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OXFORD TO CAMBRIDGE EXPRESSWAY STRATEGIC STUDY

Deliverable 1 – Examination of the Strategic Case for New Expressway East-West Road Links

08/07/2016

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Client

Highways England / Department for Transport

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1 Introduction and Study Objectives

STRATEGIC CASE

This study demonstrates that there is a strong case for transport interventions within the broad arc defined by the study area. Such interventions would improve east-west connectivity, build transport network resilience and promote economic growth. Study area transport interventions are expected to improve economic productivity, thus supporting jobs and growth across the local and regional areas as well as the country as a whole. Interventions in the corridor could provide opportunities at three functional levels:

- Strategic: the role of the corridor in the context of the national rail and strategic road network;
- Regional: supporting significant growth planned along the corridor and the contribution that these areas have to the UK economy and international markets; and
- Local: sections of the corridor will have potential positive impacts in their own right, such as access between homes and jobs.

There is expected to be around 40 percent increase in travel demand by 2035, with associated worsening of congestion on the existing primary east-west road route, resulting in reduced journey time reliability and increased journey times. Interventions in the corridor would address this and have a positive impact on local, regional and national economic performance, contributing strongly to the UK Gross Domestic Product (GDP). When combined with similar performance across the rest of the corridor there is significant potential to deliver economic growth and uplift to the benefit of the UK.

The Government's investment strategy for the Strategic Road Network (SRN) for the period 2015 to 2020 identifies the existing weak connection between Oxford, Milton Keynes and Cambridge and the need for an Expressway that connects the three settlements to help promote knowledge based economic growth. It is anticipated that existing roads will form much of the Expressway; however gaps along the network need to be addressed, particularly the section between the M1 near Milton Keynes and the M40. This would complement other national infrastructure projects including East West Rail.

Investments in strategic transport interventions contribute to economic performance by delivering user, productivity, investment and employment benefits. Interventions in the study area will generate user-benefits, comprising journey time and vehicle operating cost savings as a result of reduced congestion on the network.

Transport investment will lead to productivity benefits for firms and workers as transport improvements support economic interactions between firms and between firms and consumers. Study area interventions will enable firms to reach wider markets, support the growth of the knowledge rich service sectors clustered in Oxford, Milton Keynes and Cambridge and increase the catchment area of employees able to access these productive centres of activity. Finally, transport investment can alter patterns of private sector investment by making locations more attractive for investment.

Transport investment within the study area will deliver wider economic benefits, including increasing labour market catchment areas, supporting the expansion of the knowledge intensive clusters in Oxford, Milton Keynes and Cambridge and encouraging firms and workers to locate within the study area.

1.1 Introduction

1.1.1 WSP | Parsons Brinckerhoff, CH2M, Transport Research Laboratory (TRL) and Steer Davies Gleave have been commissioned to prepare a 'Oxford to Cambridge Expressway Strategic Study' for Highways England on behalf of the Department for Transport (DfT).

1.1.2 The requirement for this study was set out in the first Roads Investment Strategy (RIS), published in December 2014, which announced a programme of new Strategic Studies to explore options to address some of the Strategic Road Network's (SRN) large and complex challenges. The results of these high-level studies will inform the second RIS.

1.1.3 The Strategic Studies are:

- Northern Trans-Pennine Study;
- Trans-Pennine Tunnel Study;
- Manchester North-West Quadrant Study;
- A1 East of England Study;
- Oxford to Cambridge Expressway Study; and
- M25 South-West Quadrant Study

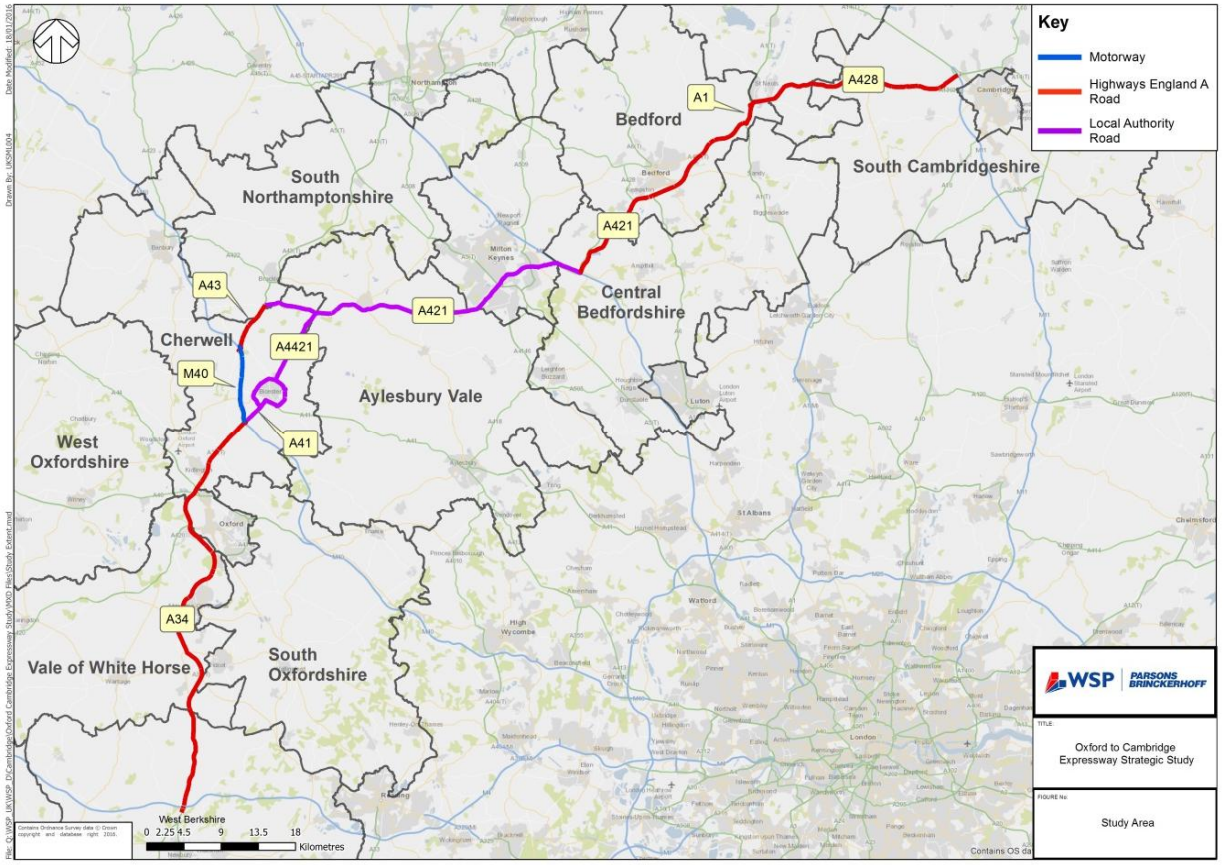
1.1.4 England's Economic Heartland Strategic Alliance has also identified this study as one of its strategic priorities. It recognises the strategic importance of the study corridor, linking Oxford, Bicester, Milton Keynes and Cambridge. The Strategic Alliance recognises greater economic benefit can be achieved by investing in the transport system on a wider strategic basis than at the individual county level. The Oxford to Cambridge corridor is one such strategic artery that requires a collaborative approach.

