckingham.

E-bikes broaden the rural travel reach of urban centres but require attractive infrastructure (high quality cycle routes connecting settlements and places of employment) to encourage modal shift. In addition, policy / legislation needs to support new forms of mobility in order for them to have any meaningful impact. There is a risk that lower income households may be excluded from new forms of mobility as they are unable to afford an e-bike.

Data Source: Open Route Services



Networks – Public Transport

Network Overview - Rail

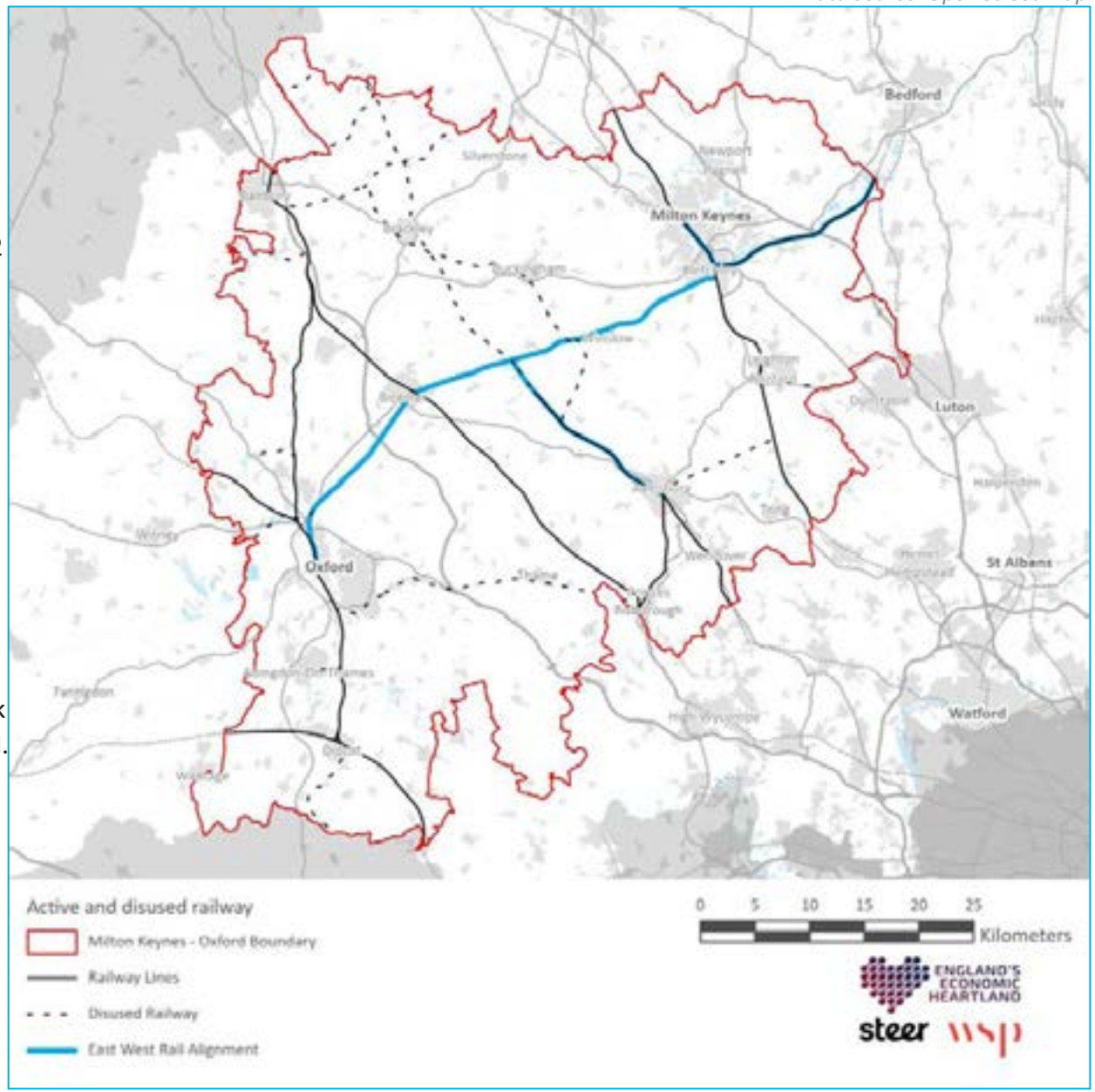
Within the corridor, there are good radial rail links through Oxfordshire and Milton Keynes. The main rail lines within the corridor are:

- **Cherwell Valley Line -** connecting Oxford, Didcot and Bicester to London and the Midlands (off-peak service 2 tph operate between Oxford and Didcot);
- **Chiltern Main Line -** connecting Bicester and Princes Risborough to the Midlands (off-peak 1 tph operates between Bicester North and Princess Risborough);
- **London – Aylesbury line -** connecting Aylesbury and London Marylebone (off-peak 3 tph operate between Aylesbury and London Marylebone);
- **West Coast Main Line -** connecting Milton Keynes and Leighton buzzard to London, Northampton and the Midlands (off-peak 4 tph operate between Milton Keynes and Leighton Buzzard); and
- **Marston Vale Line -** connecting Bletchley to Bedford – providing a low-level of east-west connectivity (off-peak service of 4 tph operate between Bletchley and Bedford. Off-peak this is operated by a rail replacement service).

High Speed 2 (HS2) - will operate through the corridor in the near future. Although there will be no stations within the corridor, it will allow for released capacity and potential changes to timetabling.

Currently there is no direct rail connection between Oxford and Milton Keynes; however East-West Rail will create a connection by 2024, transforming public transport connectivity across the study area.

Data Source: Open Street Map



Networks – Public Transport

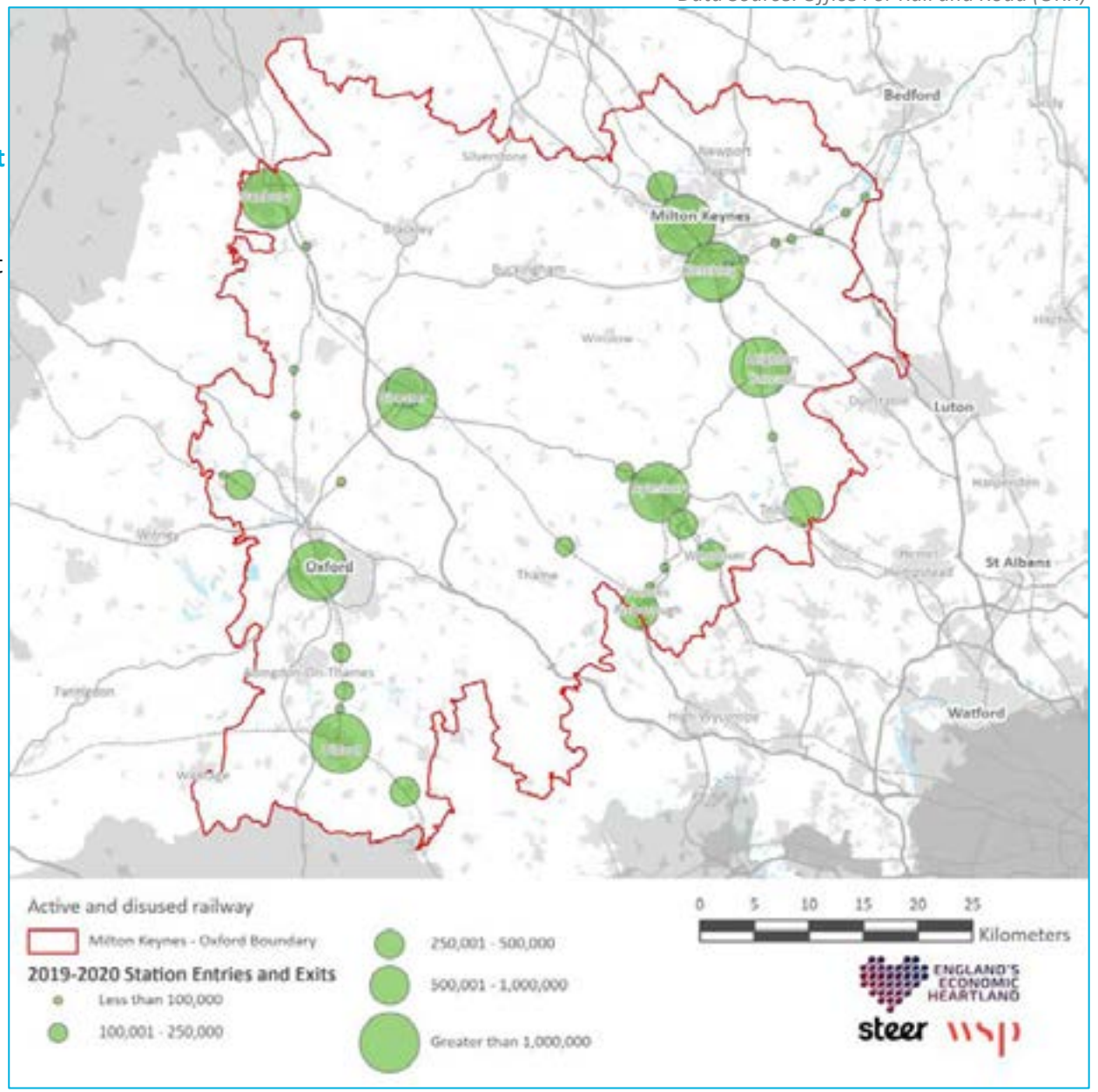
Network Overview - Station Usage

A total of 33,391,298 station entries and exits took place in 2019-2020. This represents 20% of the total station entries and exits in the EEH region. The most used station in the corridor is Oxford Railway Station with a total of 8.7 million entries and exits, representing 26% of the total usage (ORR). The least used stations within the corridor can be found within smaller settlements in rural areas - for example, Combe, with 1,856 entries and exits. In total, all stations outside urban areas represent 6% of usage. The current usage of each main radial rail line through the corridor is as follows:

Rail Line	Stations	Entries & Exits in the Study area
Cherwell Valley Line	6	1,11,9128 (33%)
Chiltern Main Line	5	474,782 (14%)
West Coast Main Line	7	125,4780 (37%)
Other routes	18	542,608 (16%)

It is important that a range of sustainable and attractive modes of transport connect rail stations with residential areas, employment areas and town centres. This will maximise opportunities for residents, workers and visitors to travel by rail. This may also increase the attractiveness of less well used rail stations.

Data Source: Office For Rail and Road (ORR)



Networks – Public Transport

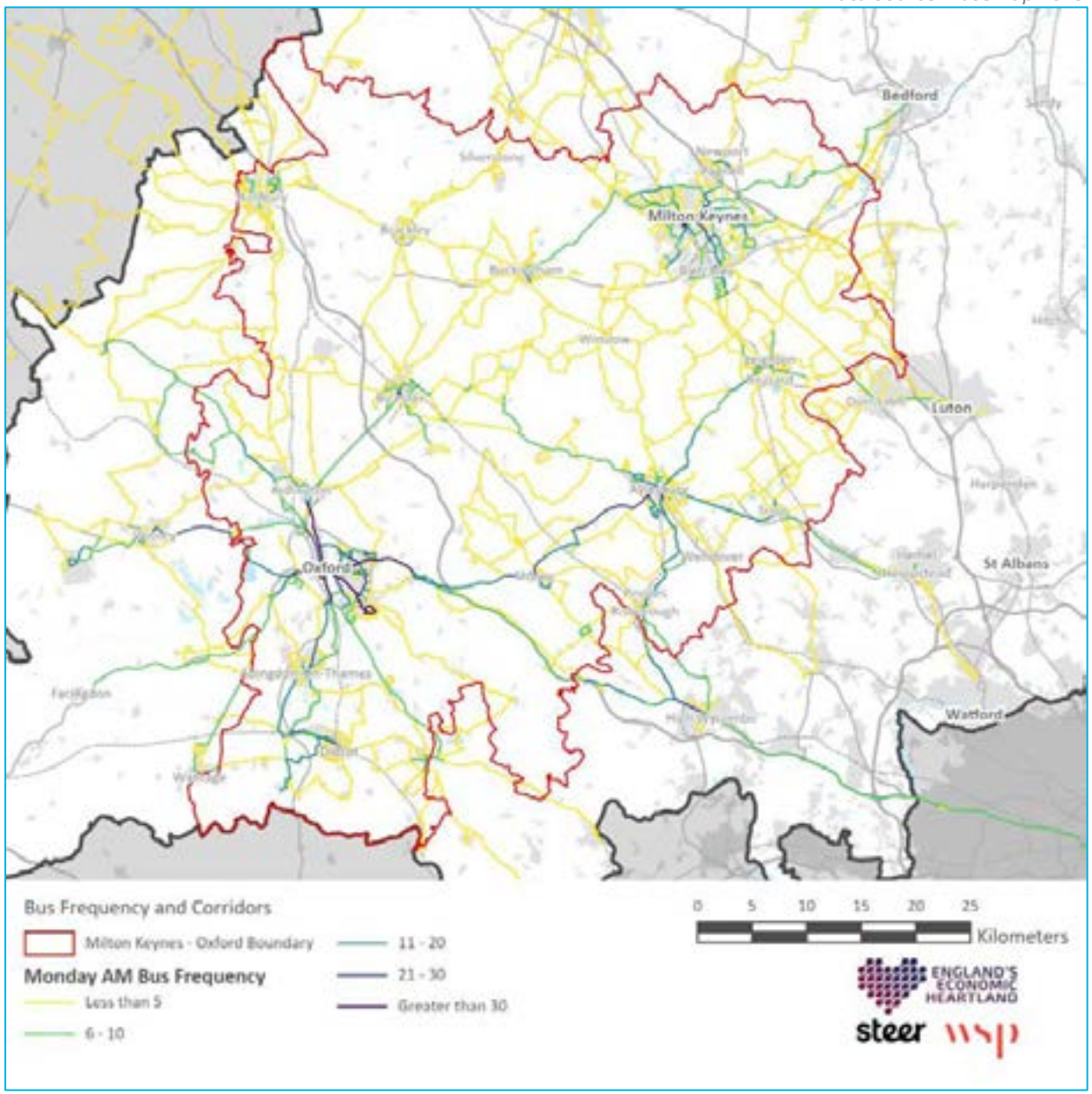
Network Overview - Bus

Buses provide an alternative to private car travel for intra and inter-urban travel; however, service frequencies vary which impact upon their attractiveness. The plan opposite shows the number of local bus and coach services (two-way total) on links between the key settlements during the morning peak hour (0700 to 0859) on a Monday in 2019.

It shows high frequency local bus corridors are centred around Milton Keynes, Oxford and Aylesbury. Unsurprisingly, local bus connectivity between settlements in the heart of the study area which comprises the small settlements and rural areas are less well served. Bicester, Buckingham and Brackley are not directly connected by a high frequency local bus services and locations surrounding Milton Keynes. There is no high frequency local bus service along the A43 corridor towards Silverstone which is a key employment location.

There are limited inter-urban local bus services operating between the key settlements, which greatly restricts the ability of residents of the study area to travel between all the main towns by public transport. Public transport options that are attractive, high frequency and reliable performance should be explored.

Data Source: Basemap 2019



Networks – Public Transport

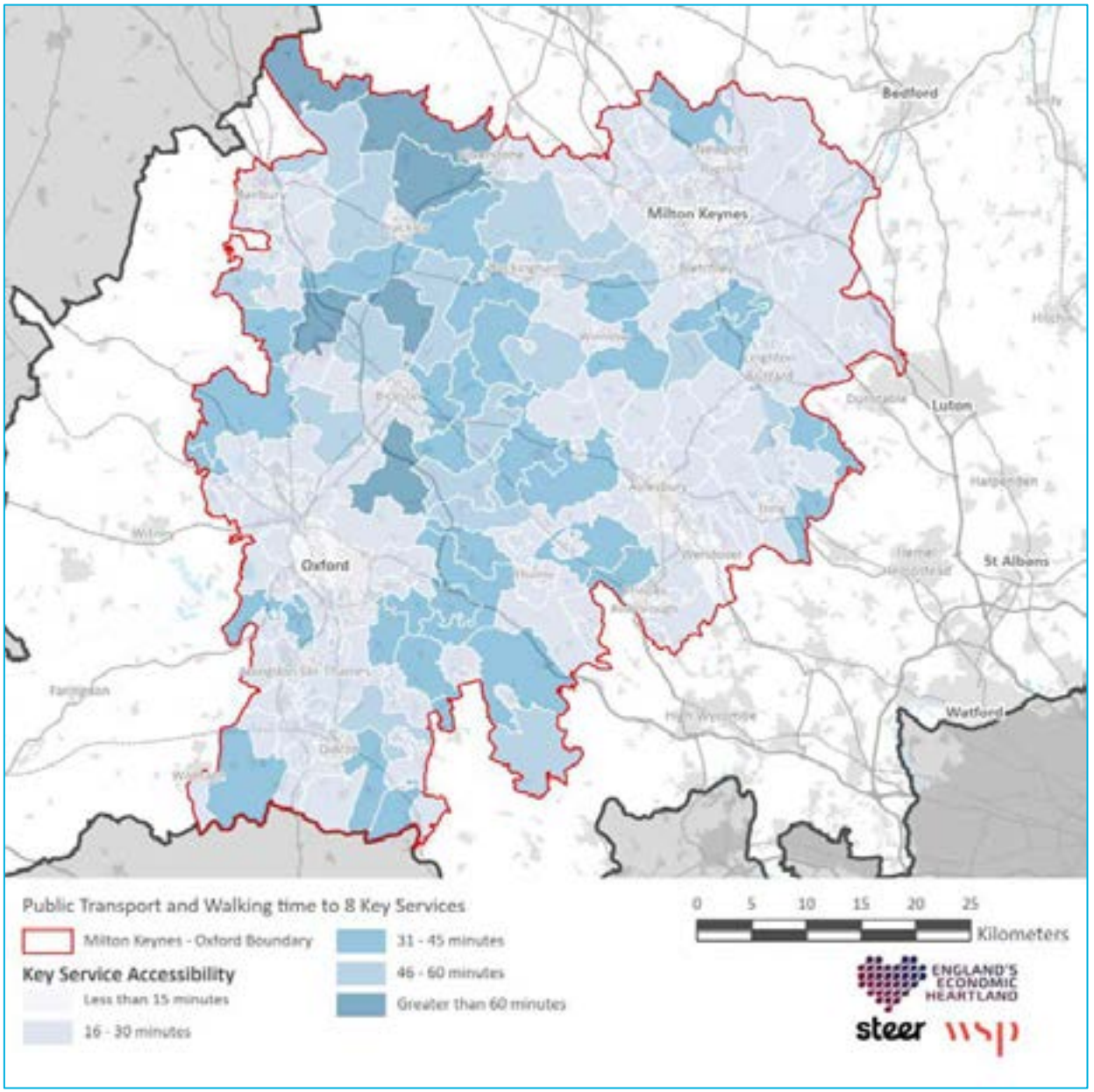
Access to Services

Having easy access to services and amenities within a reasonable public transport journey time can reduce car dependency. The plan opposite shows the average accessibility by walking and public transport to eight key services and facilities (medium sized employment centres; primary schools; GPs; secondary schools; further education colleges; hospitals; food stores and town centres).

The distribution of accessibility follows the two main north / south rail lines within the corridor. Areas surrounding Didcot to Oxford to Bicester have good accessibility along with Aylesbury, Leighton Buzzard and Milton Keynes. The shortest journeys (less than 15 minutes) can be found mostly within the urban settlements, highlighting close proximity to services and public transport connectivity.

Poor accessibility to services by public transport can be found in the central and northern parts of the corridor, with many rural areas lacking good connectivity, increasing levels of car dependency. **Transport interventions will need to deliver connectivity between the key service centres and surrounding rural communities.**

Data Source: DfT Journey Time Statistics 2016



Networks – Road

Network Overview

To understand the performance of the local and strategic road network through the corridor and identify existing pinch points, **the percentage change in speed between the AM / PM peak hour and free flow conditions (85th percentile) has been reviewed.**

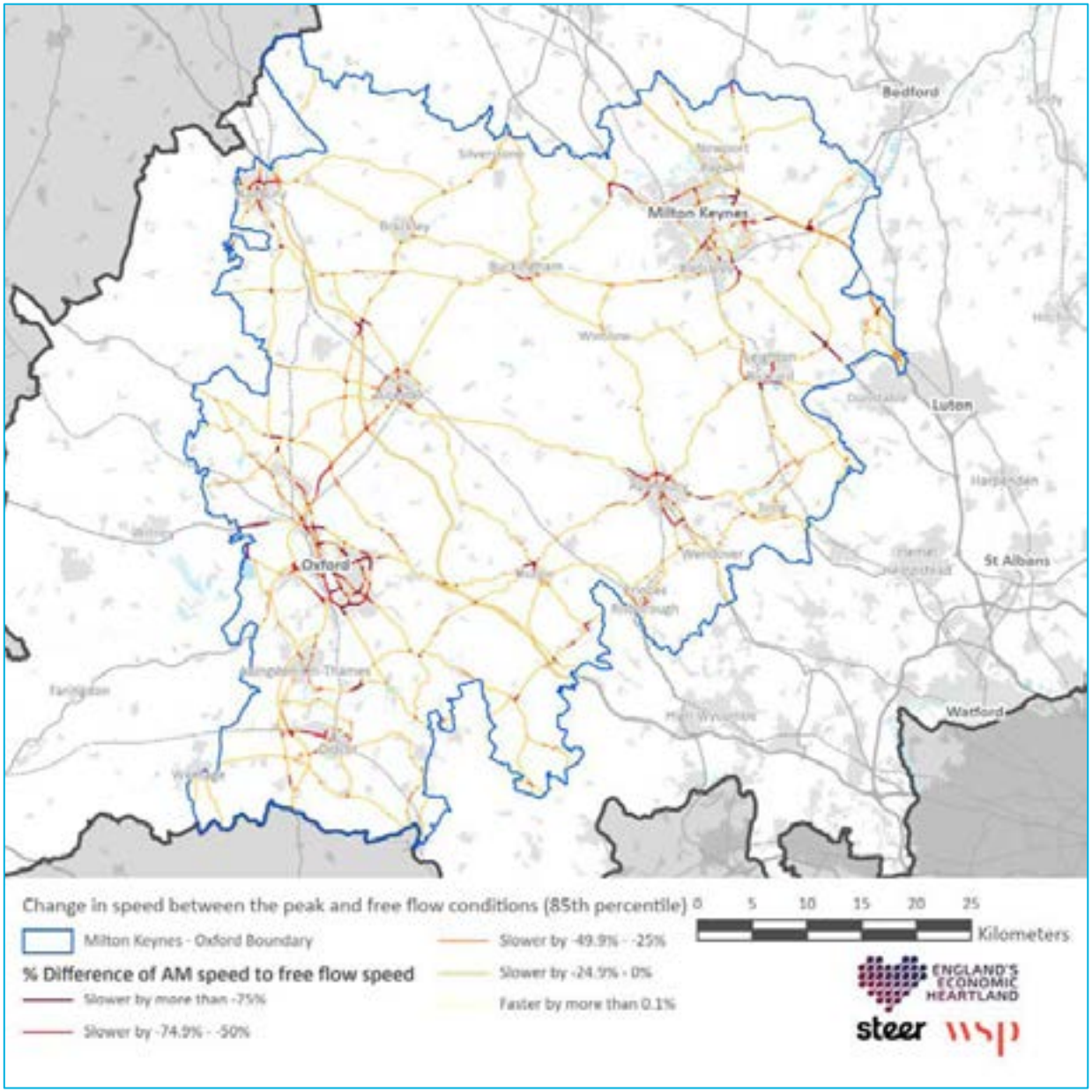
AM Peak Network Speeds

Compared to free flow conditions, AM peak hour (08:00 to 09:00) speeds are generally more than 50% slower in urban areas and between 0% and 25% slower in rural areas indicating congestion. Pinch points on the local and strategic highway network include A34 between Bicester and Oxford M1 Junction 13 (Milton Keynes) M40 Junction 10 (Bicester) as well as local pinchpoint At Aylesbury and Thame.

The evidence indicates that there are congestion hot spots on the strategic and major roads in the study area as well as the main routes through the major urban areas.

With the challenge of decarbonising the transport system, careful consideration needs to be given to planning investment in highway improvements focused on tackling pinch-points.

Data Source: TrafficMaster



Networks – Road

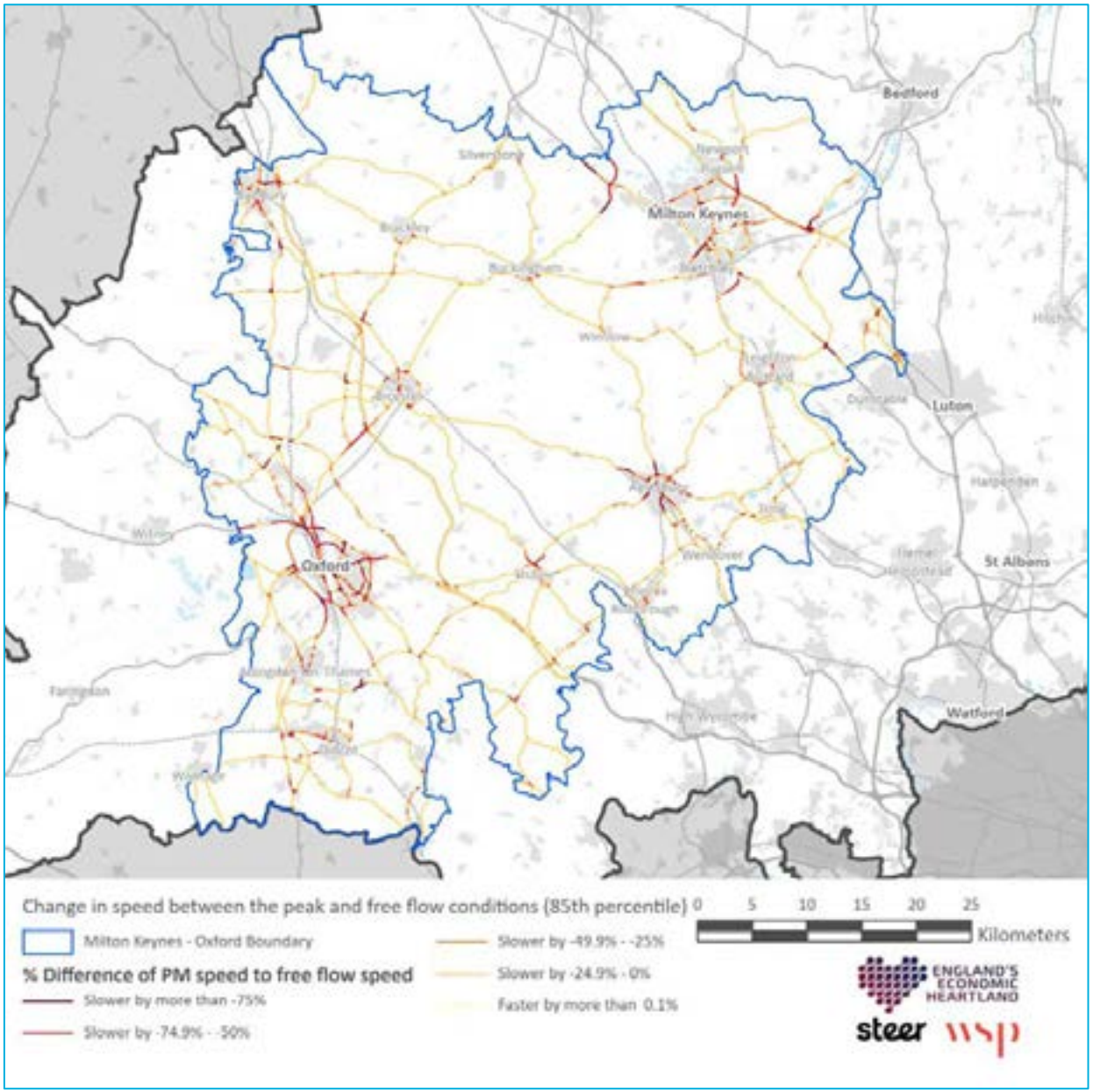
Network Overview

Again, compared to free flow conditions, PM peak hour (17:00 to 18:00) speeds are generally more than 50% slower in urban areas and between 0% and 25% slower in rural areas; however, the speed reduction impact is slightly less when compared to the AM peak hour, indicating peak spreading. Pinch points on the local and strategic highway network include:

- A34 between Bicester and Oxford; and
- M40 junction 10.

The evidence indicates that the key highway links throughout the corridor are typically congested, resulting in increased journey times, lack of journey time reliability, reduced productivity, and knock on environmental and community issues. **There is a risk that highway improvement schemes to address existing capacity constraints on the local and strategic highway network could encourage more people to travel by car. Along select corridors (such as the A34 between Bicester and Oxford) public transport and active travel interventions should be explored as an alternative to capacity improvement schemes. This will aid the decarbonisation of the transport system across the corridor.**

Data Source: TrafficMaster



Networks – Road

Freight Movements

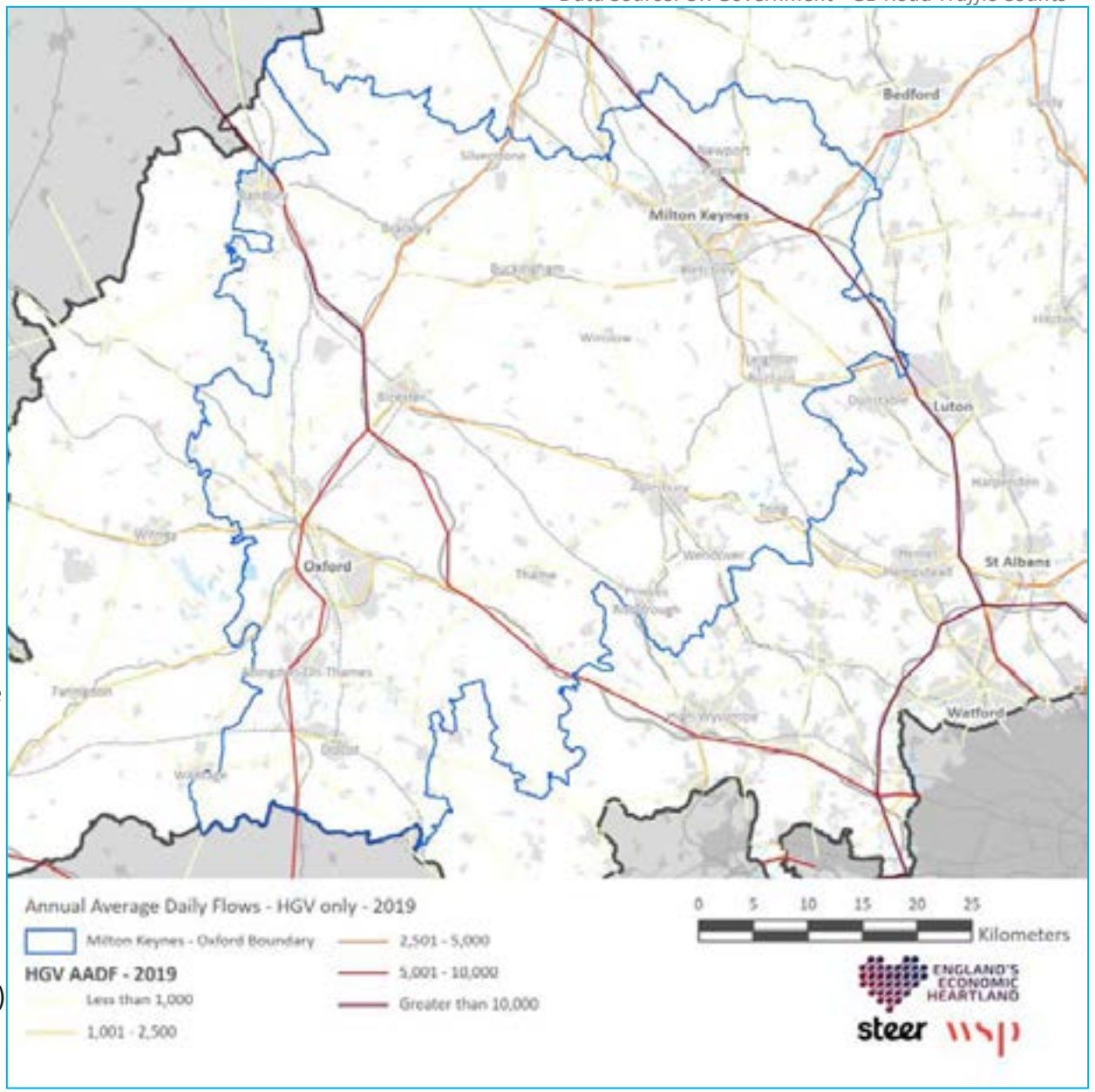
Providing efficient ways of accessing goods to unlock economic potential, protect the environment and communities, and future-proof networks to accommodate economic growth and improve efficiency is essential to the corridor.

Freight movements - Average Annual Daily Traffic (AADT) of Heavy Goods Vehicles (HGVs) - on motorways and A-roads across the corridor indicates that the highest HGV flows occur along north-south routes - particularly the A34 and M40 to the west and the M1 to the east. As shown previously, these links experience congestion within the peak travel periods which impacts upon business productivity.

Milton Keynes is geographically central nationally and strategically located with accessibility from the M1, M6 and M69 motorways making it an attractive location for road-based distribution centres. Magna Park, to the east of Milton Keynes, is the largest distribution center in Europe.

Transport interventions should explore HGV management and explore opportunities for non-road based freight options. Promotion of the Daventry International Rail Freight Terminal (DRIFT) could help facilitate multi-modal rail-road freight journeys.

Data Source: UK Government - GB Road Traffic Counts



Networks – Road

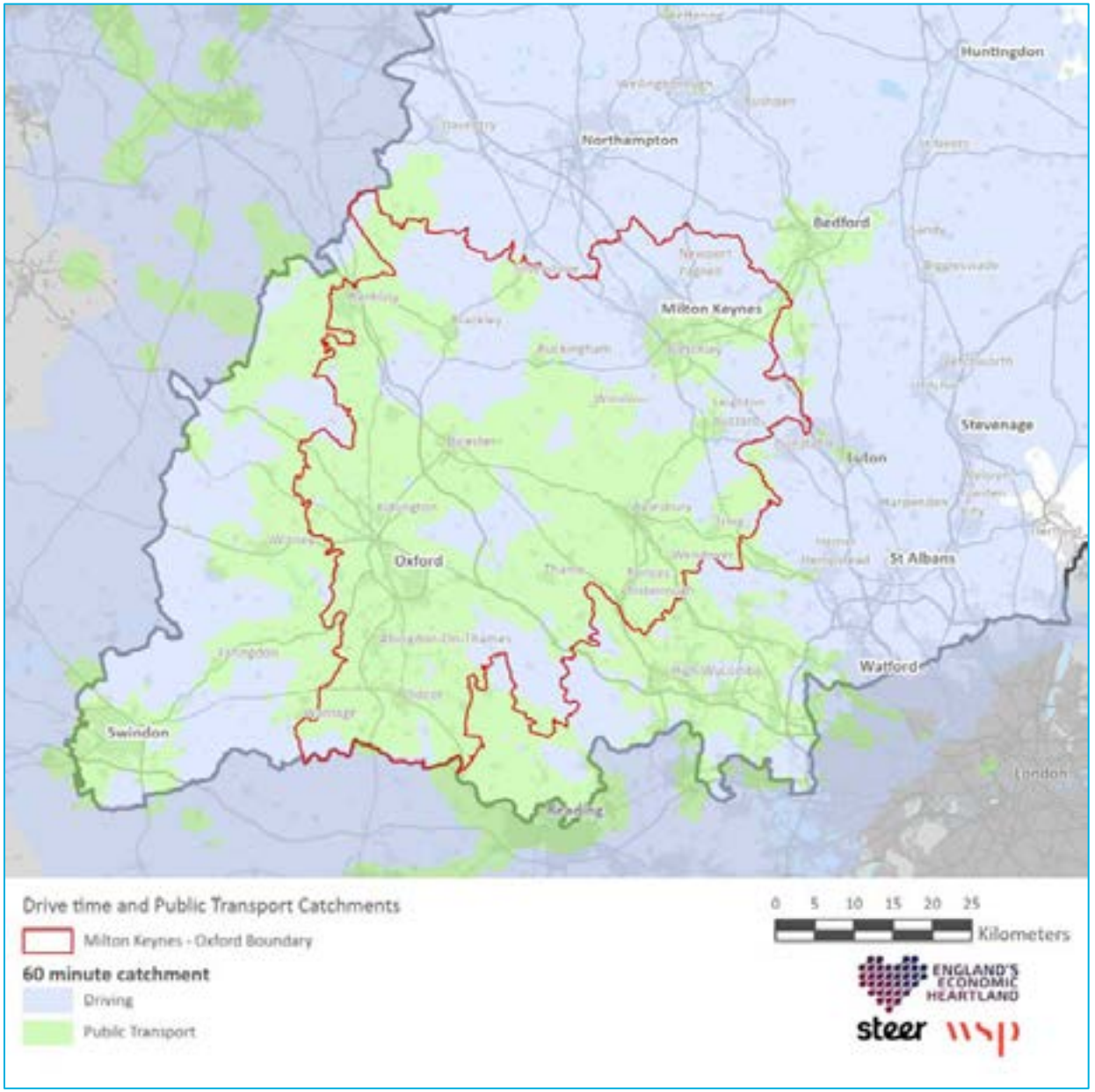
Accessibility Catchments

Data Source: TRACC – Journey Time Data

In order for public transport to be a realistic alternative to private car travel it must provide a similar level of accessibility. This plan indicates the combined 60-minute AM peak public transport and car driver catchments for travel towards seven Centres of Strategic Importance (CoSI): Aylesbury, Bicester, Didcot, Millbrook, Milton Keynes, Oxford, Princess Risborough, Silverstone Park and Westcott Venture Park. Separate catchments by CoSI are provided in Appendix B.

The entirety of the corridor, and a significant area beyond, can access one or more CoSI within a 60- minute drive. However, only 64% of the corridor can access one or more CoSI within a 60-minute journey via public transport (notable exceptions are settlements along major rail lines for example, Bath). Accessibility by public transport to the north of the of the corridor, particularly around Milton Keynes and more rural areas, are limited, due to a lack of direct radial routes.

Transport interventions should seek to promote public transport in urban areas where it offers a realistic alternative to the private car. In rural areas, where public transport is unlikely to offer similar levels of accessibility, alternative shared mobility solutions should be explored.



Networks – Road

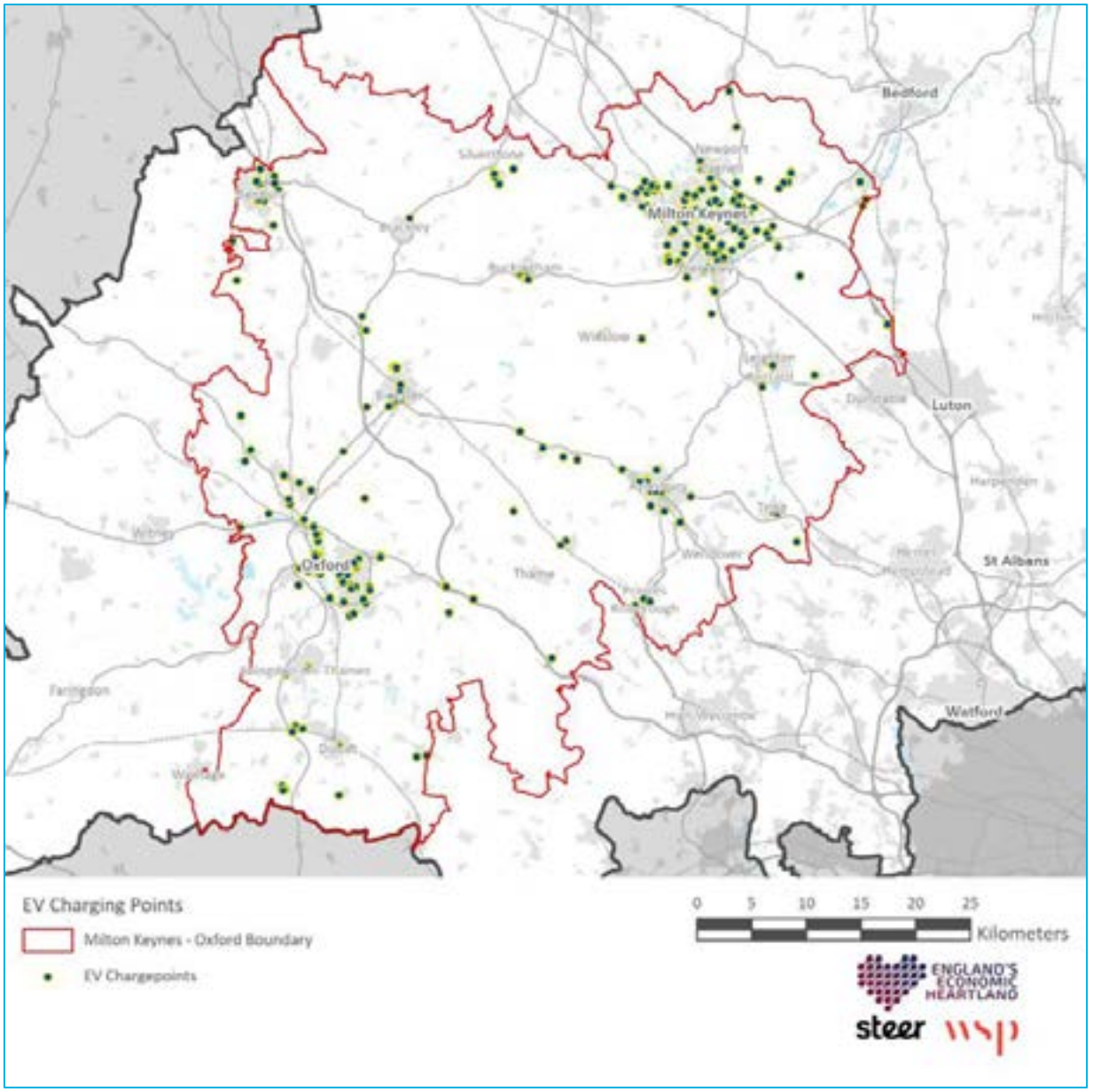
Electric Vehicles & Infrastructure

The transition to Electric Vehicles (EV), combined with a commitment to ban the sale of petrol and diesel cars by 2030, are a key component of the government's plans to decarbonise transport and reach net zero carbon emissions by 2050.

To support this transition, it is vital that there is good public availability of EV Charge Points (EVCP) within the corridor. In total 647 non-residential EVCP's are available for public use across the corridor. The distribution shows a clear urban / rural divide with the majority of EVCP's located in Milton Keynes (378 / 58% of the corridor total). The number of EVCP's in Milton Keynes is the second highest of any settlement in the UK. In rural areas, EVCP's are mostly located in areas of tourism or at strategic employment sites such as Eberton Country park and Millbrook Technology Park.

To help facilitate the transition to EV, transport intentions should consider how EVCP can be best delivered in residential areas where no-off street parking is available and rural less populated areas where EVCP may not be commercially viable. Consideration must also be given to the provision of EVCP for buses and as technology progresses, HGVs.

Data Source: National Charge Point Registry (NCPR) 2021



Travel Patterns & Behaviour

Origin-Destination

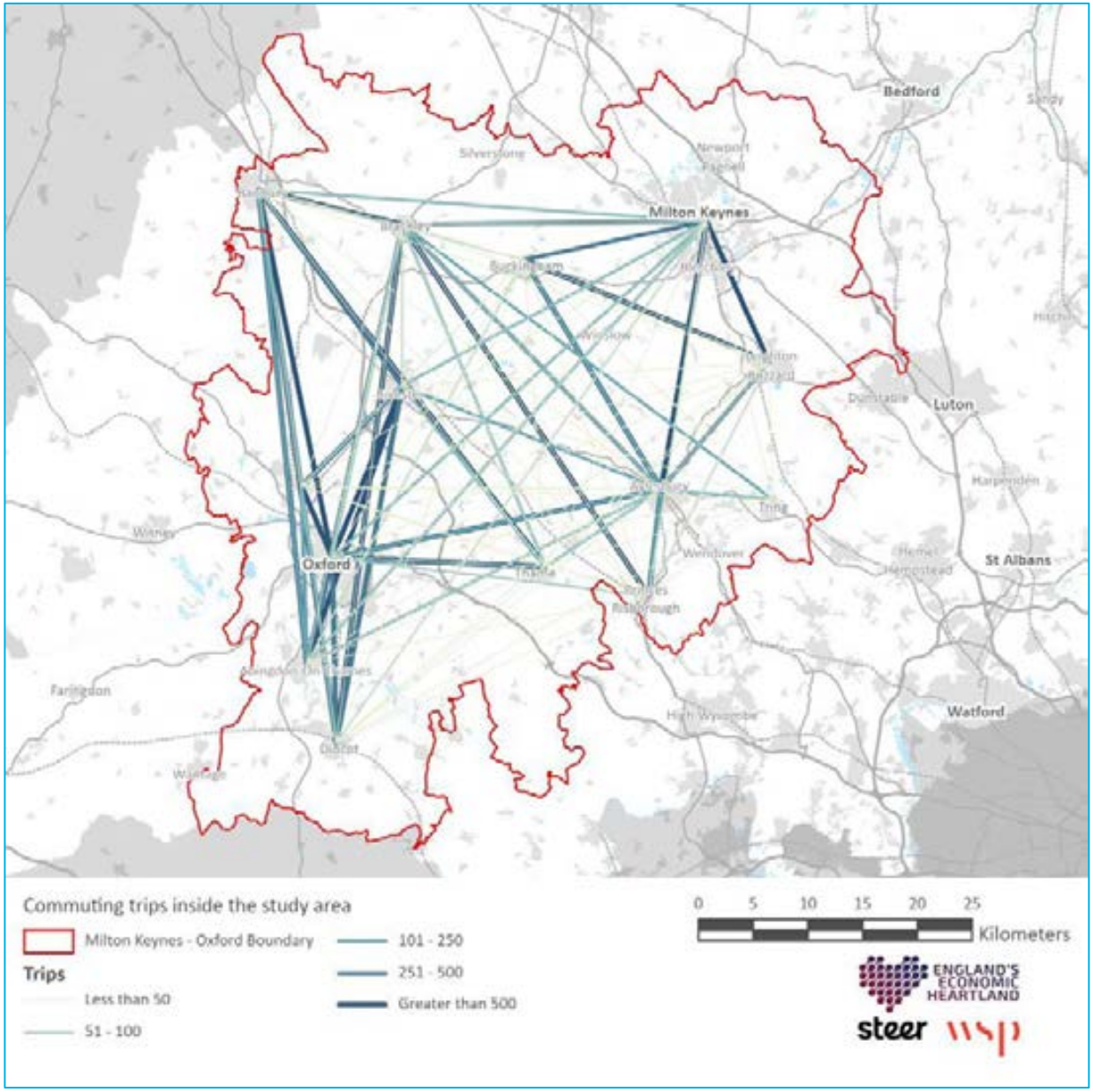
In 2011 there were 279,037 daily commuting movements within the corridor, of these 65% were between the 13 main settlements within the study area. A full origin-destination matrix table is provided on page 51.