1.1.5 The study areas Local Enterprise Partnerships (LEPs), County Councils and Local Planning Authorities have strong policy support for investment in strategic transport infrastructure that improves east-west connectivity which is viewed as vital to unlocking housing and economic growth in their respective regions.

1.2 Study Area

1.2.1 The geographical scope of the study area focuses on the broad arc from Didcot – Oxford – Milton Keynes – Bedford – Cambridge. The primary east-west route within the study area linking these conurbations is formed of the A34, M40, A43, A4421, A421 and A428. A map of the approximate geographical scope of the study area along with the primary east-west route that is examined in this study is shown in Figure 1-1.

Figure 1-1: Study Area Primary East-West Route



1.2.2 The primary east-west corridor functions as an important regional and sub-regional commuter route into and between the major conurbations as well as interfacing with a number of national strategic routes including the M4, M40, M1, A1, A14 and M11. The various interface points are considered to be of significant regional importance as these national strategic routes facilitate principal freight access, connecting with wider economic regions of the United Kingdom.

1.3 Study Objectives

1.3.1 The strategic aim of this study is to investigate the case for linking existing roads and creating an Oxford to Cambridge Expressway, which would create a high-quality strategic east-west link between Oxford and Cambridge, via Bedford and Milton Keynes.

1.3.2 The RIS Investment Plan describes the purpose of this study as follows:

> *"…examine the case for creating an Expressway to connect the towns and cities of the 'Brain Belt' together. It will also look at other enhancements on existing roads along the route, including the A34 around Oxford."*

1.3.3 The study will identify options for a new strategic Expressway corridor and upgrading existing routes, with the aim to improve east-west connectivity within the study area, build network resilience and support economic growth.

1.3.4 The study will identify options that can feasibly be constructed and appraise the strategic, economic, safety, environmental, operational benefits and impacts for each of the options, making recommendations regarding a preferred option(s).

1.3.5 Key to forming a judgement will be the wider economic costs and benefits of different options, in particular their impacts on the local labour/product markets and the economic geography of the study area. The assessment of the wider economic costs and benefits will provide an understanding of how the options can act as an enabler of the local authority and LEP growth plans within the study area. The study specific objectives are identified in Table 1-1.

Table 1-1: Oxford to Cambridge Strategic Study Objectives

NUMBER	STUDY OBJECTIVES
1	Review previous study work, relevant available data, and current investment plans to understand current performance and constraints of the existing road infrastructure, and confirm the strategic case for considering further investment.
2	Identify feasible options for improving and/or providing new road links within the study area that improve east-west connectivity to create an Expressway standard route between Oxford, Milton Keynes and Cambridge.
3	Understand the benefits and impacts resulting from the provision of a new strategic east-west corridor, to further inform the strategic and economic case for investment in new road infrastructure in the study area. The benefits assessment will consider congestion-relief, reliability, safety, and environmental outcomes of constructing a new strategic east-west route. The study will consider a range of individual and combined investment proposals.
4	Understand the wider socio-economic benefits that result from the strategic transport options, including improved economic productivity and investment and employment benefits.
5	Have reference to and reflect wherever possible the key findings of the proposals being developed by other studies in the south including East West Rail, High Speed 2 (HS2) and the A1 East of England strategic study to understand the interdependencies between the potential options arising from this study and the other strategic transport proposals. This study will have reference to and include: • Understanding the implications of the timing and phasing of potential schemes; and • Identification of opportunities for synergy or optimal sequencing of major road and rail works involved in, and options for mitigating strategic risks arising from, major complex projects being undertaken within the same function geography potentially within the same Roads Period.

1.3.6 The outputs from the study will be used to inform the second phase of the RIS (beginning in 2018). The overall programme for constructing 'RIS 2' upgrades is from 2020 onwards.

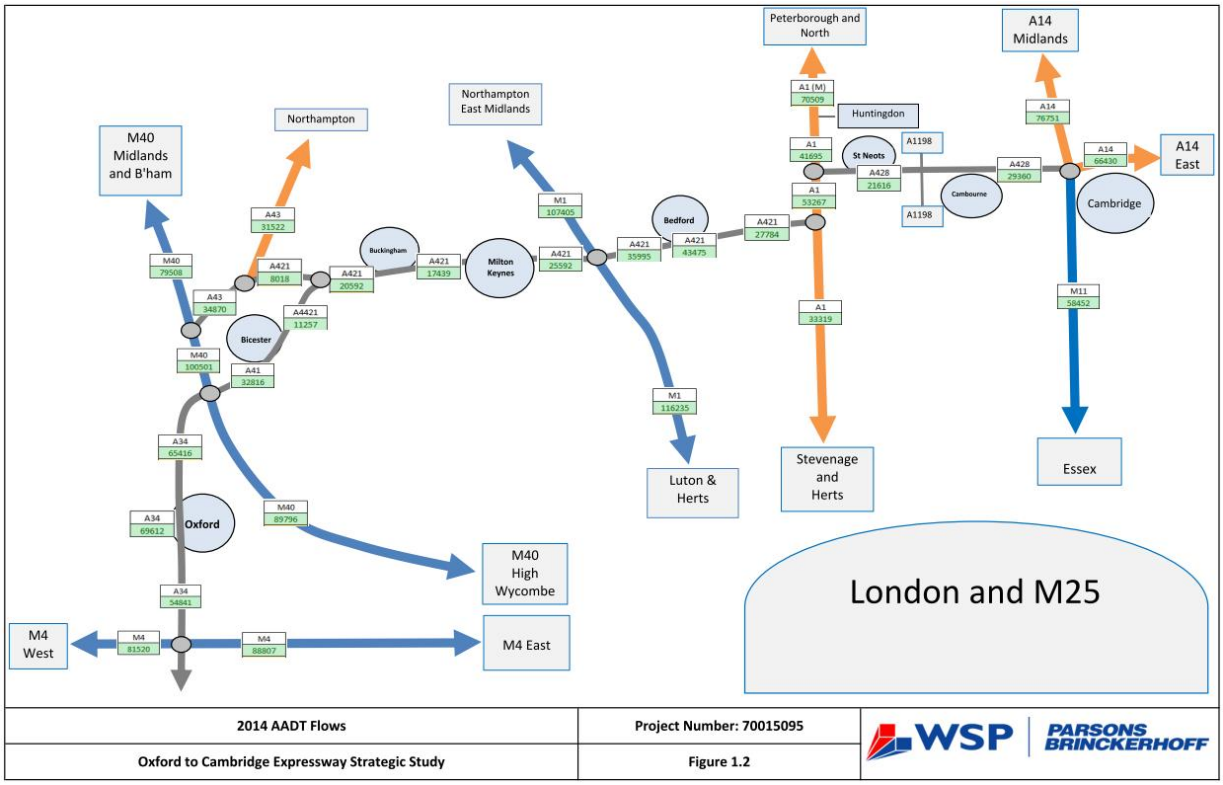
1.4 Strategic Opportunities

1.4.1 There is currently a lack of east-west connections across this part of the UK north of London and south of the Midlands. This study and the corridor itself provide the potential for addressing this missing link in the national infrastructure. Interventions in the corridor could provide opportunities at three functional levels:

- **Strategic** – the role of the corridor in the context of the national rail and strategic road network;
- **Regional** – addressing significant growth planned along the corridor and the contribution that this areas has to the UK economy and international markets; and
- **Local** – sections of the corridor will have potential positive impacts in their own right, such as access between homes and jobs.

1.4.2 A summary diagram showing the 2014 Annual Average Daily Traffic Flows (AADT) on the SRN and the primary east-west route within the broad ark from Didcot – Oxford – Milton Keynes – Bedford – Cambridge is provided in Figure 1-2.

Figure 1-2: 2014 AADT Study Area Link Flows



1.5 Study Stages and Programme

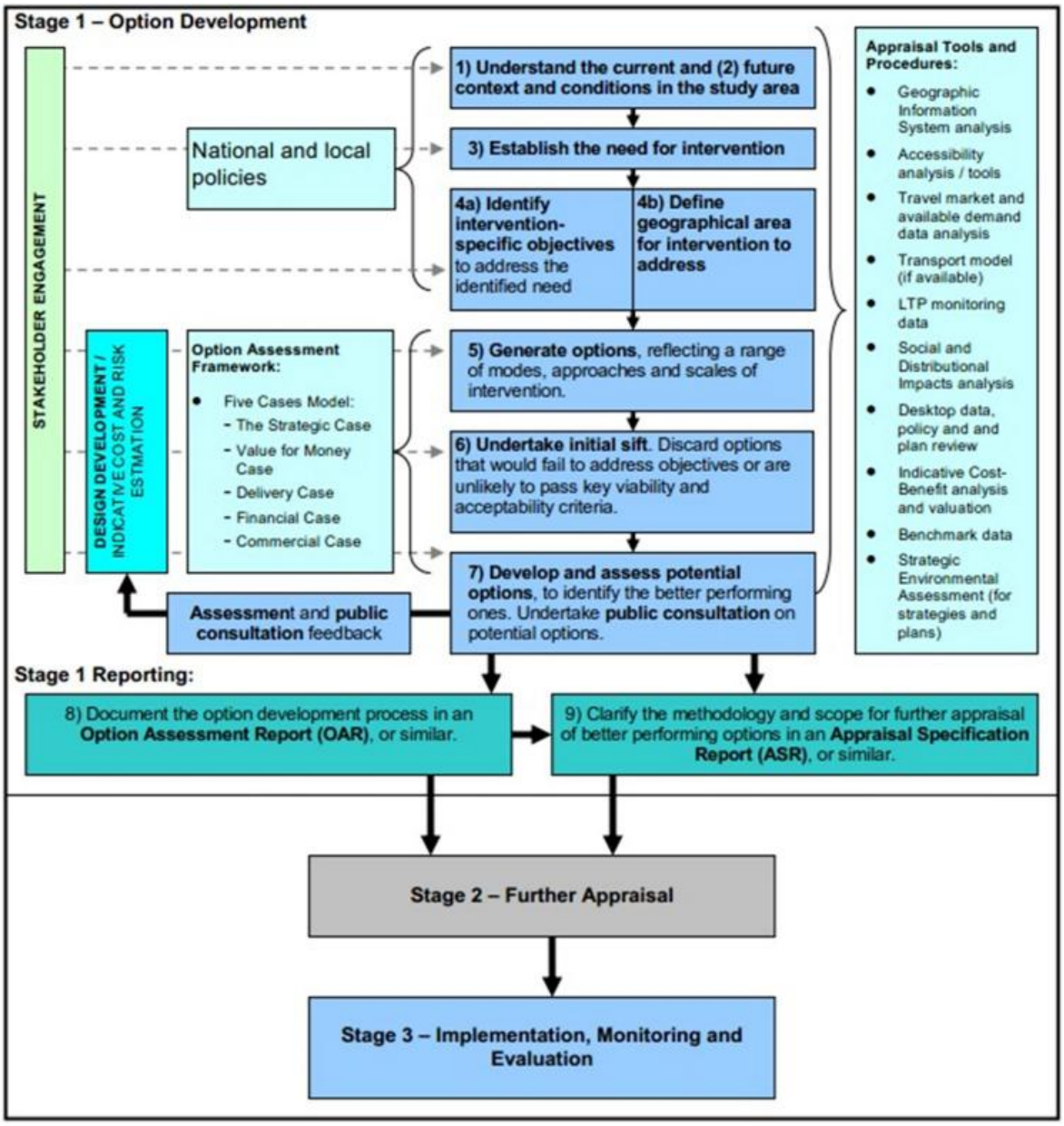
1.5.1 This strategic study will be delivered in three distinct stages as described in Table 1-2 below.