The highest flow of commuter trips were recorded between Abingdon and Oxford with a total of 4,617 trips in total. The largest number of internal commuting movements occurs in Milton Keynes (63,877 internal commuter trips – this equates to 23% of all commuter trips in the corridor.)

The largest inter-settlement commuter flows are in a north-south direction and clustered around Didcot, Oxford, Abingdon, Kidlington, Bicester and Banbury. East-west inter-settlement commuter flows are relatively low. This is reflective of the relatively poor east-west rail and road connectivity in the corridor.

The evidence shows that due to the nature of the study area, with substantial rural areas, there is a complex set of movement patterns within the settlements, between settlements and to neighbouring destinations, resulting in a wide range of connectivity needs across the study area and particularly into the main service centres of Oxford and Milton Keynes.

Data Source: 2011 Census – WU03EW Location of Usual Residence and Place of Work by Method of travel to work



Travel Patterns & Behaviour

Origin-Destination Matrix

Data Source: 2011 Census – WU03EW Location of Usual Residence and Place of Work by Method of travel to work

Major Urban Settlements	Abingdon	Aylesbury	Banbury	Bicester	Brackley	Buckingham	Didcot	Kidlington	Leighton Buzzard	Milton Keynes	Oxford	Princes Risborough	Thame	Tring	Rural Areas (corridor exc. major urban settlements)	London	Corridor Total	EEH	EEH exc. corridor	England and Wales exc. EEH
Abingdon	4,902	23	45	73	7	1	371	25	2	23	3,653	5	25	0	3,803	306	12,958	14,149	1,191	825
Aylesbury	31	11,448	56	240	23	46	13	6	160	715	445	314	311	43	7,303	1,899	21,154	25,772	4,618	1,048
Banbury	49	25	12,321	505	393	9	16	40	2	86	1,189	1	8	0	2,665	325	17,309	18,797	1,488	1,501
Bicester	131	171	516	5,252	143	21	50	92	8	185	2,920	14	72	1	3,413	467	12,989	13,836	847	639
Brackley	9	41	649	272	1,826	57	5	7	7	257	271	3	14	0	1,182	141	4,600	5,340	740	390
Buckingham	1	159	29	79	49	433	0	1	8	440	62	7	3	0	971	85	2,242	2,454	212	100
Didcot	779	14	14	45	1	0	2,948	22	0	13	1,444	3	20	0	4,113	391	9,416	10,532	1,116	1,185
Kidlington	90	10	128	200	15	3	29	528	0	10	2,908	1	9	0	786	85	4,717	5,037	320	192
Leighton Buzzard	0	478	14	15	6	11	1	1	5,249	2616	22	6	6	18	1,631	1740	10,074	14,365	4,291	426
Milton Keynes	18	592	92	170	92	189	2	3	751	63,877	192	14	23	8	8,049	4,670	74,072	86,600	12,528	2,712
Oxford	964	208	483	472	43	11	244	321	6	145	40,566	16	91	1	7,506	1,833	51,077	53,644	2,567	2,559
Princes Risborough	6	205	2	6	2	0	1	0	2	31	47	530	36	1	424	417	1,293	2,286	993	196
Thame	25	147	6	29	2	2	14	4	2	11	285	41	467	1	1,031	158	2,067	2,412	345	164
Tring	0	110	2	0	0	1	0	0	12	26	1	1	3	187	551	265	894	1,760	866	67
Rural Areas (corridor exc. major urban settlements)	2,671	6,752	3,935	2,854	978	930	1,331	473	1,270	14,115	16,774	578	1,162	352						
London	97	381	236	104	19	27	47	2	103	1,406	1,411	40	63	18						
Corridor Total	9,676	20,383	18,292	10,212	3,580	1,714	5,025	1,523	7,479	82,550	70,779	1,534	2,250	612						
EEH	12,040	23,082	21,408	10,969	4,608	1,841	5,838	1,633	9,842	104,099	82,650	2,221	2,595	856						
EEH exc. corridor	2,364	2,699	3,116	757	1,028	127	813	110	2,363	21549	11,871	687	345	244						
England and Wales exc. EEH	981	691	3,127	533	413	33	498	54	260	5,565	5,205	125	513	29						

Travel Patterns & Behaviour

Mode Share by Settlements

To understand the effectiveness of transport options within the corridor, it is important to assess the travel mode share of existing residents. This can help gain an understanding of how travel behaviour varies by place and the type of interventions that are needed.

When assessing movements for the major urban areas, it is clear that car driving remains as a dominant form of transportation as 59% of all movements by residents in the key settlements are made by private car.

Public transportation makes up 12% of all commuter movements from key settlements within the study area (8% by bus and 4% by train), with a further 18% using active travel modes (12% walking and 6% cycling). Kidlington and Oxford recorded the highest public transport mode share (19%), with Oxford also recording the highest active travel mode share (35%). Oxford had the most sustainable journey to work mode share with 63% of all journeys to work using sustainable transport options. Pre-Covid, 5% of people worked from home. Further detail on travel patterns and behaviour in corridor is provided in **Appendix D**.

The evidence indicates that the current commuter travel patterns are car dominated and there is therefore potential to encourage modal shift.

Data Source: 2011 Census – QS701EW Method of travel to Work

	Car/Van (Driver)	Car/Van (Pass.)	Bus	Train	Cycling	Walking	Work From Home
Abingdon	11,027 (62%)	824 (5%)	1,474 (8%)	295 (2%)	1,525 (9%)	1,660 (9%)	870 (5%)
Aylesbury	21,885 (65%)	1,883 (6%)	1,425 (4%)	1,250 (4%)	810 (2%)	4,877 (15%)	1,362 (4%)
Banbury	14,140 (60%)	1,518 (6%)	766 (3%)	762 (3%)	847 (4%)	4,671 (20%)	899 (4%)
Bicester	11,444 (66%)	1,080 (6%)	728 (4%)	559 (3%)	777 (4%)	1,931 (11%)	763 (4%)
Brackley	5,263 (74%)	296 (4%)	88 (1%)	89 (1%)	78 (1%)	873 (12%)	418 (6%)
Buckingham	2,170 (69%)	143 (5%)	94 (3%)	74 (2%)	41 (1%)	423 (14%)	185 (6%)
Didcot	9,092 (65%)	722 (5%)	544 (4%)	995 (7%)	645 (5%)	1,498 (11%)	488 (3%)
Kidlington	3,466 (56%)	313 (5%)	1,156 (19%)	40 (1%)	388 (6%)	530 (9%)	297 (5%)
Leighton Buzzard	13,105 (66%)	875 (4%)	322 (2%)	1,835 (9%)	385 (2%)	2,164 (11%)	1,058 (5%)
Milton Keynes	70,377 (66%)	7,332 (4%)	6,717 (6%)	4,683 (4%)	3,334 (3%)	8,665 (8%)	5,005 (5%)
Oxford	24,968 (37%)	2,336 (7%)	11,574 (17%)	1,483 (2%)	11,836 (17%)	11,927 (17%)	4,187 (6%)
Princes Risborough	2,383 (65%)	126 (3%)	92 (2%)	344 (9%)	44 (1%)	399 (11%)	303 (8%)
Tring	1,692 (65%)	117 (5%)	54 (2%)	195 (8%)	31 (1%)	325 (13%)	178 (7%)
Corridor Total	**298,113 (60%)**	**21,933 (4%)**	**28,157 (6%)**	**17,693 (4%)**	**23,374 (5%)**	**46,806 (10%)**	**57,377 (12%)**
EEH Total	**1,433,810 (62%)**	**111,900 (5%)**	**97,426 (4%)**	**117,264 (5%)**	**82,195 (4%)**	**204,767 (9%)**	**257,013 (11%)**
England and Wales Total	**15,264,527 (61%)**	**1,347,280 (5%)**	**1,949,442 (8%)**	**1,371,025 (5%)**	**762,334 (3%)**	**2,846,588 (11%)**	**1,422,708 (6%)**

**England and Wales Total Excludes Metro, Tram and Underground.*

Summary

Theme	Issues & Opportunities
 ROADS	**Issues** • **Car trips -** the evidence indicates that the current commuter travel patterns are car dominated. • **Congestion –** there are pinch points on the major and strategic road network, resulting in increased journey times, lack of journey time reliability, reduced productivity, and knock on environmental and community issues • **HGVs -** freight movements also put increased demands on the major roads of the corridor, with the M1 and A34 have the largest movements of HGVs. **Opportunities** • **Modal Shift -** the most common travel to work distance for the corridor ranges from 6-10km in total, which are achievable distances using active and sustainable modes. • **Connectivity –** the road networks provide good connectivity, with the entirety of the corridor able to access one or more centres of strategic importance within a 60-minute drive. Public transport and active travel interventions need to be considered in order to achieve modal shift and support the decarbonisation of the transport system. The rollout of EV Chargepoints will help to decarbonise the road network. • **Freight Transfer -** promotion of the DRIFT could help facilitate multi-modal rail-road freight journeys and reduce the stress on the M1 and A34 which experience congestion. A long term strategy to decarbonise road base freight transport needs to be developed.
 PUBLIC TRANSPORT	**Issues** • **Bus -** connectivity in rural areas is lacking in service quality and frequency, increasing private car usage. • **Rail -** current rail lines offer limited east-west connectivity whilst and operate a low frequencies. **Opportunities** • **Bus -** higher frequency services, Demand Responsive Service, urban first mile/last mile options could help improve attractiveness from rural areas into key service centres. There are also plans for Mass Rapid Transit solutions within Milton Keynes. • **Rail -** the development of East-West Rail will result in new rail connectivity for the corridor. Electrification of the existing rail network would also help decarbonise the rail network. • **Rural Mobility Hubs** – potential for rural mobility hubs to facilitate movement to higher frequency bus/ rail areas.
 ACTIVE MODES	**Issues** • **Catchments -** opportunities for active travel commuting differ throughout different the study area due to levels of active travel infrastructure as well as commuting distances. **Opportunities** • **Shared mobility -** with the onset of shared mobility scheme trials and e-bikes becoming mainstream, more options for active travel are appearing and increasing potential for modal shift.
 DIGITAL CONNECTIVITY	**Issues** • **Internet speeds –** there are slow download speeds across the corridor, especially in rural areas where download speeds are often less than 25 mb/s. **Opportunities** • **Agile working –** improved internet speeds allow more opportunities for home working, which would reduce dependency on cars throughout the corridor as well as travel at peak periods.

Part 2d

Stakeholder Engagement

Stakeholder Engagement

Steering Group

Two Steering Group Workshops have been held on the study to gain insight into the corridor, the studies Critical Success Factors and infrastructure priorities. A summary of the key findings from the first steering group workshops is provided below.

Key Corridors:

- A40 between Witney and Oxford
- A34 including between the Chilton slips and Bicester and south of Oxford
- A44 through Woodstock
- Oxford-Aylesbury-Milton Keynes (A40/A418/A4146)
- A41 – Bicester to Aylesbury
- Banbury-Heyford-Oxford
- Banbury-Buckingham-Milton Keynes-M1 Junction 13 (A422 and A421)
- A5 Towcester to MK and to M1 Junction 11A

Strategic Trip Attractors:

- **Oxfordshire**: Harwell Campus, Culham Science Centre, Oxford University, Oxford Hospitals, Milton Park, North Oxford Business Park, Cotswold and Saltcross Garden Villages, Park and Ride Sites, Haddenham and Thame train stations;
- **Cherwell**: Heyford Creative City, Bicecter Garden Village, Bicester Heritage Westcott Enterprise Zone, Banbury Castle Quy;
- **A43**: Silverstone and Towcester
- **Milton Keynes**: Central Milton Keynes, Bletchley, Hospital, Coachway, Cranfield Technology Park
- **Aylesbury**: Arla Milk and Woodlands Enterprise Zone

Issues and Opportunities

A summary of the key issues and opportunities under the Transport Strategy principles:

Issues in achieving Principle 1: Net-zero carbon emissions from transport no later than 2050.

- Cherwell – highest carbon emissions per capita
- High car dependency including Buckinghamshire, Central Bedfordshire, A43 corridor, Milton Keynes, West Northants
- Car communing costs lower
- Public transport needs to be cheaper, faster and easier than the car
- High rural population – isolated communities
- Requires behaviour change
- Rail competition between passenger and freight movements
- Lack of digital connectivity in rural areas
- High demand for road based freight movements
- The A421 corridor runs beyond Milton Keynes through J13 of the M1 to Bedford, impacting on 3 authorities.
- J13 of the M1 is recognised as a pinch point.

Opportunities

- More bus priority infrastructure
- More flexible working patterns
- Milton Keynes Redways and MRT
- Shared transport in rural communities
- Hadden to Thame cycle way
- Oxford – low car dependency
- East West Rail
- Zero emission buses
- EV infrastructure provision in Milton Keynes
- Wider rollout of e-scooters
- Bucks-Waddesdon greenway cycle route

Stakeholder Engagement

Issues in achieving Principle 2: Improving quality of life and wellbeing through an inclusive and accessible transport system which emphasises sustainable and active travel.

- Areas of high deprivation in Oxford, Milton Keynes and Aylesbury;
- Poor air quality
- Elderly and ageing population limits active travel
- Poor safety for cyclists
- High propensity to drive
- High cost of public transport
- Car-centric growth already planned
- Lack of cycle parking – central Oxford
- Lack of joined up cycle networks
- Lack of segregated cycle facilities on busy road corridors.

Opportunities

- Demand Responsive Travel (in Milton Keynes and Aylesbury)
- Improve public transport connectivity on the A5 corridor
- High bus mode share in Oxford and Cherwell and rail mode share in Aylesbury Vale and Milton Keynes
- Active travel connections to travel hubs
- Behaviour change programmes
- Healthy place programmes
- East-West Rail
- Shared transport- particularly for younger people living in rural locations
- Step change in mobile digital connectivity;
- More active travel options to smaller stations
- Low Traffic Neighbourhoods
- Mobility Hubs
- Step free access at all stations
- Zero-emission zones
- Micro-mobility take-up
- Improve public transport connectivity to Silverstone.

Issues in achieving Principle 3: Supporting the regional economy by connecting people and businesses to markets and opportunities.

- Poor east-west connections from Oxford to Milton Keynes
- A418 congestion – Aylesbury-Milton Keynes
- A421 Buckingham to Milton Keynes and Aylesbury town centre
- Strategic movements through central Milton Keynes
- Access to Cranfield University
- Out of town retail parks
- Poor public transport access to Buckinghamshire economic assets
- A34 freight route
- Silverstone poorly served;

Opportunities

- Multi-modal ticketing
- Remote working
- Nationally important economic clusters that are growing
- Good radial rail links
- Employment growth in Bicester and Milton Keynes
- East-west rail
- Attractor sites to include mobility hubs
- Demand Responsive Transport to access jobs in town centres
- Business hubs and key transport hubs
- Innovation and live lab trials
- Links to Luton airport
- Local neighbourhood flexible workspaces
- Full gigabit connectivity rollout
- Motorsport triangle – Banbury-Silverstone-Brackley
- New park and ride sites
- Car share, car club and EV infrastructure expansion
- E-cargo deliveries
- Mass rapid transit for the largest economic hubs

Stakeholder Engagement

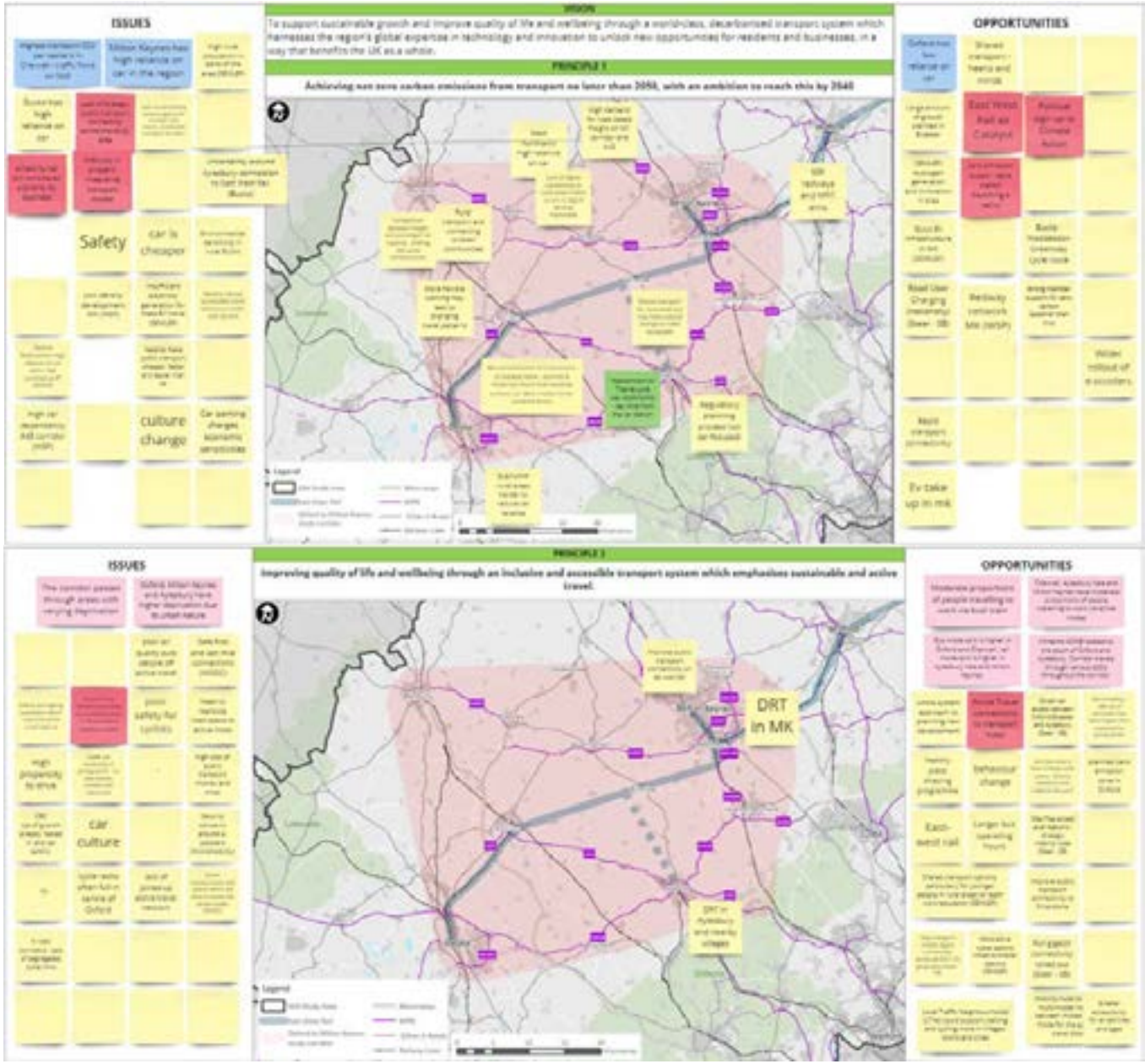
Data Source: Steering Group 1 Miroboard

Issues in achieving Principle 4: Ensuring the Heartland works for the UK by ensuring the efficient movement of people and good through the region and to international gateways.

- High HGV movements on the A34, M40 Junction 9 and Junction 10
- East-west rail and HS2 construction impacts
- Increased home delivery movements
- Rail investment focused on passengers
- HS2 passing through but not directly serving the region
- Poor network resilience/diversion routes

Opportunities

- Rail freight – Bicester-Aylesbury-London, Southampton-Oxford-Midlands
- Western rail access to Heathrow
- Hydrogen fuel development
- Location of distribution hubs
- East-west rail freight potential
- Cranfield Air park development
- Mobility Hubs/Park and Ride
- East-West Rail/HS2 crossover
- Distribution hubs in Milton Keynes and Bicester
- Rail Freight interchanges planned Sundon and Northampton
- Road user charging
- Sort of rail freight at source – ports.
- Freight consolidation centres.



Stakeholder Engagement

Stakeholder Group

A Stakeholder Workshop has been held on the study to gain insight into key issues and opportunities the study needs to address. A summary of the key findings under the Transport Strategy principles:

Issues in achieving Principle 1: Net-zero carbon emissions from transport no later than 2050.

- Railway electrification
- Need efficient road routes but Expressway cancelled;
- Radial rail routes
- Conflicts between commuting and freight traffic
- Introduction of EV charging infrastructure in sensitive areas
- Poor public transport access to areas north and east of Oxford
- Diesel fuelled HGV's

Opportunities

- Autonomous on-demand electric transport;
- Connectivity that encourages modal shift
- Best practice guidance for freight operators
- Better digital connectivity
- 5G availability on public transport
- Carbon capture through greening and biodiversity net-gain
- Inter-modal freight hubs, EV delivery vehicles – Bicester and Marston Vale

Issues in achieving Principle 2: Improving quality of life and wellbeing through an inclusive and accessible transport system which emphasises sustainable and active travel.

- Demographic of rural communities – ability to use active travel modes
- Poor links between East-West Rail and north-south routes
- Interchange anxiety
- Co-ordination of rural bus services with new rail infrastructure

Opportunities

- Remote surveillance of assets to avoid the need to travel
- Better data to plan efficient journeys
- Facilities on board trains for cycle carriage
- Improved digital connectivity
- Incentives to walk
- Improve access to green spaces
- Park and Ride for freight
- Rail electrification
- Parkway stations at Winslow, Aylesbury Vale

Issues in achieving Principle 3: Supporting the regional economy by connecting people and businesses to markets and opportunities.

- Digital access to active travel information
- Poor historic connectivity on Bedford-Bletchley services to Midland Main Line and West Coast Main Line
- **Opportunities**
- Co-ordinated last-mile goods transport to minimise load on the transport system
- Reliable train connections
- HGV driver shortages
- Delivery of East-West Rail
- Rail connection between Aylesbury and Oxford
- East-West rail to have freight paths and link to Felixstowe and Southampton
- Starship home delivery roll-out
- Rail-connected warehousing
- Parkway stations
- Re-allocated road space to restaurants/cafes

Stakeholder Engagement

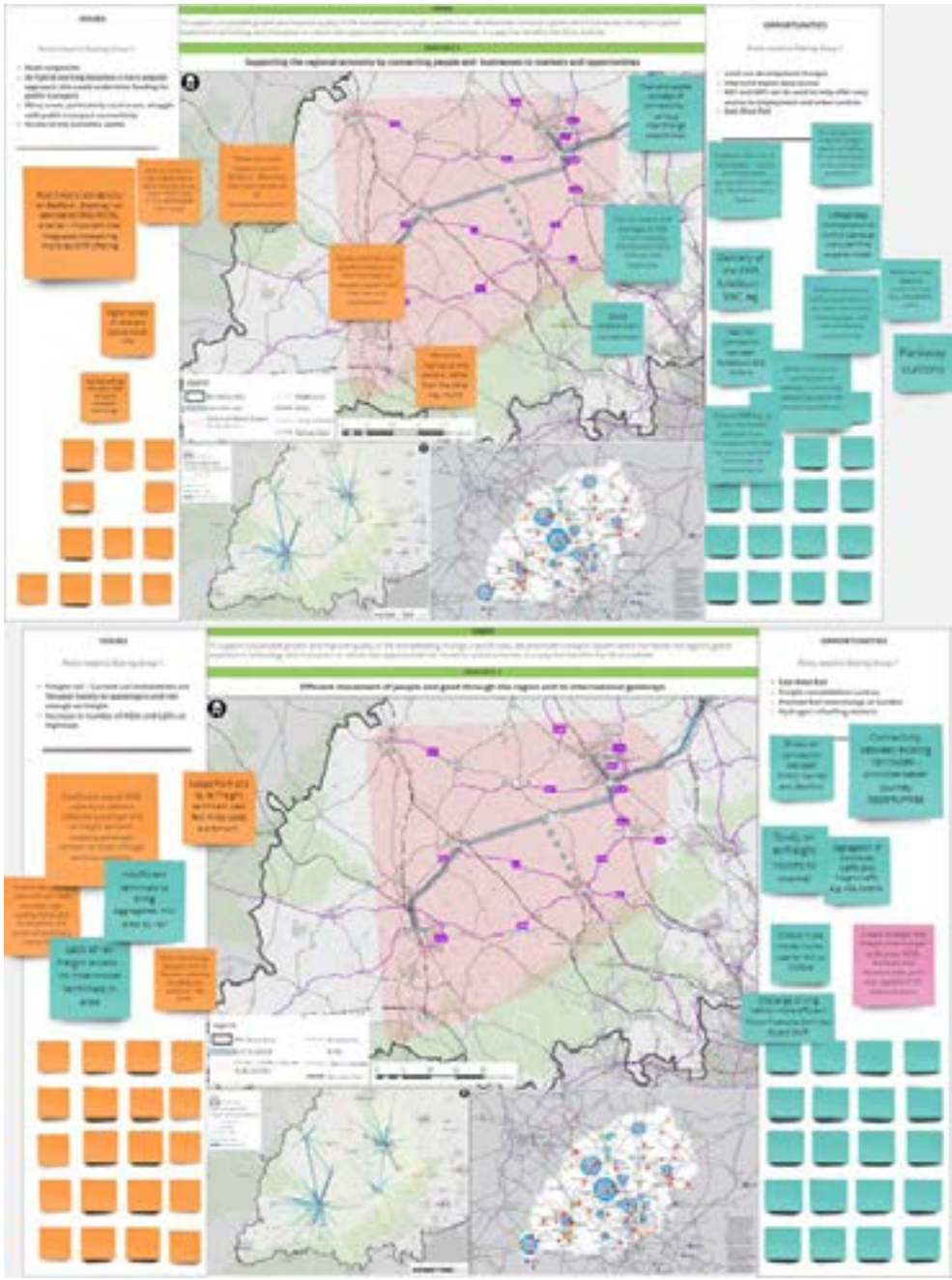
Data Source: Stakeholder Group 1 Miroboard

Issues in achieving Principle 4: Ensuring the Heartland works for the UK by ensuring the efficient movement of people and good through the region and to international gateways.

- East-West rail provides insufficient capacity to address the collective passenger and rail freight travel demands
- Access from district centres to rail freight terminals
- Lack of rail freight intermodal terminals
- Poor rail interchange between Bicester stations will impact Milton Keynes to Banbury movements on East West Rail.

Opportunities

- Direct rail connection between Milton Keynes and Bedford;
- Better connectivity to existing rail routes
- Segregate HGV and commuter traffic on the A34
- Need strategic rail freight interchanges at Bicester, Marston Vale, Appleford.



Call for Evidence

Call for Evidence

A Call for Evidence was held in June 2021 for the Oxford – Milton Keynes corridor study area. The call for evidence was made public on the EEH website and promoted amongst stakeholders with an interest in the study but not involved in either the steering or stakeholder groups.

This opportunity allowed external organisations to outline key issues in the study area and identify potential interventions. Stakeholders were asked to responded to four unique questions surrounding the study area.

It should be noted that more responses were received from Oxfordshire and those in the Buckingham area. This may have impacted the prevalence of location specific interventions suggested during the call for evidence.

A summary of the responses to these questions is provided below. A full, more detailed, list of interventions identified by respondents as a part of the call for evidence will be included in the long list of options.

Question 1: Key Themes

What are the over-arching themes the connectivity study should look to consider when developing a package?

- Active Travel infrastructure / Provision
- Decarbonisation of the transportation System.
- All forms of Public transportation
- Environmental Protection
- Accessibility
- Digital Connectivity

There is a clear trend of interest towards sustainable travel within the corridor, with active travel, decarbonisation, public transport being the most important and popular points mentioned in the call for evidence.

Question 2: Key Movements

Based on your experience, what are the key journeys being made in the study area?

- Linking villages and outlying settlements to local towns or cities
- Local connectivity for villages and market towns.
- Journeys linking centres and communities to each other for services and employment,
- Freight Movements from Felixstowe, Southampton and London Gateway towards Bicester International Freight Terminal.
- First mile last mile/ local connectivity within towns and cities

The most highly mentioned specific movements were:

- Oxford – Milton Keynes
- Buckingham to Milton Keynes (with specific reference to the A421)
- Bicester – Didcot
- Aylesbury – Bicester

Responses also referenced COVID-19, stating that it had led to an increased need to access services digitally (rather than physically) which was challenging in some areas / for some sections of the population.

Call for Evidence

Question 3: Opportunities and Challenges

What are the key connectivity opportunities and challenges in the study area?

Opportunities

- Making best use of East West Rail (EWR), including electrification and external connections to other settlements.
- Sustainable access to EWR stations.
- Improved connections to existing rail stations.
- Investment in the road network (specifically at pinch points).
- Upgrading Road system to withstand forecasted traffic demand and Agricultural and HGV traffic.
- Integration of active travel and public transportation

Challenges

- Funding
- The corridor is to reliant upon private cars. A culture change may be needed to reduce overall car dependency.
- Integrating land use planning and transport.
- Future growth may increase congestion at pinch points, notably on major roads such as the A421 and A34.
- Restoring public confidence in public transport following a reduction in usage due to the COVID-19 Pandemic.

Challenges and opportunities for the freight industry were also noted by respondents, including a request for 'blue sky thinking' in relation to rail freight opportunities.

Question 4: Interventions

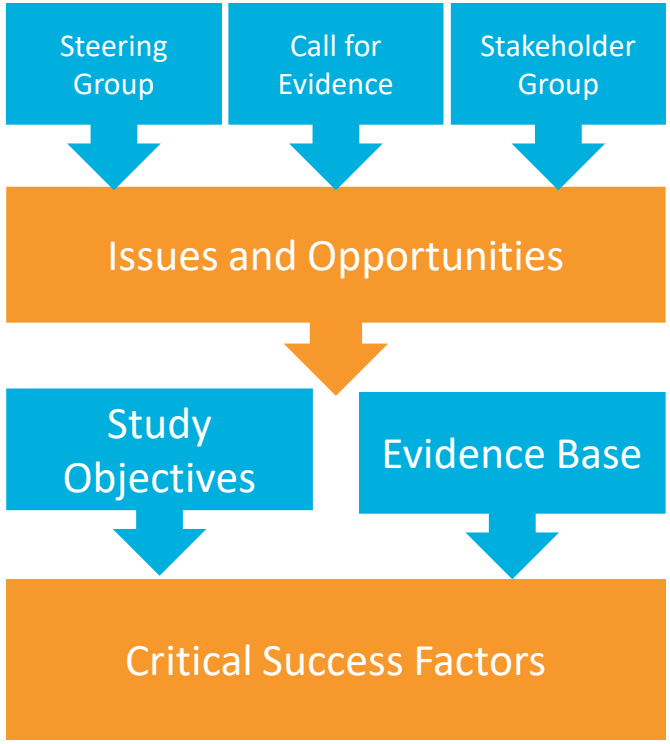
What interventions do you think the study should consider?

The interventions identified by respondents focus on improvements to public and active transport and promotion of multi-modal journeys. A summary of the key themes and high level interventions identified by respondents is provided below.

- Completion of all parts of the East West rail project, including the Aylesbury Spur.
- Improvements to digital connectivity speeds and access, notably in rural areas
- Improved public transport services along with reduced costs.
- Better connectivity of Public transport (notably busses) in Buckingham.
- Improved bus connectivity within urban areas with bus lanes and improved integration between bus/ active travel access to rail stations.
- Implementation of segregated active travel infrastructure in areas of Buckingham, North Oxfordshire and South Northamptonshire.
- Sustainable access to stations.
- Improved electric vehicle charging provision for urban areas.
- Investment in the A421.
- Improvements to the A41.

Summary

The feedback received from the Steering Groups, Stakeholder workshops and Call for Evidence have been used to gain an understanding of the connectivity issues and opportunities within the study area which has helped inform the development of the evidence base, which has in turn informed the development of the study objectives and critical success factors (Part 4 Need for Intervention).



EEH Principle	Issues Summary	Opportunities Summary
Achieving Net Zero	• High car dependency • Lack of public transport infrastructure • Lack of rural digital connectivity • Competing rail passenger/freight demands • Diesel fuelled HGV's	• Zero emission vehicles • Behaviour change • E-scooter roll-out • Bus priority • East-west rail
Sustainable and active travel	• Cyclist safety • Poor quality infrastructure including connectivity and segregation • Car-centric developments • Poor air quality	• Demand Responsive Transport • Active Travel integration with East-West Rail • Shared transport options • First Mile Last Mile connectivity with Mobility Hubs
Connecting people and businesses to opportunities	• Pinch point road congestion • Strategic movements through central MK • Hybrid working threatens public transport viability • Rural public transport connectivity • Access to key economic assets – e.g. Cranfield • A34, A418 and A421	• Land-use planning • Improved digital access • Demand Responsive Transport and Mass Rapid Transit • East-West Rail • Mobility Hubs • Park and Ride sites • E-cargo bike deliveries
Efficient Movement of People and Goods	• Rail freight – competition between passengers and freight • Increasing numbers of HGV's and LGV's including home deliveries	• East-West Rail – people and freight • Freight consolidation centres • Rail freight interchanges – Sundon • Hydrogen fuelling

Part 2e
Summary

Summary Findings

People

The evidence provided in this section has demonstrated that the study area is socially diverse; therefore, transport investment has a key role to play in delivering an attractive and inclusive transport network that enables all residents to access the wide range of jobs, services and amenities provided within the study area as well as improving residents physical and mental health through increased active travel and reduced social isolation and loneliness.

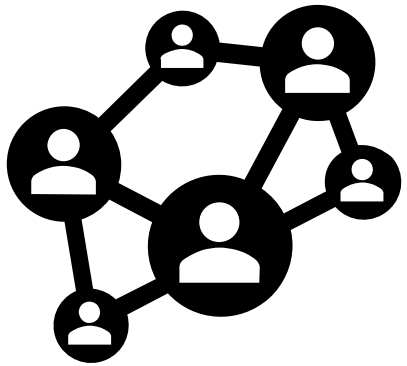
Place

The evidence presented in this section has demonstrated that there is a need to preserve and enhance the quality of the local environment and support the existing diverse economy through enhanced connectivity to ensure the study area remains an attractive place to live and work for existing and future residents.

Investment in connectivity throughout the study area has a key role to play in enhancing the local environment, town centres and the economy by achieving modal shift and inclusive access to jobs and services.

Reducing the study areas transport system emissions will help support achievement of the local, regional and national commitment to be net zero by 2050.

Connectivity



The evidence presented in this section has demonstrated that there is a lack of attractive east-west public transport connectivity between the main settlements. Existing travel patterns are car dominated, resulting in congestion at a number of pinch points which negatively impact the local environment and economy.

Investment in a comprehensive and connected multi-modal transport network through the corridor, incorporating shared mobility services supporting longer journeys undertaken by public transport modes, will enable modal shift for existing inter-urban and intra-urban movements, as well as opening up new journey opportunities for existing residents across the full length of the corridor.

Sub area profiles

Combining observations from the previous analysis has helped us to identify five distinct sub-areas, each with their own place quality, challenges and opportunities:

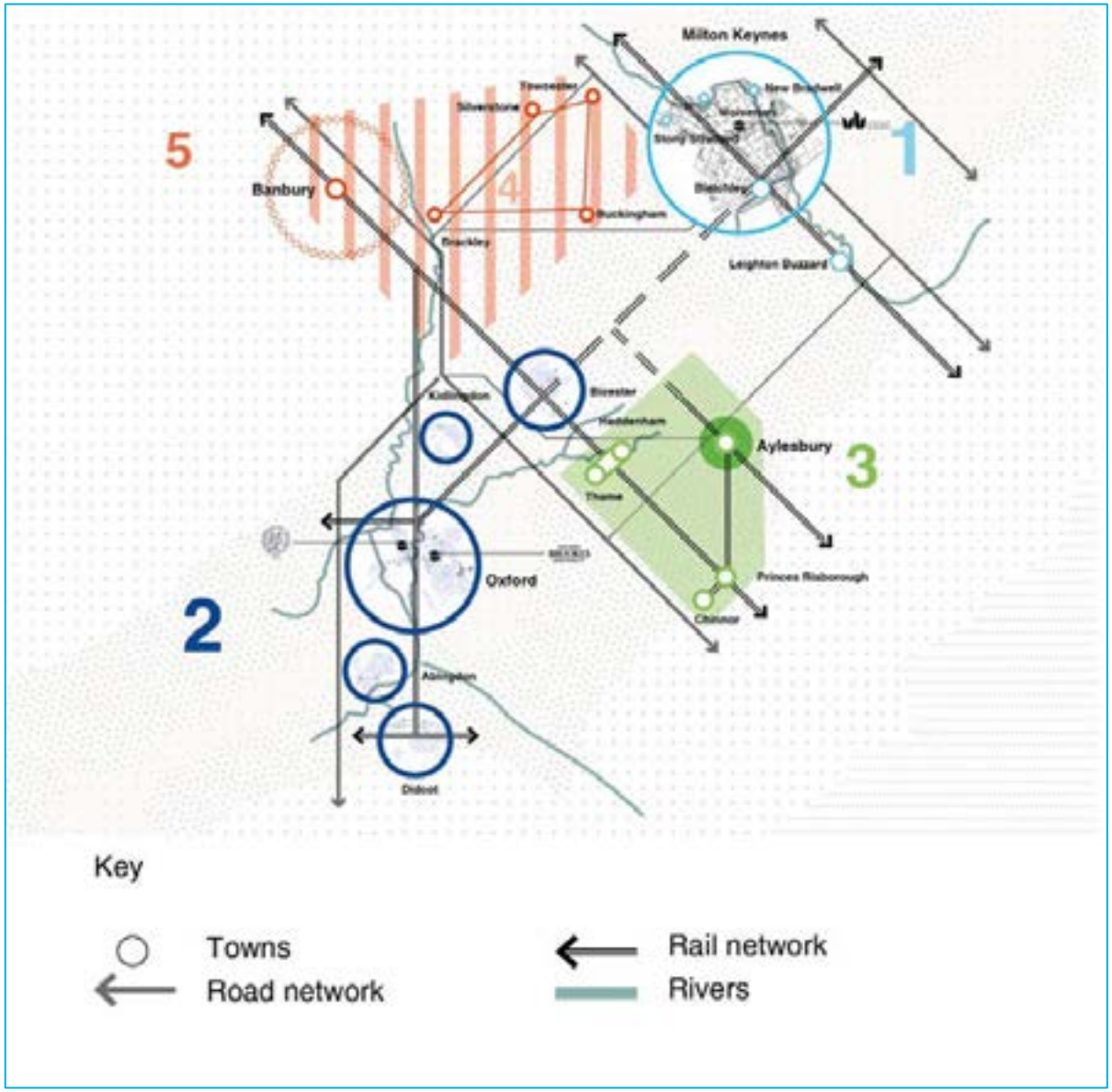
1 Milton Keynes - a highly self-contained settlement, with a strong, mostly landscape and infrastructure derived sense of place, but challenges associated with it low density, zonal planning and the legacy of car-oriented development forms, but plenty of scope for intensification, growth and the retrofit of the grid roads to support public transport.

2 Central Oxfordshire Corridor - A collection of linked settlements in the Oxfordshire Knowledge spine, with particular challenges around ensuring that this network of settlements and out-of-town employment locations can work effectively together in transport terms.

3 Aylesbury Vale - Scattered stand-alone settlements in a rural hinterland, with relatively poor interconnectivity or links to other major settlements within the study area, with some orientation to London but also towards Milton Keynes, Bicester and Oxford.

4 Brackley-Buckingham-Silverstone Triangle - a collection of dispersed smaller towns and visitor destinations in a rural hinterland, that are difficult to serve by public transport.

5 Banbury - a self contained market town, well linked to national networks within a wider, relatively sparsely populated rural hinterland.



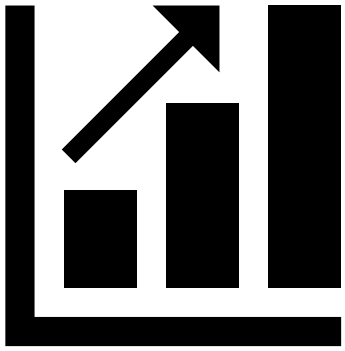
Part 3
Future Context

Overview

Background

The purpose of this chapter is to set out the scale of the growth challenge and an understanding of the committed transport improvements schemes within the core study area. It will also set out the potential implications of planned growth if transport interventions are not provided that address the existing car dependent travel behaviour issues identified in Part 2, that will undermine the ability for the study area to provide long-term sustainable housing and economic growth that delivers EEH's ambition for the future.

Growth Challenge



Significant levels of housing and employment growth are forecast in the study area. This is expected to result in a substantial increase in the residential population, number jobs and demand for travel within the study area. The evidence presented in this section will be used to identify interventions that can support planned growth and the ambitions of the study area.

Covid-19

The undesirable arrival of a shock event, such as the recent Covid-19 Pandemic, has required a fundamental shift in how society and business functions to advance through a difficult period of uncertainty. Under the resulting lockdowns, some mobility trends have accelerated (for example: working from home; active travel; increased freight and more local deliveries) whilst others have been paused or moved in the other direction. Whilst some of these trends will be short lived, such a fundamental pause in everyday life will undoubtedly lead to some longstanding lifestyle changes in behaviour which are discussed.

Future Growth Sites

Residential Sites

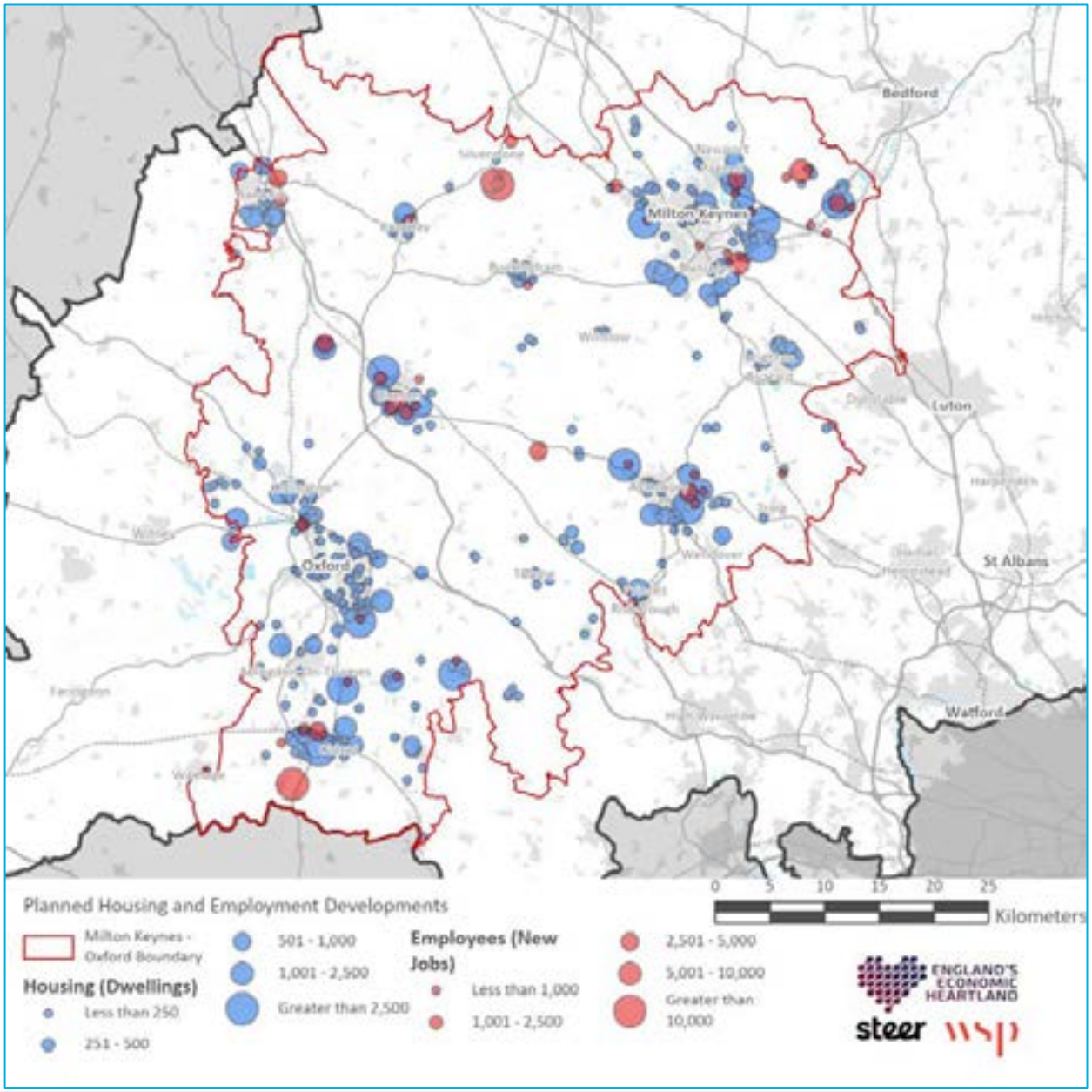
A total of 348 residential developments around the corridor are planned to be constructed by 2031, with a total increase of 140,830 dwellings. The largest residential developments are planned on the outskirts of Milton Keynes and Oxford, and in South Oxon and the Vale of White Horse south of Oxford. This provides challenges in delivering attractive sustainable transport connectivity to service centres, rail stations and employment centres.