Table 1-2: Oxford to Cambridge Strategic Expressway Study Deliverables Schedule

STAGE	DELIVERABLE	DFT TIME-SCALE
1	**Initial Report** – assessing current transport situation/future situation and establishing the need for intervention.	Spring 2016
2a	**Long list of Options** – develop a range of alternative measures or interventions that look likely to achieve the study objectives.	Spring 2016
2b	**Initial Option Sifting** –to identify any show stoppers that would clearly fail to meet the key objectives identified for the study. Options will be considered or discarded on the basis of evidence and the Early Assessment and Sifting Tool (EAST). Following the EAST assessment and Options Assessment Framework assessment will be carried out.	Summer 2016
3	**Appraise short list of better performing options** – develop a strategic outline business case document for the better performing options including an assessment of the wider economic costs and benefits.	End 2016

1.5.2 The study has been undertaken in line with the Nine Step Process of Option Development contained within Transport Analysis Guidance - Unit 2.1.2D. Figure 1-3 presents a diagrammatic representation of the nine steps involved and provides an overview of the work flow which will be associated with the study. The proposed methodology will ensure that any potential options are developed in a manner which ensures proportionate analysis that will provide a sound basis for identifying problems and developing interventions for future funding opportunities.

Figure 1-3: WebTAG Appraisal Process



1.5.3 This document represents the Initial Report (Table 1-2 Stage 1) and presents the high-level strategic case for investing in transport interventions that improve east-west connectivity within the study area. This study has been informed by the available evidence base relating to the exiting and forecast future position on the SRN within the study area.

1.6 Stakeholder Reference Group

1.6.1 There is significant interest in the Oxford to Cambridge Expressway Strategic Study and a Stakeholder Reference Group (SRG) has been established to provide input into the project as it develops. The SRG organisation list is maintained by the DfT and is being used to identify key organisations that will be consulted as the study progresses.

1.6.2 The SRG includes:

- Local Enterprise Partnerships;
- County Councils;
- District and Unitary Planning Authorities;
- Transport Associations; and
- Environmental Groups.

1.6.3 Meetings between the integrated delivery team and representatives of the SRG were conducted in 2015 and will continue during 2016 in order to establish the views of various parties and all relevant feedback has been taken into account during the preparation of this Stage 1 report.

1.6.4 A further event was held in February 2016 in order to review the existing evidence base and the study objectives. The results of the initial sifting stage and assessment of shortlisted schemes will then be reported through a SRG meeting. A further SRG meeting will be undertaken later in 2016 to discuss the emerging findings of the study prior to the production of a finalised report.

1.7 Stage 1 Objectives

1.7.1 Stage 1 of the study seeks to confirm the high-level strategic case for creating an Expressway route connecting the towns and cities of the study area. This analysis seeks to:

- Understand the current and future context/conditions within the study area, including a review of previous studies, current policy, travel patterns, road congestion and capacity, safety, journey times, public transport options, environmental and physical constraints, future development, socio economics and labour markets; and
- Establish the need for intervention through the preparation of a robust body of evidence to demonstrate the requirement for development of an appropriate improvement scheme.

1.7.2 This report establishes the background evidence base by providing a high-level assessment of the study area and a more detailed assessment of the primary east-west road route under consideration. The principal objectives of Stage 1 are therefore to:

- Examine the strategic case for new east-west Expressway links and upgraded road connections, within the study area; and
- Confirm whether there is a strategic case for new east-west Expressway links and upgraded road connections, within the study area.

1.8 Stage 1 Report Structure

1.8.1 Following this 'Introduction and Study Objectives' section, this study is structured as follows:

- **Chapter 2 – Current Situation:** This section presents the current transport policy, the existing socio-economic and transport context, network performance/safety and environmental considerations associated with the study area corridor;
- **Chapter 3 – Future Situation:** This section presents the forecast economic and transport context associated with the operation of the primary east-west route; and
- **Chapter 4 – Need for Intervention:** This section provides a summary of the current/future transport problems and identifies the need for intervention.

2 Current Situation

NEED FOR INTERVENTION
Currently there is a lack of east-west connections across this part of the UK, north of London and south of the Midlands. Transport interventions across the broad Oxford to Cambridge arc would address this missing link in the national infrastructure. Whilst the study area benefits from good radial connections into London, the Midlands and the North of England, east-west connectivity is poor, and capacity constraints occur along key roads, such as the M1, A34, A421 and A428 resulting in congestion and unreliable journey times. Congestion, unreliable journey times and poor connections to national and global markets constrains competitiveness, reduces business efficiency and increases business costs due to less productive employees. Transport constraints are identified by England's Economic Heartland and the study area LEPs as a key challenge to delivering housing and employment growth. Road congestion, limited capacity on the rail network, poor east-west connectivity and limited public transport are identified as barriers to future economic growth and prosperity. Furthermore, international competitiveness within high-tech and science based knowledge industries is restricted, as excellent connectivity is a vital pre-requisite for growth. The existing evidence base shows low levels of interaction between the main urban areas within the study area due to existing travel times between the main conurbations. There is a very low commuter travel demand for longer-distances trips within the study area, for example between Oxford and Cambridge, and Oxford/Cambridge to Milton Keynes and vice versa. There are also only two percent of journey to work end-to-end trips through the corridor. This is as a direct result of a lack of any strategic infrastructure and the route being unattractive to all types of journey. New transport infrastructure could address this, and in particular potentially reduce the current unattractive journey times between Cambridge and Oxford, of over two and half hours by road and rail by an hour or more. This equivalent to being able to travel between Oxford and Milton Keynes in around 45 minutes and a similar time between Cambridge and Milton Keynes. This is in line with transport and economic performance guidance where a journey time of up to 45 minutes is acknowledged as encouraging wider economic benefits to occur in terms of productivity and investment benefits, allowing skilled workers to access jobs and improving business to business connectivity. The study area has experienced substantial growth in population. There has been population growth of ten percent within the study area in the past ten years, two percent above the national average. Economic analysis shows that Cambridgeshire, Oxfordshire and Milton Keynes are home to expanding, strong, dynamic, innovative and successful knowledge based economies generating greater value added per hour worked than the national average. For example, within Milton Keynes, Gross Value Added (GVA) per hour worked is approximately seventeen percent higher than the UK average. These high performing economies contribute disproportionately towards economic output and as such investment in strategic transport infrastructure is essential to drive their economic growth to the benefit of the functional economic areas and the UK as a whole.

2.1 Introduction

2.1.1 This section of the strategic study provides a summary of the current policy, transport and socio-economic context associated with the study area. The specific details are presented in accordance with the following structure:

- Policy Background;
- Transport Networks;
- Travel Demand;
- Network Operation;

- Network Safety;
- Socio-economic Context;
- Current opportunities and constraints; and
- Stakeholder views.

2.2 Policy Background

2.2.1 This section of the report sets out the current economic and transport policy base which is considered pertinent to the context of the 'Oxford to Cambridge Expressway Strategic Study'. This section identifies the national, regional and local policy support for improved east-west transport infrastructure within the study area. Table 2-1 lists the documents that have been reviewed.

Table 2-1: Policy Documents

POLICY TYPE	RELEVANCE	DOCUMENTS REVIEWED
National Policy	Sets out the national case for infrastructure investment, including the need to improve east-west connectivity in the study area.	National Infrastructure Plan 2014
		Road Investment Strategy 2015/16-2019/20
		Highways England: Strategic Business Plan 2015-2020
		Highways England: Delivery Plan 2015-2020
		National Planning Policy Framework 2012
Regional Policy	Sets out the regional priorities in transport infrastructure investment to support regional economic growth.	Greater Cambridge Greater Peterborough Strategic Economic Plan
		South East Midlands Strategic Economic Plan
		Oxfordshire Strategic Economic Plan
		Northamptonshire Strategic Economic Plan
		Thames Valley Berkshire Strategic Economic Plan
		Buckinghamshire Thames Valley Strategic Economic Plan
		England's Economic Heartland
Local Policy	Sets out the local transport infrastructure priorities to support local housing and employment growth.	Cambridgeshire Local Transport Plan
		Central Bedfordshire Local Transport Plan
		Bedford Local Transport Plan
		Milton Keynes Local Transport Plan
		Buckinghamshire Local Transport Plan
		Oxfordshire Local Transport Plan
City Deal	Sets out the transport infrastructure priorities to support economic and housing growth.	Greater Cambridge City Deal
		Oxford and Oxfordshire City Deal

National Policy

Strategic Imperative

Investment in improved east-west transport infrastructure within the study area complements the Government's National Infrastructure Plan objectives to create a national road network that improves economic productivity, thus supporting jobs and growth across the country.

The national Road Investment Strategy (RIS) clearly identifies the strategic need to invest in new transport infrastructure between Oxford, Milton Keynes and Cambridge to drive growth in these knowledge-based regional economies.

National Infrastructure Plan 2014

2.2.2 In December 2014, the HM Treasury published the National Infrastructure Plan 2014 (NIP 14), which states that there is a strong economic case for infrastructure investment and that it is a key element of the Government's long-term economic plan. The Government's objective is to create a national road network that improves economic productivity, thus supporting jobs and growth across the country. It seeks to:

- Increase capacity;
- Tackle congestion;
- Support development;
- Strengthen connectivity;
- Improve reliability and resilience; and
- Ensure a road network of the best possible quality.

2.2.3 NIP 14 states that the road network is vital to the economic sustainability of the UK and that well connected road infrastructure enables people to travel for work/leisure (with over 90 percent of passenger miles made by road) and businesses to transport goods (with over 65 percent of freight movements made by road).

2.2.4 With Gross Domestic Product (GDP) and population levels expected to rise, demand for travel on the SRN is forecast to increase further. DfT analysis estimates that by 2040 traffic in England will be between 27 percent and 57 percent higher than observed 2013 operating conditions.

The NIP 14 identifies the strong economic case for transport infrastructure investment. Transport investment in the study area will strengthen and drive growth in the innovative and successful regional knowledge based economies, supporting job creation, economic productivity and investment.

Road Investment Strategy (RIS) 2015/16-2019/20

2.2.5 The RIS is a suit of documents that set out the Government's strategic vision for the SRN in England for the period 2015 to 2020.

2.2.6 The investment strategy identifies the existing weak connection between Oxford, Milton Keynes and Cambridge and the need for an Expressway that connects the three settlements to help promote knowledge based growth. The RIS states that existing roads will form much of the Expressway; however it highlights gaps on the network that need to be addressed, particularly the section between the M1 near Milton Keynes and the M40.

2.2.7 The RIS includes investment of over £15 billion on the SRN. This investment includes the dualling of the A428 within the study area, between the A1 and the Caxton Gibbet Roundabout to an Expressway standard. As a part of this scheme, major improvements are proposed to the A1 Black Cat Roundabout. The RIS also announced a separate A1 East of England Feasibility Study looking at how to improve the safety and performance of the A1 between Peterborough and the M25.

2.2.8 The RIS identifies the strategic need for transport investment in the study area to allow regional economies to compete more effectively, open up new opportunities and drive economic growth locally, nationally and internationally. Better transport connections between the Cambridge, Milton Keynes and Oxford functional economic areas (the fastest growing and best performing regional economies) will deliver wider economic benefits by supporting knowledge-based economic growth.

Strategic Business Plan 2015-2020

2.2.9 The Highways England Strategic Business Plan 2015-2020 recognises that the roads which make up the SRN are a key enabler of economic growth/prosperity and are essential to quality of life across the nation. It states that 98 percent of UK manufacturers consider the condition of roads on the network to be critical to the potential success of a business and that 60 percent of congestion is caused by a general lack of available capacity.

2.2.10 Highways England consider that in order to improve the capacity and performance of the network, it will be required to:

- Modernise the network;
- Maintain the network; and
- Operate the network.

2.2.11 The Highways England: Strategic Business Plan recognises the importance of the SRN in enabling and supporting economic growth and productivity. Investment in the SRN within the study area will support the Highways England Strategic Business Plan by improving network capacity and resilience and thus support economic growth and productivity.

Highways England: Delivery Plan 2015-2020

2.2.12 The Highways England: Delivery Plan 2015-2020 builds on the Strategic Business Plan discussed previously and provides detail on how the company intends to deliver strategic outcomes, measure success, identify goals and plan for the future. Its focus will be on:

- Supporting economic growth;
- A safe and serviceable network;
- A more free-flowing network;
- Improved environment; and
- An accessible and integrated network.