The largest planned residential development is the Milton Keyes Western Expansion, providing 6,079 dwellings in total. Other notable areas of high development are taking place surrounding Oxford, Aylesbury, Didcot and Bicester.

Employment Sites

A total of 50 planned employment sites have been identified with a total floor space of more than 1,300 hectares. The largest of the employment developments can be found within and surrounding Milton Keynes. The most notable developments include: Cranfield Technology Park (600ha), Milton Keynes East developments (105ha) as well as areas surrounding Silverstone. **To support planned growth, transport interventions will need to connect existing and new development sites.**

Data Source: EEH Databank



Population Growth

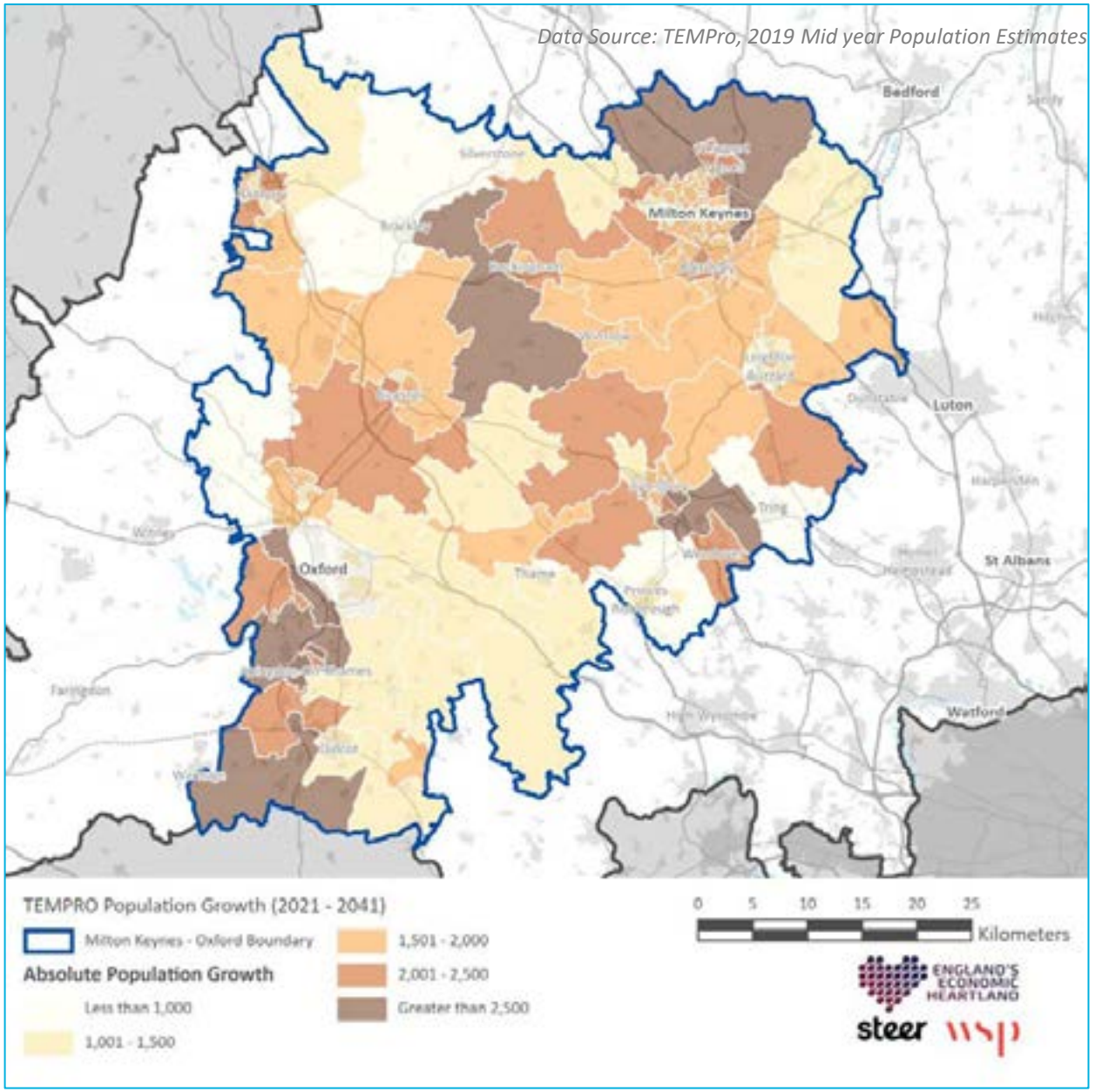
TEMPro Forecasts

Population estimates for 2041, highlight an expected growth of 214,981 residents within the study. This equates to a 19% growth in population over the next 20 years. This is slightly higher than the growth forecast across the EEH region as a whole (15%) and significantly higher than the growth forecast across England and Wales as a whole (10%).

The distribution of growth differs throughout the corridor, with some areas forecast to grow faster than others. The largest levels of growth are forecast to occur in the MSOAs located on the outskirts of the major settlements.

The most notable area of growth is found in the area North of Milton Keynes, which comprises the developments at Cranfield and Milton Keynes East. The presence of large residential developments also coincides with areas experiencing large population growth. Within Oxford itself, Tring and Princes Risborough little population growth is forecasted.

The planned increases in population will result in additional intra-urban and inter-urban travel demands that will put further pressure on the existing transport networks.



Population growth forecasts are based on information extracted from the National Trip End Model (NTEM). This was last updated in 2017 and may not reflect the location of all strategic growth sites.

Transport Improvement Schemes

Data Source: Local Authority Major Transport Schemes, Highways England RIS 2 Schemes and Network Rail 's 2019-2024 Delivery Plan

In response to the transport issues on the core study area's existing transport networks, and to support planned housing and employment growth, a number of strategic transport improvement schemes are currently being delivered. This includes:

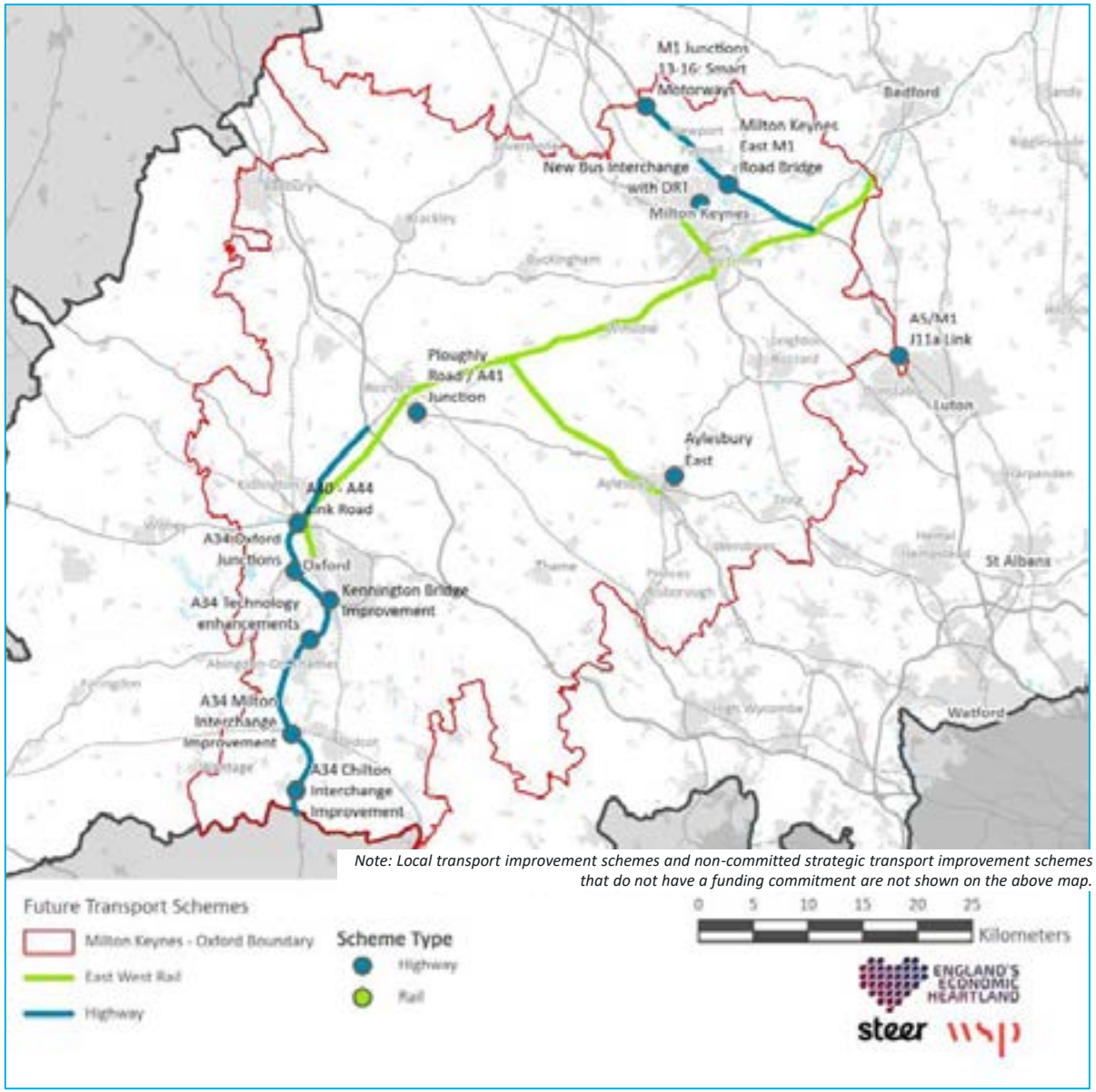
East–West Rail: expected to complete in 2024 (Phase 1) and will allow for direct rail connections between Oxford and Milton Keynes, along with potential access from Aylesbury.

A34 Improvement Project: Highways England are exploring opportunities to reduce congestion on the A34 between the M4 and M40. Their immediate focus is understanding how the A34 and the local roads interact in order to explore potential improvements.

South East Aylesbury Link Road: Phases 1 and 2 of the project will provide a new dual carriageway from the A413 Wendover Road westward to the connection with the Stoke Mandeville Relief Road. The link road will help draw traffic away from the town centre. There are ambitions for this to connect with new western and eastern relief roads to provide a circular relief road around all of Aylesbury.

M1 Smart Motorway Scheme: Junctions 13-16. Hard shoulders are being converted into a fourth lane, new electronic signs, CCTV cameras and noise barriers are being implemented as part of the scheme.

There is a focus on road improvement schemes. To address EEH's strategic priorities a greater focus on promoting new sustainable transport infrastructure such as public transport or active travel developments will be required



Note: Local transport improvement schemes and non-committed strategic transport improvement schemes that do not have a funding commitment are not shown on the above map.

Covid-19 Recovery

The undesirable arrival of a shock event, such as the recent Covid-19 Pandemic, has required a fundamental shift in how society and business functions to advance through a difficult period of uncertainty. Under the resulting lockdowns, some mobility trends have accelerated (for example: working from home; active travel; increased freight and more local deliveries) whilst others have been paused or moved in the other direction.

National Response

In combating the spread of COVID-19, the UK government has taken a number of significant actions that have placed restrictions on individuals, areas and the wider economy. Whilst these restrictions have caused very significant disruption to people's lives, they have also resulted in changes of behaviour which, if continued, could help to resolve some transport-related issues.

The organisational and business actions are a snapshot of those taken by individual organisations and whole industries to cope with the ongoing pandemic and its impacts on how organisations operate:

- Investing in IT systems to support remote working
- Expansion of capacity of home delivery services
- Contactless payment preference
- Community groups to help with local capacity
- Bus services reduced in medium to long term
- Reduced local services due to closing down

Attitudes to Public Transport

Due to the increased physical interaction required by public transport, there has been reluctance to return to bus and rail use. Transport Focus's latest research from September 2021 found:

- 86% of train passengers feel safe in relation to COVID-19; however only 62% of non-rail passengers would feel safe if they had to make a rail journey.
- 83% of bus passengers feel safe in relation to COVID-19; however only 54% of non-bus passengers would feel safe if they had to make a rail journey.

The safety concerns expressed by non-rail and bus users is likely to be a significant barrier to encouraging mode shift and encouraging greater use of public transport. Careful consideration will need to be given to how public attitudes on the safety of travelling by rail and bus can be improved.

Work From Home

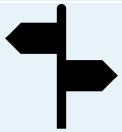
The biggest impact of Covid-19 has been the increased usage and attractiveness for work from home (WFH) behaviours. A total of 40% of all adults began working from home at the start of the first lockdown. The DfT's "All Change?" document has outlined the reluctancy of many workers returning to the office on a regular daily basis.

Several large companies have established policies outlining future WFH patterns that can be allowed for employees in the future. British Airways, BP, and Nationwide have outlined that WFH will become an accepted practice for at least a few days a week. As more and more companies and organisation embrace the use of WFH on a full or part-time basis, it is likely that the amount of total commuting in the corridor will fall. WFH will have several impacts on the future of transport and developments:

- Significantly reduced greenhouse gas emissions from reduction in commuting. COVID-19 lockdown led to a 42% reduction in Nitrogen Dioxide levels.[1]
- Changes to the way offices are structured, Savills found that office vacancy rate increased from 4.9% to 8.4% from early 2020 to 2021.

[1] Lee, J. D., Drysdale, W. S., Finch, D. P., Wilde, S. E., Palmer, P. I. (2020) UK surface NO2 levels dropped by 42% during the COVID19 lockdown: impact on surface O3. Atmospheric Chemestry and Physics Discissions. [Online]. Available at: https://acp.copernicus.org/preprints/acp-2020-838/acp-2020-838.pdf [Accessed 1 August 2021].

Summary

Theme	Issues & Opportunities
 **FUTURE GROWTH**	**Issues** • **Growth –** significant levels of housing and employment growth are forecast in the study area. This is expected to result in a substantial increase in the residential population, number jobs and demand for travel within the study area. Interventions will need to support planned growth and the ambitions of the study area. **Opportunities** • **Networks -** investment in a comprehensive and connected multi-modal transport network to support long-term sustainable economic growth supporting local, regional and national objectives.
 **TRANSPORT SCHEMES**	**Issues** • **Demand -** the planned increases in population will result in additional intra-urban and inter-urban travel demands that will put further pressure on the existing transport networks. **Opportunities** • **Planned Schemes -** investment in a comprehensive and connected multi-modal transport network to support long-term sustainable economic growth supporting local, regional and national objectives.
 **COVID-19**	**Issues** • **Demand for public transport -** the initial transport impact of COVID-19 was a significant reduction in transport demand with public transport trips being worse hit than other modes. Car trips have recovered somewhat, but public transport trips remain low. **Opportunities** • **Working from home -** enforced working from home as a result of Covid-19 has resulted in a significant reduction in the need for travel. This has had a temporary positive impact on carbon emissions of transport, but there is an opportunity to embed these behaviours and lock in the positive impacts.

Part 4

Need for Intervention

SWOC Analysis

A summary of the highlighted strengths, weaknesses, opportunities and challenges for the study area are provided below. As highlighted significant challenges are faced 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.

Strengths

- The study area is home to over 1 million people and is generally growing, resulting in a substantial 'addressable market' that will directly benefit from enhanced intra-urban and inter-urban connectivity.
- The corridor is characterised by a highly skilled workforce in the areas of innovation and technology. Transport investment will enable employers to better attract and retain the right skills needed to drive economic growth.
- Large service centres of Oxford and Milton Keynes provide substantial opportunities for increasing active and sustainable travel along with connectivity to their surrounding hinterlands.
- In total 647 non-residential EVCP's are available for public use across the corridor. Shared-mobility services are also being trialled across the corridor, all of which provide a good foundation for future-ready transport interventions.

Weaknesses

- The existing population is predominately located in a series of large and medium-sized cities / towns dispersed across the corridor creating unique and complex connectivity issues.
- 20% of the corridor is protected for ecological / heritage reasons and many of the waterways within the corridor pose a potential flood risk. The diverse environmental constraints may impact upon the deliverability of interventions.
- Current rail lines do not offer east-west connectivity, and buses in rural areas lack service quality and frequency, reducing the attractiveness of public transport and increasing private car usage across the corridor.
- There are congestion and safety hot spots across the network as a result of high levels of car dependence, particularly in more rural areas of the study area.

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.
- 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.
- The most common travel to work distance for the corridor ranges from 6-10km, which are realistic distances using bicycles and public transport modes thereby representing an opportunity to encourage modal shift.
- The development of East-West Rail will provide new rail connectivity for the corridor. Potential electrification of the railway lines in the corridor would help promote sustainable decarbonised transport.

Challenges

- The study area includes a wide range of geodemographics, each of which demonstrate different desirable characteristics of mobility which packages of multi-modal transport interventions need to appeal to.
- Car travel within the corridor combined with the vehicles on the Strategic Road Network passing through the corridor, 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 to the north of the of the corridor, particularly around Milton Keynes, and more rural areas is challenging, resulting in high car dependency.
- Unprecedented levels of growth will result in substantial increases in population, jobs and travel demand, threatening the quality of the local environment, levels of sustainable travel and the quality of place.

Objectives

The evidence base and issues and opportunities identified at Steering Group 1 have been used to establish 19 draft objectives for the connectivity study. These are centred around the four strategic principles of the connectivity study.

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

Critical Success Factors

To help shape the development of this Connectivity Study and the development of a long list of transport interventions for the corridor, **ten critical success factors have been identified**.

They have been developed to provide:

- an articulation of the **need for intervention**;
- specificity around the **outcomes that need to be achieved** through each Connectivity Study without defining what interventions are required for achieving those outcomes;
- the "**missing step**" between issues and opportunities and option development; and
- a **basis for the multi-criteria assessment framework** that will be used to assess the long list of transport interventions.

The Critical Success Factors are drawn from:

- The Evidence Base (this report)
- The Call for Evidence
- Previous Steering Group inputs; and
- 1st Stakeholder workshop inputs.

The critical success factors are focused around the **three themes** listed opposite.

The following pages provide a more detailed overview of the challenges associated with each Critical Success Factors.

Global Issues

- *Improved digital infrastructure reduces the need to travel*
- *The carbon emissions of transport are reduced to net zero*
- *Improved public transport connectivity enables planned development growth to be delivered sustainably*
- *The benefits of new technologies are accessible to everybody.*
- *The area's towns, cities and rural communities are well connected by improved east/west transport corridors*

Active Travel

- *Active travel mode share within and between our towns and cities increases*

Public Transport and Shared Mobility

- *There is a step change in public transport connectivity within our urban areas*
- *A high quality, sustainable, transport network connects people into the corridor's strategic economic assets*
- *Rural communities and market towns are well connected to the public transport network*
- *The benefits of East West Rail are maximised and widely distributed*
- *East West Rail is fully integrated with the local public transport network with stations developed to facilitate onward public transport connections*

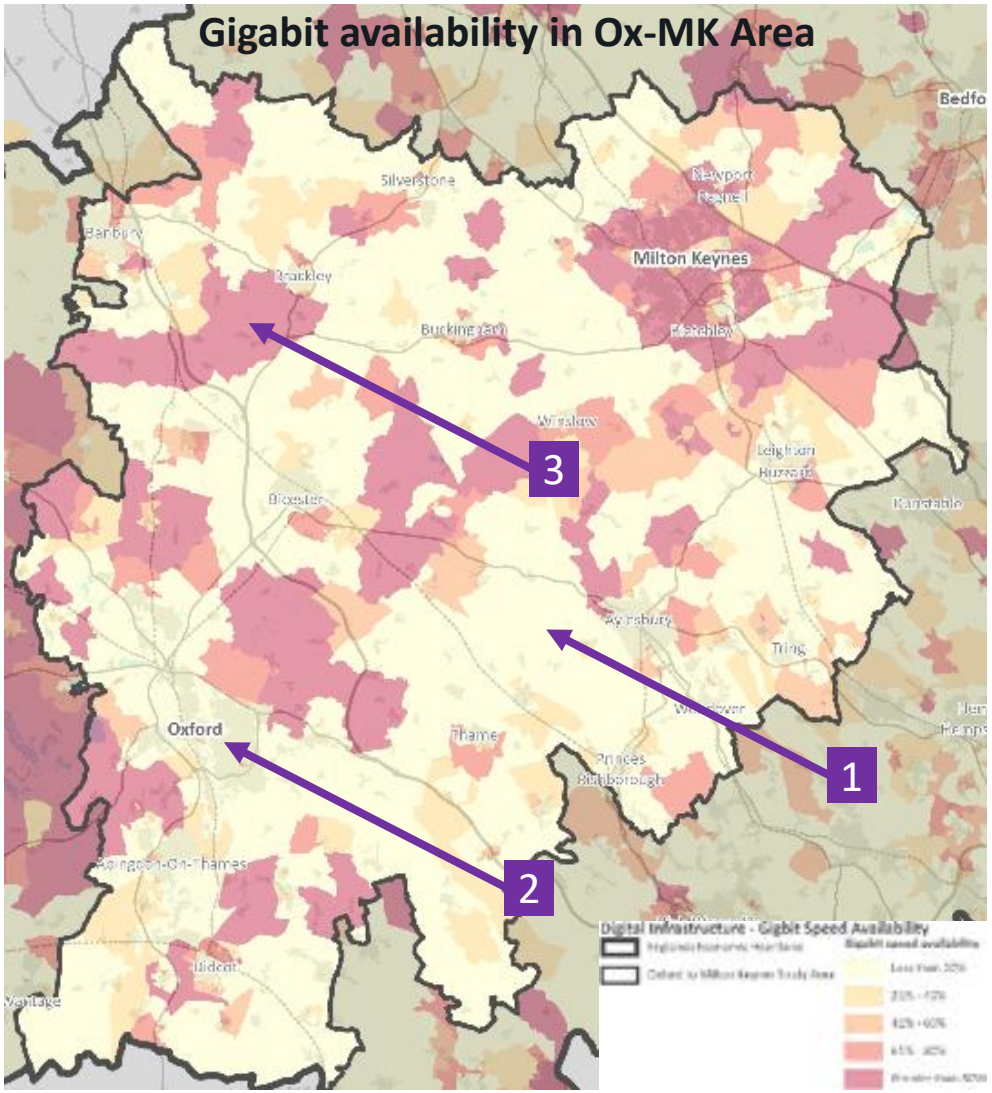
1 Improved digital infrastructure reduces the need to travel

The impact of Covid-19 has increased attractiveness for working from home behaviours, increased usage of e-commerce facilities and increased communications via digital platforms, highlighting the importance of access of superfast and ultrafast broadband.

The DfT's "All Change?" document has outlined the reluctancy of many workers returning to the office on a regular daily basis; therefore, several large companies have established policies outlining future working from home patterns that can be allowed for employees in the future, thus increasing pressures on digital infrastructure.

The evidence demonstrates that gigabit provision across the corridor is not uniform, with significant parts of the corridor with less than 20% of the population having gigabit speed availability (1). Many of these areas are located in urban environments - particularly in Oxford, but also parts of other key settlements (2). Alternatively, areas with a high proportion of populations with access to gigabit speed include several rural / semi-rural areas (3).

Improved digital infrastructure has the potential to reduce demand for transport but also support new transport technologies; therefore, there is a need to future-proof digital infrastructure across the corridor. In the short-term, targeted improvements in rural areas should be made to bring connectivity to a good baseline, whilst medium / long-term solutions should focus upon bringing all infrastructure up to a gigabit standard.



Challenge – Evidence indicates that access to digital infrastructure is variable across the corridor, increasing the need for those to travel where availability is low**. How can we make high speed digital infrastructure more accessible?**

2 The carbon emissions of transport are reduced to zero by 2050

To address the UK's Greenhouse Gas emissions, the Government has set a legally binding target of reaching net zero carbon emissions by 2050, which is a challenging target for the transport sector, the largest carbon-emitting sector of the UK economy.

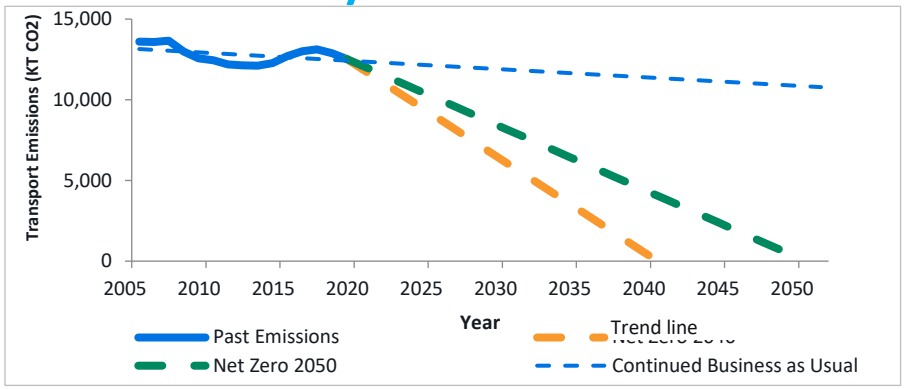
The graph shows the decarbonisation trajectories required to achieve decarbonisation from transport by 2040 and 2050 and the extent these deviate from the trend line. The trajectory shown indicates that, at the current rate, EEH will not reach its net-zero carbon target.

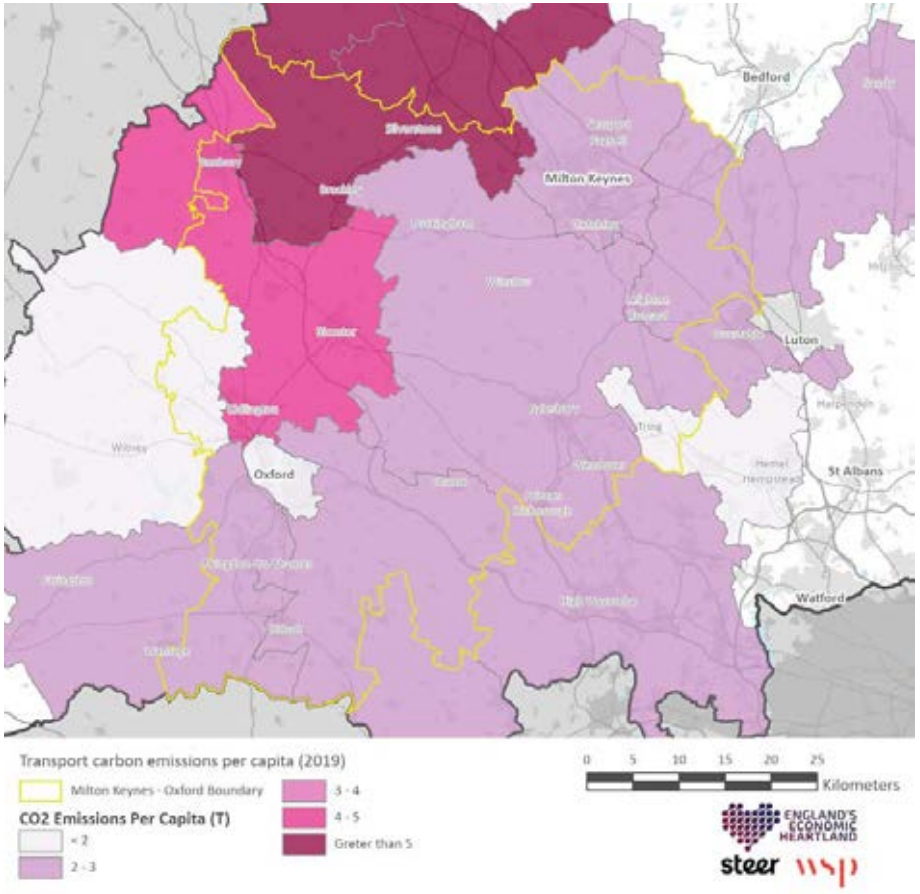
The evidence indicates that Carbon Emission per capita vary in each local authority across the corridor. The average Carbon Emission per capita within the corridor was 2.32 Tonnes with several local authorities above the corridor average, including Central Bedfordshire, Daventry, South Northamptonshire, Cherwell, South Oxfordshire and Vale of White Horse.

In 2017 transport emissions equated to 47% of the Heartland's total carbon dioxide emissions. Transport emissions are increasing at a faster rate than elsewhere in the UK (9.4% increase between 2012 and 2017). Of this, in 2019, 55.4% of the emissions came from cars/ taxis, 15.9% HGVs and 15.7% LGVs across the UK.

To achieve this there must be reduction in the number trips made using internal combustion engine cars, vans, LGVs and HGVs and a substantial change in the vehicle fleet towards zero-emission vehicles. This must be coupled with technological solutions to improve vehicle efficiencies and the use of the road and rail networks.

Challenge – As the trajectory shown indicates, at the current rate, England's Economic Heartland will not reach its net-zero carbon target. **How can we minimize carbon emissions of transport and reach this target by 2050 (if not earlier)?**





3 Improved public transport connectivity enables planned development growth to be delivered sustainably

Having easy access to required services and amenities within a close distance for walking and public transportation, can help promote sustainable travel patterns and reduce single occupancy car trips.

A priority should be to deliver high quality services and facilities within new developments, to reduce the need to travel. It is imperative the new developments area also designed in a way to reduce propensity to travel by car.

The map illustrates connectivity issues at a settlement level. Currently the proportion of residents who drive to work is generally higher in peripheral areas of our urban settlements. It can be seen for example the contrast between the inner suburbs of Milton Keynes (centre-right, yellow) and recent peripheral urban extensions (left and far-right, red). There is significant housing growth forecast in the periphery of the of the large and medium-size settlements in the corridor, particularly where existing access to key services and amenities via active and sustainable modes is more limited, thereby increasing reliance on private vehicles. The evidence demonstrates that there are high levels of multiple car ownership per household across the study area and there is a clear pattern of rural / urban divide for access to services / amenities as well as differences based on levels of transport provision / infrastructure.

Improved connectivity enables sustainable growth; therefore, there is a need to target interventions in areas where accessibility to services and amenities is poor, particularly where the public transport offer does not provide a viable alternative to the car.

Plan showing % of all residents aged 16-74 who drive to work by car or van
Source: Datashie.org.uk *Census data (c) Crown Copyright Office of National Statistics. Contains Ordnance Survey data (c) Crown copyright & database right 2014-5.*

Challenge – Development is often located in areas where existing sustainable transport options and access to key services are more limited. **How can we best improve transport connectivity to address inequalities and accessibility issues for planned development?**

4 The benefits of new technologies that enable improved connectivity are accessible to everybody

EV's, e-bikes and micro-mobility schemes represent a key component of a future multi-modal transport network that is capable of achieving net zero targets.

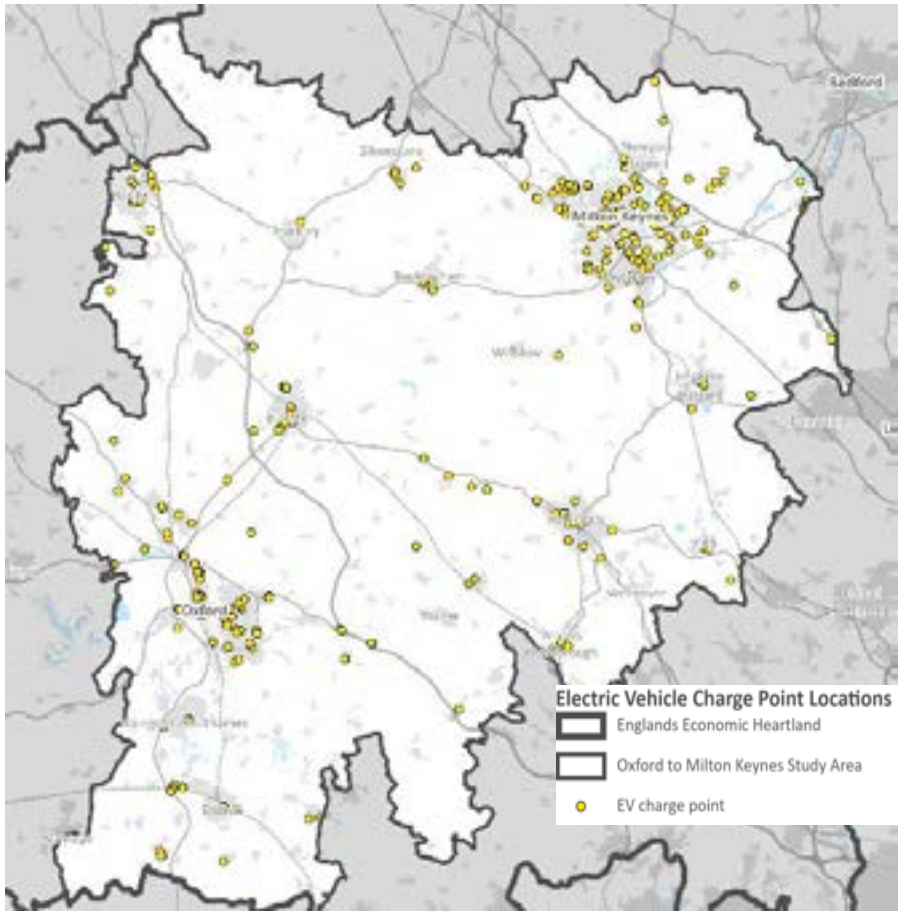
At a corridor level, electric vehicle charging points are well spread throughout, though at a relatively low volume, potentially limiting the uptake of EVs. Across the urban areas in the corridor there is a range in the number of public electric vehicle charging points. The smaller areas such as Didcot, Tring, Bicester and Princes Rishborough each have fewer than 10, while Oxford has 73 and Milton Keynes has 364.

E-bikes allow good connectivity when commuting within urban areas as well as offering opportunities to support inter-urban trips. To support the use of e-bikes, appropriate and attractive infrastructure (routes, charging points and changing facilities) are required.

Shared / public micro-mobility schemes have also become a new first mile / last mile active travel option, forming part of a longer journey undertaken by passenger transport. However, micro-mobility schemes are more viable in urban areas where there is a critical density that ensures commercial viability.

The evidence indicates that new technologies promoting low-carbon travel modes can form part of an inclusive and connected transport network. Interventions should seek to create networks of high-quality infrastructure supporting short-distance trips undertaken by shared micro-mobility schemes. In addition, gaps in the electric vehicle charging points network should be filled, particularly in rural areas to encourage greater uptake.

Data Source: National Charge Point Registry (NCPR) 2021



Challenge – There are significant gaps in infrastructure to support future technologies – notably electric vehicle charging infrastructure. **What is required to ensure that the connectivity and decarbonisation potential of new technology is fully realised.**

5 The area's towns, cities and rural communities are well connected by improved east/west transport corridors

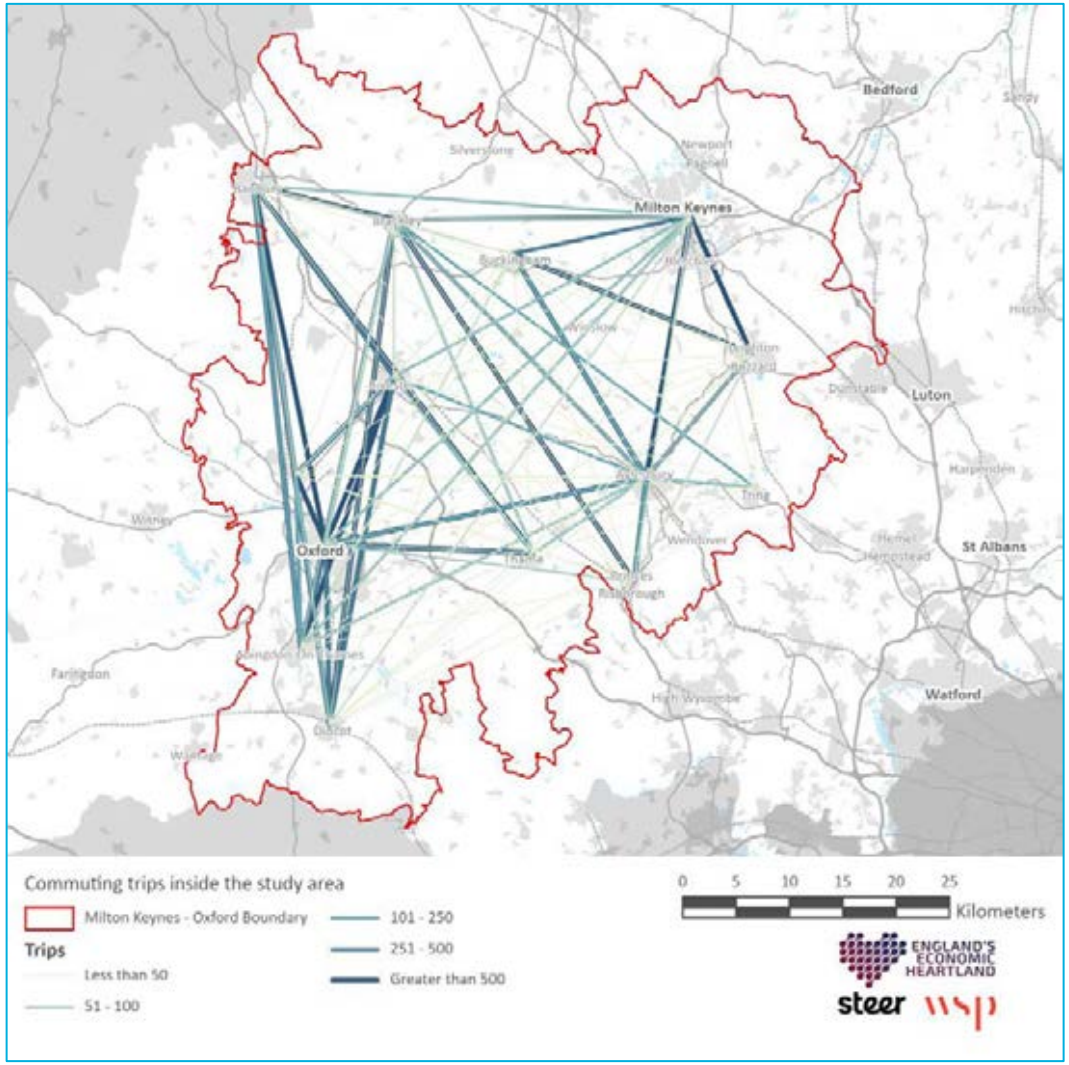
The connectivity study area currently suffers from inadequate east/west transport links which stifle social and economic interaction between urban, rural and market town communities.

In comparison, on a north/south axis the area benefits from two motorways the M40 and the M1 providing strategic national connectivity. Four north/south railway lines run through the area, the Cherwell Valley Line from Oxford, the Chiltern Mainline through Bicester and Banbury, the London-Aylesbury Line and the West Coast Mainline through Milton Keynes.

The plan to the right shows the impact that this disparity in connectivity has on the commute travel patterns, with far more commute trips taking place in a north south direction than in an east west direction. This also shows quite pronounced travel to work areas have emerged with commuting trips from locations in the west of the area principally being towards Oxford and those in the east being towards Milton Keynes.

The advent of East West Rail will substantially improve east west connectivity between Oxford, Bicester, Winslow and Milton Keynes, but there are a number of market towns and rural communities which will not directly benefit from this intervention. For these communities there are opportunities to improve existing east west highway links for the benefit of the private car as well as for bus-based public transport, active travel and micro mobility.

Data Source: 2011 Census – WU03EW Location of Usual Residence and Place of Work by Method of travel to work



Challenge – East West transport connectivity is sparse and of variable quality compared to north south connectivity– **what is required to support enhanced social and economic interaction between all of our communities?**

6 There is a step change in public transport connectivity within and between our urban areas

Buses represent a good alternative to the private car and promote sustainable travel within the corridor. However, there are varying service frequencies which impact upon attractiveness. The plan shows bus corridors in the connectivity study geography with a frequency of 4 buses per hour of greater. It can be seen that:

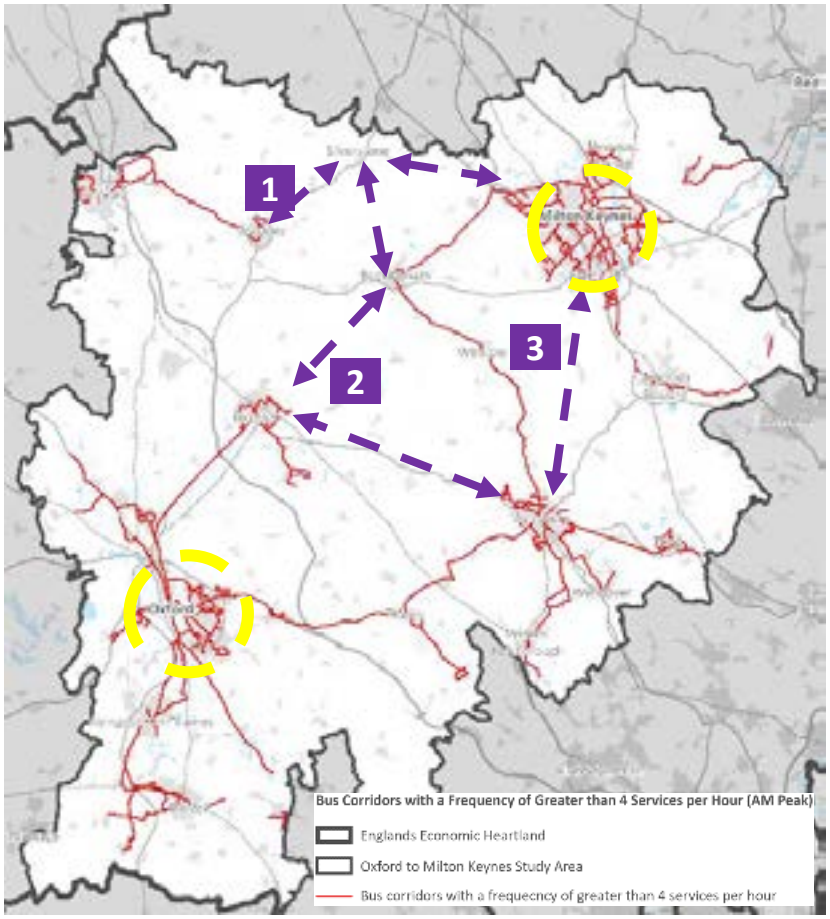
- There is poor bus connectivity between the smaller urban areas in the north of the corridor, namely between Buckingham, Silverstone, Brackley and Milton Keynes (1).
- There is a lack of high frequency public transport service along the A41 corridor between Aylesbury and Bicester (2).
- There is a lack of bus connectivity along the A418 / A4146 corridor between Aylesbury and Milton Keynes (3). Although a new hourly bus service between Aylesbury and Bicester was introduced in July 2021 (Service 17 operated by Red Rose Travel Buses).

Oxford and Milton Keynes have also been highlighted as having an opportunity to implement Mass Rapid Transit (MRT) systems, which would act as attractive, efficient and affordable means of urban transit.

Market towns play an important role in providing access to a wide range of everyday services and activities. Improvements to rural public transport will not only improve the accessibility of market towns by sustainable transport, but also provide the opportunity for sustainable multi-modal journeys where local bus services connect with express bus / coach services or rail stations.

Interventions should focus on improving service frequency on existing routes and providing connectivity between planned development and key service centres in the first instance. In the medium to long-term connectivity between areas of strategic interest (identified above) should be explored with potentially new high-quality, high-frequency services to bring about a step change in travel behaviour.

Bus movements (2-way total) Monday morning peak (0700-0859).
Data source: Basemap 2019



Bus connectivity gaps
MRT Opportunities

Challenge – High frequency bus corridors are centred around a few major settlements**.** Availability of a "turn up and go service increases the likelihood of modal shift from car to bus. **How can we improve public transport connectivity within and between urban areas and reduce reliance on car?**

7 A high quality, sustainable, transport network connects people into the corridor's strategic economic assets

Ensuring sustainable future growth within the corridor will be reliant upon an effective transport network. Current and Future employment sites will need to consider local transport networks throughout the corridor to ensure good connectivity for employees and residents.

Ensuring adequate transport infrastructure and services will help promote sustainable transport connections between strategic economic assets and major residential locations.

The graphic to the right shows a high level assessment of connectivity between major settlements. This looks at the quality of connectivity by highway, railways and bus. The final column considers the population, employment and proximity of the two major settlements to identify a theoretical level of demand. The assessment has shown that the two of the most high impact connectivity gaps are between Milton Keynes and Aylesbury and between Silverstone and Milton Keynes.

There is currently quite poor public transport between these locations. Implementing East-West rail along with active travel and other alternative public transport modes could help improve connectivity and promote sustainable travel.

Constraints could be partly addressed by East West Rail

Challenge – Potential demand between our strategic economic assets is constrained by the public transport network? **How can we ensure high quality connections are provided that meet sustainability needs?**

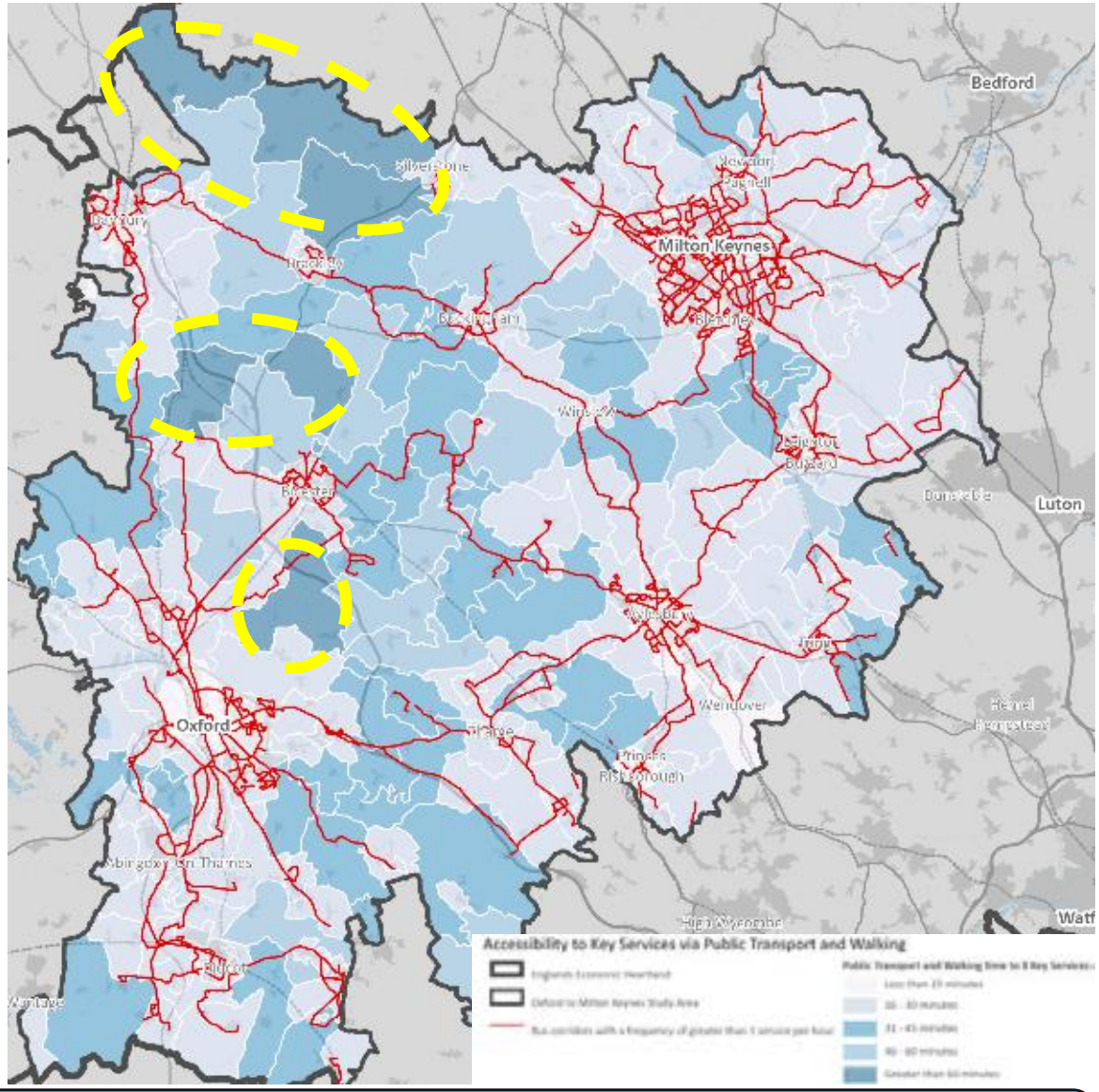
8 Rural communities and market towns are well connected to the public transport network

Sustainable travel options are currently poor in many rural areas. Gaps in public transport accessibility to services are particularly severe to the north of Oxford and in-between Banbury and Buckingham.

Lack of adequate Public Transport services and frequency reduces the likelihood of usage and in turn increases the amount of private car usage within the corridor. This can lead to future levels of unsustainable congestion, along with increased carbon emissions. The commercial viability of public transport in rural areas presents difficulties due to the low population densities.

Potential solutions for increasing public transport include:

- Demand Responsive Transport
- Increasing and subsidising better public transport routes
- Integration with other modes using Mobility hubs.



Challenge – Bus connectivity is available across large parts of the area, but there remain public transport gaps, particularly in the more rural areas where journey times to key services and facilities are inadequate. **How can we improve the public transport offering in rural areas where existing bus services do not provide access to key services and facilities?**

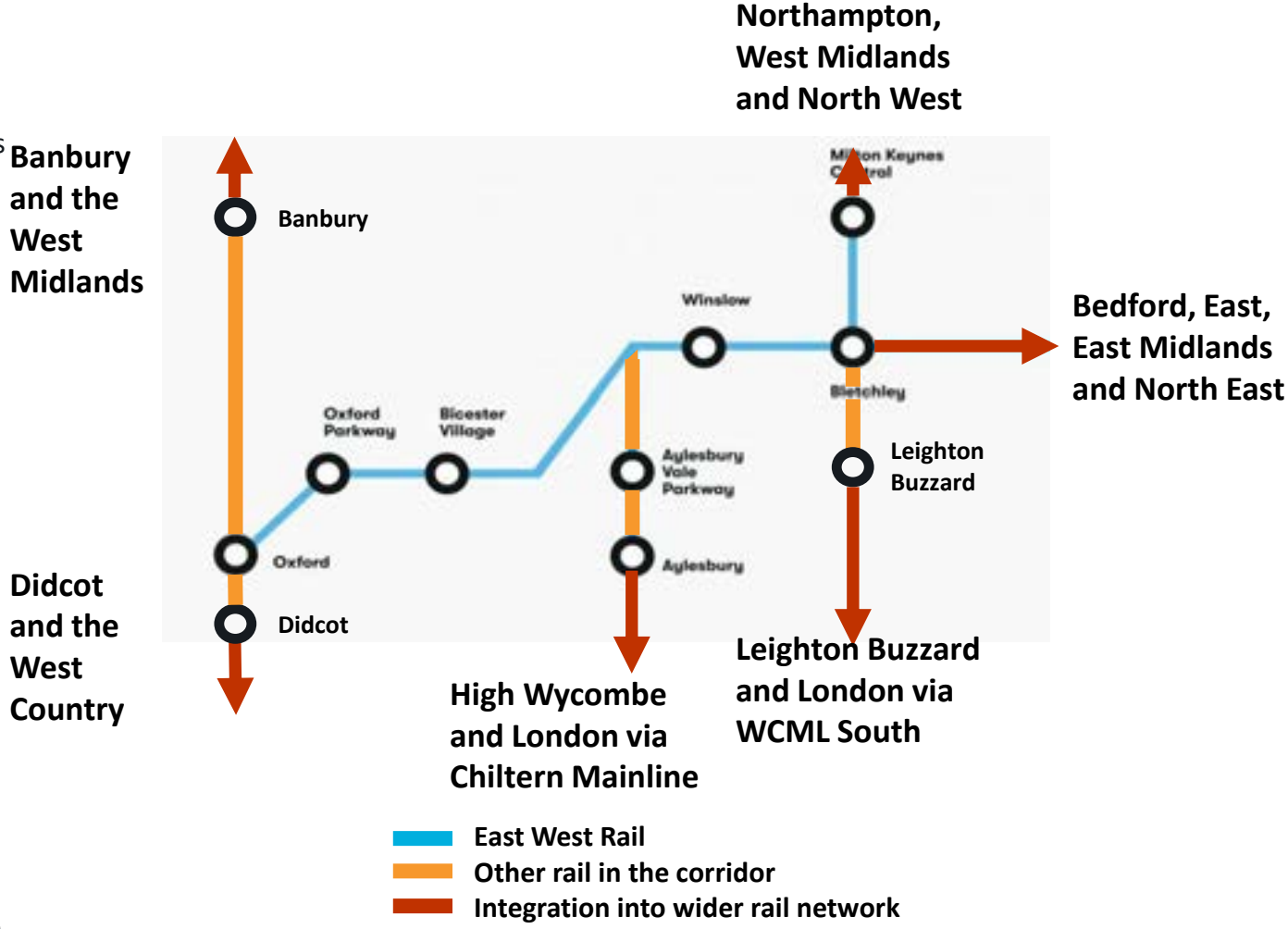
9 The benefits of East West Rail to passengers and freight are maximised and widely distributed

East West Rail will transform connectivity on a East-West axis on this corridor, bringing significantly better journey times between Oxford and Milton Keynes and other stations along the line. The line is planned to open in 2024 bringing a step change in regional connectivity.

For passengers, the planning, timetabling, and integration of the network must be conducted in a way which ensures that the benefits are optimised and widely distributed. East West Rail has the potential to increase wider connectivity to other locations within England's Economic Heartland and beyond and help to release capacity of existing rail lines.

For freight, East West Rail presents new opportunities to transport more freight on rail from the Solent Ports to the East Midlands and North East, or increasing the proportion of freight from Harwich that can be transported by rail.

Interventions to enhance infrastructure and service provision on the network linking into East West Rail will support benefit optimisation.



Challenge – East West Rail will provide a step change in connectivity between Oxford and Milton Keynes as well as intermediate stations. **How do we ensure that the benefits of this transformational rail scheme on passenger and freight movements are felt across the EEH area and beyond?**

10 East West Rail is fully integrated with the local public transport network with stations developed to facilitate onward local transport connections

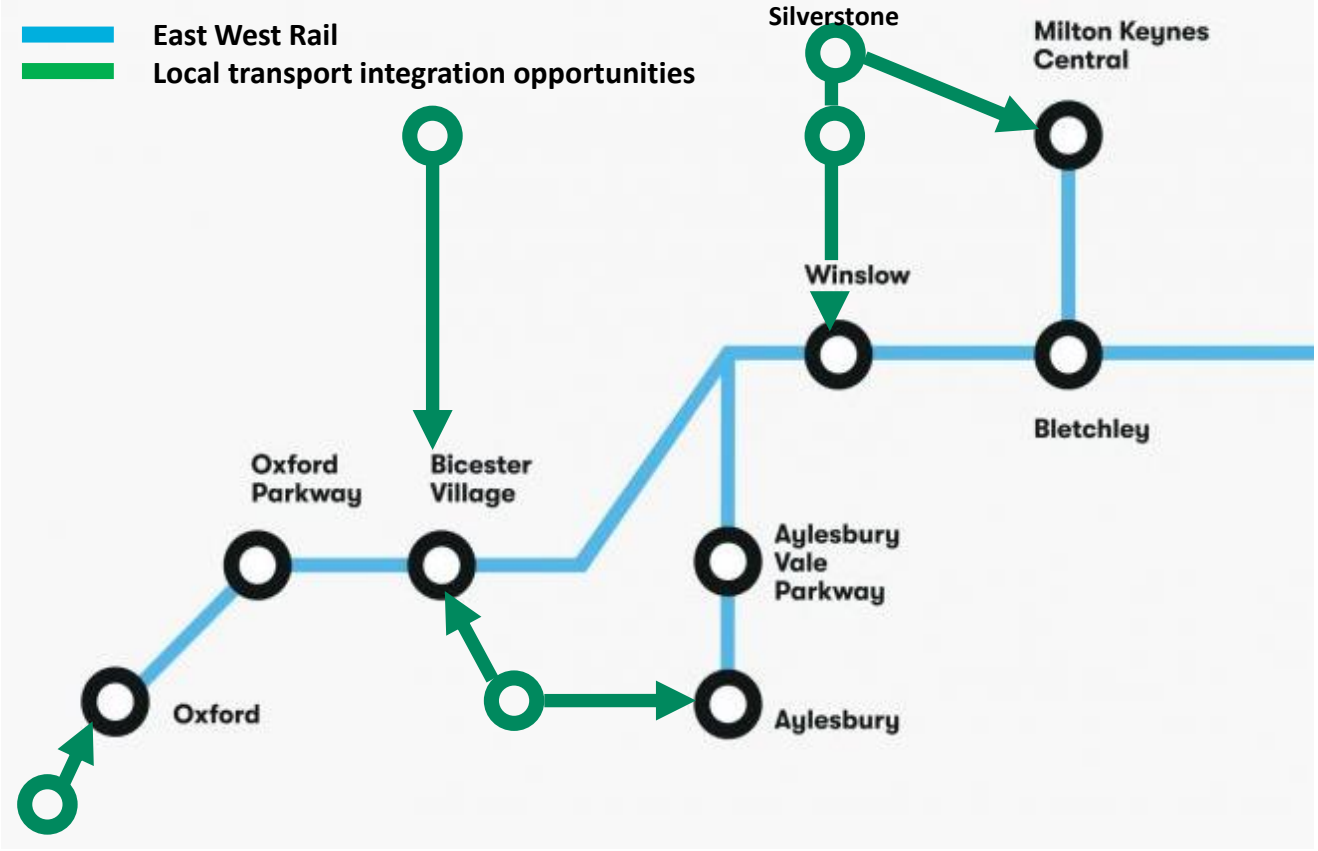
Public transport connectivity between major settlements within the corridor as well as connectivity to rural locations is currently poor.

East West Rail presents an opportunity for a substantial uplift in local transport connectivity in the area. Stations along the line should be well integrated with the wider public transport and active travel network to help facilitate seamless, end to end sustainable journeys.

There are a number of ways which this connectivity could be delivered including:

- Timetable integration between bus and rail
- Active travel infrastructure
- Public Micromobility schemes
- DRT schemes.
- Mobility hubs to integrate all forms of travel.

Delivery of a range of measures will ensure that connectivity from rural areas as well as small, medium and large towns and cities will improve as a result of East West Rail.



Challenge – As well as providing a step change in regional connectivity, East West Rail can provide local transport hubs for onward bus connections. **How can station facilities and mode interchange be optimised to facilitate sustainable first mile/last mile trips?**

11 Active travel mode share within and between our towns and cities increases

Active Travel is one of the most sustainable forms of transport and with DFT's recent publication of *Gear Change, the Transport Decarbonisation Plan* and the funding available from the Active Travel Fund there is substantial government support for Active Travel infrastructure.

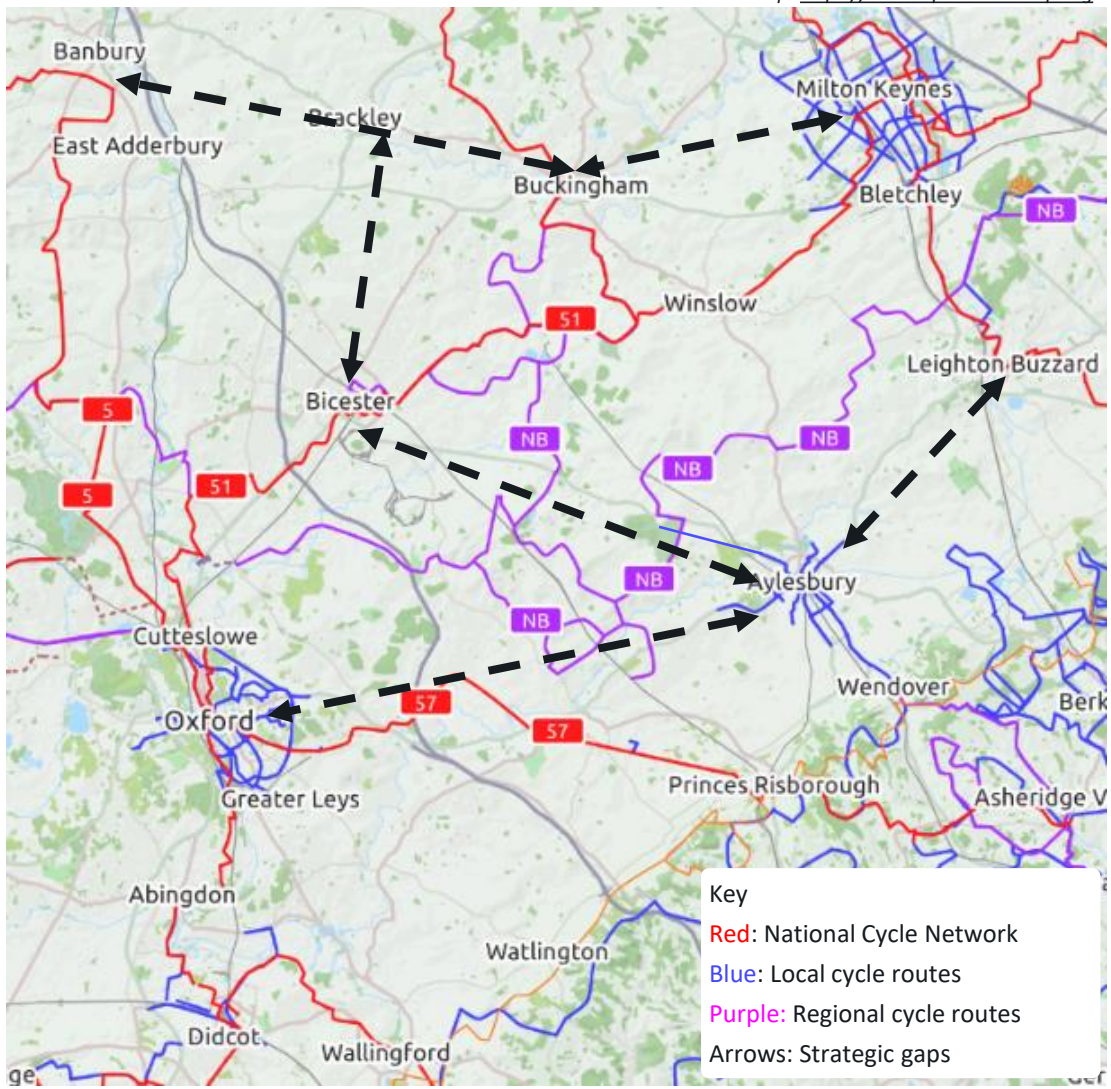
In the Oxford to Milton Keynes areas cycling currently accounts for a small proportion of inter-urban trips. This is, in part, due to the long distance nature of journeys, meaning public transport and private car has a higher mode share. The delivery of LCWIPs will be crucial to improve walking and cycling within the cities and towns in the study area.

The current inter-urban cycle network in the area is inadequate engendering a perception of or actual lack of safety for cyclists. This presents a barrier to cycling taking a higher mode share of inter urban trips. This and there are particular network gaps between the following:

- Oxford – Aylesbury;
- Banbury – Brackley – Buckingham – Milton Keynes; and
- Aylesbury to Leighton Buzzard

A high quality, segregated cycle network could promote greater uptake of active travel particularly with the advent of E-Bikes which will significantly

Map: https://www.openstreetmap.org



Map: https://www.openstreetmap.org

Challenge – Many of our adjacent towns and cities are within 10 miles of each other. The advent of e-bikes significantly increases reasonably cyclable distances. **How can we upgrade the cycle network and encourage more people to use cycling as a utility mode?**

Part 5
Infrastructure Scenarios

Overview

Scenario Planning

Scenario planning is increasingly viewed as good practice in long-range planning given how uncertain the future is so.

As part of the programme of Connectivity Studies we have two approaches

- Alternative Futures – at an England's Economic Heartland level (reported in Appendix F); and
- Infrastructure Scenarios – at a Connectivity Study level

Both will help inform the options we identify and shortlist as part of each Connectivity Study, as well as testing the resilience of our shortlists

We want consistency of approach between Connectivity Studies so that when the Investment Pipeline is developed from the sum of the Connectivity Studies' shortlists, we can demonstrate to stakeholders that the shortlists have undergone the same fair and robust process of validation

Infrastructure and mobility scenarios

Infrastructure scenarios represent different voices and approaches to infrastructure planning all of which could contribute to realizing England's Economic Heartland's Transport Strategy and addressing the objectives and Critical Success Factors of the Connectivity Study. However, on their own, none of the infrastructure scenarios can fully achieve these goals.

They have been developed to present plausible and realistic scenarios from which the most appropriate components with the highest positive impact can be drawn to develop an optimal infrastructure scenario which will then guide option development.

Four infrastructure scenarios have been developed all of which are made up of a range of component interventions and supporting elements.

Four scenarios

Over the next four slides the infrastructure and mobility scenarios are presented in more detail in summary they are:

- **Digital and demand management**: Focused on interventions which reduce the need to travel or manage its demand for people and goods.
- **Sustainable First Mile Last Mile:** Focused on interventions which support low carbon journeys, particularly over shorter distances, for people and goods as part of a single trip or as part of a First Mile-Last Mile leg of a longer journey.
- **Rail & Mass Rapid Transit:** Focused on interventions which deliver fast, frequency, reliable, high capacity transit options which connect people and goods where they need to travel.
- **Highway:** Focused on interventions which improve highway efficiency between key origins and destinations for people and goods.

Digital and Demand Management

Infrastructure impact

In this infrastructure scenario, improved digital infrastructure reduces the need for individuals to travel for many activities. This includes increased home- or local-working, and reduced commuting, the resurgence of home delivery for many goods, and the ability for many services to be provided remotely.

The reduction of the need to travel and the advent of 'mobility as a service' (MAAS) also reduced the need for some individuals to own a car.

Demand Management measure will reduce the amount of vehicular traffic within an urban area reducing congestion, and its negative impacts on the places it affects including noise, pollution and severance.

Demand management can support the reallocation of road space to other uses, including improved walking and cycling facilities, segregated or priority public transport, all of which have the potential to help transform currently abrasive, car-dominated environments, into pleasant places to be.

Impact on place

Improved digital infrastructure results in less need for many people to travel outside of their immediate neighbourhood for many day-to-day activities. This implies a greater focus on the local area as a setting for certain activities so local shared workspaces, libraries, community facilities, places for eating and socialising, and streets that support more inhabitation are all potential responses to this at a place level.

As fewer car parking spaces are required a substantial amount of space could be released for other uses, whether that be cycle parking, greenspace or better residential or commercial development within a given site.

Similarly, demand management measures such as Workplace Parking Levies, may also free up space currently used for parking associated with existing places of work. This could allow the environmental improvement of these places, helping secure the attractiveness of communal workplaces as an alternative to working from home. It may also allow the densification of these existing – effectively brownfield - places, helping reduce pressure to develop elsewhere.

Summary

Core elements

- Urban Demand Management
- Integration of land use and transport planning
- Increased digital connectivity
- Deliver of Mobility as a Service.

Supporting elements

- Increase adoption of shared mobility solutions.
- Bikeshare scheme across the corridor.
- Demand responsive transport.
- Road space reallocation to public transport.
- Road space reallocation to active modes.

Alignment with vision and strategic principles

Pros

- Reduces carbon emissions.
- Improves air quality.
- More efficient use of road space.

Cons

- Limitation on the scale of economic impact
- Possible equity issues (access to new tech, impact of low emission zones)
- Increase in urban freight traffic.

Sustainable First Mile Last Mile

Infrastructure impact

This scenario involves prioritisation of first mile last mile intra-urban movement within each settlement whilst also linking key population centres by improving inter-urban movement by low-carbon transport form of transport. This allows end-to-end journeys utilising public transport to be a realistic choice across the area.

In residential areas simple and low-cost interventions to restrict through-traffic and create low traffic neighbourhoods can radically improve the street environment for local communities as well as supporting walking and cycling for a broader group of the population

Demand responsive transport, coupled with access to real time information can bring public transport closer to many people's homes, particularly in low density suburbs and rural areas, and may lead to the removal of many fixed bus stops or shelters in some locations, and the creation of hubs, linked to a broader range of activities, in others.

New, high-quality inter-urban bus routes would better connect people to employment, vital services and leisure opportunities.

Impact on place

This scenario presents a great opportunity from a 'place' perspective. General vehicular traffic is an inefficient use of limited road space within towns, compared to the capacity that active travel and public transport can achieve within the same space, so the reallocation of space to these modes has the potential to both increase capacity and release more space other purposes. Reduced space for vehicles can lead to safer streets, and lower impact from noise and air pollution.

High-quality inter-urban bus connectivity presents opportunities for 'transit-oriented development.' Subject to other planning considerations and environmental constraints, settlements can grow around the catchment of intermediate stations or stops strung along the new high-capacity public transport routes. The parallel active travel routes (as per the Cambridgeshire guided busway) further increase the development potential.

Conversely there are challenges in creating new routes through the countryside given the potential impact on the landscape from the infrastructure itself, and any associated development – although new landscape interventions, biodiversity net-gain and the repurposing of existing routes can all mitigate against this.

Summary

Core elements

- Alternative bus operating models
- Bus service improvements
- Adoption of shared mobility solutions
- Sustainable urban goods transport.
- Segregated active travel network
- Strategic mobility hubs across the corridor.
- Demand responsive transport.

Supporting elements

- Urban Demand Management
- Integration of land use and transport planning
- Support deliver of Mobility as a Service
- Road space reallocation to public transport.
- Road space reallocation to active modes.

Alignment with vision and strategic principles

Pros

- Reduced carbon emissions
- Improves health
- Improves air quality
- Inclusive interventions

Cons

- Measures less effective on longer distance journeys through corridor.
- Less priority given to strategic freight and passenger trips

Rail & Mass Rapid Transit

Infrastructure impact

This scenario suggests a focus on creating a grid of fast and frequent rail and/or Mass Rapid Transit (MRT) connections across the area, through improvements on existing lines, new lines connecting major settlements and intra-urban MRT in major settlements.

Rail-based MRT network in major settlements would provide high capacity, fast, reliable, frequent public transport services for the corridors major settlements, better connecting people to key opportunities and reducing car dependence. New rail lines connecting major settlements would provide fast, direct, low carbon alternatives to road-based options.

Rail network improvement in the areas will be supported by capacity increases on the national network as a result of HS2 and other rail upgrades. Service improvement on existing rail lines would make rail more attractive. Improved integration of rail with other modes would support mode shift for longer journeys within the corridor from road based to rail reducing congestion and emissions.

Impact on place

From a 'place' perspective, a focus on development of a rail and MRT network may support creation of a more singular regional place identity which would support economic agglomeration effects and consequent boosts to growth and productivity in the area.

A key aspect of this scenario from a place perspective is the role and potential of stations. Many of the area's existing stations are poorly connected to their wider urban setting, are surrounded by vacant or low-density development, with low intensity of use, or areas with regeneration potential. Stations should be secured as concentrated places in their own right – with the needs of interchange and onward travel integrated within a strong and site-specific approach. The environs of station should reflect the needs and characteristics of the community as well as making them as attractive for use as possible.

One challenge with the creation of any new cross-country routes, and the development that might be associated with them, would be the effect on the existing places that they pass through - in terms of visual impact and noise.

Summary

Core elements

- Rail-based MRT network in major settlements
- New rail lines connecting major settlements
- Increase capacity on existing rail lines
- Service improvement on existing rail lines
- Improved integration with other modes

Supporting elements

- Support deliver of Mobility as a Service
- Bus service improvements in major settlements
- Bus based MRT between major settlements
- Inter-urban segregated active travel network
- Region-wide smart and integrated ticketing
- Road space reallocation to active modes

Alignment with vision and strategic principles

Pros

- Reduced carbon emissions
- Improves air quality
- High capacity, low emission, fast, reliable alternatives to road-based travel

Cons

- Requires sufficient demand to present Value for Money
- Does not aim to reduce the need for travel
- Possible negative impact on existing quality of 'place'

Highway

Infrastructure impact

This scenario focusses on highway interventions which seek to ensure road space meets the needs of the corridor in the most efficient way, provides for accessibility requirements and supports sustainable Planned growth. Inter-urban journey times are already relatively good, particularly when compared to the available alternatives thus further justifiable upgrades would likely be focused on specific pinch points or where safety is of concern.

Given the constraints around further capacity increases, this scenario assumes the reallocation of road space for walking, cycling (including e-bikes) and public transport alternatives to the private car, to provide greater choice and address congestion issues. Segregated active travel routes, combined with Low Traffic Neighbourhoods (LTNs) would also support freight delivery by sustainable modes such as cargo bike operated from strategically located depots linked to the main road and/or rail networks.

Interventions which provide the enabling conditions for alternative fueled and automated vehicles are also part of the scenario.

Impact on place

Highway influences 'place' at a range of levels – from the main inter-urban roads, to the highways in urban areas to local access roads. Capacity reallocation of road space on main inter-urban roads has huge potential to create a positive improvement from a 'place' perspective.

To aid placemaking, where access roads are considered, it may be appropriate to think of these as lower speed urban high streets with associated facilities including segregated walking and cycling routes rather than as high-speed 'distributor roads'. In residential areas the creation of low traffic neighbourhoods (LTNs) would support walking and cycling and allow greater occupation of residential streets for play and socialising.

Small scale 'pinch point' interventions on main inter-urban roads along with incremental changes to the charging and digital technology unlikely have a significant effect on the overall place quality of the study area but may offer opportunities for localised place improvements.

This scenario is also probably most pertinent to smaller settlements – such as Bicester or Brackley – where there are fewer constraints on peripheral growth.

Summary

Core elements

- Inter-urban, private car journey time improvements
- Enabling access to development
- Improved safety package
- Access to vital services e.g. healthcare
- Freight connectivity
- Developing enabling conditions for new modes and vehicle automation
- Road space reallocation to public transport
- Road space reallocation to active modes
- Alternative fuel vehicles infrastructure

Supporting elements

- Increase digital connectivity – connected vehicles

Alignment with vision and strategic principles

Pros

- Supports flexible, efficient movement of people and goods movement
- Builds on existing road-based infrastructure

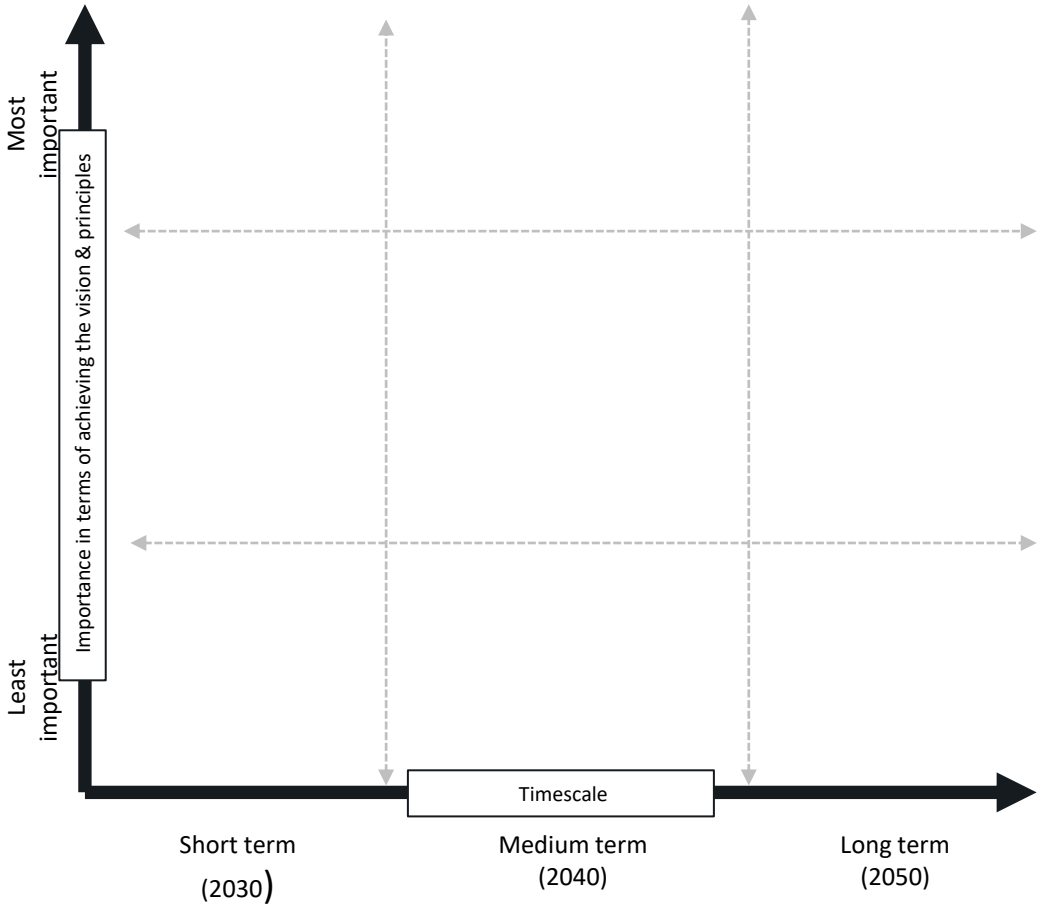
Cons

- Dependent on significant development to achieve significant carbon reduction
- Continued congestion impacts on the economy
- Continued social exclusion and health impacts

Developing an optimal infrastructure scenario

The four scenarios provide different infrastructure planning approaches. In collaboration with partners, elements from these four scenarios have been combined to develop an optimal scenario. An activity with Steering Group members was conducted in which each element (detailed in the graphic to the left) was ranked in term of its importance in delivering England's Economic Heartland's strategic priorities as well as the timescales in which the element should be delivered.

1 Urban Demand Management (e.g. Low Emission Zones, Workplace Parking Levy) 1	2. Integration of land use and transport planning (e.g. Trans Orientated Development) 2	3. Increase digital connectivity – connected vehicles 3	4. Increase digital connectivity – Broadband. 4
5. Support deliver of Mobility as a Servic 5	6. Alternative bus operating models (Franchising, Enhan Partnership) 6	7. Focus infrastructure investment on dep communities 7	8. Region-wide smart and integrated tick 8
9. Bus-based MRT (bus priority & segregat between major settlements 9	10. Increase adoption of shared mobility solutions e.g. bike share. 10	11. First Mile/Last Mile – sustainable urba goods transport. 11	12. Bus service improvements (fre and operating hrs major settlements 1 2
13. Intra-urban segregated activ network 13	14. Inter-urban segregated active network. 1 4	15. Network of multi-modal mobility hu across the corrido 1 5	16. Demand responsive transport. 16
17. Bus service improvements (fre and operating hrs) rural settlements 17	18. Station improvements to improve rail/P/act travel integration 18	19. Rail-based MRT network in major settlements. 19	20. New rail lines connecting majo settlements 20
21. Intervention to increase capacity existing rail lines. 21	22. Service improvement on existing rail lines. 22	23. Highway – Improved safety package 23	24. Highway – Enabling access to development 24
25. Highway - Road space reallocatio (public transport) 25	26. Highway - Road space reallocatio (active modes) 26	27. Highway - Access to vital services e.g. healthcare 27	28. Accelerate uptake of alternative fue vehicles through infrastructure.
29. Highway – Freight connectivity 29	30. Developing enabling conditions for ne modes and vehicl automation 30	31. Highway – inter-urban journey tim improvements 31	32
33	34	35	36



Optimal Infrastructure Scenario

On the basis of the outputs of the stakeholder activity and our findings from the evidence base the optimal scenario (detailed in the graphic below) has been developed. Included in this scenario are the elements from each of the infrastructure scenarios which will support realisation of England's Economic Heartland's strategic priorities. These elements have then been allocated to either the short term (2025-30), medium term (2030-2040) or the long term (2040-2050) depending on the views of stakeholders and a high-level assessment of their deliverability, cost and complexity.

	Packages					
	Demand management	**Making best use of reallocated road space**	**Supporting rail to provide fast, reliable strategic connectivity**	**Making it easier for people to shift to active and sustainable modes**	**Sustainable and efficient freight solution**	**Plans to enable sustainable, planned development and a decarbonised fleet**
	Infrastructure elements					
Short term (2025-30)	• Road space reallocation to active modes • Urban Demand Management • Increase digital connectivity	• Bus service improvements (freq. and operating hrs) • Intra-urban segregated active travel network	• Station improvements to improve rail/bus/active travel integration • Service improvements on existing and planned rail lines.	• Support delivery of Mobility as a Service. • Increase adoption of shared mobility solutions • Intra-urban segregated active travel network	• Sustainable urban goods transport. • Freight on rail optimization • Accelerate uptake of alternative fuel vehicles through infrastructure.	• Highway to enable access to development for all modes • Accelerate uptake of alternative fuel vehicles through infrastructure.
Medium term (2030-40)	• Road space reallocation to public transport	• Inter-urban segregated active travel network.	• Intervention to increase capacity on existing and planned rail lines.	• Demand responsive transport.	• Network of multi-modal mobility hubs across the corridor.	• Integration of land use and transport planning
Long term (2040-50)		• Bus-based MRT (bus priority & segregation) between major settlements				

Part 6
Next Steps

Next Steps

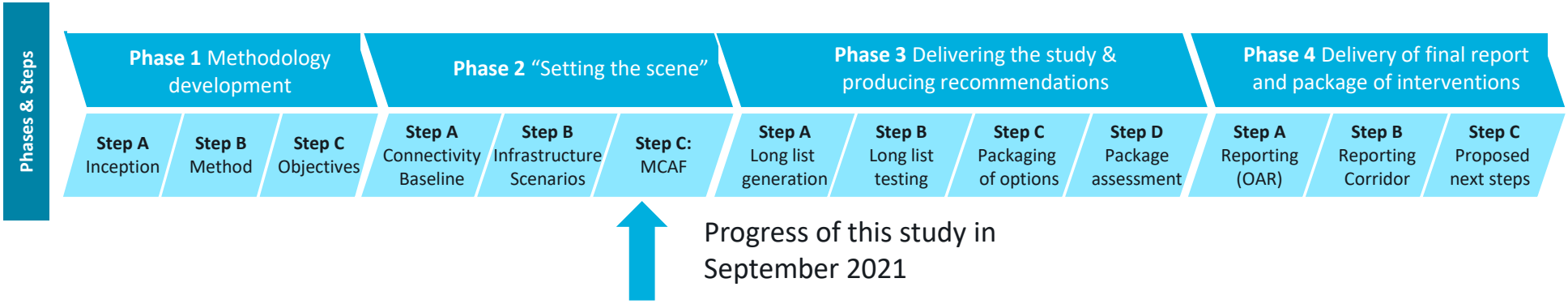
This report provides a summary of the work undertaken in the second of the four phases underpinning the Milton Keynes to Oxford Connectivity Study. The graphic below shows the phases and steps that are being delivered for this study.

This report presents the connectivity baseline providing a common understanding of the current and future context, demonstrates a need for intervention in the area, and defines objectives for the Milton Keynes to Oxford Connectivity Study. It also shows the identification of alternative infrastructure scenarios and the development of an optimal scenario.

The next Phase for this study is **Phase 3**. The purpose of this phase is to generate a long list of options in response to the need for intervention and guided by the detail of the optimal scenario identified in Phase 2, describe them in a consistent way, and assess them informed by the evidence base, against the criteria included in the Multi Criteria Assessment Framework (MCAF) tool, also developed as part of Phase 2. The optimal scenario and subsequently the package of options will be modelled in the England's Economic Heartland Economy and Land Use Model to support quantification of impact

This phase has already mobilized and will be reported in December 2021.

The purpose of **Phase 4** will be is to produce outputs to make the case (to government and others) for investment in the England's Economic Heartland infrastructure networks. This will mobilise in January 2022 and report by the end of March 2022.



Part 7
Appendices

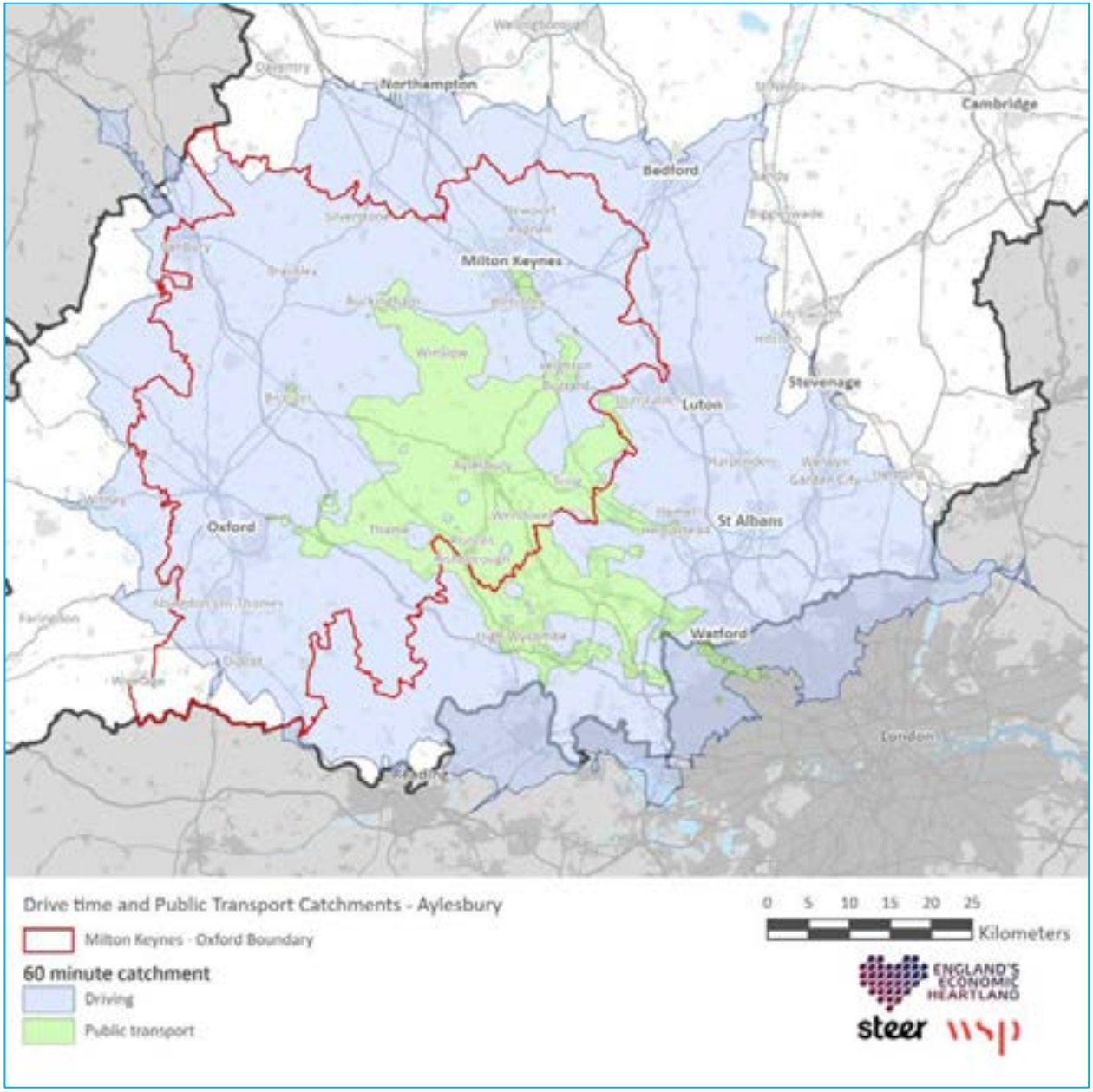
Appendix A – Mosaic Groups

Mosaic Groups

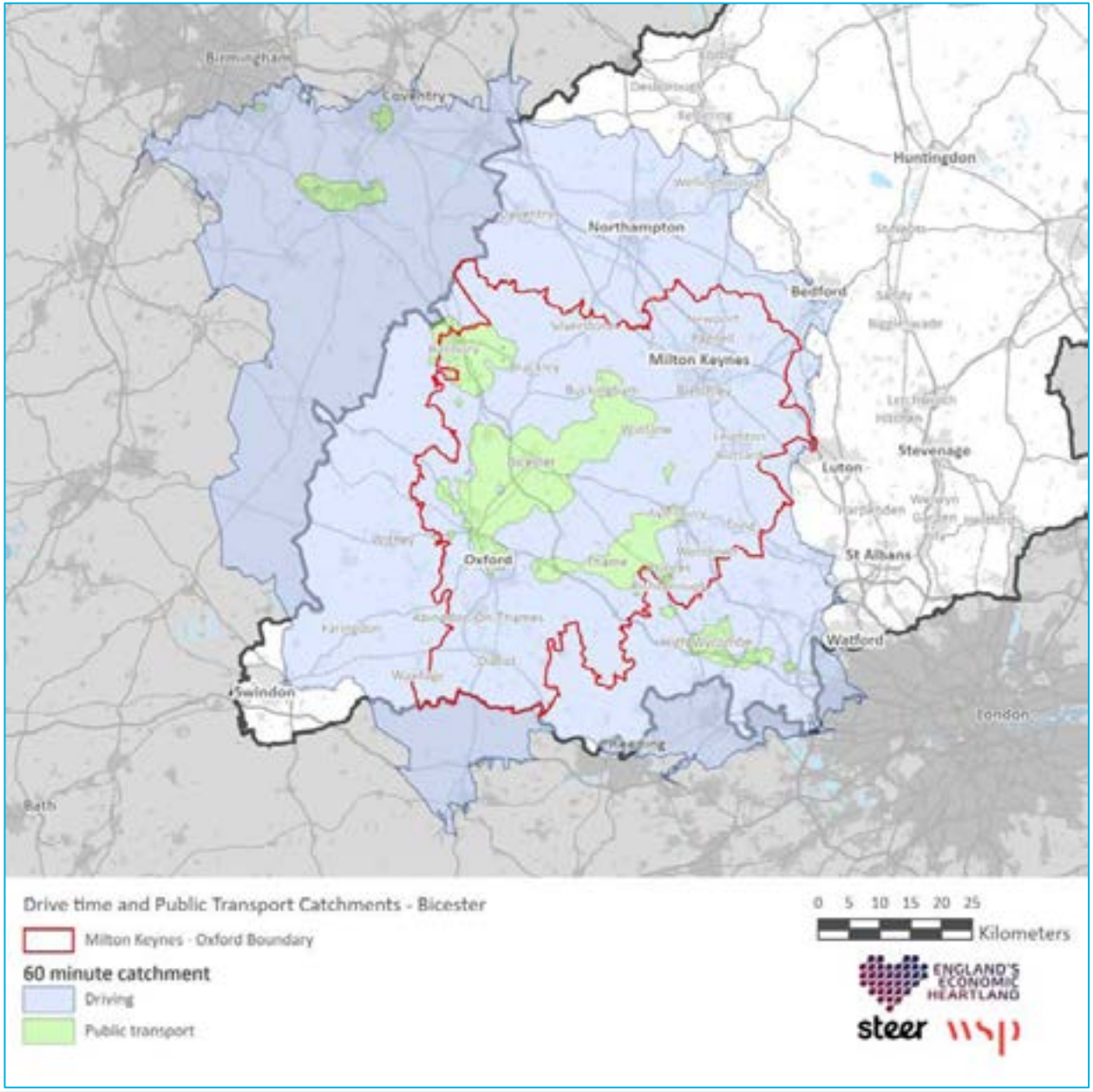
Mosaic Group	Characteristics Description
City Prosperity	Living in central locations and pursuing careers with high rewards. Likely to be married couples, in managerial / senior positions, supporting students or older children, and are used to using online services.
Prestige Positions	Living in a high value detached homes, being employed in managerial or senior positions and supporting students/older children.
Country Living	Well-off owners in rural locations enjoying the benefits of country life. High car ownership and high levels of internet use.
Domestic Success	Thriving families who are busy bringing up children and following careers. They are likely to have children and own new technology.
Suburban Stability	Living in a suburban mid-range home, which they've lived in for several years with older children.
Aspiring Homemakers	Younger households, in full time employment, settling down in housing priced within their means, which may be in the suburbs.
Urban Cohesion	Residents of settled urban communities with a strong sense of identity. They are likely to be multicultural and reside in the suburbs. Younger family members are likely to have an interest in new technology.
Rural Reality	Householders living in inexpensive homes in village communities or outlying houses. Experience slower internet speeds.
Transient Renters	Single people privately renting low cost homes, often in terraced housing, for the short term.
Modest Traditions	Smaller terraced properties located in the outskirts of urban areas. They tend to be composed of couples with no children (or with children who have left home). They are quite likely to have access to a car.
Rental Hubs	Educated young people privately renting in urban neighbourhoods. They are likely to be single or sharing accommodation. They have high smart phone use.
Senior Security	Elderly and those who are enjoying a comfortable retirement. These more elderly households have lower mileage and less likely to take up new technology.
Family Basics	These families limited resources who have to budget to make ends meet. Likely to have children, limited resources. squeezed budgets.
Municipal Tenants	Mature residents living in affordable suburban housing.
Vintage Value	People living alone, in small homes or flats, on low income and need of support.