2.2.13 The Highways England: Delivery Plan recognises the importance of supporting economic growth through the creation of a more free-flowing, integrated and accessible network. Investment in improved east-west transport infrastructure within the study area will help deliver Highways England's strategic outcomes.

National Planning Policy Framework (NPPF)

2.2.14 The NPPF states that the purpose of the planning system is to help achieve sustainable development and recognises that there are three separate but inter-linked dimensions: economic, social and environmental. The NPPF recognises the role of planning in contributing to building a strong, responsive and competitive economy and by identifying and coordinating development requirements, including the provision of infrastructure.

2.2.15 The policies within the NPPF seek to improve health, social and cultural wellbeing for all, deliver sufficient community and cultural facilities and services to meet local needs and secure a good standard of amenity for all existing and future occupants of land and buildings. Development is expected to contribute to the conservation and enhancement of the natural and historic environments and prevent development from contributing to unacceptable levels of pollution.

2.2.16 The NPPF places emphasis on good design which is a key aspect of sustainable development and should contribute positively to making places better for people and should avoid significant adverse impacts which can affect health and quality of life.

Regional Policy

Strategic Imperative

Investment in improved study area east-west transport infrastructure supports the LEPs and England's Economic Heartland Strategic Alliance regional policy objectives. The Oxfordshire, South East Midlands, Thames Valley, Greater Cambridgeshire and Greater Peterborough LEPs and England's Economic Heartland Strategic Alliance all identify a clear case for investment in strategic transport infrastructure in order to support and unlock economic growth within each of their regions.

The LEPs and England's Economic Heartland Strategic Alliance identify that improved east-west connectivity will support their growth aspirations, resulting in significant regional economic benefits and importantly supporting the delivery of the national growth agenda.

2.2.17 This section outlines the Strategic Economic Plan (SEP) of each LEP within the study area, focusing on their economic strengths and barriers to future economic growth. The section also summarises England's Economic Heartland Strategic Transport and Infrastructure Proposition.

Greater Cambridge Greater Peterborough Local Economic Partnership

2.2.18 Greater Cambridge Greater Peterborough (GCGP) stresses their position as one of the most productive regional economies in the UK, with significant global expertise in scientific research and advanced manufacturing, including bio-tech and life sciences.

2.2.19 Nearly 300 such companies, including NAPP Pharmaceuticals, GlaxoSmithKline and Medimmune, form a key cluster centred on Cambridge, to be joined by AstraZeneca's global headquarters in 2016. ICT and telecommunications also employ nearly 50,000 people across the region, and technology-based creative companies also form an important cluster, with ten percent of the UK's electronic games developers located within five miles of Cambridge City Centre. The LEP area also has significant manufacturing, engineering and processing, agriculture, creative and logistics sectors, hosting firms such as Perkins and BAe Systems.

2.2.20 Within the SEP, GCGP identify six priorities for government investment, designed to build upon the economic strengths of the region and tackle the key barriers to growth. These barriers include:

- Poor digital connectivity;
- Constrained transport networks;
- Skill shortages;
- Lack of Innovation and Incubator Space; and
- Confusing business support service limiting business growth potential.

2.2.21 Relevant to this study, GCGP identify that transport constraints are a key challenge to supporting housing and employment growth within the LEP region. Road congestion, limited capacity on the rail network, poor east-west connectivity and limited rural public transport all act as a barriers against future economic growth and prosperity.

South East Midlands Local Economic Partnership

2.2.22 South East Midlands LEP (SEMLEP) stress their prime geographical position with excellent north and south transport links, a knowledge-intensive corridor including key educational institutions, and a strong record of housing and employment growth.

2.2.23 The local economy retains a strong foundation in a range of economic sectors, including High Performance Technology, Manufacturing and Advanced Technology, Life Science (including pharmaceuticals), logistics and within the creative and cultural sectors. Milton Keynes – and the area surrounding Silverstone near Daventry – forms a key cluster for the UK's motorsport industry, home to approximately 1,500 high performance technology companies, employing 21,000 people and generating an annual local turnover of £2 billion. Key businesses within the region include Nissan Technical, Carlsberg, Unilever and Lockheed Martin.

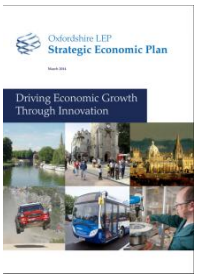
2.2.24 The SEP identifies key opportunities and constraints to growth within the region, which formulate the SEMLEPs proposed interventions. The key constraints include:

- Congestion on key transport routes;
- Significant infrastructure investment is required to facilitate large scale development; and
- Employment growth is failing to keep pace with population growth across the region, with key barriers including a lack of business support, access to finance, poor leadership and management and skills shortages; Localised pockets of deprivation and high unemployment occur in the region resulting in lower employment rates and poor access to the labour market.

2.2.25 Relevant to this study, SEMLEP identify that whilst the region benefits from good connections to London, the rest of the Midlands and the North of England, east-west connectivity is poor, and congestion along key arterial roads, such as the M1 and A43, leads to unreliable journey times. SEMLEP identifies that these transport barriers constrain competitiveness and economic growth, and acts as a key barrier to future housing development;

Oxfordshire Local Economic Partnership

2.2.26 Oxfordshire LEP (OxLEP) similarly stresses their position as a strong, dynamic regional economy, with a central focus on knowledge-intensive sectors. High-tech firms form a core Oxfordshire technology cluster, with strengths focused in four overlapping sectors:



- Life sciences, including bioscience, medical technology and pharmaceuticals;
- Physics related specialisms, including cryogenics, instruments, magnets and the space sector;
- Engineering and electronics, including motorsport; and
- Telecoms and computer hardware and software.

2.2.27 Oxfordshire also benefits greatly from world-leading universities and scientific institutions, which provide an outstanding environment for investment and business. Numerous 'big science' research facilities are located within the LEP area, including the UK Atomic Energy Authority Medical Research Council and the European Space Agency. Other key economic sectors include publishing, car manufacturing and motorsport.