Appendix B – Drive Time and PT Catchments

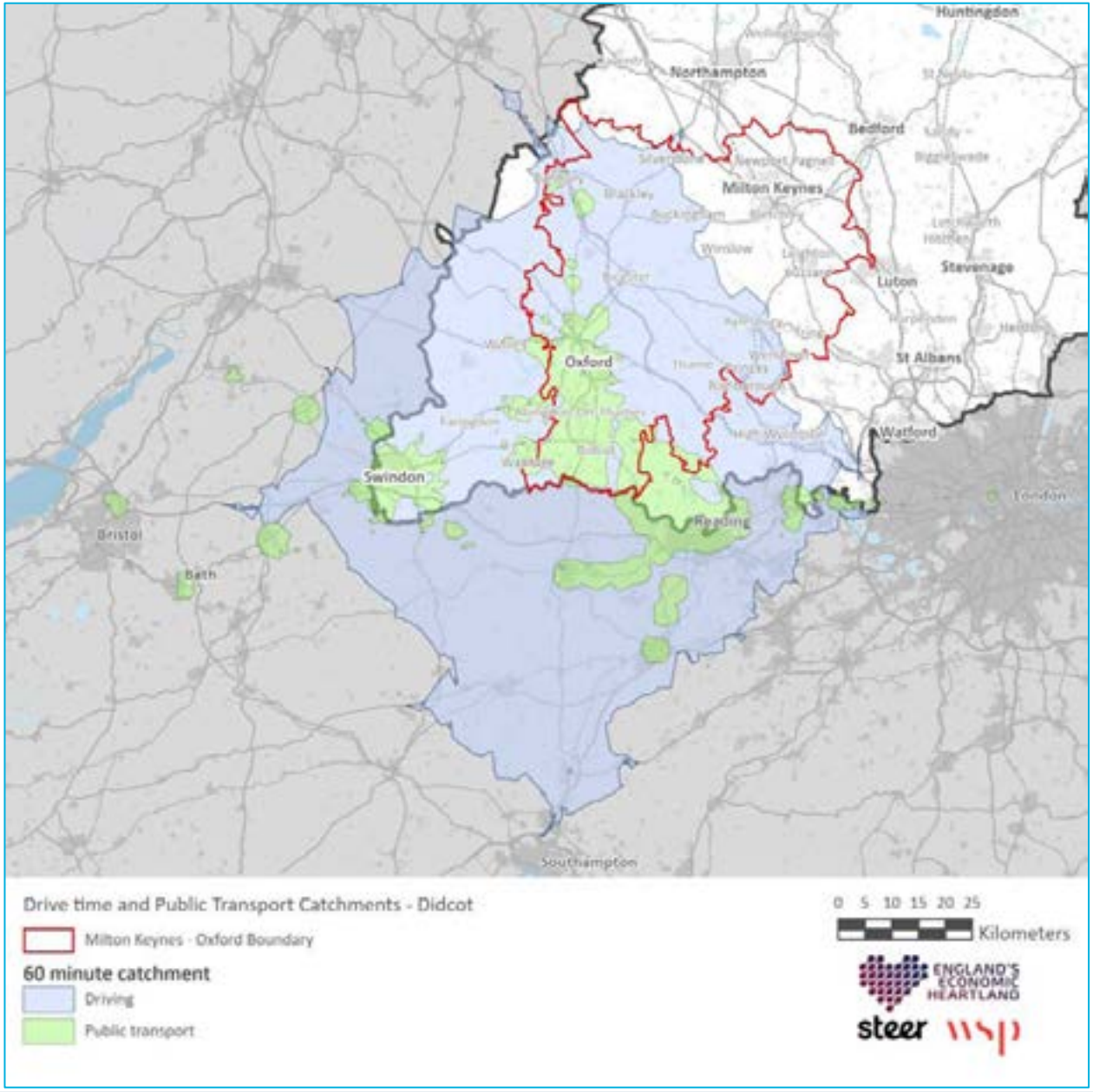
60 Minute Drivetime / PT Catchment - Aylesbury



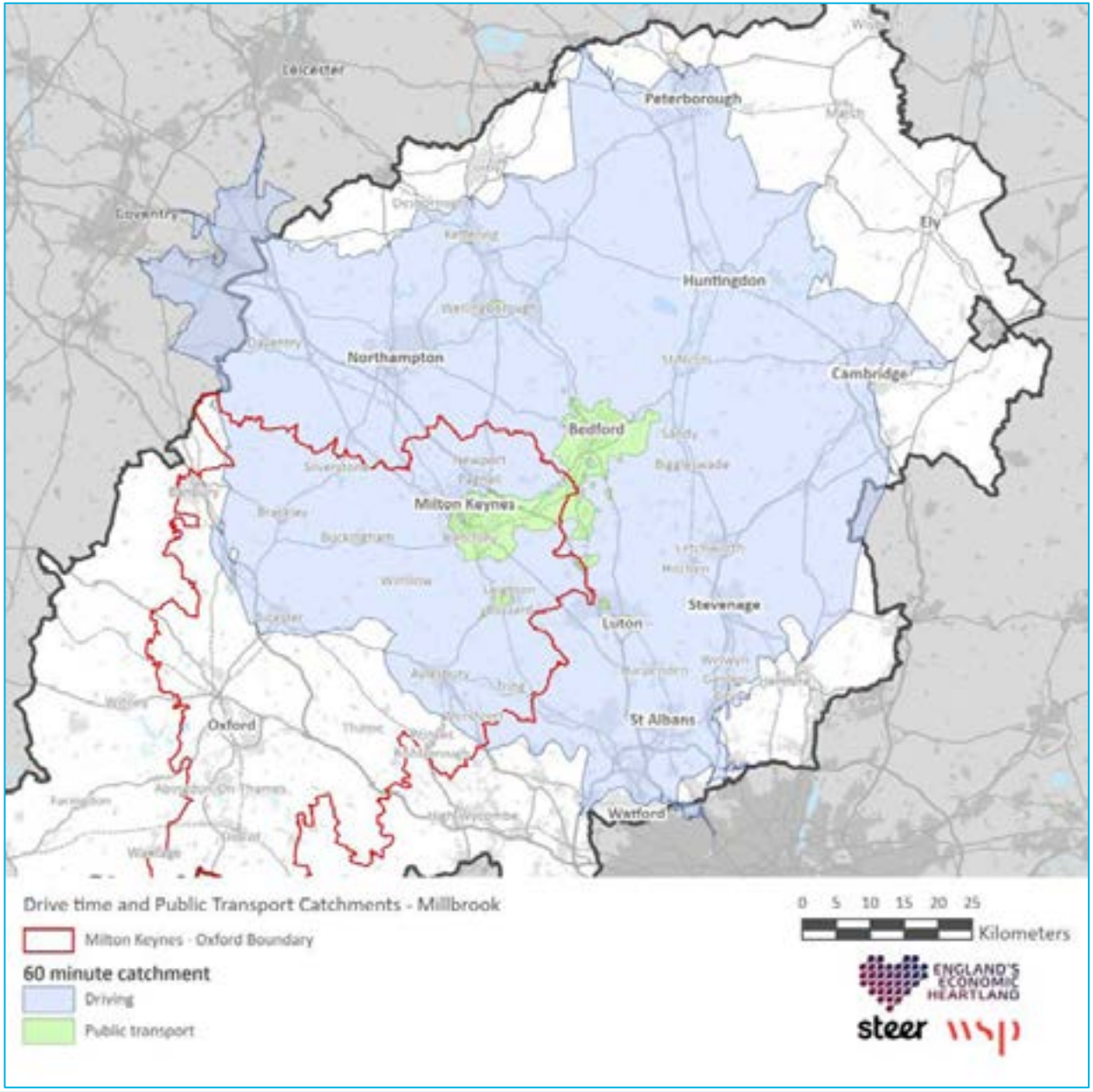
60 Minute Drivetime / PT Catchment - Bicester



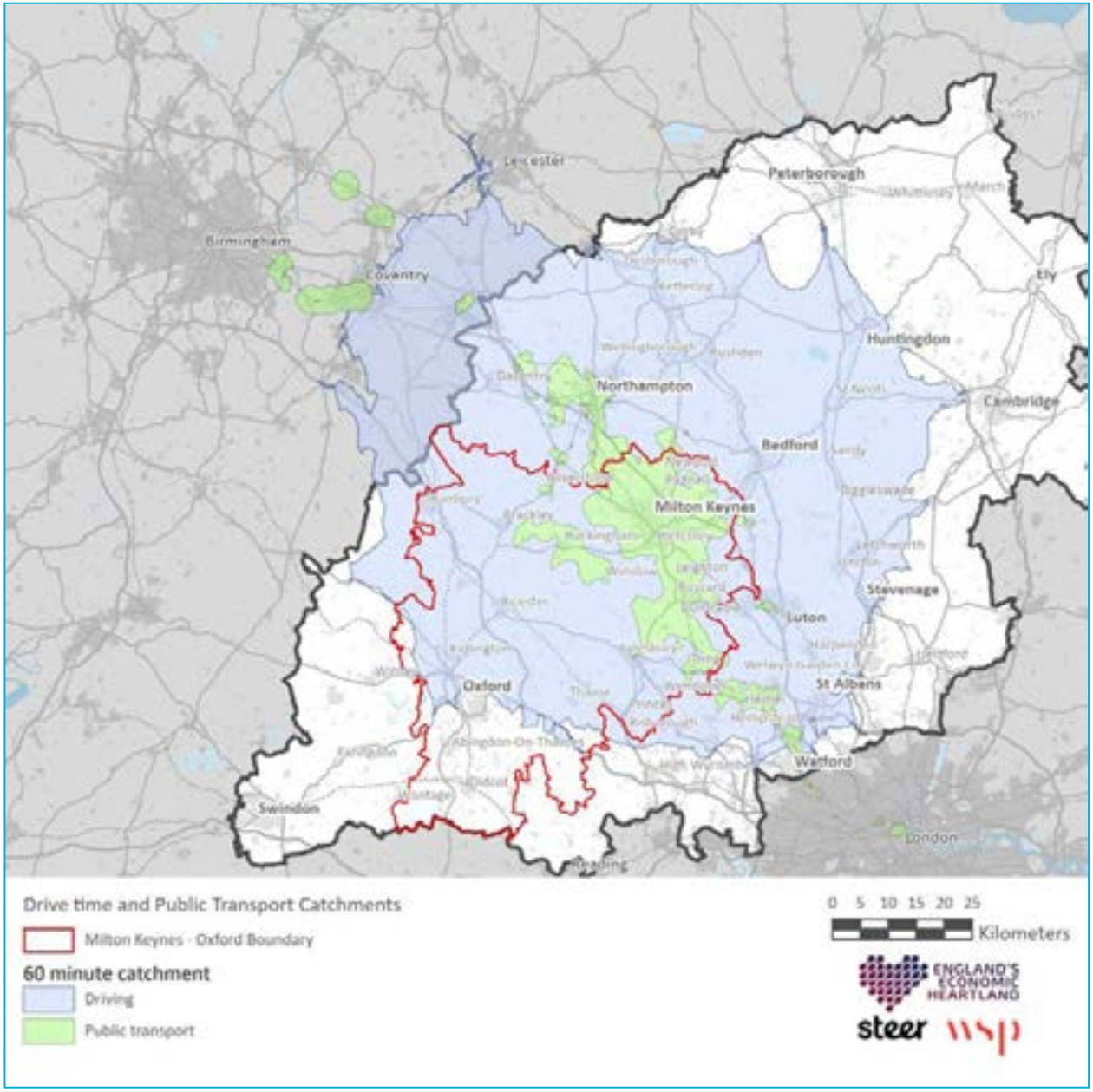
60 Minute Drivetime / PT Catchment - Didcot



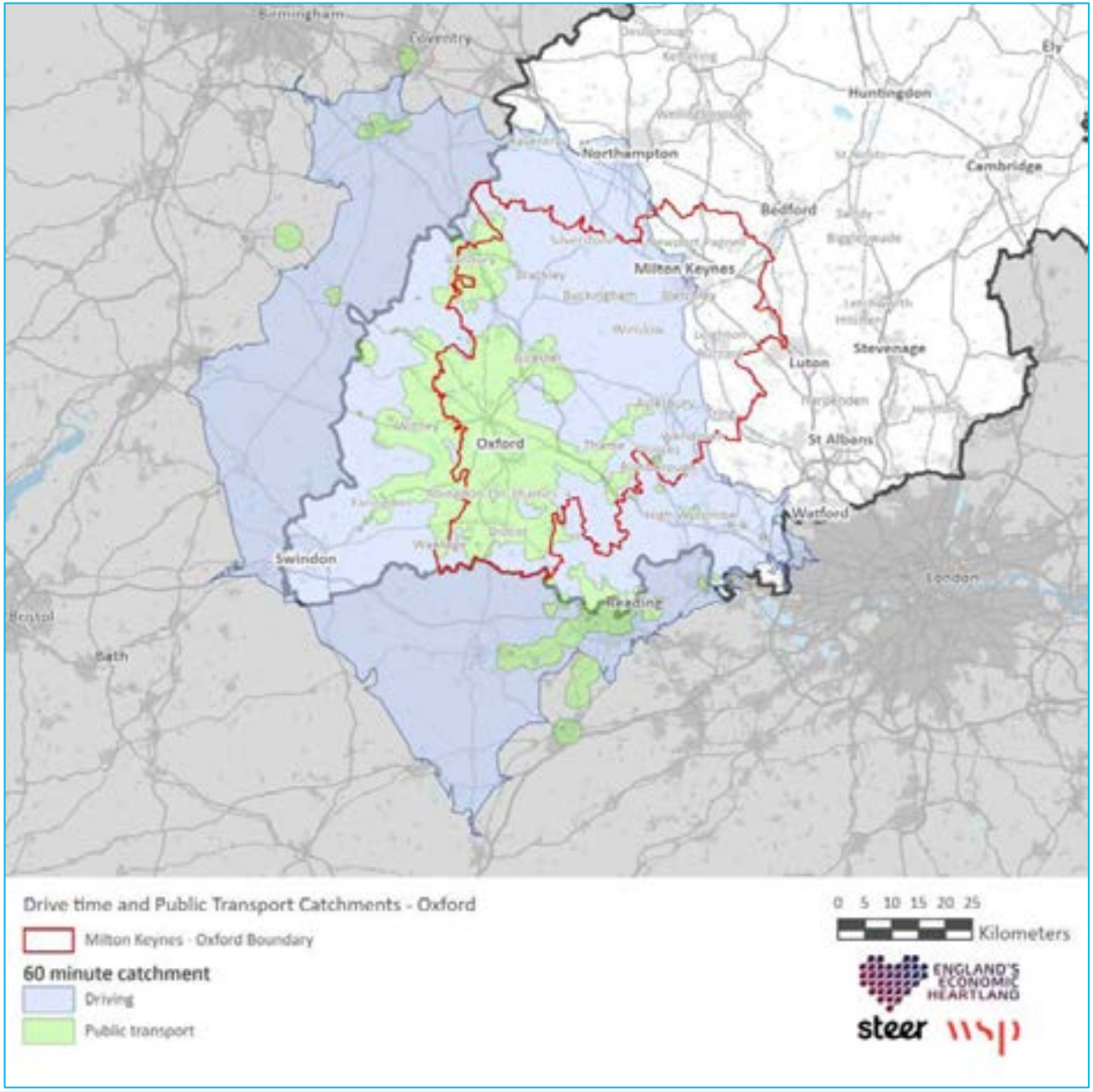
60 Minute Drivetime / PT Catchment - Millbrook



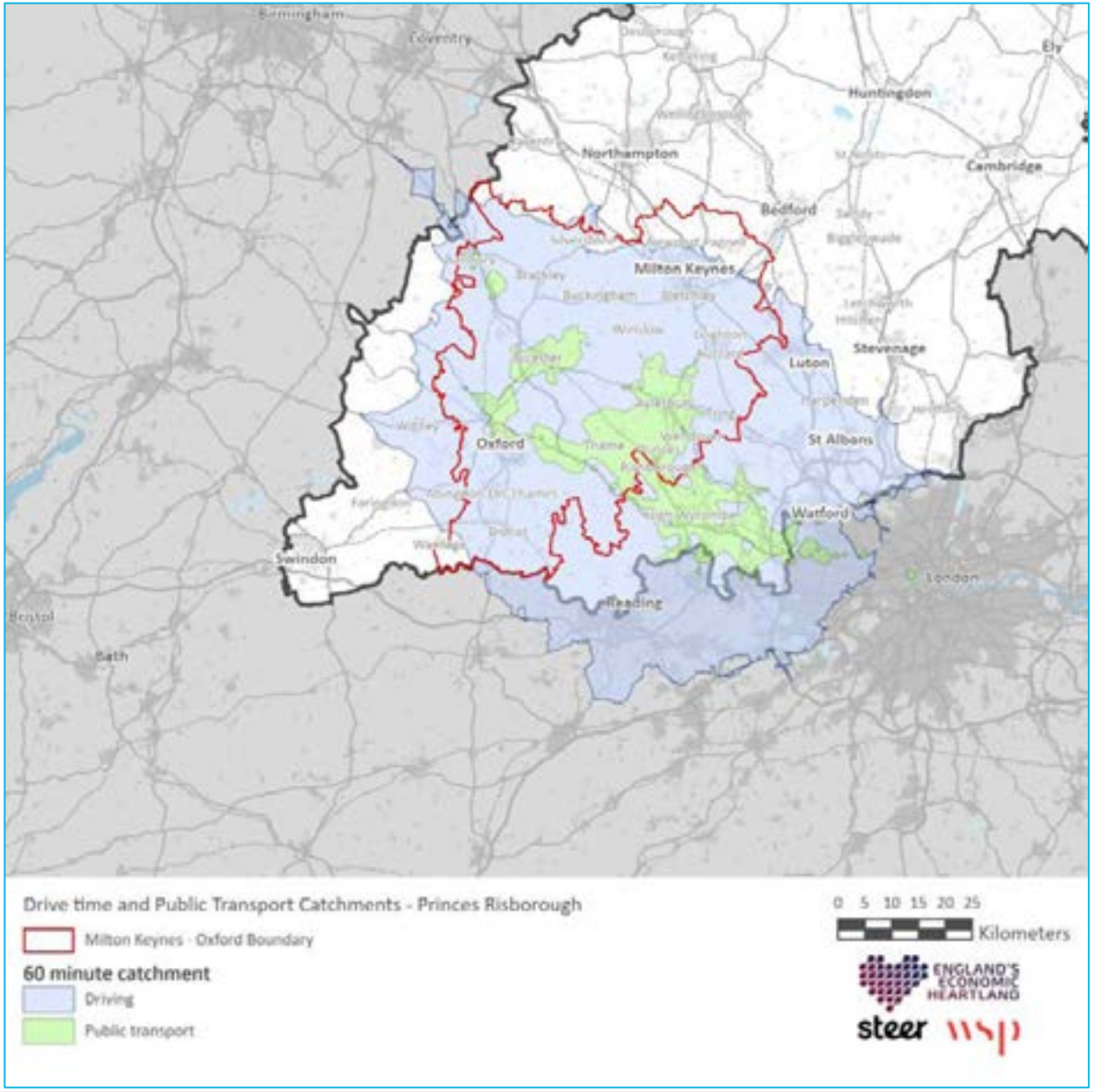
60 Minute Drivetime / PT Catchment – Milton Keynes



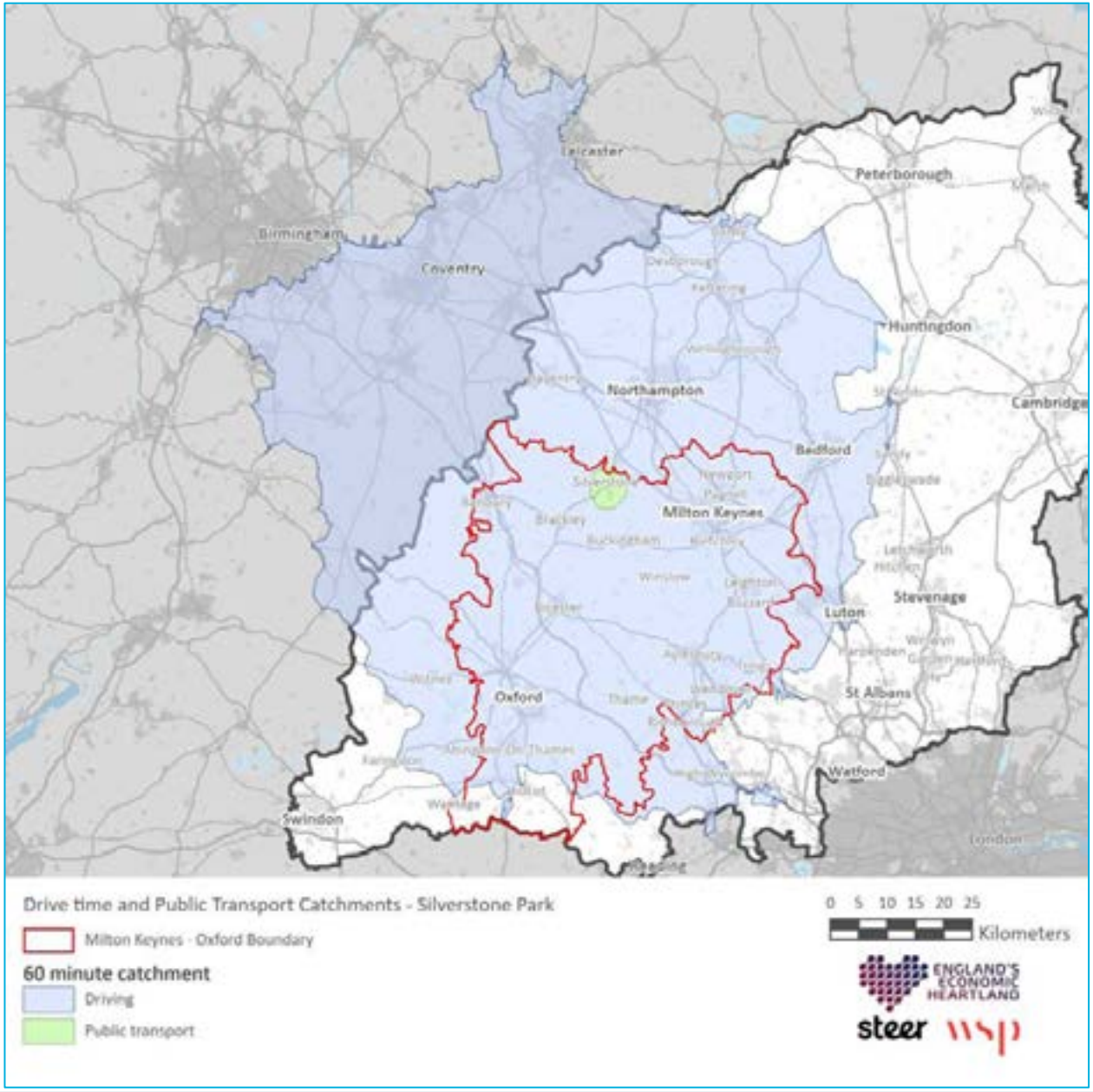
60 Minute Drivetime / PT Catchment - Oxford



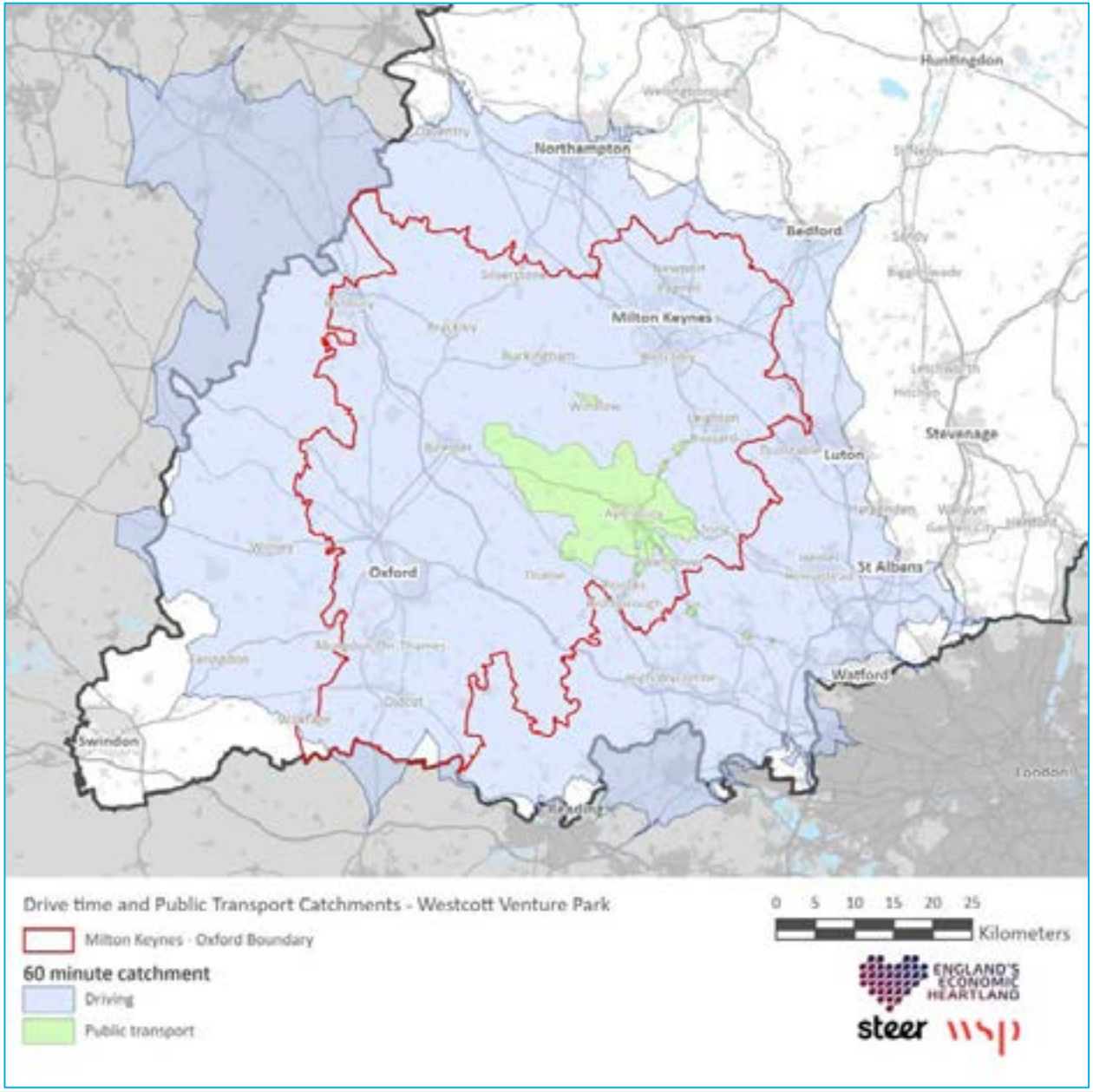
60 Minute Drivetime / PT Catchment – Princes Risborough



60 Minute Drivetime / PT Catchment – Silverstone Park

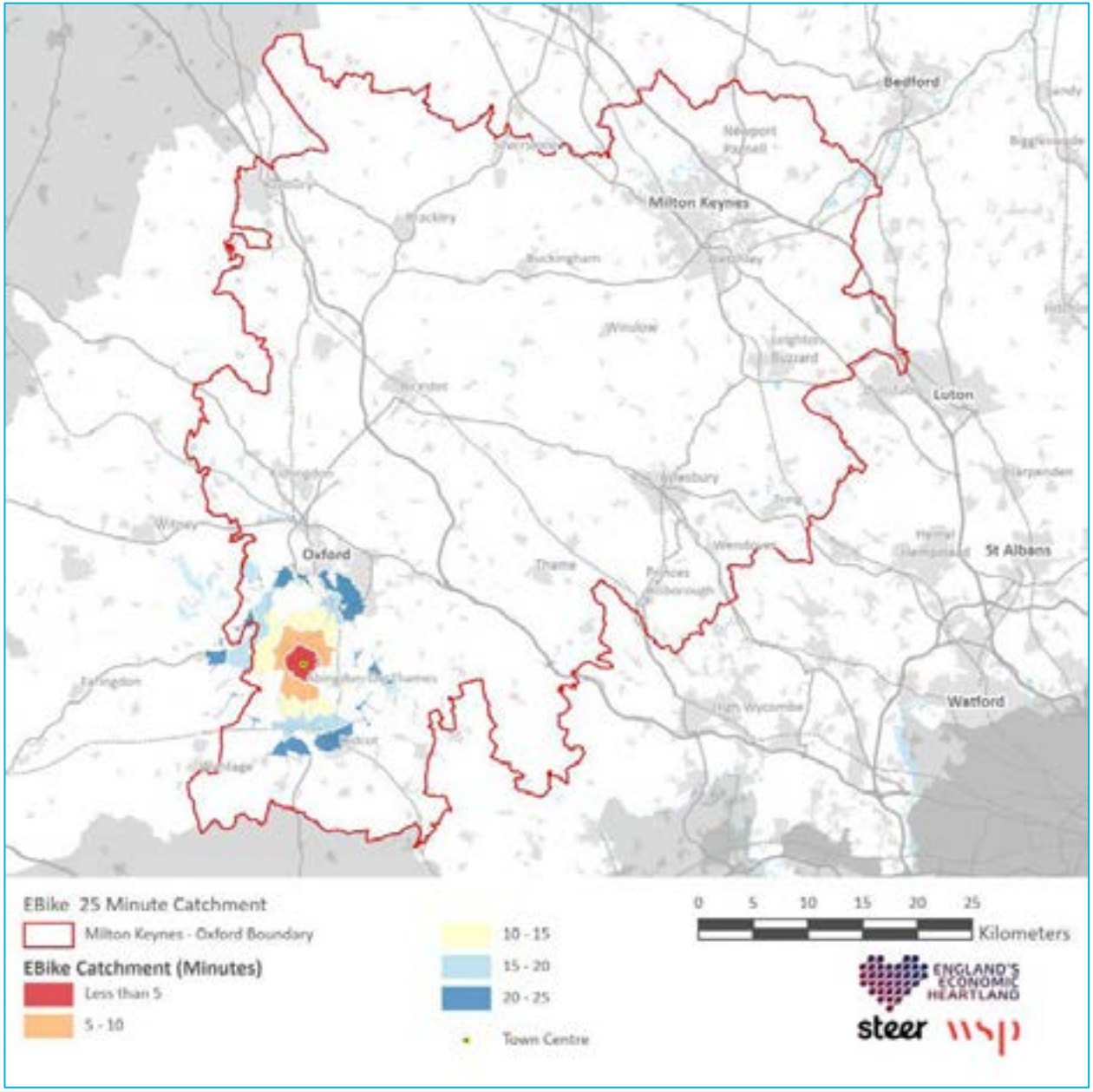


60 Minute Drivetime / PT Catchment – Westcott Venture Park

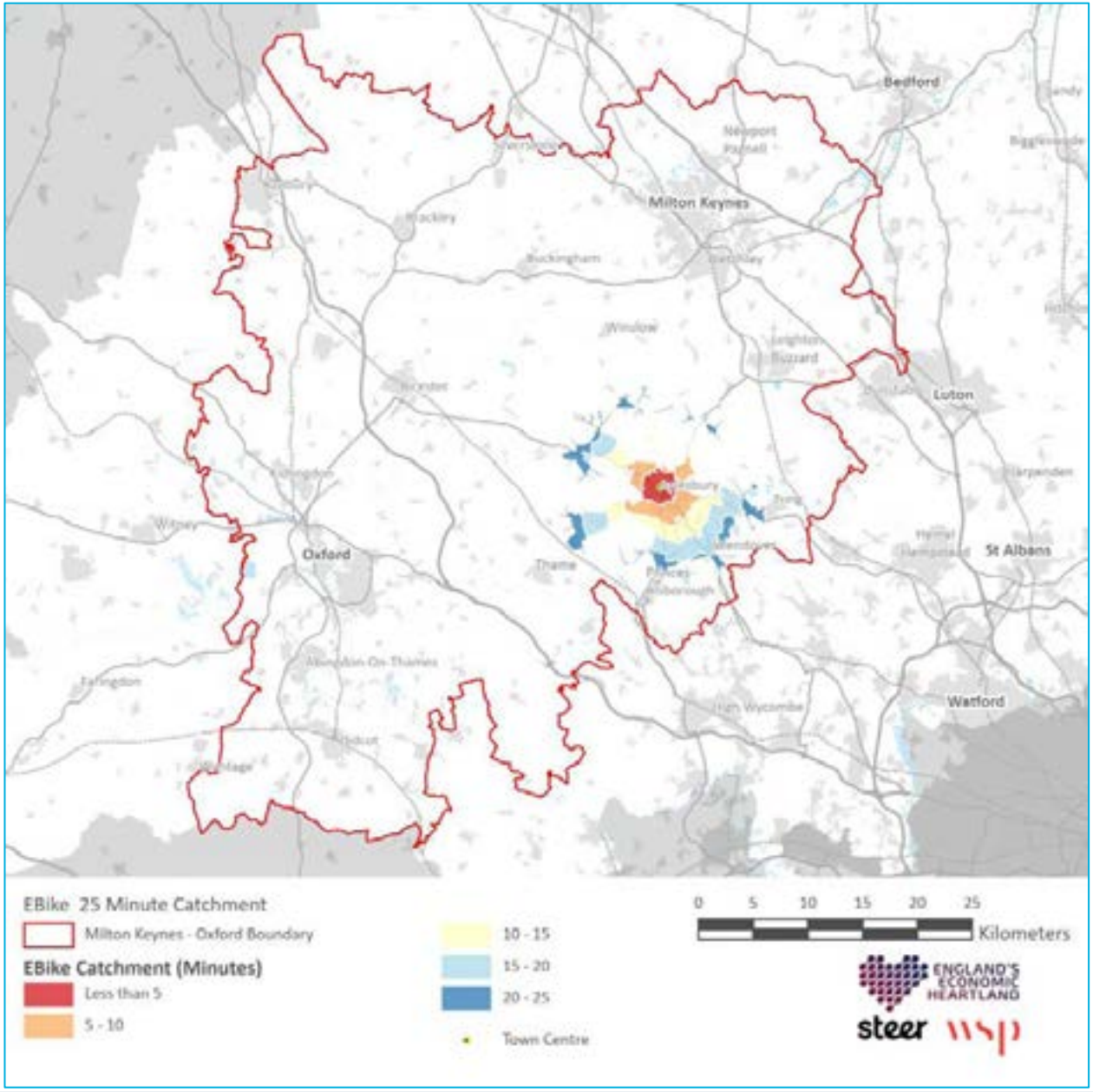


Appendix C – E-Bike Catchments

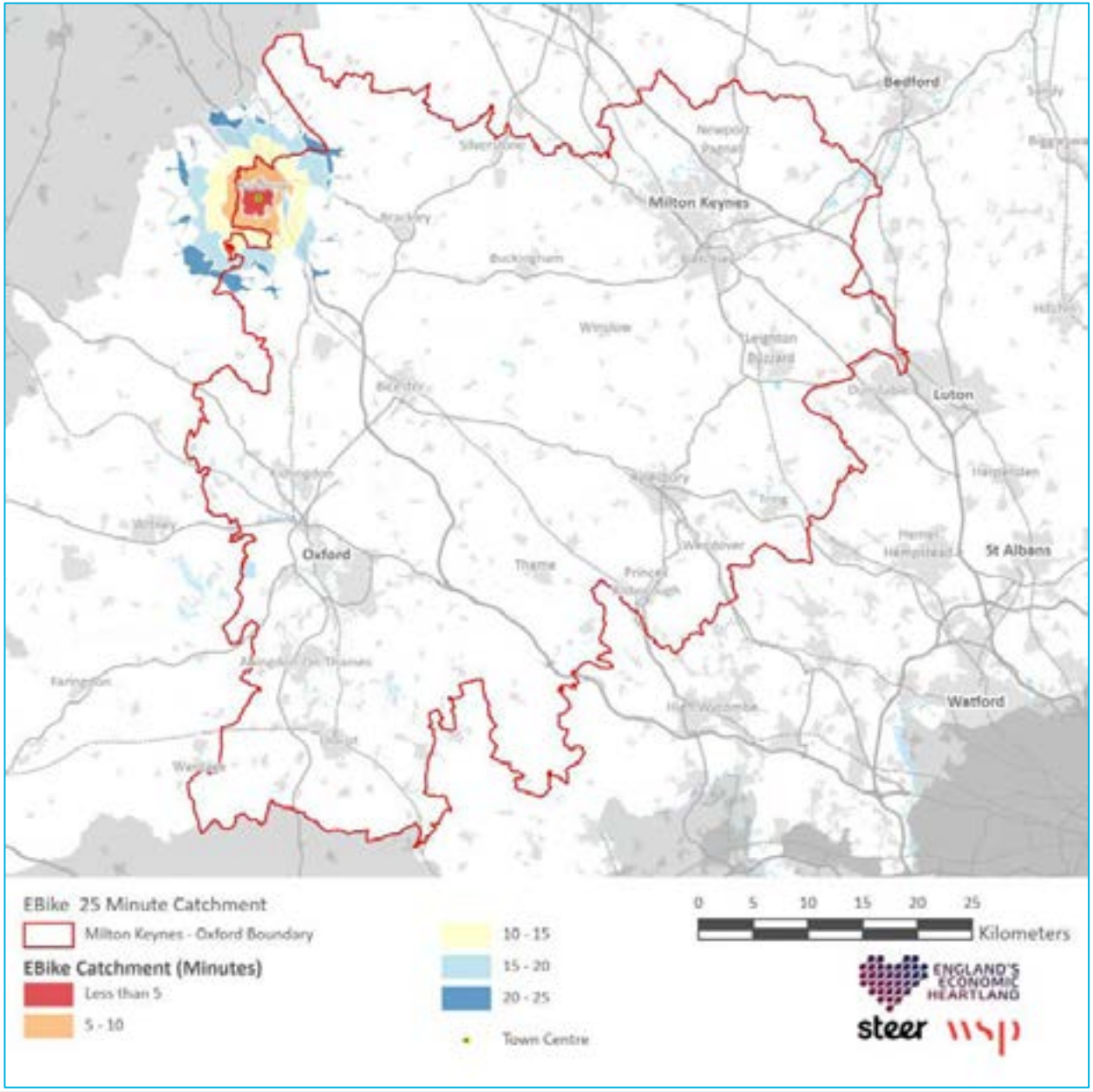
E-Bike 25 Minute Catchment – Abingdon



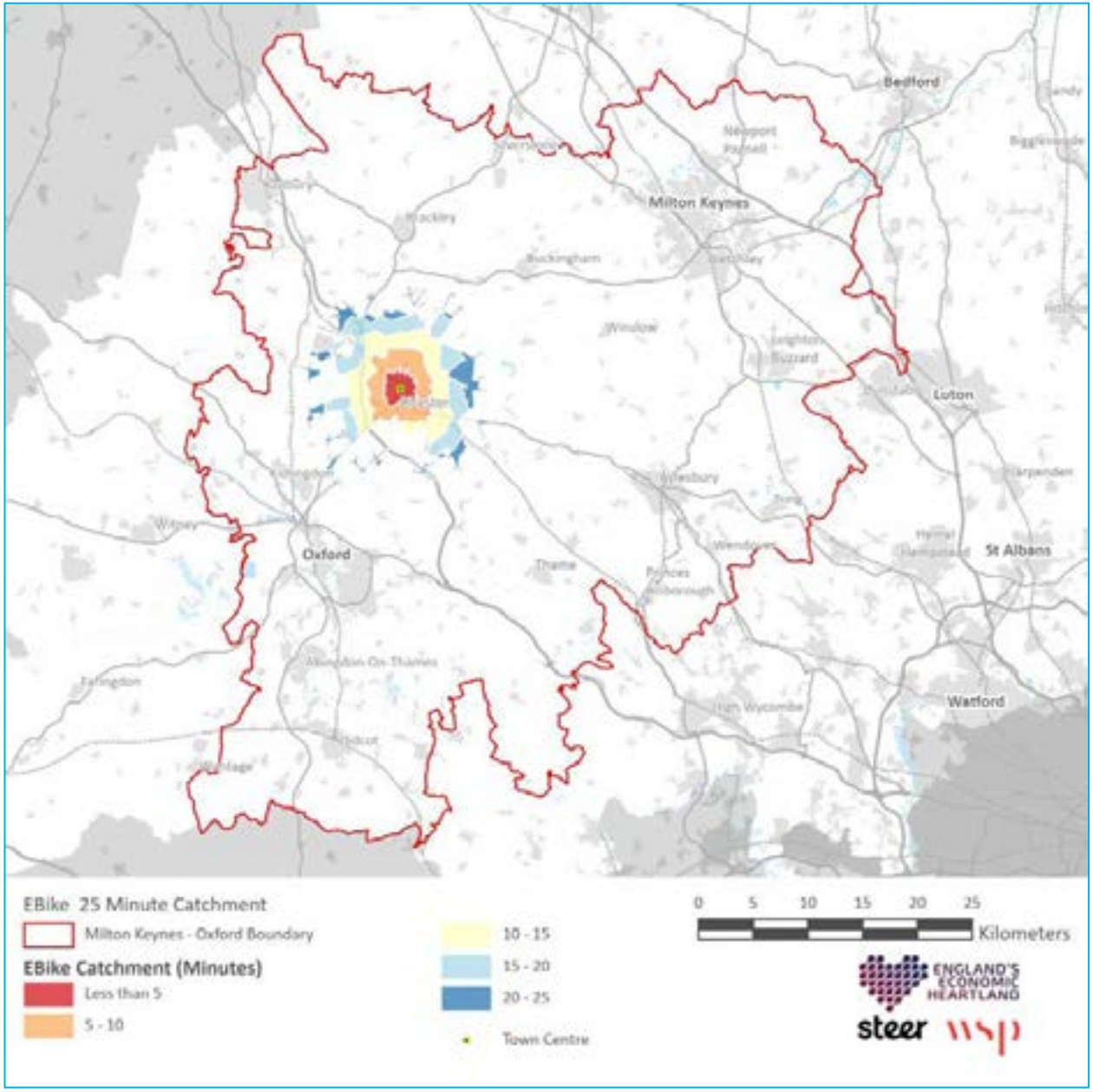
E-Bike 25 Minute Catchment – Aylesbury



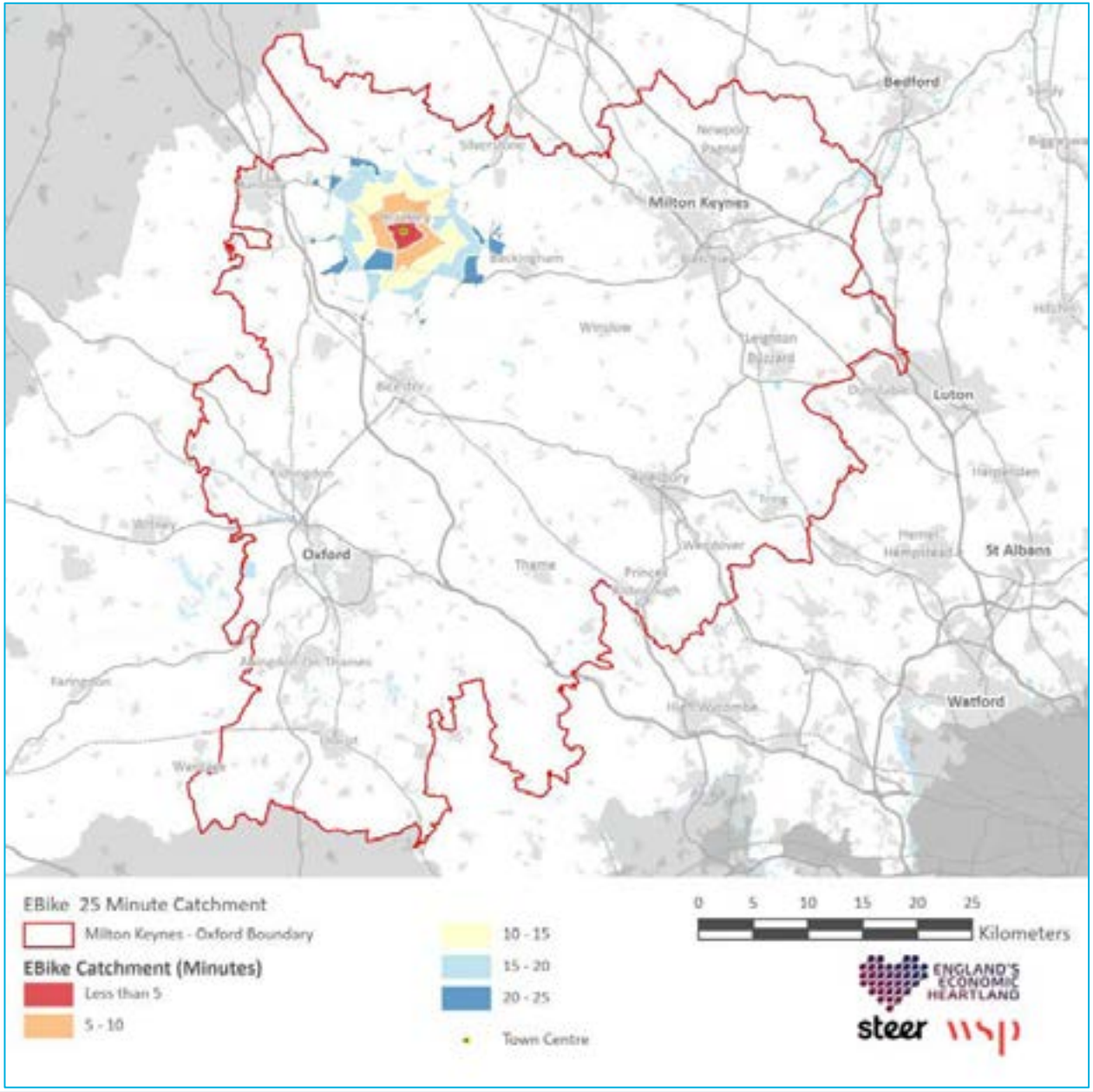
E-Bike 25 Minute Catchment – Banbury



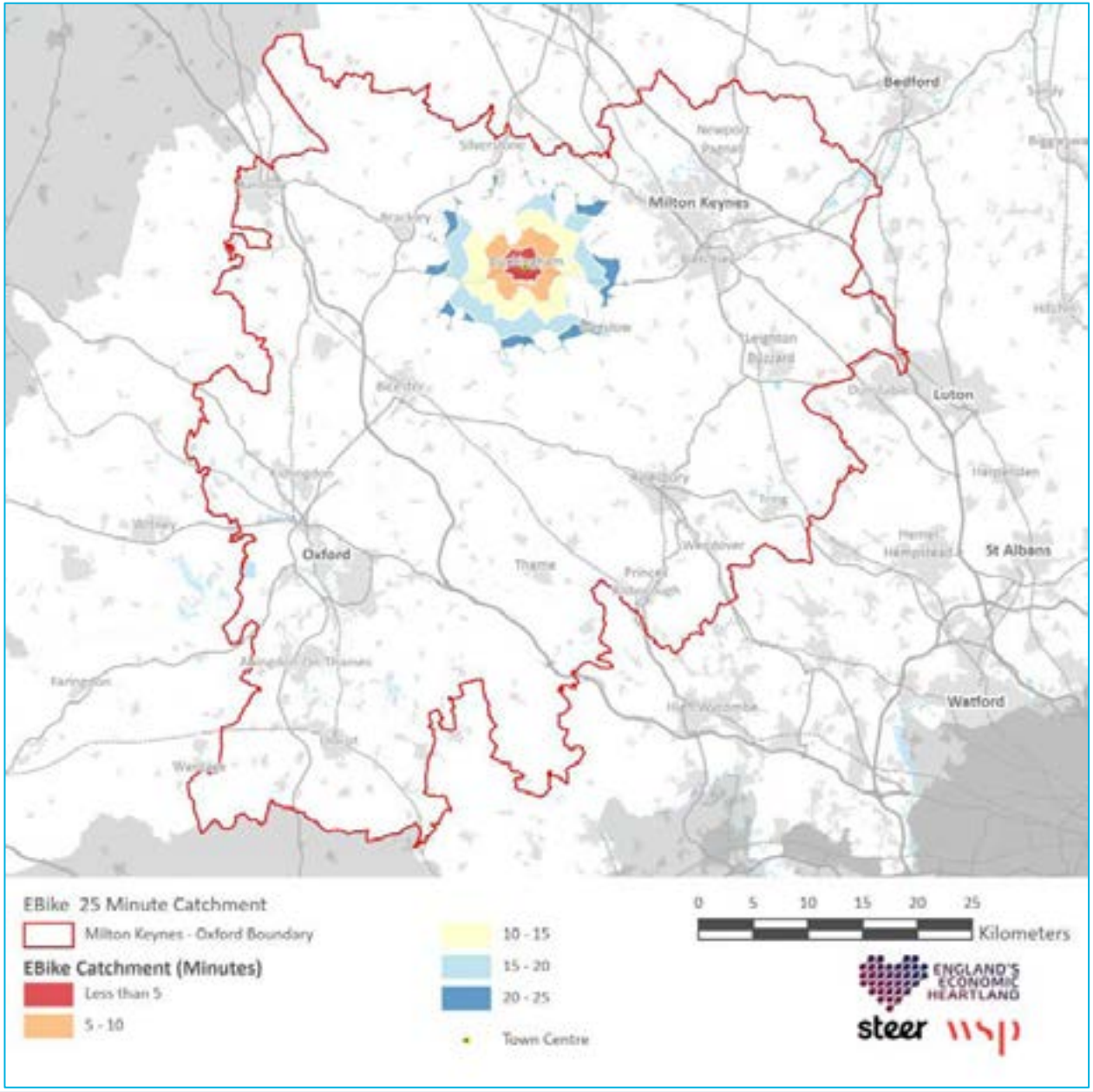
E-Bike 25 Minute Catchment – Bicester



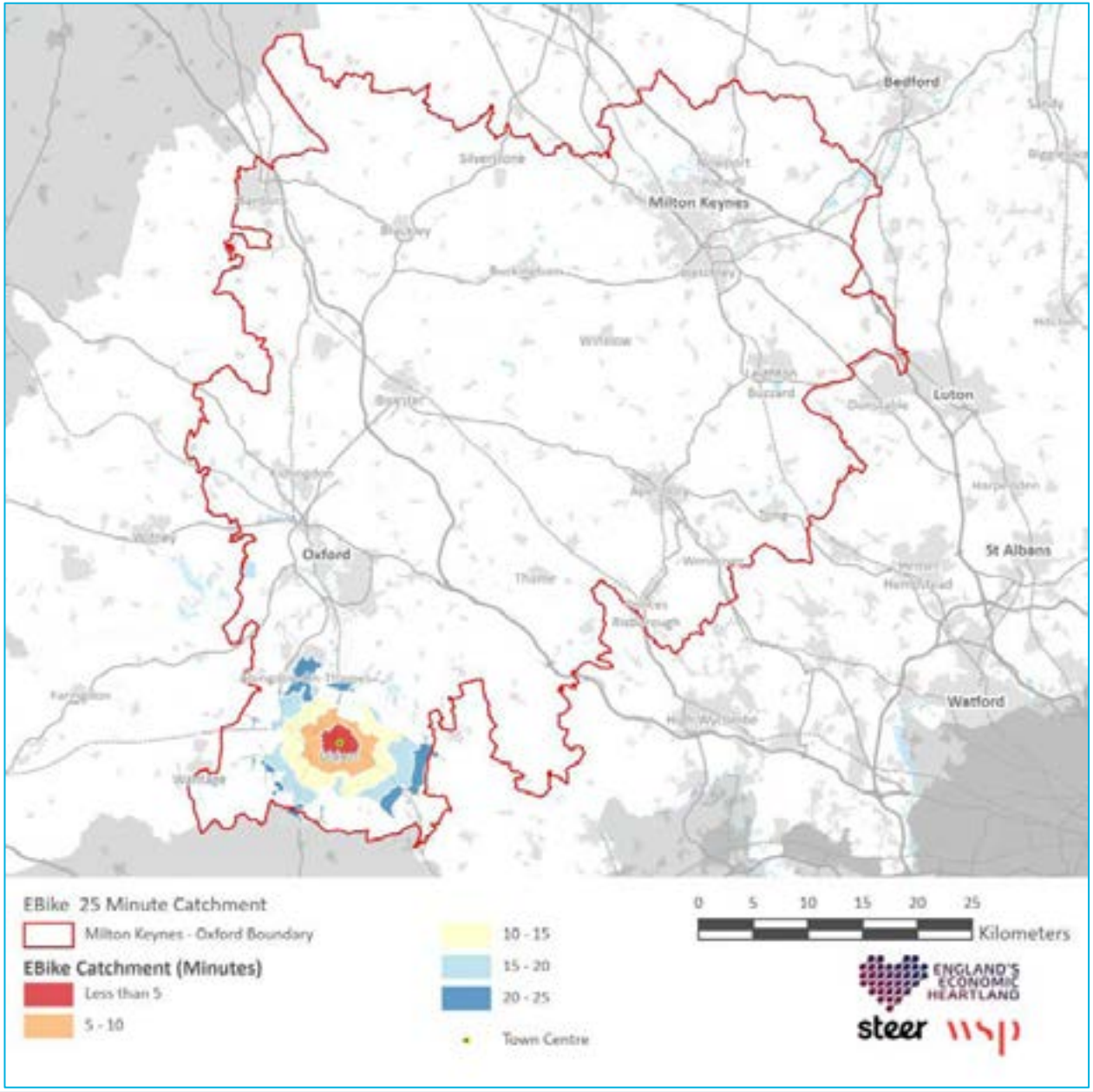
E-Bike 25 Minute Catchment – Brackley



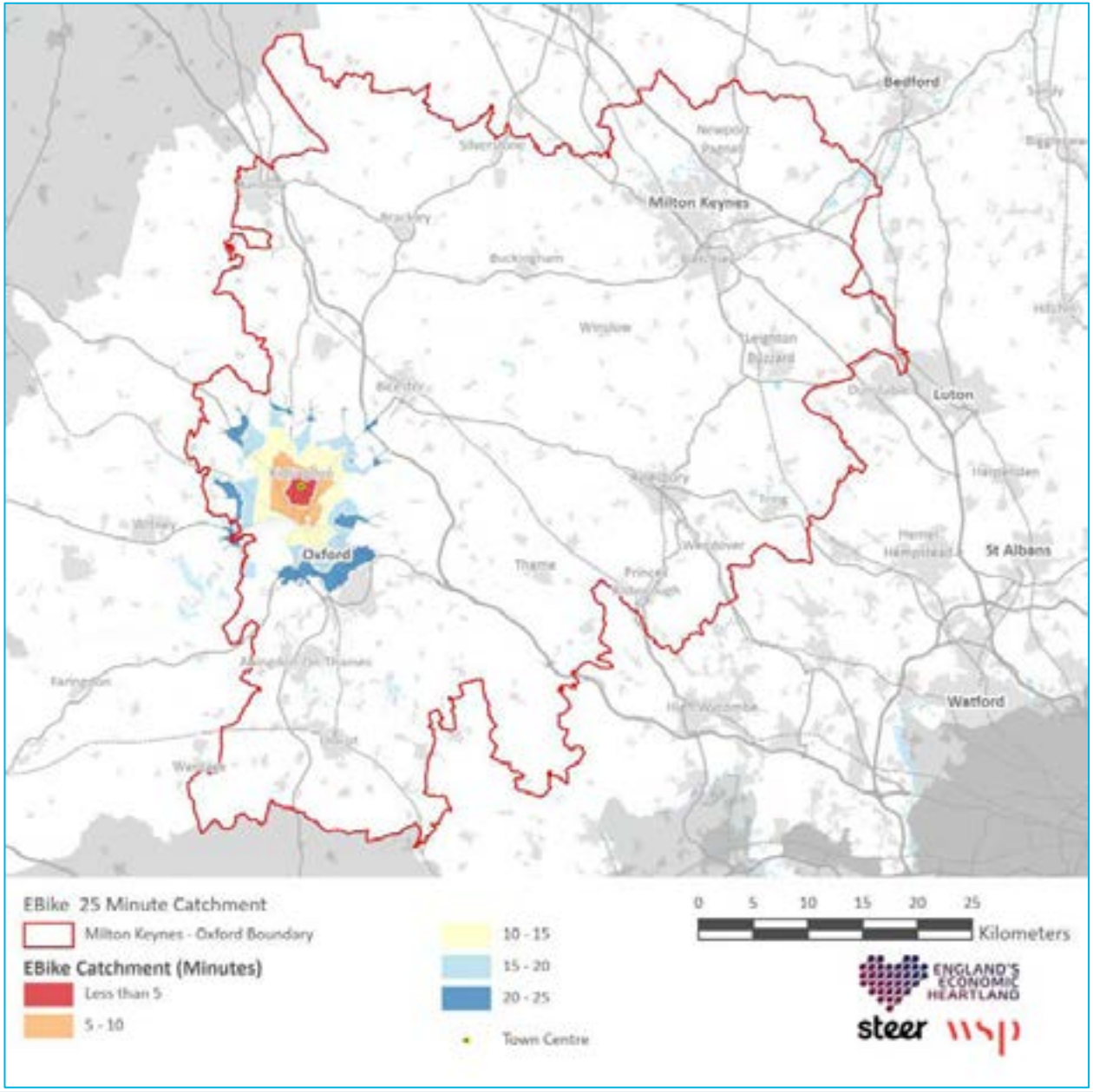
E-Bike 25 Minute Catchment – Buckingham



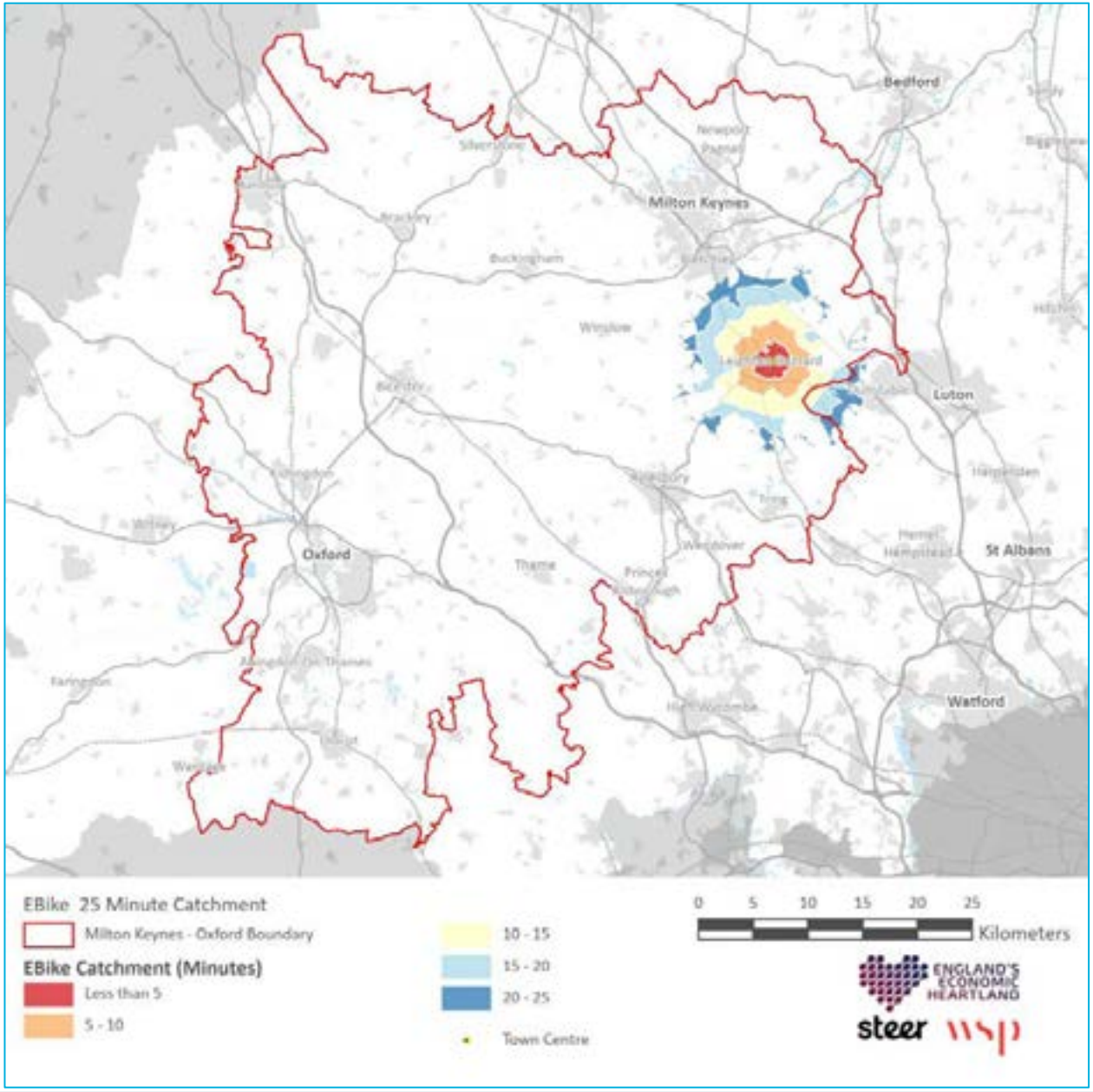
E-Bike 25 Minute Catchment – Didcot



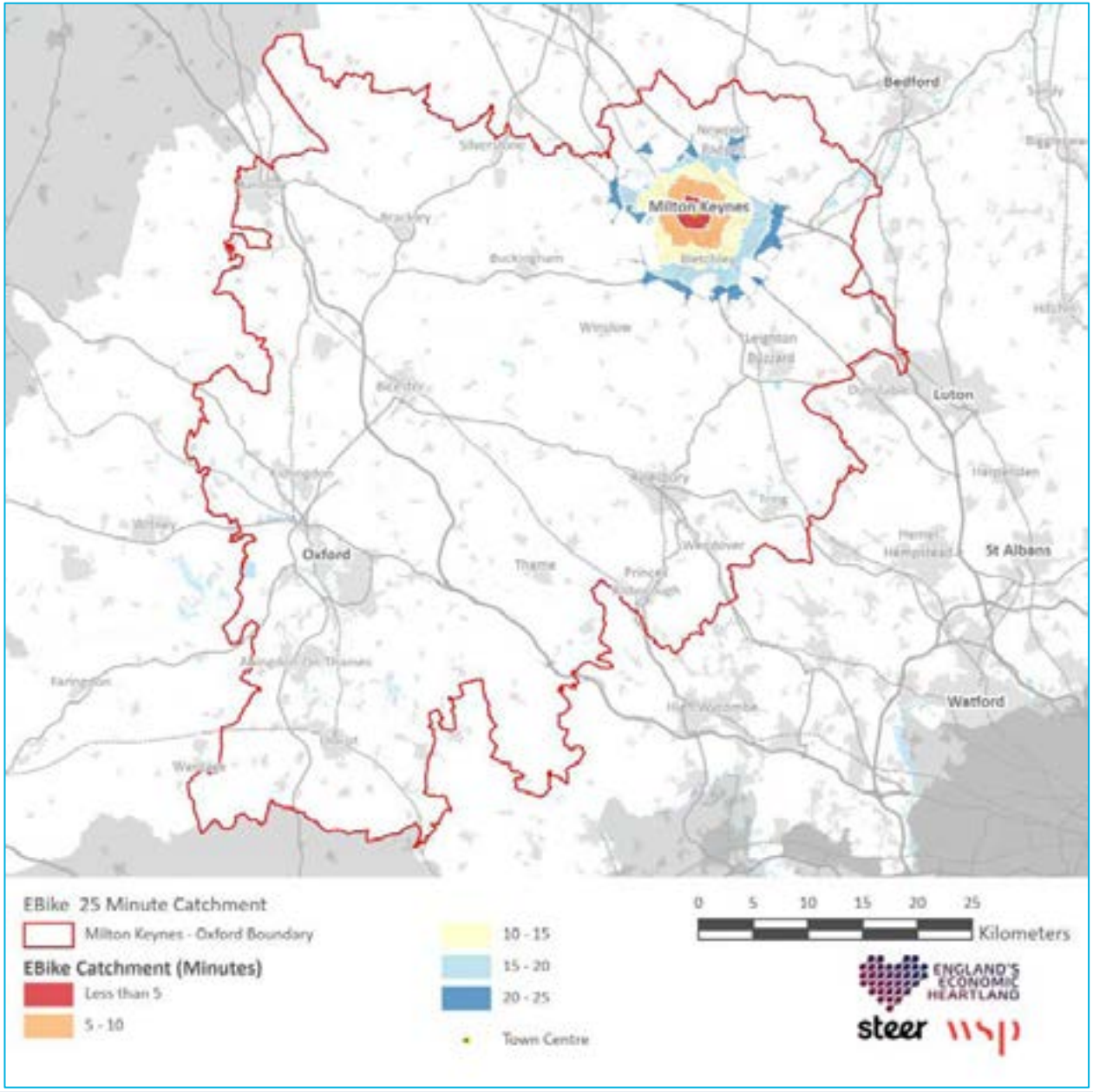
E-Bike 25 Minute Catchment – Kidlington



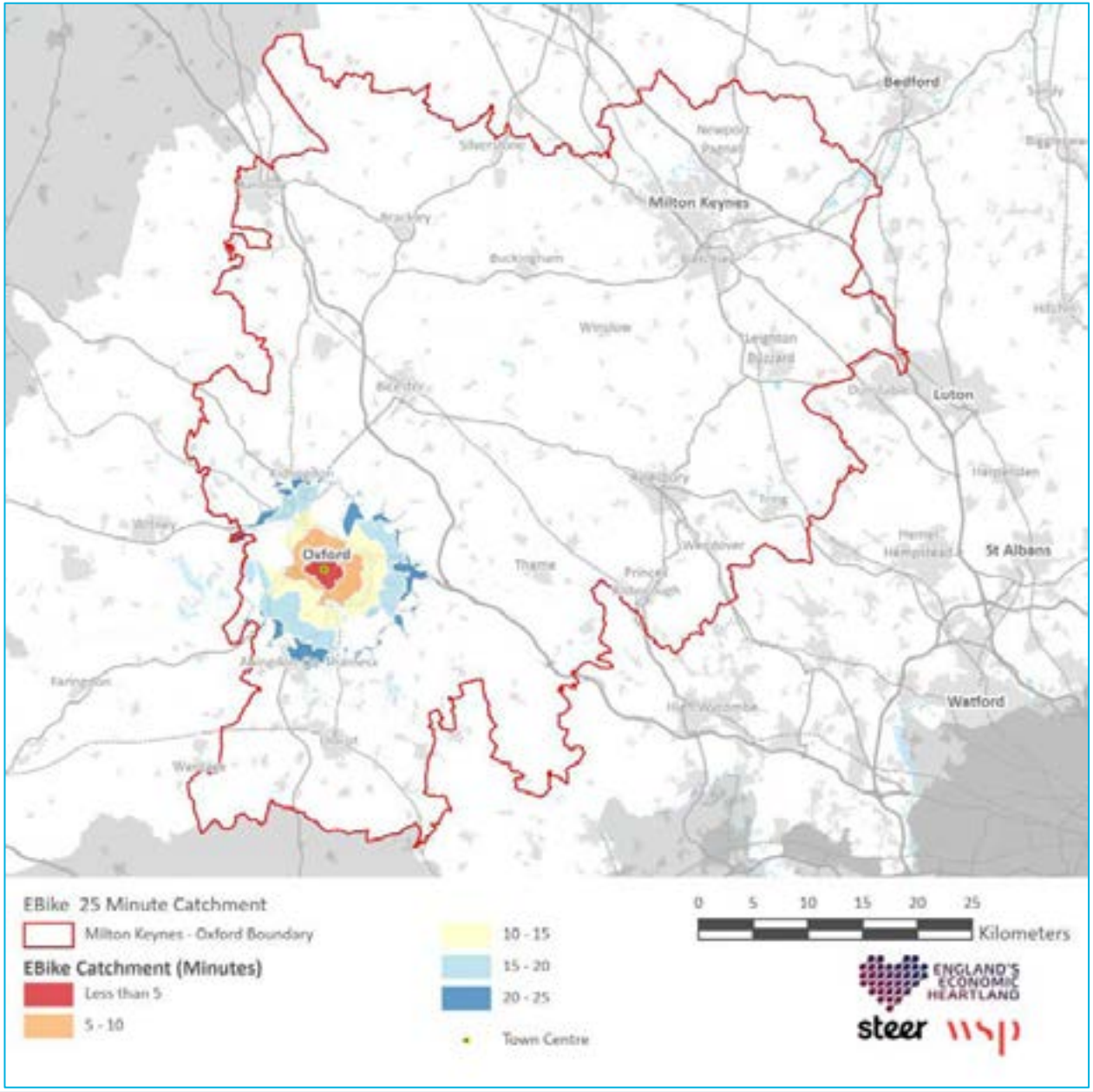
E-Bike 25 Minute Catchment – Leighton Buzzard



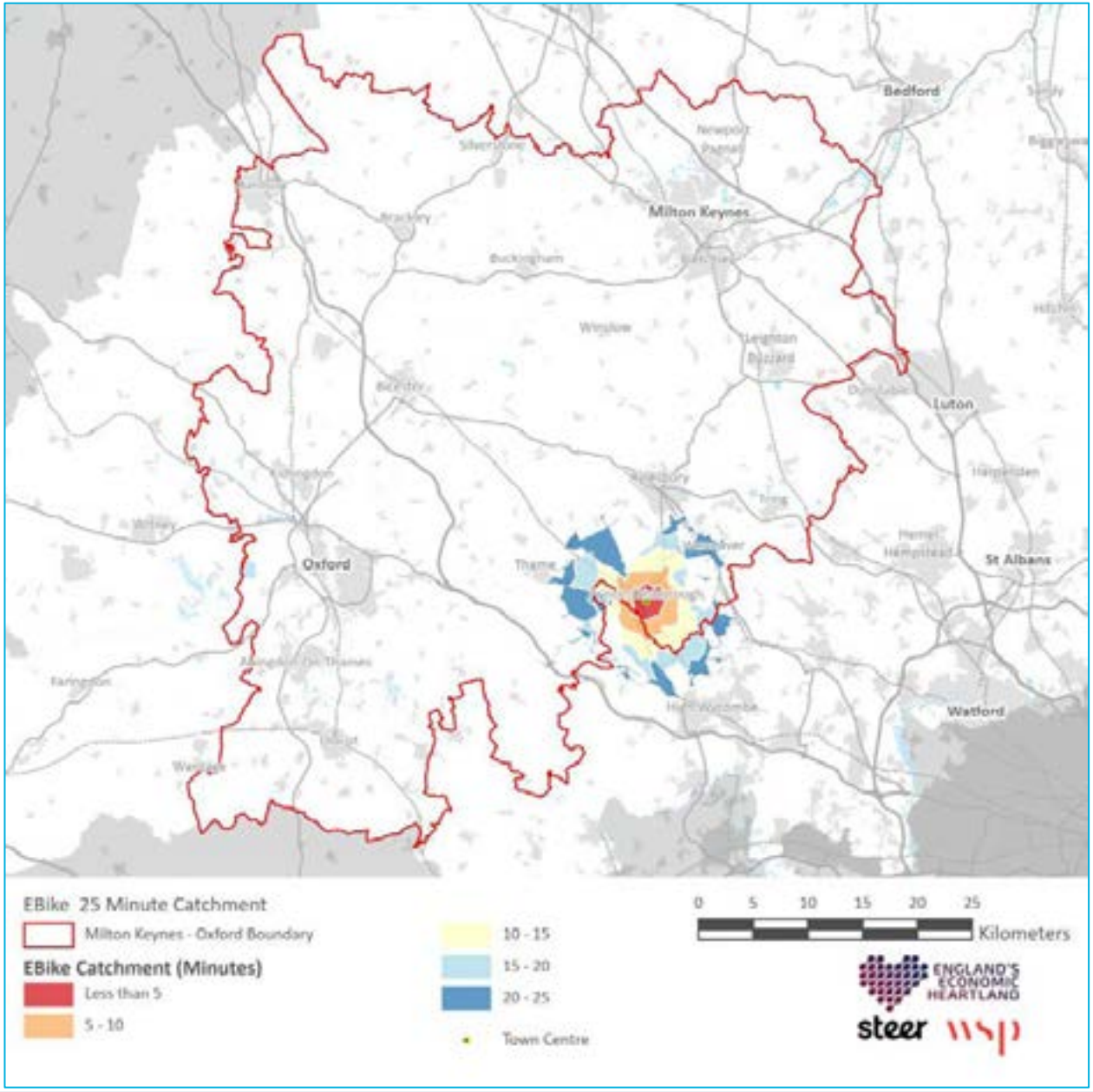
E-Bike 25 Minute Catchment – Milton Keynes



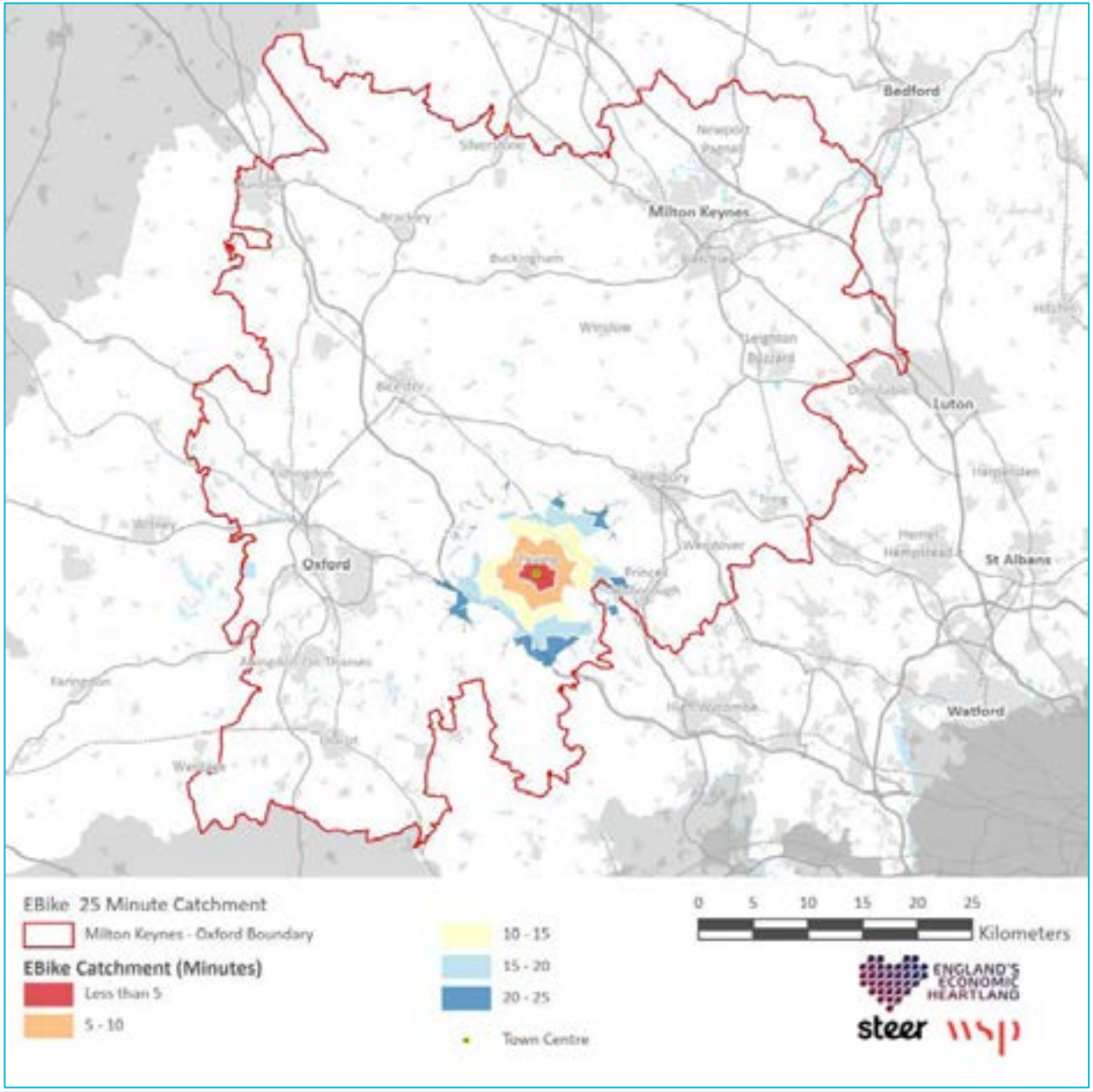
E-Bike 25 Minute Catchment – Oxford



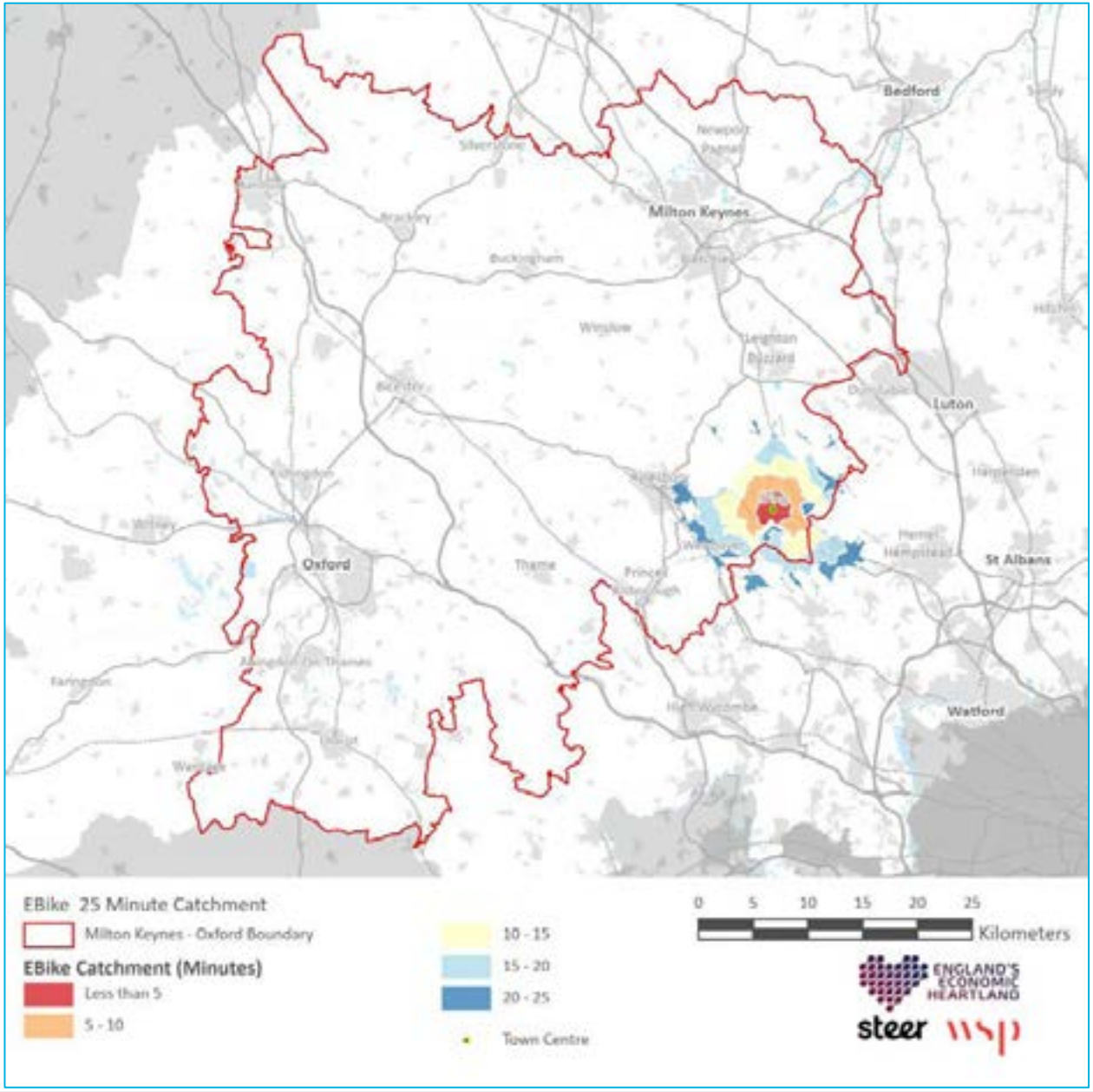
E-Bike 25 Minute Catchment – Princes Risborough



E-Bike 25 Minute Catchment – Thame



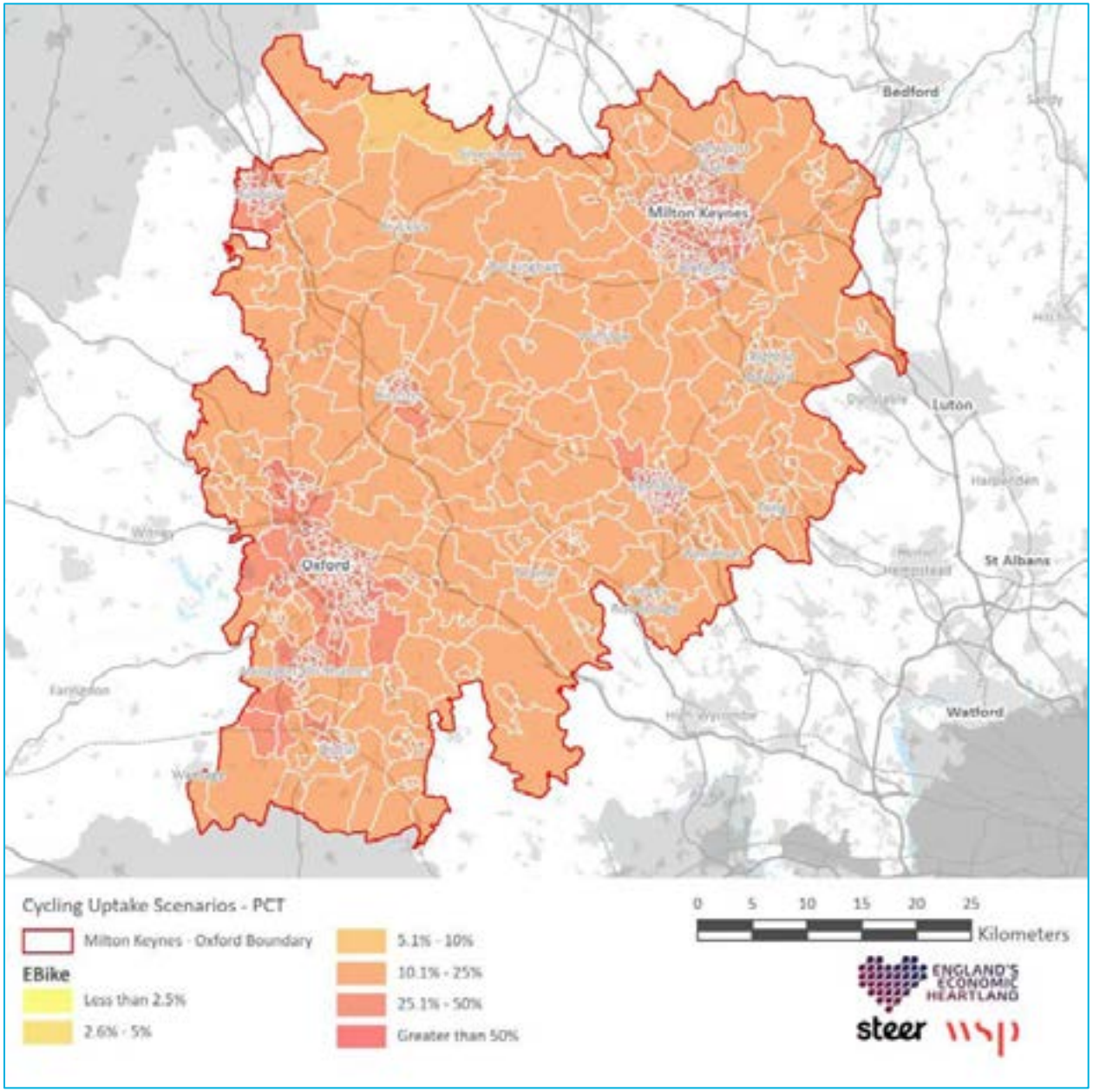
E-Bike 25 Minute Catchment – Tring



Appendix D – Cycling Propensity Tool Scenarios

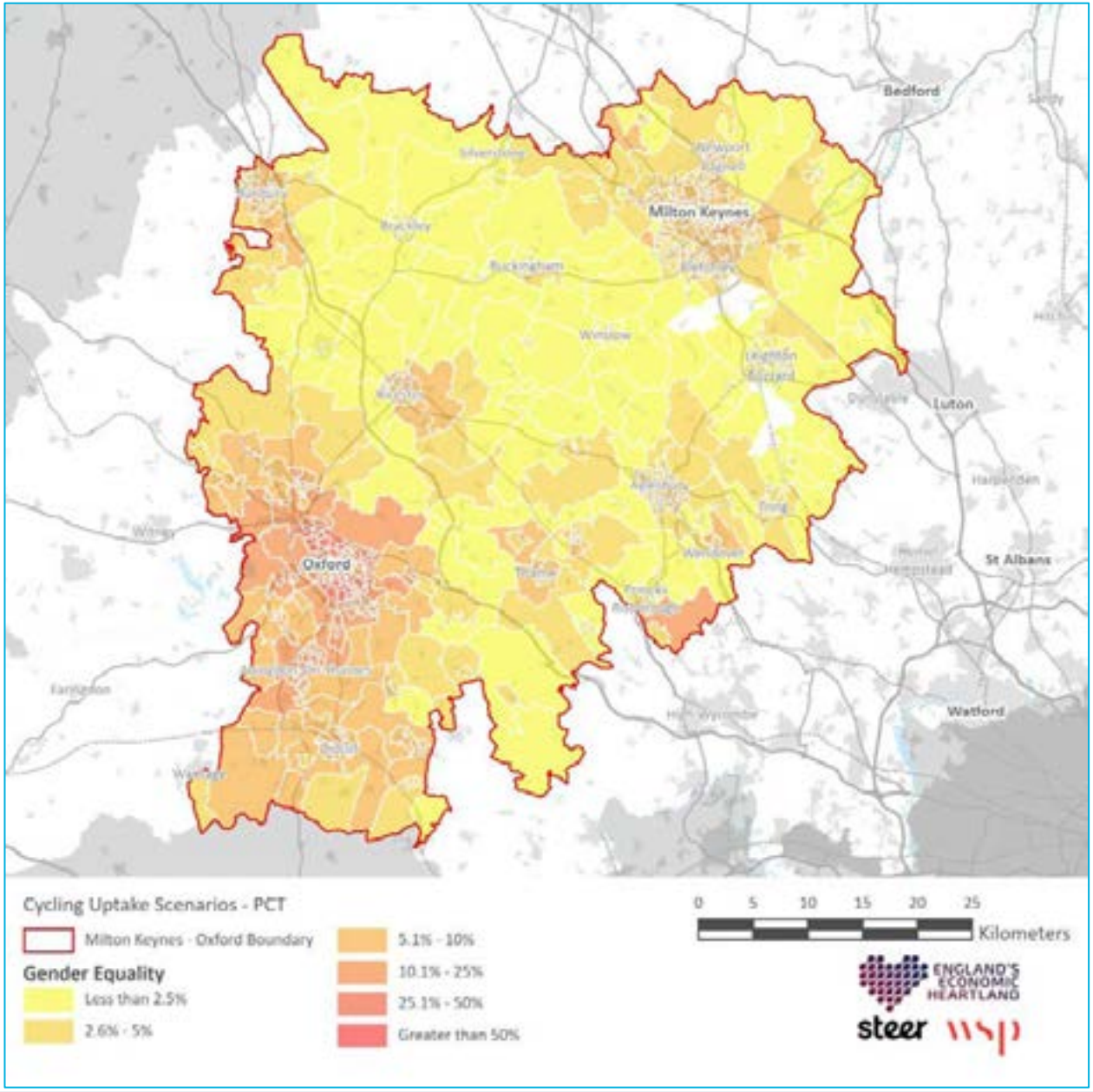
Cycling Propensity – E-Bike

This scenario considers the level of cycling that would be achieved through the widespread uptake of electric cycles



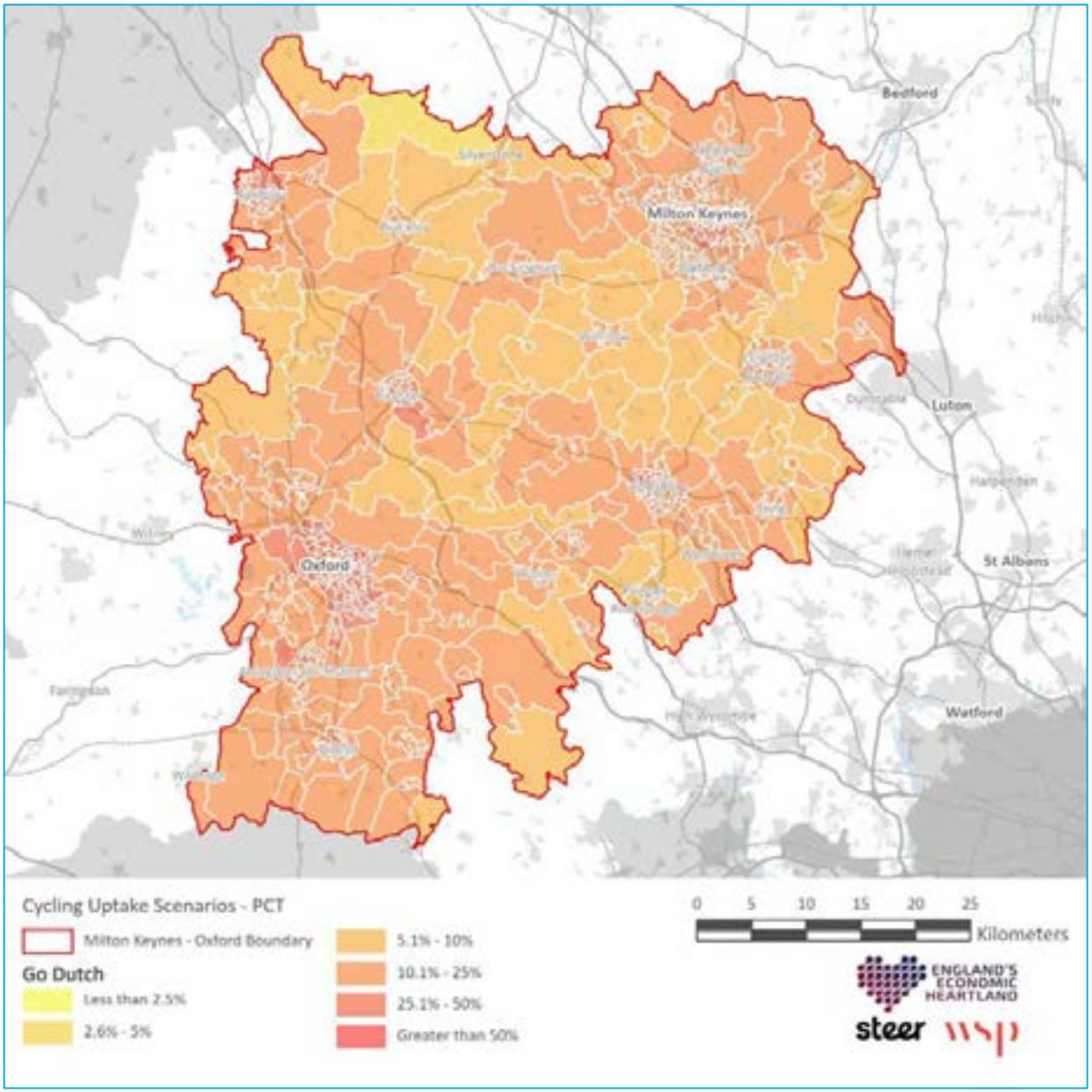
Cycling Propensity – Gender Equality

This scenario considers the level of cycling that that would be achieved if gender disparities are eliminated



Cycling Propensity – Go Dutch

This scenario considers the level of cycling that would be achieved if areas had investment bringing the same infrastructure and cycling culture as the Netherlands.