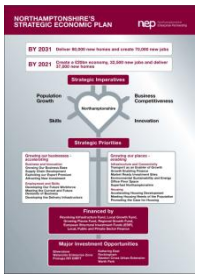
2.2.28 OxLEP's approach to growth is centred along a 'knowledge spine' from Didcot and Harwell in the South to Bicester in the North, centred upon four thematic objectives:

- Enterprise – despite a dynamic economy, the region suffers from low business formation, with too few new businesses forming and trading internationally;
- People – a mismatch of skills with current and projected unemployment, together with a tight labour market with low unemployment and high competition for employees, makes it difficult for employers to recruit sufficiently qualified staff;
- Place – housing affordability remains a key challenge, with the average house price in Oxford fifteen times the average salary, and hence the LEP aims to bring forward sites for development and improve the viability of development; and
- Connectivity – key arterial road routes suffer from chronic congestion, with limited connectivity along the 'knowledge spine', proposed to be tackled through targeted improvements to road and rail corridors.

2.2.29 OxLEP SEG identifies a number of inter-linked factors and challenges that need to be addressed for the LEP to realise its growth ambitions. These include housing affordability, key arterial routes operating at capacity and transport infrastructure that does not match travel desire lines.

2.2.30 Relevant to this study, OxLEP identify that Oxfordshire currently suffers from capacity issues creating constraints to economic productivity and growth in the county. The A34 and A40, in the heart of Oxfordshire, suffer from poor journey times that are a significant constraint as the economy grows. The delays caused by congestion are a cost borne by businesses and can lead to less productive employees. These (and other) capacity restrictions limit business efficiency and investment, and the ability for communities to access the full range of services. Businesses cite the A34 and A40 as having a significant impact on business and it is identified as the key piece of infrastructure restricting innovative growth.

Northamptonshire Enterprise Partnership



2.2.31 Northamptonshire Enterprise Partnership (NEP) is a LEP with a clear objective to support economic growth through the creation of new jobs and the delivery of new homes. NEP strategic priorities include:

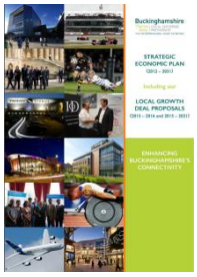
- Business and Innovation – investments to improve productivity, enhance supply chain performance, increase export performance and attract new business investment,
- Employment and Skills – improve the resident workforce skills base available to business to drive growth,
- Infrastructure and Connectivity – key enablers of growth requiring significant up-front infrastructure investment, and
- Housing – accelerating housing development to support the fast growing population needed to fulfil the demands of the local economy.

2.2.32 NEP stresses their position as one of the fastest growing populations with the highest employment rates in the country, means Northamptonshire is well placed to support the national economic recovery. Northamptonshire has a strong, diverse regional economy, the key sectors include:

- High-Performance Technology companies – home to three major racing venues and more than 200 motorsport companies including Cosworth, Mercedes Benz and Cummins;
- Logistics– including Tesco Distribution, Yusen Logistics, Knights of Old, Kuehne and Nagel; Wincanton;
- Food and Drink - Calsberg UK, Weetabix, Alpro and TMI Foods; and
- Creative Industries: growing sector including leather fashion and boot and shoe designers and manufacturers.

2.2.33 Relevant to this study, NEP recognises the importance of transport infrastructure investment as fundamental for its future growth. One of the four strategic priorities is to provide the necessary infrastructure to facilitate sustainable economic growth. The SEG stresses that removing the key barriers to growth will enable development that will ensure that Northamptonshire continues to drive nationally significant economic growth and deliver an even more significant return to UK PLC.

Thames Valley Berkshire Enterprise Partnership



2.2.34 Thames Valley Berkshire Local Enterprise Partnership (TVBLEP) has a clear objective to drive the local economy to new levels of growth by delivering essential housing, enhancing urban connectivity and growing the skills base and targeting business support. TVB identifies a number barriers to future economic growth including:

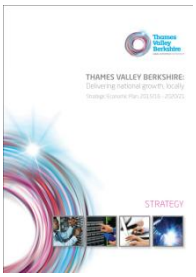
- Uncertainty surrounding the future of Heathrow airport;
- The need to progress improvements in western rail access to Heathrow Airport and the M4 motorway;
- A need for a greater supply of skilled people, particularly in science, technology and engineering; and
- Need to invest in the region to ensure it continues to provide a good quality of life.

2.2.35 TVB is an economic powerhouse of enormous importance to the UK economy. Key sectors of the TVB economy include:

- Small and medium sized enterprises - TVB has vibrant populations of SMEs operating in all sectors of the economy;
- Tech-based economy – TVB has the strongest tech-based (IT-based) economy in the UK;
- Internationalisation - The proximity to Heathrow airport is also important as a major employer and instrumental in attracting inward investment; and
- Corporations – TVB has over 200 European or Global corporate headquarters.

2.2.36 TVB consider the biggest single risk to the future economic contribution of TVB is the transport and communications infrastructure. The growth of the economy is fundamentally shaped by connectivity. Within TVB, Heathrow is crucial to support ongoing inward investment, the M4 motorway and Great Western Mainline provides important links to London. Congestion on the transport networks is threatening to undermine the intrinsic growth potential.

Buckinghamshire Thames Valley Enterprise Partnership



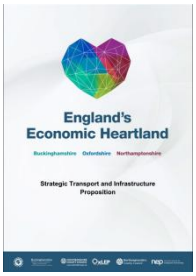
2.2.37 Buckinghamshire Thames Valley Local Enterprise Partnership (BTVLEP) has a Local Growth Deal based on five key pillars and thirteen key projects. The four relevant pillars are:

- Transport Infrastructure – Includes projects to support the Aylesbury East expansion, regenerating High Wycombe, developing a A355 Improvement Scheme, delivering modal shift by improving sustainable transport links to East West Rail and Winslow Station and CrossRail stations in Taplow;
- Skills Capital – Transforming Amersham and Wycombe Colleges and investing in the Waterside Centre education facility in Aylesbury Town;
- Business Growth – Stimulating SME, electronics, telecommunications, film, visual effects and games business growth; and
- Housing and Town Centre Development – creation of a housing investment fund and regenerating Aylesbury town centre.

2.2.38 BTVLEP recognises that in order the deliver higher levels of growth in Buckinghamshire capital funding is required to ensure infrastructure develops appropriately to match population growth (particularly for transport). Relevant to this study is BTVLEPs support for Network Rails East West Rail scheme. BTVLEP identifies that if the growth forecasts for the region are to be realised, transport connectivity to other key economic centres needs to be improved and traffic congestion in south Buckinghamshire needs to be addressed.