Appendix E – Travel Patterns and Behaviour

Travel Patterns & Behaviour

Car Driver

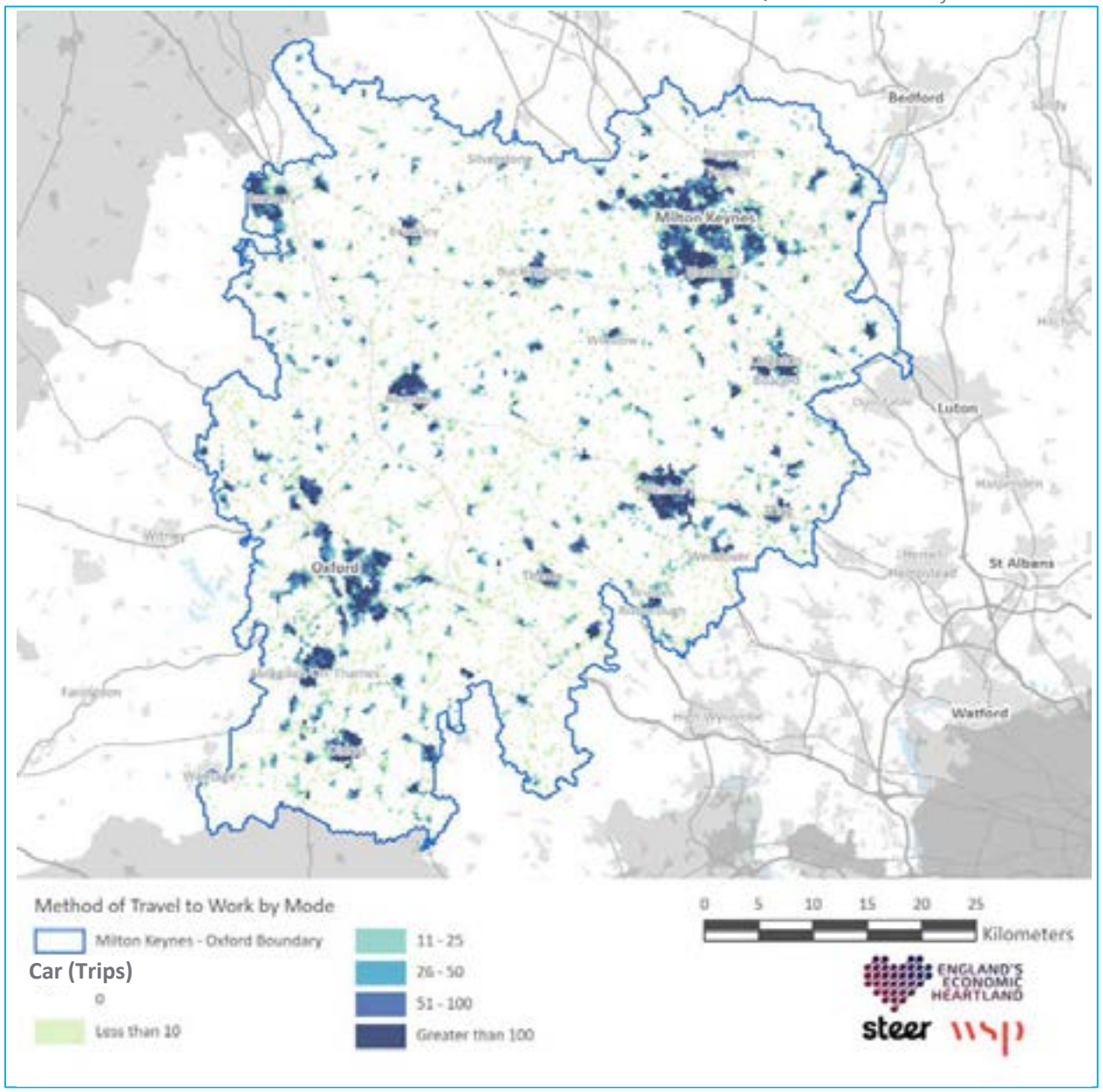
For the entire corridor, trips by car make up the majority of all commuting movements. There is a total of 298,113 trips by car drivers within the corridor, representing a total of 57% of the total trips within the study area.

The plan opposite shows that the majority of car drivers originate from the key settlements in the corridor. Traveling by car is the main method of travelling to work in all key settlements in the corridor; however, the mode share is highest in Milton Keynes and Aylesbury.

The distribution also highlights the continued reliance of private car travel for rural areas. A total of 36% of all car journeys are made from rural areas, with many smaller rural settlements exhibiting private car movements that exceed 100 trips per hex cell, a level comparable to many of the key urban areas.

The reliance on private vehicles particularly in the larger urban settlements is unsustainable. When compared to car passenger numbers, a total of 93% of all car driver trips are single occupancy, further reducing the sustainability of this form of travel.

Data Source: 2011 Census – QS701EW Method of travel to Work



Travel Patterns & Behaviour

Car Passengers

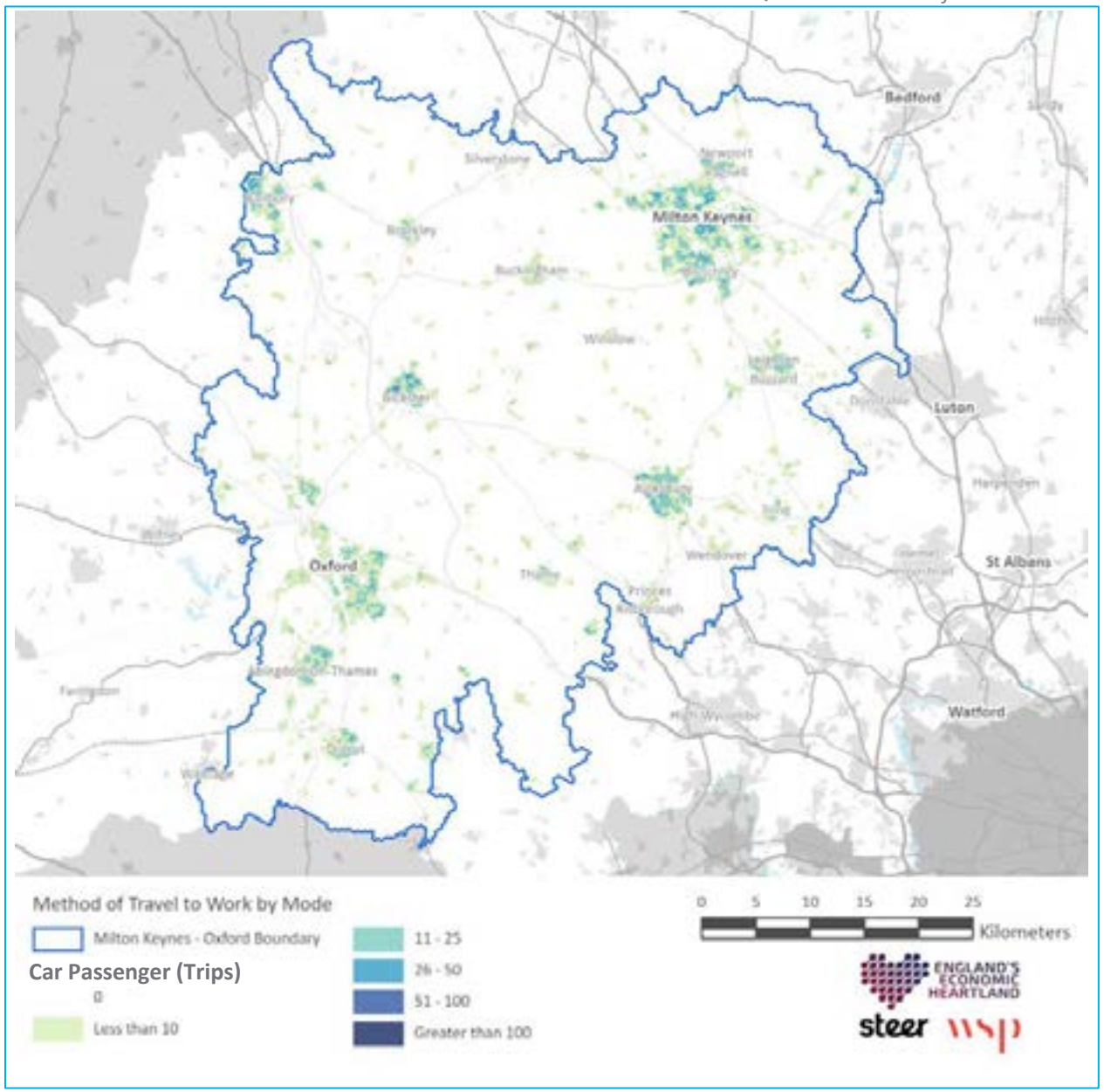
When assessing the total amount of car passenger trips, there is a clearly distinguished correlations with car driver trips. A total of 21,933 trips to work are undertaken via car share, equating to a total of 4% of all movements within the study area.

In total 7% of all commuting trips are as a car passenger, indicating a relatively low level of car sharing within the corridor. The plan opposite shows the highest number of commuting journeys as a car passenger to be in Milton Keynes, Aylesbury and Bicester. This may reflect effective car pooling / sharing schemes within these settlements.

Travelling as a car passenger is also a popular form of travel within rural locations. In total travelling by car with a passenger makes up 20% of all car passenger journeys in the corridor.

The effectiveness of implementing or expanding formal car pooling / car share programs to rural areas should be assessed to promote greater uptake of car sharing and reduce single occupancy trips.

Data Source: 2011 Census – QS701EW Method of travel to Work



Travel Patterns & Behaviour

Bus, Minibus and Coach

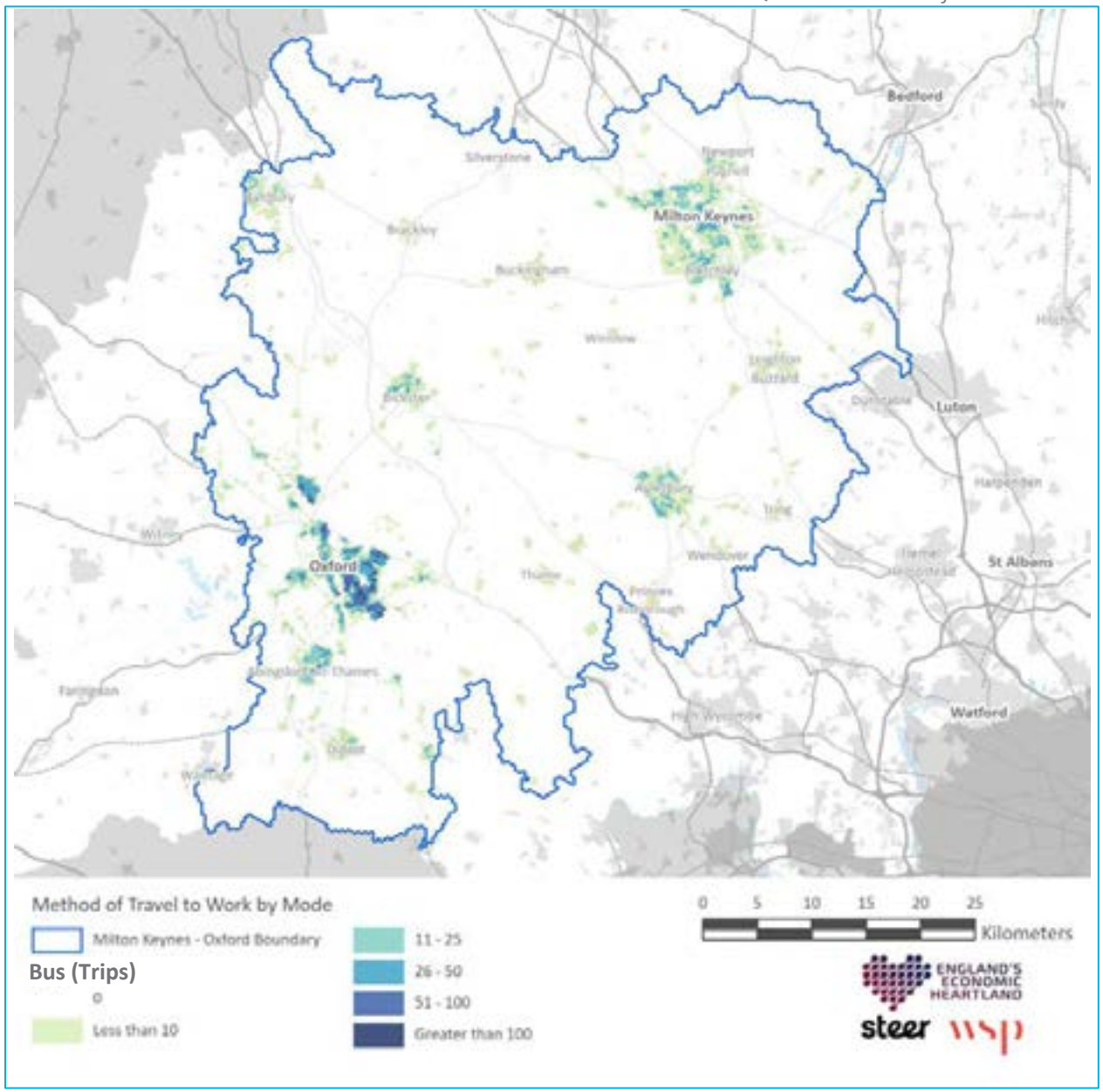
Bus usage makes up the majority of the public transport movements within the study area, which is expected, as inter-urban rail connectivity is limited to two north-south routes and a low frequency east-west route.

A total of 28,157 movements are made by bus, equating to 5% of the total mode share, and making up 58% of all public transport movements.

The distribution of bus travel highlights an urban / rural divide with the highest bus usage found in Oxford and the surrounding settlements which support high frequency bus services. There is a lack of high frequency bus connectivity within areas outside the major urban areas. A total of 3,123 trips are made by bus from rural areas, equating to 11% of all bus travel.

Bus travel between neighbouring settlements on high frequency bus routes is relatively high; however, there are east-west connectivity challenges and a lack of high-frequency services to key rural locations (e.g. Silverstone), thereby reducing the mode share and presenting an opportunity to increase services and future-proof the network.

Data Source: 2011 Census – QS701EW Method of travel to Work



Travel Patterns & Behaviour

Train

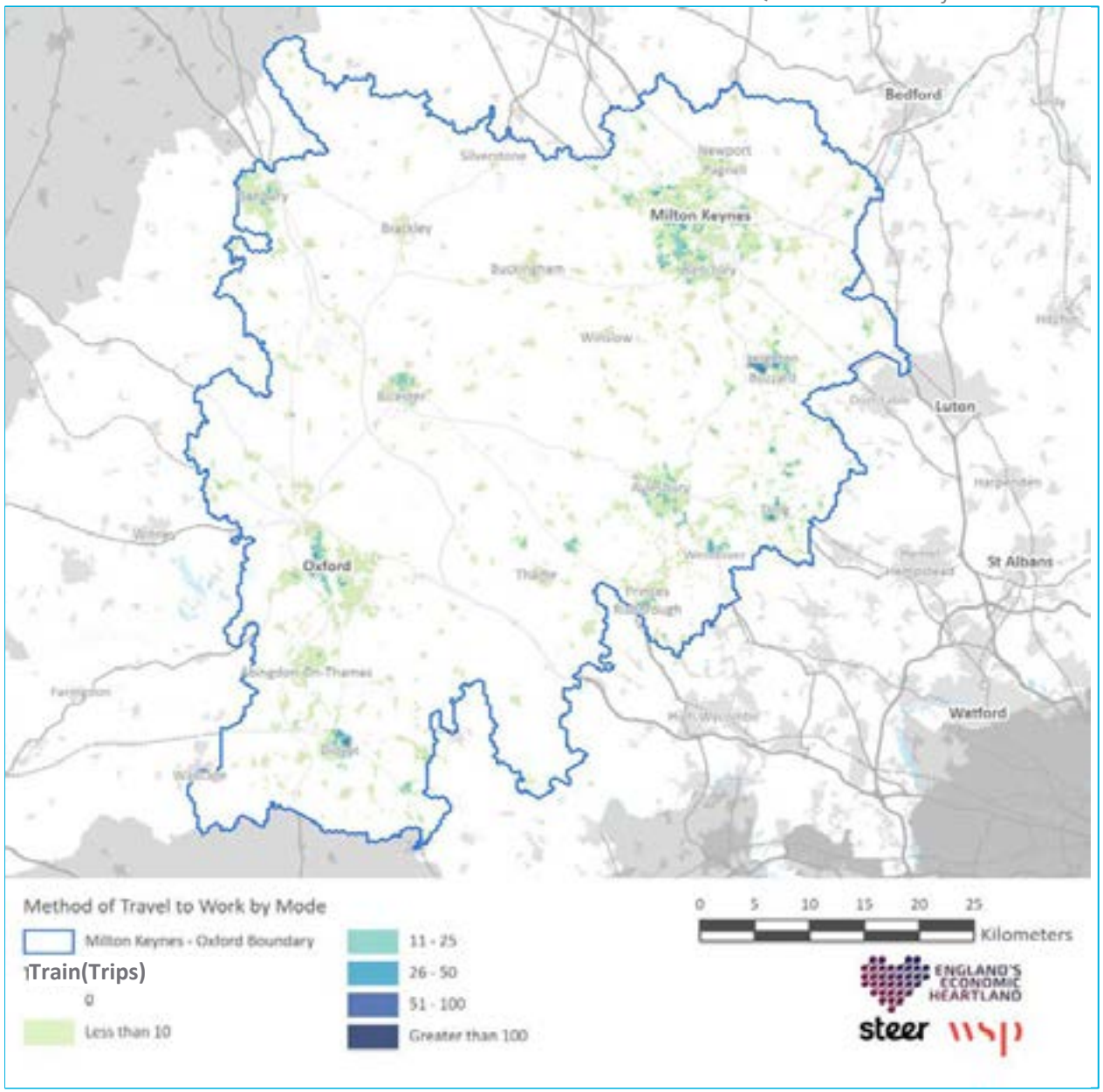
There is a total of 17,693 trips made by train within the study area, representing 3% of total commuting movements.

Train modal share represents 19% of all public transport movements, making it a less attractive form of public transport compared to buses, which is due to a lack of connectivity between settlements across the study area.

The distribution of train trips highlights a correlation between rail station usage and rail modal share. Major urban areas have the highest train modal share; however some rural locations with stations on the key rail lines do have good mode shares. A total of 29% of all train trips are made from rural areas

With the development of new rail schemes within the corridor such as East-West Rail, there is an opportunity for modal shift towards rail, as travel by rail will become more attractive and viable. Local connectivity to and from the rail stations is important to encourage greater uptake in journeys by rail.

Data Source: 2011 Census – QS701EW Method of travel to Work



Travel Patterns & Behaviour

Cycling

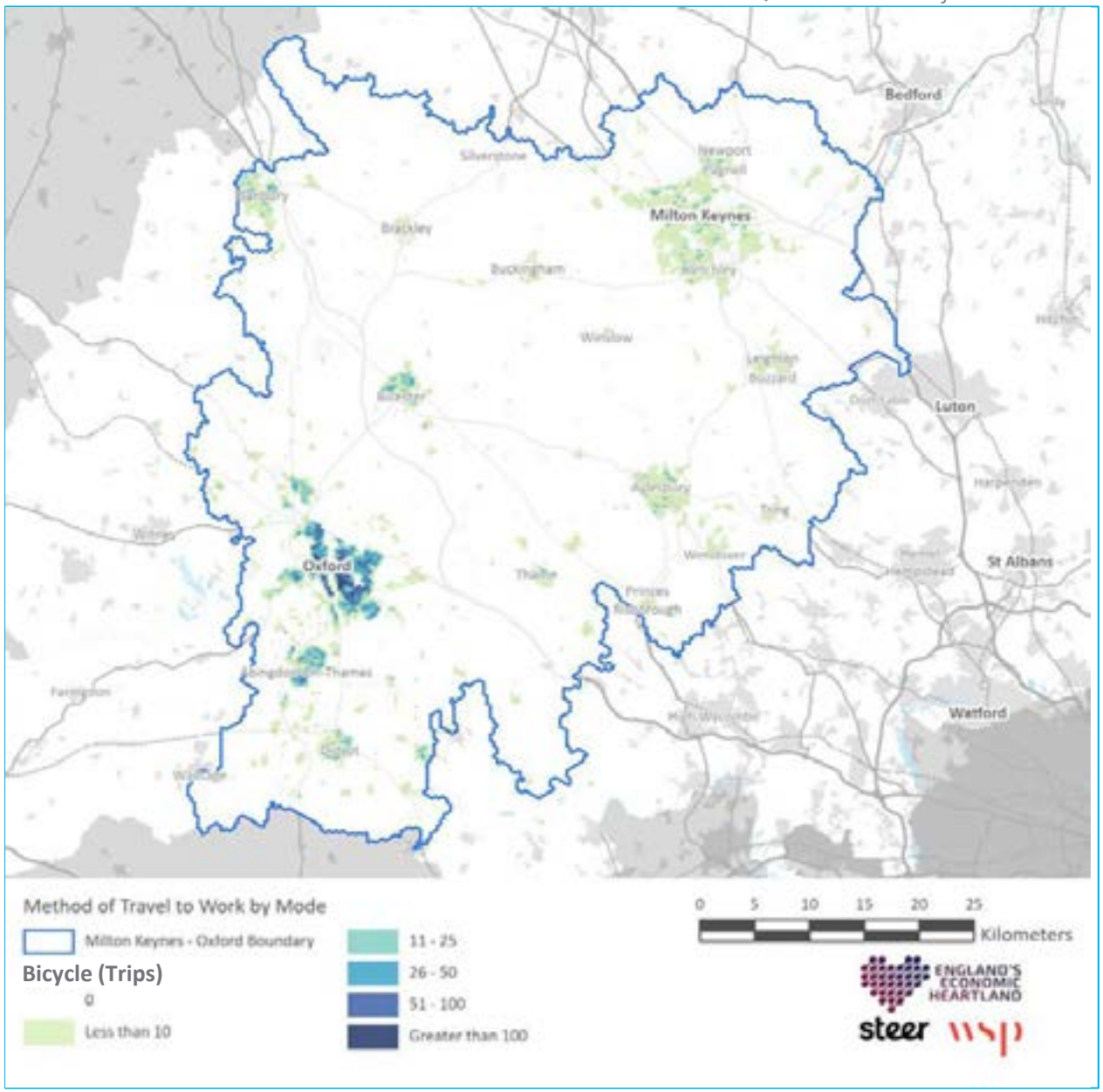
The total number of journey to work trips undertaken by cycling in the study area is 23,374, representing 33% of all active travel movements.

The majority of cycling trips occur within the major urban areas due to reduce commuter travel distances. Oxford has the highest number of cycle to work trips, including the surrounding settlements such as Kidlington, Bicester and Abingdon. Compared to Oxford, Milton Keynes has a much lower level of cycling despite a well-established segregated cycle network.

Cycling to work journeys is limited in rural areas as the majority of jobs are located within the urban areas – too far to be undertaken by cycle on a daily basis. A total of 11% of all cycling journeys in the corridor originate from rural areas.

The opportunities for active travel for the urban areas (Milton Keynes, Oxford and the surrounding areas) is high; however there is a lack of active travel from rural areas due to the travel distances to access jobs and services. The onset of E-bikes as well as future shared mobility schemes may increase the propensity to travel by bicycle.

Data Source: 2011 Census – QS701EW Method of travel to Work



Travel Patterns & Behaviour

Walking

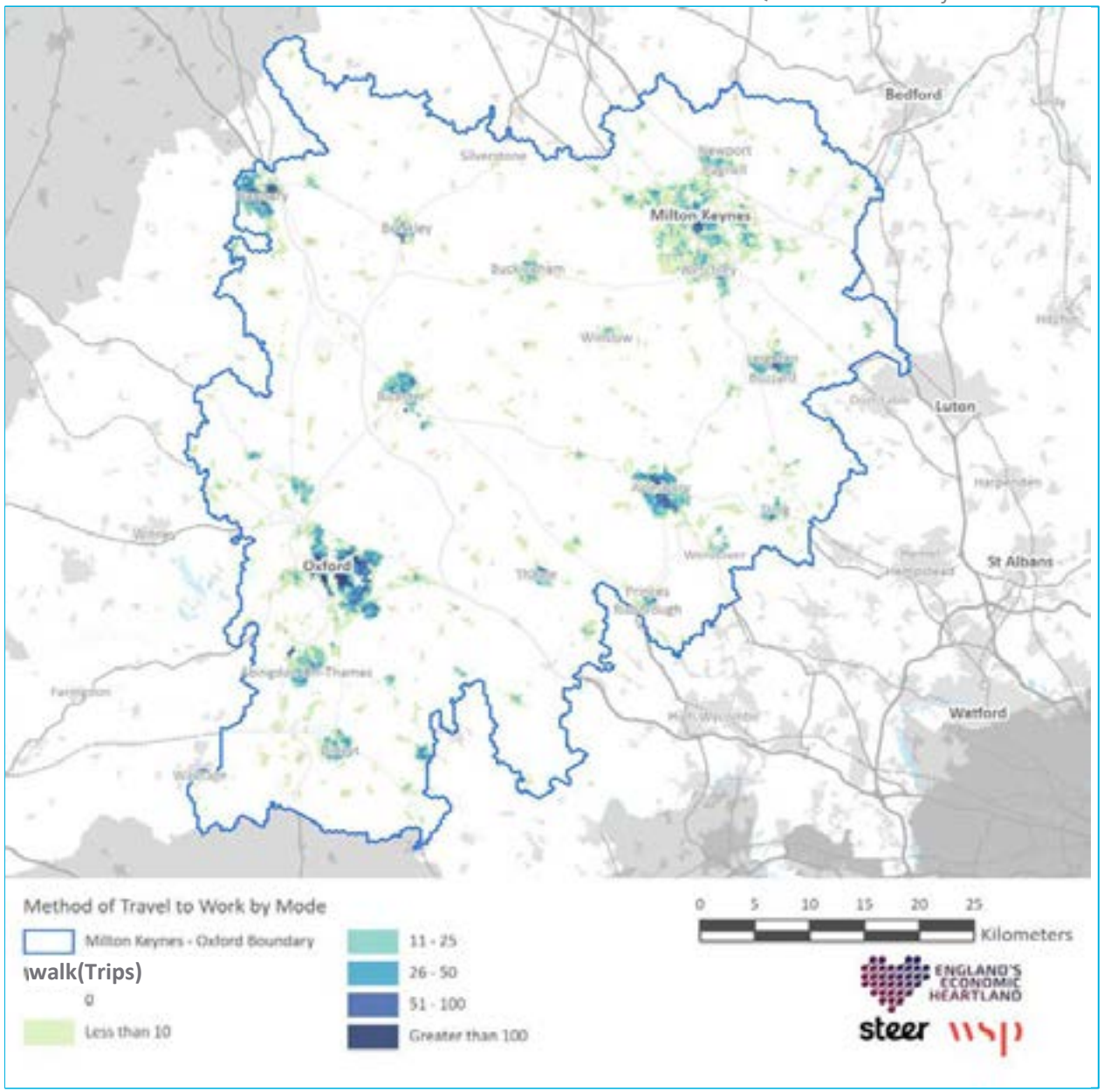
The total amount of pedestrian trips in the study area represents 46,806 commuting movements. This represents 9% of all movements within the corridor.

Pedestrian movements within the corridor make up 67% of the active travel mode share, thereby representing an important mode share for all movements. However, the distribution of walking trips highlights that there is a large urban / rural divide.

The majority of all walking trips take place in urban areas as only 15% of all walking trips originate from rural areas. The larger settlements offer the greatest opportunities for walking through 15/20 minute neighbourhoods, with local jobs and services within reasonable walking distances.

Transport interventions should focus on schemes that deliver attractive infrastructure that encourages walking and cycling for end-to-end journeys or part of a longer journey by passenger transport.

Data Source: 2011 Census – QS701EW Method of travel to Work



Travel Patterns & Behaviour

Work From Home (WFH)

One of the most important changes to transportation in a world post Covid-19 is the increase in Work from home (WFH) with the onset of hybrid working patterns.

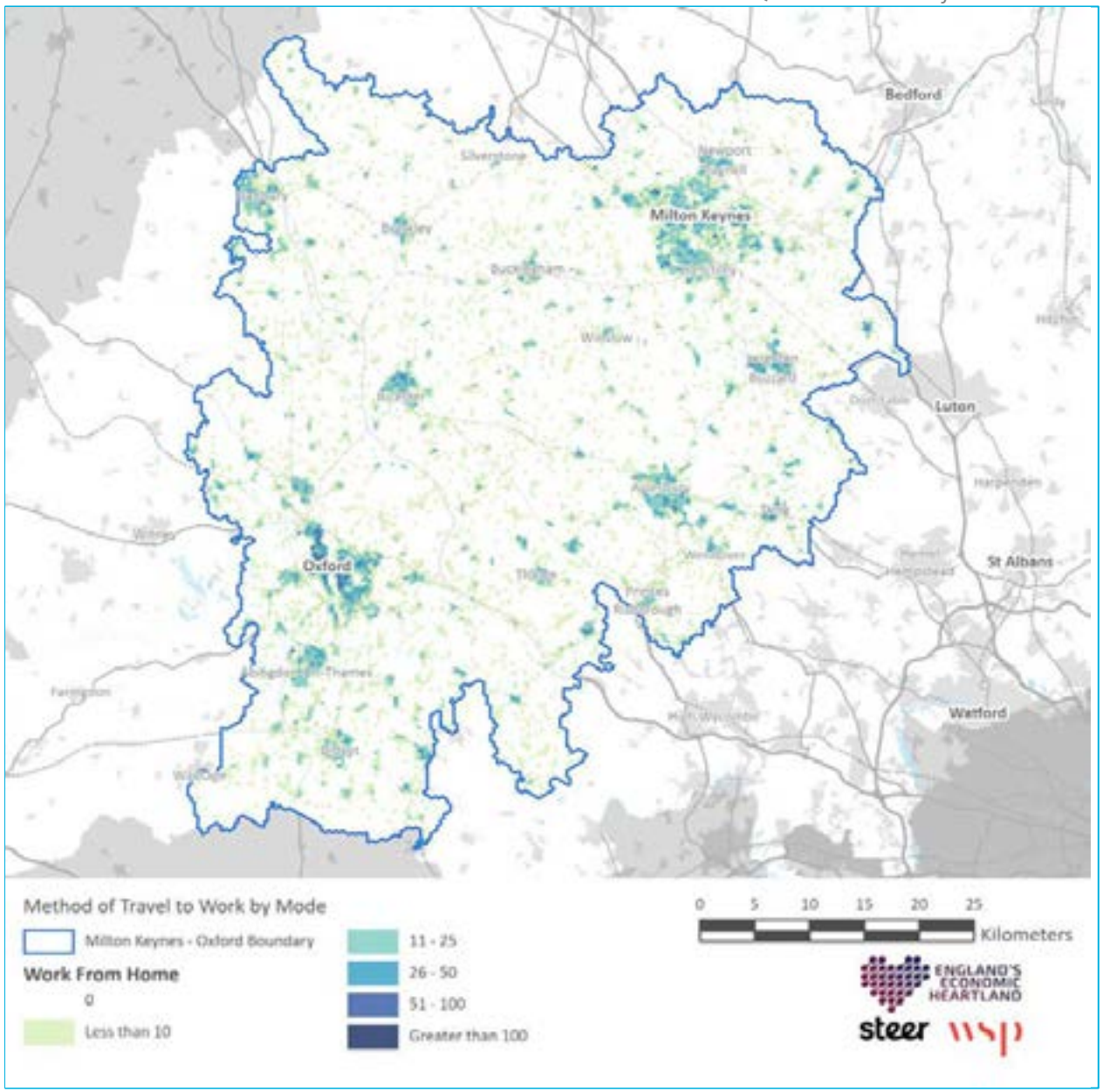
Pre-pandemic patterns of WFH behaviours show that 57,377 people worked from home, representing a total of 11% of the corridor.

The distribution of work from home patterns highlights that the majority of people within the corridor that WFH can be found outside of major urban settlements, with a total of 72% of all WFH takes place in rural areas; especially in locations that are supported by superfast and ultrafast broadband.

The distribution and uptake of people WFH is likely to change in the future with the adoption of hybrid working as a result of the Covid-19 pandemic (discussed in more detail on page 74).

It is estimated that through hybrid working, an overall traffic reduction of 10-14% in peak hours can be achieved, thus, supporting hybrid working options will provide wider environmental and community benefits.

Data Source: 2011 Census – QS701EW Method of travel to Work



Travel Patterns & Behaviour

Distance Travelled to Work

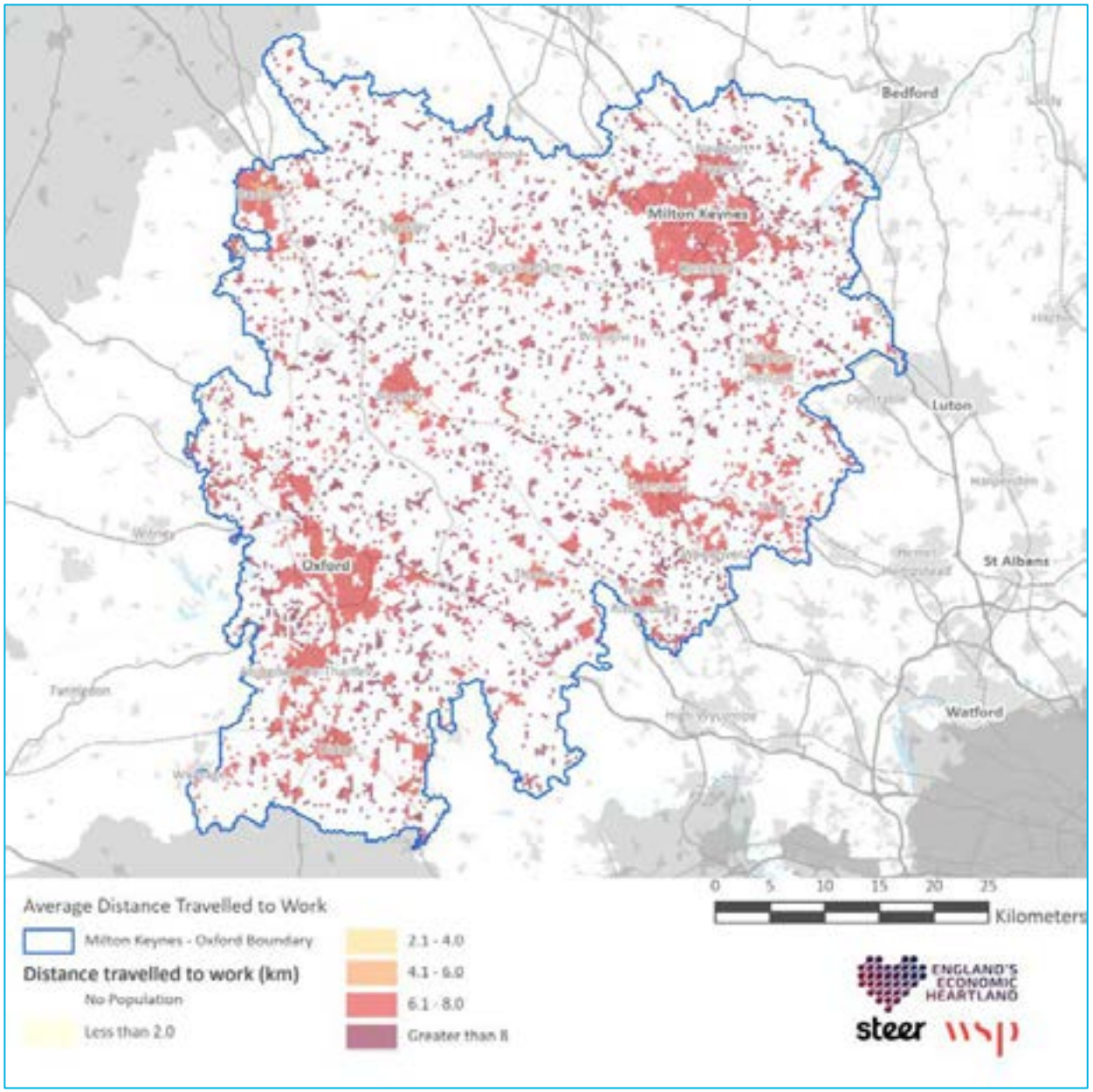
Travel distance can have a major influence on travel mode, with short distance trips able to be undertaken by active travel modes.

The majority of short-distance journeys to work (less than 6km) are found in urban areas which is expected as this is where the majority of jobs within the corridor are located. Rural areas typically have journey to work distance in excess of 8km, highlighting that rural commuting is generally longer than urban commuting and typically requires travel by car or public transport.

Universities and large healthcare facilities also typically include shorter commuting distances due to the workforce being typically close. Areas surrounding Oxford University, Buckingham University and John Radcliffe Hospital have commutes less than 6km.

The most common travel to work distance for the corridor ranges from 6-10km in total, which are realistic distances for travel by bicycle and public transport modes. Transport interventions should seek to provide attractive alternatives for short to medium journeys to reduce reliance on single occupancy car trips.

Data Source: 2011 Census – QS702EW Distance travelled to Work



Appendix F – Alternative Futures

England's Economic Heartland: Development of Alternative Futures

August 2021 (Draft)

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Context

- This slide pack reports on the approach to creating, and the purpose of, the alternative future scenarios for England's Economic Heartlands.

- Two workshops have been facilitated by Steer, WSP and England's Economic Heartland, and attended by key stakeholders to support the development of the alternative futures.

How will the scenarios be used for the connectivity study?

- The four alternative futures will support a high level qualitative assessment of the infrastructure scenarios that have been developed as part of the connectivity studies. The alternative futures will not be modelled.

- While alternative futures are not modelled, optimised infrastructure scenarios are being modelled. This approach continues to be in line with TAG, however, we have not explicitly modelled higher or lower demand scenarios (e.g. as a result of a higher or lower levels of housing or employment), rather housing, employment, and demand are outputs of the model.

- The futures will then form one part of the multi-criteria assessment framework process, for the assessment of the long list of infrastructure options, and support with the short listing to arrive at the preferred package of options. Infrastructure options that perform well, not only in relation to the connectivity study and transport strategy objectives, but also against all futures, implies a more resilient strategy.

- The formation of these alternative futures are distinct from the Transport Strategy and Local Economic Strategies future – the exercise was not designed to scope/re-scope this preferred future.

- The emerging Transport Strategy and local economic strategies future is the benchmark against which infrastructure scenarios will be tested.

Stage 1: Driver Mapping

- The first stage in the development of the alternative futures is Driver Mapping. This process is drawn from 'The Futures Toolkit' by the Government Office for Science and aligns with the Department for Transport's Transport Analysis Guidance (TAG) – 'Uncertainty Toolkit'.

- Driver Mapping is used to identify the various political, economic, societal, technological, legislative and environmental drivers shaping the future environment. It is intended to:
  - Identify drivers shaping the future;
  - Identify which drivers are most important for the future; and
  - Identify which drivers are most uncertain in the future.

Workshop 1: Driver Mapping

- An online stakeholder workshop was held on 22 June to explore what attendees believe would drive changes in transport demand between today and 2050.

- Stakeholders were divided into groups and invited to assess a number of 'external drivers' which describe broad areas outside of the control of EEH which could have an impact on future transport outcomes in the EEH area.

- There are a number of areas where EEH and its partners are defining policy and strategy which envisions specific future outcomes. The planned direction of travel for these outcomes are established, either through legally-binding requirements, regulatory frameworks or other policy arenas. Therefore, for the purpose of the EEH Alternatives Futures work, these will be assumed as established, and drivers related to these areas were not included in the driver mapping exercise.
  - Net zero carbon
  - Regional development (committed growth in Local Plans, following 'trends' of growth past plan period)
  - Regional economic development / industrial sectors (as set in the Arc Economic Prospectus)

- For the driver mapping exercise, stakeholders were encouraged to think about how the world could look in the long-term future – thinking beyond what is on the horizon now, and what could be of much more importance in the future.
- The drivers are listed on the following slide. All drivers except those in the 'Anything else' section were suggested by the project team, and stakeholders were invited to suggest additional external drivers that ought to be considered in the development of alternative futures.

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‘External Drivers’

Theme	#	Driver	Detail
Economy	A	**Covid-19 recovery pathway**	Medical resolution pathway to current health crisis
	B	**Economic shocks**	Degree of economic stability nationally and regionally e.g Covid-19, Brexit, trade wars, globalisation/isolationism
	C	**Robotics/AI in industry**	Extent of automation effects on employment.
	D	**Demographics**	Changes in migration patterns and age profiles
Policy	E	**Government spending**	Extent of public expenditure on local/regional authorities and infrastructure
	F	**How we pay for transport**	Forms of payment for consuming mobility including distance or tax-based.
	G	**Last-mile connectivity**	Local transport plans/strategies and degree of connectivity beyond the private car
Environment	H	**Attitudes to the environment**	Degree of support for protection of the natural environment
Technology	I	**Health technology**	Improvements in medicine and healthcare
	J	**Automation in transport**	Change in share of manually controlled motor vehicles
	K	**Clean transport technology**	Rate of diffusion of lower carbon transport technologies
	L	**New transport modes**	Changing modal mix of mobility with new modes entering the industry (e-scooters, hyperloop, ?)
Attitudes	M	**Attitudes to health**	Importance of addressing public health individually and collectively
	N	**Attitudes to shared mobility**	Willingness to share journeys and reduction in vehicle ownership
	O	**Changes in working patterns**	Extent of flexible working and its effects on commuting.
	P	**Changes in remote activities**	Degree that remote activities increase/decrease over face-to-face (business, leisure, retail, education)
Energy	Q	**Energy prices**	Oil, gas and electricity wholesale cost changes
	R	**Data and connectivity**	Communications technology and influence of data/networks on service delivery
Anything else?	S	**Social structure/inequality**	
	T	**Attitudes to diversity**	
	U	**Place design/placemaking**	
	V	**Environmental policy and protection**	
	W	**Policy and planning delivery**	
	X	**Attitudes to carbon**	
	Y	**Attitudes to radical change**	

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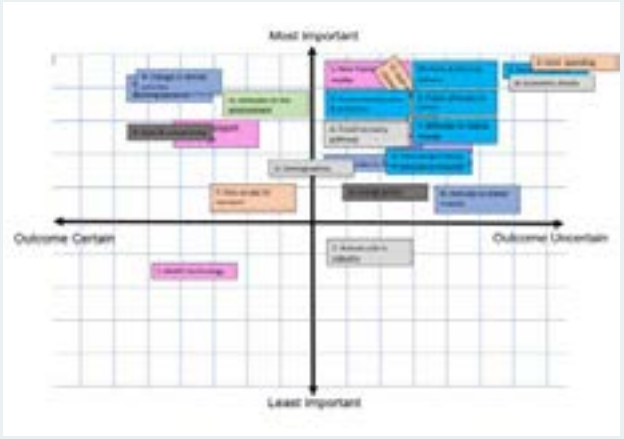
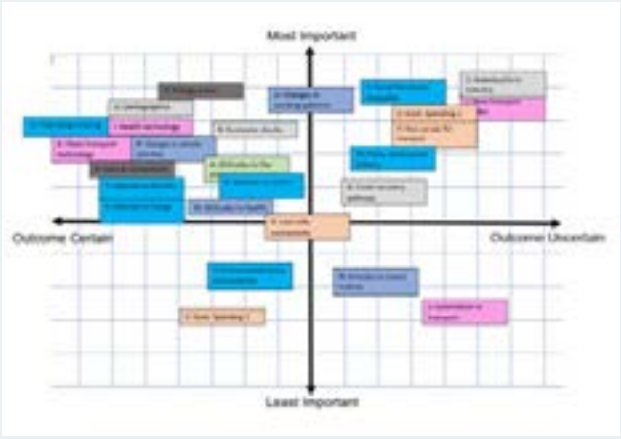
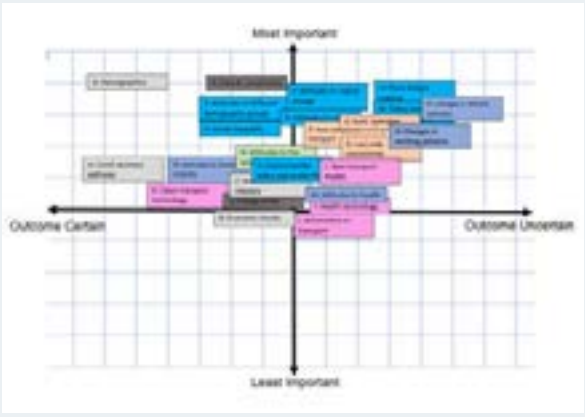
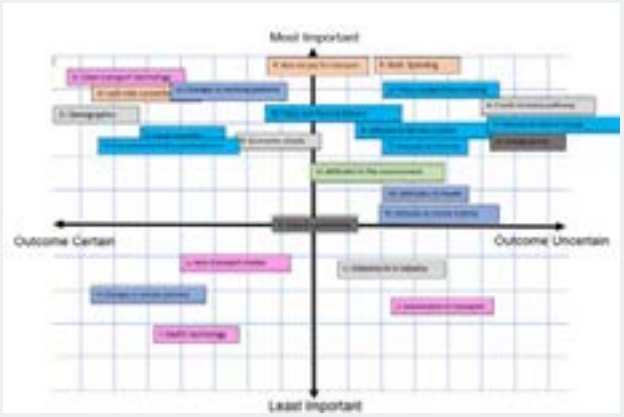
Workshop 1: Driver Mapping Outputs

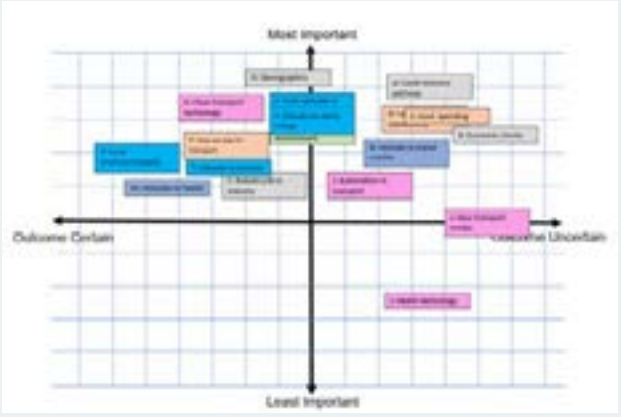
- In breakout rooms, and using the axis shown in the figures, stakeholders discussed and agreed where each driver should be placed, assessing each driver's importance and level of certainty in the future.
- The figures show the output from each breakout group. Not all groups completed this exercise, and so those drivers not mapped have been removed from the figures.











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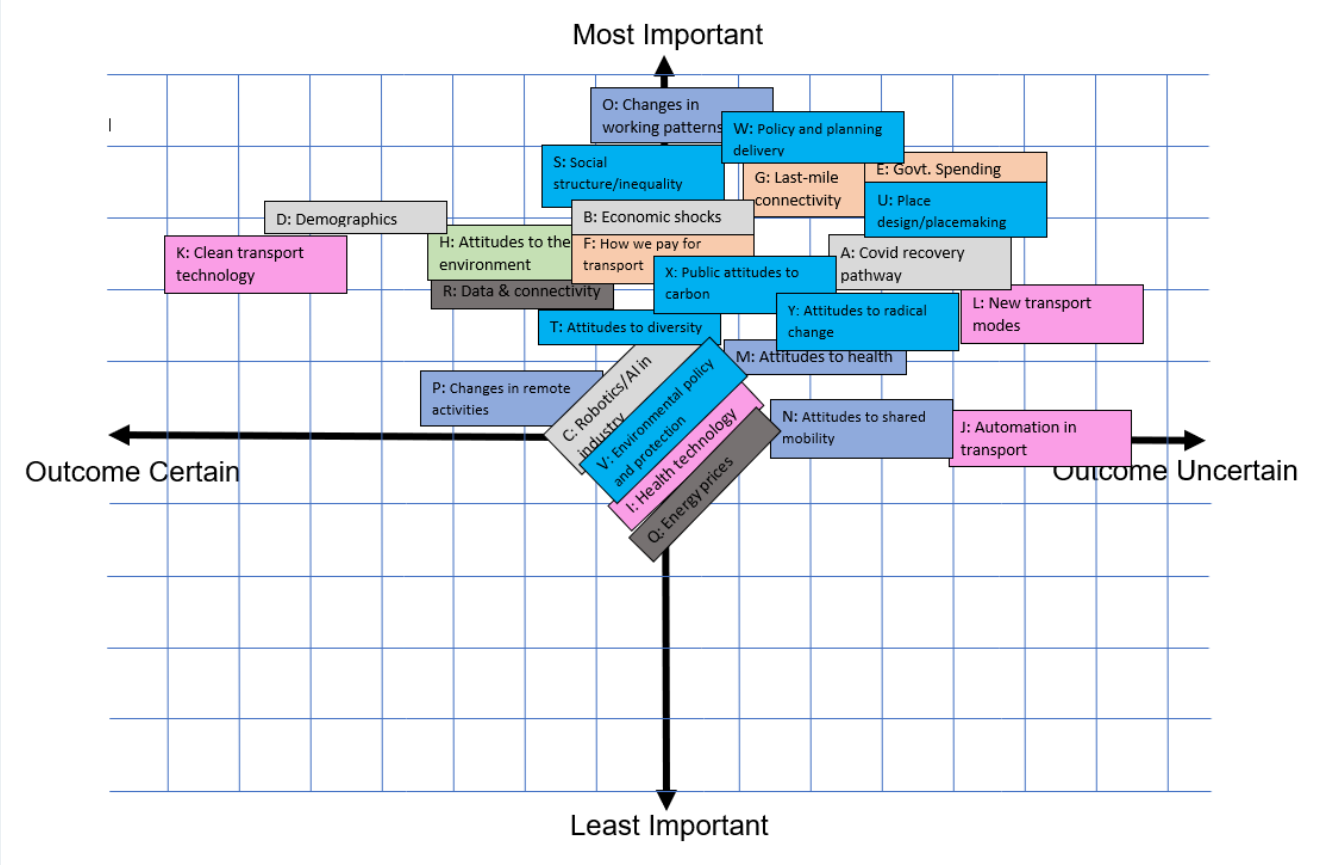
Workshop 1: Driver Analysis

- Based on the Workshop 1 outputs presented on the previous slide, Steer collated all drivers on to one axis, taking an 'average' across the outputs from the five groups.

- These were then grouped into three categories, as presented on the following slides:
  - Higher importance / Uncertain
  - Higher importance / Certain
  - Lower importance



Stage 2: Cluster Analysis

- The drivers that were grouped under each of the three categories, based on their location on the axis, is presented in the table below.
- The project team then considered which drivers naturally progress with one another, and focussed primarily on those assessed as *higher importance* and *uncertain* to develop suggested alternative futures.

Higher Importance and Uncertain	Higher Importance and Certain	Lower Importance
A: Covid recovery pathway	D: Demographics	J: Automation in transport
B: Economic shocks	H: Attitudes to the environment	N: Attitudes to shared mobility
E: Govt spending	K: Clean transport technology	C: Robotics/AI in industry
F: How we pay for transport	P: Changes in remote activities	I: Health technology
G: Last mile connectivity	R: Data and connectivity	Q: Energy prices
L: New transport modes	T: Attitudes to diversity	V: Environmental policy and protection
M: Attitudes to health		
O: Changes in working patterns		
S: Social structure/inequality		
U: Place design/placemaking		
W: Policy and planning delivery		
X: Attitudes to carbon		
Y: Attitudes to radical change		

Stage 2: Cluster Analysis

- The table below presents the outputs of this consideration. It can be seen that some of those drivers assessed as certain and/or lower importance (drivers K, R, J and N) were included within one of the groupings. The project team considered that these drivers sit naturally with drivers F and L, and had the potential to form a plausible alternative future that ought to be considered by the stakeholders in the second workshop.

Higher Importance and Uncertain	Higher Importance and Certain	Lower Importance
A: Covid recovery pathway	D: Demographics	J: Automation in transport
B: Economic shocks	H: Attitudes to the environment	N: Attitudes to shared mobility
E: Govt spending	K: Clean transport technology	C: Robotics/AI in industry
F: How we pay for transport*	P: Changes in remote activities	I: Health technology
G: Last mile connectivity	R: Data and connectivity	Q: Energy prices
L: New transport modes	T: Attitudes to diversity	V: Environmental policy and protection
M: Attitudes to health		
O: Changes in working patterns		
S: Social structure/inequality		
U: Place design/placemaking		
W: Policy and planning delivery		
X: Attitudes to carbon		
Y: Attitudes to radical change		

* Sits in two alternative futures

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Stage 2: Cluster Analysis – Alternative Futures

- The output of the cluster analysis was four plausible alternative futures, plus an additional set of drivers that will be important and certain across all futures. These are presented below.
- The formation of these alternative futures are distinct from the Transport Strategy and Local Economic Strategies future – the exercise was not designed to scope/re-scope this preferred future.

Slow Recovery	High Policy Impact	Radical Social Change	High Tech	All Alternative Futures
A: Covid recovery pathway	E: Govt spending	X: Attitudes to carbon	F: How we pay for transport*	D: Demographics
B: Economic shocks	W: Policy and planning delivery	Y: Attitudes to radical change	J: Automation in transport	H: Attitudes to the environment
O: Changes in working patterns	L: New transport modes	M: Attitudes to health	N: Attitudes to shared mobility	K: Clean transport technology
	U: Place design/placemaking		K: Clean transport technology	P: Changes in remote activities
	S: Social structure/inequality		R: Data and connectivity	R: Data and connectivity
	F: How we pay for transport*			T: Attitudes to diversity
	G: Last mile connectivity			

* Sits in two alternative futures

Stage 3: Impact of each alternative future on transport

- Each alternative future was then considered against the six criteria presented in the table below. The project team considered how demand and mode share proportions for transport modes may vary from the business as usual case under each of the futures.
- The results of this analysis for the five alternative futures is presented here, and the key is provided below. This was presented to the stakeholders during Workshop 2.

Alternative Future		Transport demand	Proportion using public transport	Proportion using active modes	Proportion using private motor vehicles	Proportion using new mobilities	Digital replacement of real-world activity
0	BAU	●	●	●	●	●	●
1	Transport Strategy	-	+++	+++	--	+++	++
2	Slow Recovery	--	--	-	--	-	-
3	High Policy Impact	+/●	++	+/++	-/●	++	+
4	Radical Social Change	-	+/●	+++	---	+	++
5	High Tech	+/++	-	-	++	+++	+++

● in line with BAU

- lower than BAU

\+ higher than BAU

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Stage 3: Impact of each alternative future on transport

- During the stakeholder workshop there was a discussion on suggested alterative futures. It was decided that the *High Policy Impact* future could be merged with the *Radical Social Change* future as one is unlikely to be a scenario without the other (i.e. there is a need for a shift in public thinking, as well as spend, regulation and policy direction). The results of the assessment when the two are merged is presented below.

Alternative Future		Transport demand	Proportion using public transport	Proportion using active modes	Proportion using private motor vehicles	Proportion using new mobilities	Digital replacement of real-world activity
0	BAU	●	●	●	●	●	●
1	Transport Strategy	-	+++	+++	--	+++	++
2	Slow Recovery	--	--	-	--	-	-
3	Radical Change	-	++	+++	---	++	++
4	High Tech	+ / ++	-	-	++	+++	+++

● in line with BAU

\- lower than BAU

\+ higher than BAU

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Workshop 2: Activity

- During Workshop 2 stakeholders were split into four breakout rooms, and each group was allocated one alternative future scenario to consider.
- Groups were asked to considered how each of the drivers grouped under the Higher Importance / Uncertain and Higher Importance / Certain categories perform under the allocated scenario. The facilitator for each group noted down the discussion points and provided a summary of discussion to the wider group.
- The outputs were collated by the project team to develop narratives for each alternative future (including the likely travel demand and behavioural patterns). These are summarised on the following slides.

Higher Importance / Uncertain

Driver	Impact on driver
A: Covid recovery pathway	
B: Economic shocks	
E: Govt spending	
F: How we pay for transport*	
G: Last mile connectivity	
J: Automation in Transport	
L: New transport modes	
M: Attitudes to health	
O: Changes in working patterns	
S: Social structure/inequality	
U: Place design/placemaking	
W: Policy and planning delivery	
X: Attitudes to carbon	
Y: Attitudes to radical change	

Higher Importance / Certain

Driver	Impact on driver
D: Demographics	
H: Attitudes to the environment	
K: Clean transport technology	
P: Changes in remote activities	
R: Data and connectivity	
T: Attitudes to diversity	

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Alternative Future: Radical Change

High government spend is coupled with a radical change in policy, directed to support a shift in public attitudes towards health and carbon and accelerate progress towards achieving net zero carbon ambitions ahead of the EEH 2040 ambition (against the backdrop of the 2050 national government target). A resilient economy has supported a fast Covid19 recovery and government spending priorities include Transport Strategy objectives, with improvements for last mile connectivity and new modes, including shared / micro mobilities and digital demand responsive transport. Automated vehicles are less of a priority, with policy and regulations behind compared to a high-tech world. Users pay for their travel fully accounting for all externalities, including carbon emissions and road space usage, and payment is fully integrated across modes. Place-making is at the heart of local policy and planning decisions, with reclamation of road space, pedestrianization and environmental, social and health outcomes prioritized over purely economic ones.

Driver	Summary
E: Govt spending	Achievement of Transport Strategy objectives is enabled by prioritisation or increase in spending.
F: How we pay for transport*	Integrated payment systems across modes for users. Cost set to encourage usage of modes with better environmental, social and health outcomes – at a minimum fully accounting for any carbon / negative externalities of each mode.
G: Last mile connectivity	Increased use of sustainable options, enabled through increased funding – on demand, integrated and seamless options.
L: New transport modes	Increased use of shared and micro mobilities, and digital demand responsive transport.
M: Attitudes to health	Increased awareness leading to behavioural change and more successful outcomes.
U: Place design/ placemaking	Revitalisation of town centres and improved connectivity to new developments. Integrated planning – “15 minute neighbourhoods”.
W: Policy and planning delivery	Strong policy environment with funding to match.
X: Attitudes to carbon	Support for acceleration of net zero carbon ambition.
Y: Attitudes to radical change	Support radical change and spending directed appropriately to support this.

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Alternative Future: High-tech

Public and government attitudes to technology and technological change are very positive. An acceptance of a hybrid model of working, locking in the benefits of home working, leads to a lower overall and peak travel demand. With less need to travel, private car ownership reduces, and individuals seek alternative shared, on-demand and convenient options. Public and private sectors work collaboratively to respond to changing travel trends with new, innovative and inclusive transport options emerging, such as CAVs. The necessary policy, regulation support, and investment to encourage and advance the pace of the shift to clean transport technology, automated vehicles and shared mobility leads to increased demand and capacity for both private and shared road transport options. Meanwhile, traditional public transport modes such as bus and rail decline. Strong national policy and supporting regulation leads to differentiated per-km charges for road space usage.

Driver	Summary
F: How we pay for transport*	Integrated payment systems across modes for users. Cost dependent on carbon / negative externalities of a given mode.
J: Automation in transport	Advanced policy and regulatory environment supports automation for users and freight.
N: Attitudes to shared mobility	Mobility as a Service is widely adopted, with individuals seeking on-demand shared mobility over private vehicle ownership.
K: Clean transport technology	Policy and regulatory environment is supportive of clean transport modes.
R: Data and connectivity	Methods to overcome potential barrier to sharing data to encourage uptake. Advancement in MaaS provides opportunities to collect and use data.

Alternative Future: Slow recovery

With a slower return to the pre-Covid19 business-as-usual and an economy vulnerable to external and internal economic shocks, there will be a prolonged period of working from home / hybrid working and subsequently, a continuation of fewer journeys for all trip types, across all modes. This will be particularly true for peak travel demand and for private vehicle trips due to wage stagnation/unemployment. Affordability will impact on social structure, with transport choice being removed for some individuals due to the cost being disproportionate to income. For journeys that are required (e.g. to access employment), there will be increased reliance on public transport and active modes. The impacts of Covid19 on retail trips will continue, with a reliance on home delivery services. There will be less focus on new transport modes, automation of transport and last mile connectivity under this scenario due to the lack of funding to create policy, invest, and incentivise change (though there may be some potential for increased use of new low cost modes such as e-scooters).

Driver	Summary
A: Covid recovery pathway	Slow recovery due to new variants emerging, resistant to the vaccine, and vulnerability of the economy more generally to external and internal economic shocks. Home working is the norm, causing lower travel demand, particularly in the peak. Increased reliance on home delivery services.
B: Economic shocks	Vulnerable economy with expected national and global economic downturn. Rising unemployment, stagnant wages and increased cost of travel works to lower travel demand, particularly private vehicle trips, and public transport. Increased reliance of low cost modes for necessary trips.
C: Changes in working patterns	Home working continues for several sectors and there is an increased degree of flexibility for working hours.

Alternative Future: Business as usual

Driver	Summary
A: Covid recovery pathway	Following period of low public transport demand, peak demand returns in short-medium term post Covid19.
B: Economic shocks	Following period of reduced overseas travel, in the short-term medium term travel demand returns to pre-Covid19 level.
E: Govt spending	Unfocussed government spending and lack of clear and consistent policy on sustainable transport across geographies. Funding available is focused on larger authorities.
F: How we pay for transport	Increased public transport fares and fuel prices reduce transport affordability.
G: Last mile connectivity	A continued gradual shift towards sustainable modes, no acceleration in pace, with individuals still reliant on private car.
J: Automation in transport	Slow shift, no acceleration in pace. Pace more advanced for freight purposes.
L: New transport modes	Public resistance to new modes causes a slow shift to new modes. No acceleration in pace. Pace more advanced for freight with continued uptake of cargo bikes, and smaller, more efficient vehicles.
M: Attitudes to health	Aspects of health, primarily air quality, increasingly a driver in policy and public attitudes.
N: Attitudes to shared mobility	Younger generations more open to shared mobility. Demand responsive transport is being trialled.
O: Changes in working patterns	Hybrid model is developed for some sectors where appropriate. Flexible working patterns are more widely accepted. Number of business trips reduced compared to pre Covid19 world.
S: Social structure/inequality	Transport poverty increased due to increased fares and fuel prices. A level of digital inequality.
U: Place design/placemaking	Some shift towards improved place design, e.g. healthy streets, with increased less focus on motor vehicles and more focus for other road users.
W: Policy and planning delivery	Shift towards green policy, but with continued disconnect between high level political drivers and local change.
X: Attitudes to carbon	Some positive shift, but not sufficient to achieve net zero ambitions within strategy timescales.

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November 2021

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Complex questions
Powerful answers

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England’s Economic Heartland: Development of Alternative Futures

August 2021 (Draft)

Context

- This slide pack reports on the approach to creating, and the purpose of, the alternative future scenarios for England's Economic Heartlands.

- Two workshops have been facilitated by Steer, WSP and England's Economic Heartland, and attended by key stakeholders to support the development of the alternative futures.

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How will the scenarios be used for the connectivity study?

- The four alternative futures will support a high level qualitative assessment of the infrastructure scenarios that have been developed as part of the connectivity studies. The alternative futures will not be modelled.

- While alternative futures are not modelled, optimised infrastructure scenarios are being modelled. This approach continues to be in line with TAG, however, we have not explicitly modelled higher or lower demand scenarios (e.g. as a result of a higher or lower levels of housing or employment), rather housing, employment, and demand are outputs of the model.

- The futures will then form one part of the multi-criteria assessment framework process, for the assessment of the long list of infrastructure options, and support with the short listing to arrive at the preferred package of options. Infrastructure options that perform well, not only in relation to the connectivity study and transport strategy objectives, but also against all futures, implies a more resilient strategy.

- The formation of these alternative futures are distinct from the Transport Strategy and Local Economic Strategies future – the exercise was not designed to scope/re-scope this preferred future.

- The emerging Transport Strategy and local economic strategies future is the benchmark against which infrastructure scenarios will be tested.

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Stage 1: Driver Mapping

- The first stage in the development of the alternative futures is Driver Mapping. This process is drawn from ‘The Futures Toolkit’ by the Government Office for Science and aligns with the Department for Transport’s Transport Analysis Guidance (TAG) – ‘Uncertainty Toolkit’.

- Driver Mapping is used to identify the various political, economic, societal, technological, legislative and environmental drivers shaping the future environment. It is intended to:
  - Identify drivers shaping the future;
  - Identify which drivers are most important for the future; and
  - Identify which drivers are most uncertain in the future.

Workshop 1: Driver Mapping

- An online stakeholder workshop was held on 22 June to explore what attendees believe would drive changes in transport demand between today and 2050.

- Stakeholders were divided into groups and invited to assess a number of ‘external drivers’ which describe broad areas outside of the control of EEH which could have an impact on future transport outcomes in the EEH area.

- There are a number of areas where EEH and its partners are defining policy and strategy which envisions specific future outcomes. The planned direction of travel for these outcomes are established, either through legally-binding requirements, regulatory frameworks or other policy arenas. Therefore, for the purpose of the EEH Alternatives Futures work, these will be assumed as established, and drivers related to these areas were not included in the driver mapping exercise.
  - Net zero carbon
  - Regional development (committed growth in Local Plans, following ‘trends’ of growth past plan period)
  - Regional economic development / industrial sectors (as set in the Arc Economic Prospectus)

- For the driver mapping exercise, stakeholders were encouraged to think about how the world could look in the long-term future – thinking beyond what is on the horizon now, and what could be of much more importance in the future.
- The drivers are listed on the following slide. All drivers except those in the ‘Anything else’ section were suggested by the project team, and stakeholders were invited to suggest additional external drivers that ought to be considered in the development of alternative futures.

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‘External Drivers’

Theme	#	Driver	Detail
Economy	A	**Covid-19 recovery pathway**	Medical resolution pathway to current health crisis
	B	**Economic shocks**	Degree of economic stability nationally and regionally e.g Covid-19, Brexit, trade wars, globalisation/isolationism
	C	**Robotics/AI in industry**	Extent of automation effects on employment.
	D	**Demographics**	Changes in migration patterns and age profiles
Policy	E	**Government spending**	Extent of public expenditure on local/regional authorities and infrastructure
	F	**How we pay for transport**	Forms of payment for consuming mobility including distance or tax-based.
	G	**Last-mile connectivity**	Local transport plans/strategies and degree of connectivity beyond the private car
Environment	H	**Attitudes to the environment**	Degree of support for protection of the natural environment
Technology	I	**Health technology**	Improvements in medicine and healthcare
	J	**Automation in transport**	Change in share of manually controlled motor vehicles
	K	**Clean transport technology**	Rate of diffusion of lower carbon transport technologies
	L	**New transport modes**	Changing modal mix of mobility with new modes entering the industry (e-scooters, hyperloop, ?)
Attitudes	M	**Attitudes to health**	Importance of addressing public health individually and collectively
	N	**Attitudes to shared mobility**	Willingness to share journeys and reduction in vehicle ownership
	O	**Changes in working patterns**	Extent of flexible working and its effects on commuting.
	P	**Changes in remote activities**	Degree that remote activities increase/decrease over face-to-face (business, leisure, retail, education)
Energy	Q	**Energy prices**	Oil, gas and electricity wholesale cost changes
	R	**Data and connectivity**	Communications technology and influence of data/networks on service delivery
Anything else?	S	**Social structure/inequality**	
	T	**Attitudes to diversity**	
	U	**Place design/placemaking**	
	V	**Environmental policy and protection**	
	W	**Policy and planning delivery**	
	X	**Attitudes to carbon**	
	Y	**Attitudes to radical change**	

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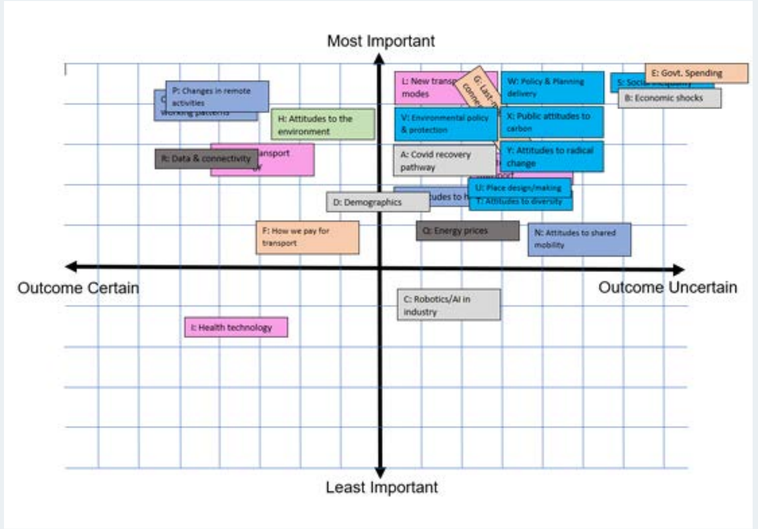
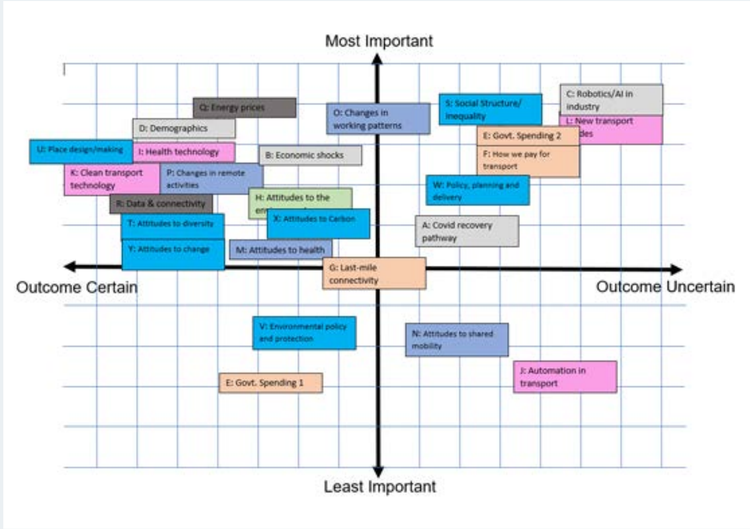
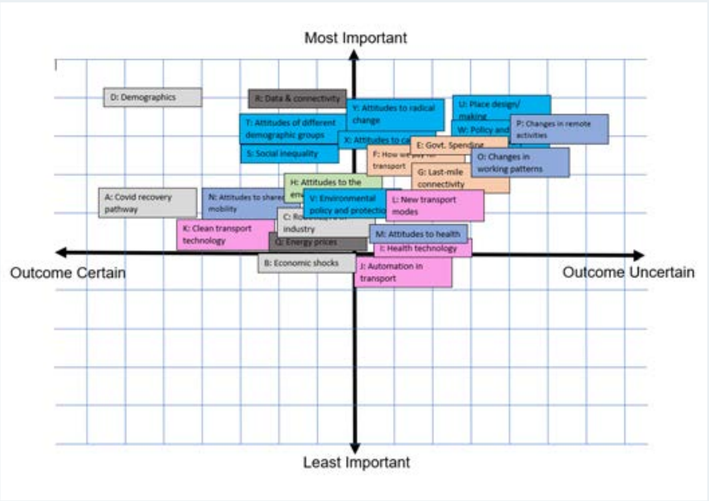
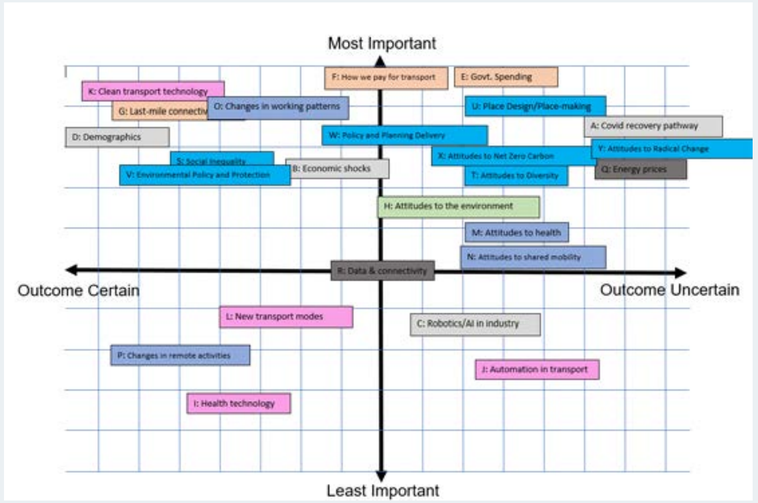
Workshop 1: Driver Mapping Outputs

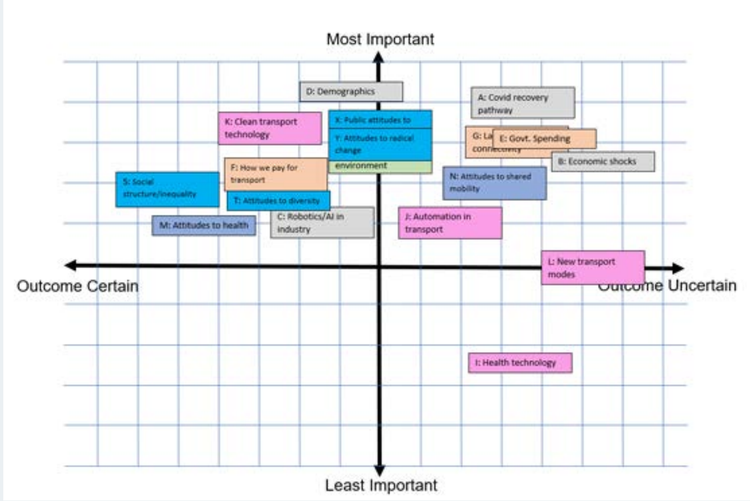
- In breakout rooms, and using the axis shown in the figures, stakeholders discussed and agreed where each driver should be placed, assessing each driver's importance and level of certainty in the future.
- The figures show the output from each breakout group. Not all groups completed this exercise, and so those drivers not mapped have been removed from the figures.







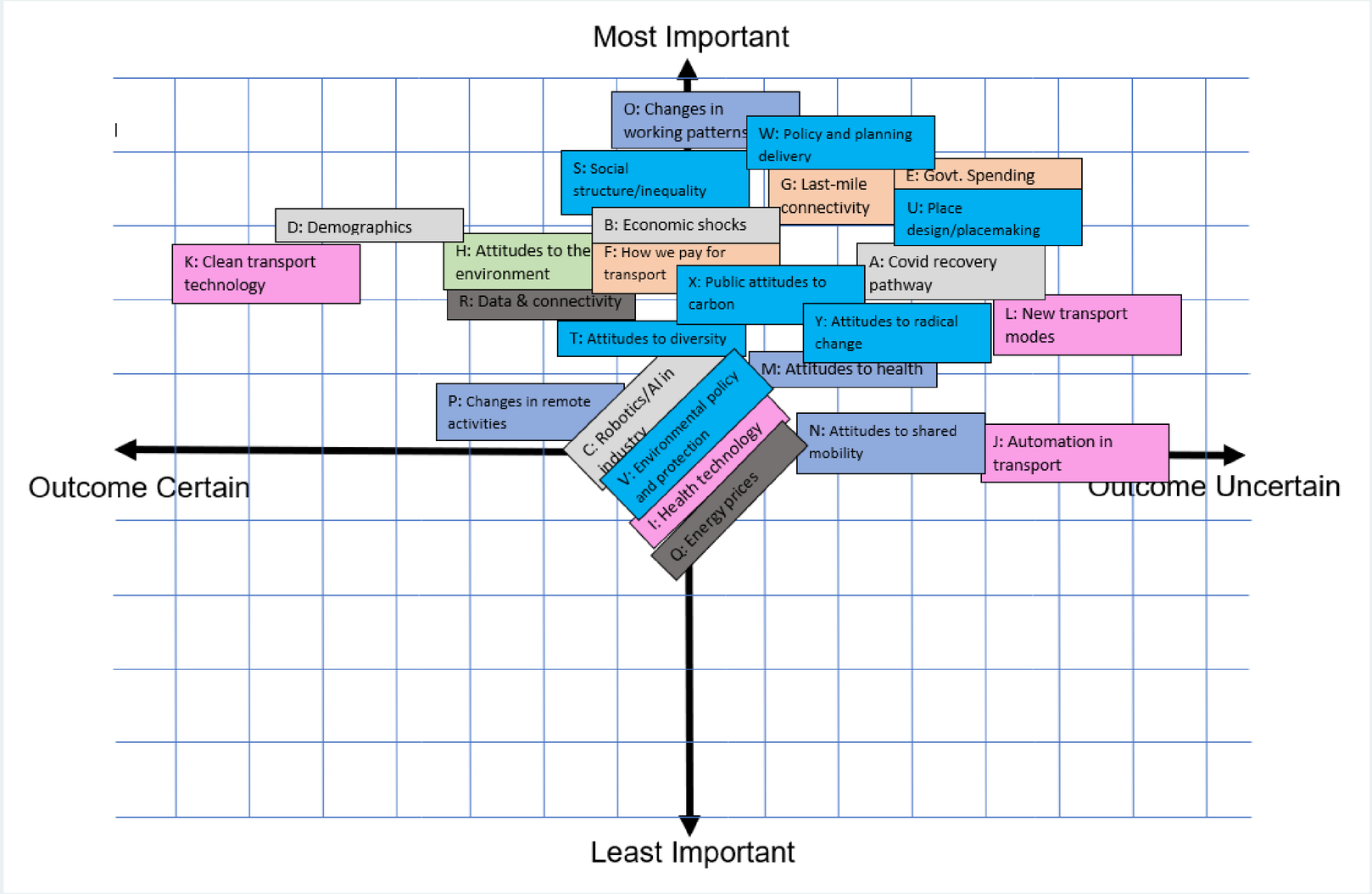




Workshop 1: Driver Analysis

- Based on the Workshop 1 outputs presented on the previous slide, Steer collated all drivers on to one axis, taking an ‘average’ across the outputs from the five groups.

- These were then grouped into three categories, as presented on the following slides:
  - Higher importance / Uncertain
  - Higher importance / Certain
  - Lower importance



Stage 2: Cluster Analysis

- The drivers that were grouped under each of the three categories, based on their location on the axis, is presented in the table below.
- The project team then considered which drivers naturally progress with one another, and focussed primarily on those assessed as *higher importance* and *uncertain* to develop suggested alternative futures.

Higher Importance and Uncertain	Higher Importance and Certain	Lower Importance
A: Covid recovery pathway	D: Demographics	J: Automation in transport
B: Economic shocks	H: Attitudes to the environment	N: Attitudes to shared mobility
E: Govt spending	K: Clean transport technology	C: Robotics/AI in industry
F: How we pay for transport	P: Changes in remote activities	I: Health technology
G: Last mile connectivity	R: Data and connectivity	Q: Energy prices
L: New transport modes	T: Attitudes to diversity	V: Environmental policy and protection
M: Attitudes to health		
O: Changes in working patterns		
S: Social structure/inequality		
U: Place design/placemaking		
W: Policy and planning delivery		
X: Attitudes to carbon		
Y: Attitudes to radical change		

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Stage 2: Cluster Analysis

- The table below presents the outputs of this consideration. It can be seen that some of those drivers assessed as certain and/or lower importance (drivers K, R, J and N) were included within one of the groupings. The project team considered that these drivers sit naturally with drivers F and L, and had the potential to form a plausible alternative future that ought to be considered by the stakeholders in the second workshop.

Higher Importance and Uncertain	Higher Importance and Certain	Lower Importance
A: Covid recovery pathway	D: Demographics	J: Automation in transport
B: Economic shocks	H: Attitudes to the environment	N: Attitudes to shared mobility
E: Govt spending	K: Clean transport technology	C: Robotics/AI in industry
F: How we pay for transport*	P: Changes in remote activities	I: Health technology
G: Last mile connectivity	R: Data and connectivity	Q: Energy prices
L: New transport modes	T: Attitudes to diversity	V: Environmental policy and protection
M: Attitudes to health		
O: Changes in working patterns		
S: Social structure/inequality		
U: Place design/placemaking		
W: Policy and planning delivery		
X: Attitudes to carbon		
Y: Attitudes to radical change		

* Sits in two alternative futures

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Stage 2: Cluster Analysis – Alternative Futures

- The output of the cluster analysis was four plausible alternative futures, plus an additional set of drivers that will be important and certain across all futures. These are presented below.
- The formation of these alternative futures are distinct from the Transport Strategy and Local Economic Strategies future – the exercise was not designed to scope/re-scope this preferred future.

Slow Recovery	High Policy Impact	Radical Social Change	High Tech	All Alternative Futures
A: Covid recovery pathway	E: Govt spending	X: Attitudes to carbon	F: How we pay for transport*	D: Demographics
B: Economic shocks	W: Policy and planning delivery	Y: Attitudes to radical change	J: Automation in transport	H: Attitudes to the environment
O: Changes in working patterns	L: New transport modes	M: Attitudes to health	N: Attitudes to shared mobility	K: Clean transport technology
	U: Place design/placemaking		K: Clean transport technology	P: Changes in remote activities
	S: Social structure/inequality		R: Data and connectivity	R: Data and connectivity
	F: How we pay for transport*			T: Attitudes to diversity
	G: Last mile connectivity			

* Sits in two alternative futures

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Stage 3: Impact of each alternative future on transport

- Each alternative future was then considered against the six criteria presented in the table below. The project team considered how demand and mode share proportions for transport modes may vary from the business as usual case under each of the futures.
- The results of this analysis for the five alternative futures is presented here, and the key is provided below. This was presented to the stakeholders during Workshop 2.

Alternative Future		Transport demand	Proportion using public transport	Proportion using active modes	Proportion using private motor vehicles	Proportion using new mobilities	Digital replacement of real-world activity
0	BAU	●	●	●	●	●	●
1	Transport Strategy	-	+++	+++	--	+++	++
2	Slow Recovery	--	--	-	--	-	-
3	High Policy Impact	+ / ●	++	+ / ++	- / ●	++	+
4	Radical Social Change	-	+ / ●	+++	---	+	++
5	High Tech	+ / ++	-	-	++	+++	+++

● in line with BAU

\- lower than BAU

\+ higher than BAU

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Stage 3: Impact of each alternative future on transport

- During the stakeholder workshop there was a discussion on suggested alterative futures. It was decided that the *High Policy Impact* future could be merged with the *Radical Social Change* future as one is unlikely to be a scenario without the other (i.e. there is a need for a shift in public thinking, as well as spend, regulation and policy direction). The results of the assessment when the two are merged is presented below.

Alternative Future		Transport demand	Proportion using public transport	Proportion using active modes	Proportion using private motor vehicles	Proportion using new mobilities	Digital replacement of real-world activity
0	BAU	●	●	●	●	●	●
1	Transport Strategy	-	+ + +	+ + +	- -	+ + +	+ +
2	Slow Recovery	- -	- -	-	- -	-	-
3	Radical Change	-	+ +	+ + +	- - -	+ +	+ +
4	High Tech	+ / + +	-	-	+ +	+ + +	+ + +

● in line with BAU

\- lower than BAU

\+ higher than BAU

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Workshop 2: Activity

- During Workshop 2 stakeholders were split into four breakout rooms, and each group was allocated one alternative future scenario to consider.
- Groups were asked to considered how each of the drivers grouped under the Higher Importance / Uncertain and Higher Importance / Certain categories perform under the allocated scenario. The facilitator for each group noted down the discussion points and provided a summary of discussion to the wider group.
- The outputs were collated by the project team to develop narratives for each alternative future (including the likely travel demand and behavioural patterns). These are summarised on the following slides.

Higher Importance / Uncertain

Driver	Impact on driver
A: Covid recovery pathway	
B: Economic shocks	
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Higher Importance / Certain

Driver	Impact on driver
D: Demographics	
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High government spend is coupled with a radical change in policy, directed to support a shift in public attitudes towards health and carbon and accelerate progress towards achieving net zero carbon ambitions ahead of the EEH 2040 ambition (against the backdrop of the 2050 national government target). A resilient economy has supported a fast Covid19 recovery and government spending priorities include Transport Strategy objectives, with improvements for last mile connectivity and new modes, including shared / micro mobilities and digital demand responsive transport. Automated vehicles are less of a priority, with policy and regulations behind compared to a high-tech world. Users pay for their travel fully accounting for all externalities, including carbon emissions and road space usage, and payment is fully integrated across modes. Place-making is at the heart of local policy and planning decisions, with reclamation of road space, pedestrianization and environmental, social and health outcomes prioritized over purely economic ones.

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X: Attitudes to carbon	Support for acceleration of net zero carbon ambition.
Y: Attitudes to radical change	Support radical change and spending directed appropriately to support this.

Alternative Future: High-tech

Public and government attitudes to technology and technological change are very positive. An acceptance of a hybrid model of working, locking in the benefits of home working, leads to a lower overall and peak travel demand. With less need to travel, private car ownership reduces, and individuals seek alternative shared, on-demand and convenient options. Public and private sectors work collaboratively to respond to changing travel trends with new, innovative and inclusive transport options emerging, such as CAVs. The necessary policy, regulation support, and investment to encourage and advance the pace of the shift to clean transport technology, automated vehicles and shared mobility leads to increased demand and capacity for both private and shared road transport options. Meanwhile, traditional public transport modes such as bus and rail decline. Strong national policy and supporting regulation leads to differentiated per-km charges for road space usage.

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With a slower return to the pre-Covid19 business-as-usual and an economy vulnerable to external and internal economic shocks, there will be a prolonged period of working from home / hybrid working and subsequently, a continuation of fewer journeys for all trip types, across all modes. This will be particularly true for peak travel demand and for private vehicle trips due to wage stagnation/unemployment. Affordability will impact on social structure, with transport choice being removed for some individuals due to the cost being disproportionate to income. For journeys that are required (e.g. to access employment), there will be increased reliance on public transport and active modes. The impacts of Covid19 on retail trips will continue, with a reliance on home delivery services. There will be less focus on new transport modes, automation of transport and last mile connectivity under this scenario due to the lack of funding to create policy, invest, and incentivise change (though there may be some potential for increased use of new low cost modes such as e-scooters).

Driver	Summary
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C: Changes in working patterns	Home working continues for several sectors and there is an increased degree of flexibility for working hours.

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Alternative Future: Business as usual

Driver	Summary
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X: Attitudes to carbon	Some positive shift, but not sufficient to achieve net zero ambitions within strategy timescales.

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Complex questions
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