England's Economic Heartland

2.2.39 England's Economic Heartland (EEH) includes Buckinghamshire, Oxfordshire and Northamptonshire and is formed of County Council Leaders and LEP Chairmen. EEH is at the heart of the UK's global competitiveness in science and technology based innovation. The combined economy is worth £46.6 billion, with productivity 30 percent higher than traditional city-regions.



2.2.40 This Strategic Alliance provides a single platform for engagement on strategic transport and infrastructure issues affecting the area and impacting on the success of the UK economy. The proposed approach complements the activities undertaken by the LEPs and supports the delivery of the Local Plans prepared by the local planning authorities in the area.

2.2.41 EEH recognises that to successfully compete in global markets is dependent upon transport and digital connectivity. Connectivity both locally and internationally is critical for economic growth. EEH recognise that strategic transport infrastructure is central to the success of the economy. EEH identify a number of key strategic arteries and corridors as being in need of a more collaborative approach that transcends traditional local authority boundaries. The corridors relevant to this study are:

- The 'A34/A43/A45 artery' – linking the south coast port with the UK's distribution and logistics hub based in and around Northamptonshire, as well as being central to realising the unique economic potential of the Oxfordshire Knowledge Spine and the Northamptonshire Arc;
- East-West Rail/A421/A428 Expressway – the future reintroduction of rail services, and with the Expressway study to follow, the strategic importance of this corridor continues to increase linking as it does Oxford, the Bicester Garden City, Milton Keynes and Cambridge; and
- A14/M1 – via the distribution and logistics hub based in and around Northamptonshire, linking the east coast ports with the rest of the UK.

2.2.42 EEH identify these investment corridors as key opportunities to support economic growth and enable the delivery of new jobs and homes. EEH recognise that a new east-west strategic road link will improve strategic east-west connectivity in the south of the geographic area in order to unlock further development and growth.

Local Policy

Strategic Imperative

Investment in east-west transport infrastructure within the study area directly supports a number of local transport priorities set out in the County Council and Unitary Authority Local Transport Plans (LTPs). These documents set out the local transport priorities, but also recognise the importance of investment in strategic transport infrastructure to support local economic growth.

The LTPs recognise the importance of east-west connectivity to improve accessibility into the main conurbations, support housing growth and key employment areas. The LTPs also recognise that congestion in local areas and on the strategic road network including the A34, A421 and A428 acts as a deterrent to investment.

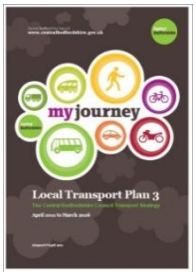
Cambridgeshire Local Transport Plan 2011-2031

2.2.43 Cambridgeshire's Local Transport Plan (LTP3) sets out the county's transport policy, transport strategy and delivery plan for the period 2011 to 2031.

2.2.44 The plan identifies the wider vision to create an Expressway between Oxford and Cambridge and identifies the existing weaknesses along the A428 and A1 corridors.

2.2.45 The LTP identifies that the A428 has been dualled from Hardwick to Caxton Common. The LTP states that as a result, the east-west corridor from Ipswich to Milton Keynes/M1 is entirely dual carriageway with the exception of a stretch of the A421/A428 between Caxton Common and Black Cat Roundabout in St Neots. The LTP states that Cambridgeshire County Council, along with Bedfordshire, South Cambridgeshire and Huntingdonshire councils, wants to see the remaining section widened to complete the dual carriageway and thereby complete the dualling of the east-west corridor. The dualling of this section of the A428 was confirmed in December 2014 as a part of the Governments RIS 2015 to 2020 and is to be delivered by Highways England.

Central Bedfordshire Local Transport Plan 3 2011-2026



2.2.46 The LTP3 identifies a gap in east-west movement across Bedford. It notes that the recently opened A421 connecting the A1 and Bedford has assisted in improving east-west connections.

2.2.47 The LTP3 identifies that traffic congestion in local areas, such as Dunstable, and on the strategic highway network, add costs to local businesses through wasted time and fuel, acting as a deterrent to investment.

2.2.48 The LTP3 states that Central Bedfordshire is relatively unique in that it is characterised by a number of smaller towns and villages rather than one large Urban City, with major urban areas on its immediate peripheries providing significant employment. These urban areas are generally accessible by public transport, the distances to these centres result in journeys to work which are much longer than average, placing additional pressure on the strategic transport routes through the area.

Bedford Local Transport Plan 3 2011-2021

2.2.49 Bedford's LTP3 is the long term transport strategy and implementation plan. The report notes the importance of East West Rail for improving rail connectivity.

2.2.50 The LTP3 also identifies the benefit of the delivery of the Phase 1 A421 to the A428 western bypass to provide western traffic relief and access for new residential development. The LTP3 also identifies that a new link between the A428 and A6 is required to complete the Bedford bypass.

Milton Keynes Local Transport Plan 3 2011 to 2031

2.2.51 Milton Keynes LTP sets out the transport vision and strategy for the period 2011 to 2031. The report recognises the importance of the knowledge based economies of Oxford and Cambridge and supports the proposals for East West Rail.

2.2.52 In the medium term the LTP3 sets out the need for the council to deliver in partnership with the Homes and Community Agency (HCA) the dualling of the A421 from M1 Junction 13 to the Kingston Roundabout (A5130) and onto the M40 in Oxfordshire. The council also supports Buckinghamshire County Council's plan to dual the A421 towards the M40 in Oxfordshire.

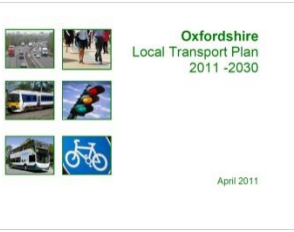
Buckinghamshire Local Transport Plan 3 2011-2016

2.2.53 Buckinghamshire's LTP sets out the County's transport policy and strategy that will be delivered by Transport for Buckinghamshire for the five year period between 2011 and 2016.

2.2.54 The plan identifies cross boarder growth in Milton Keynes and Bicester as key transport issues. The lack of interurban bus connections within Buckinghamshire and neighbouring counties is also identified as an issue, as this limits the amount that people can travel by public transport.

2.2.55 Buckinghamshire's LTP has classified the length of the A421 through the county as an interurban "priority congestion management corridor". This will allow the county to implement targeted measures along the corridor with the overall aim of improving journey time reliability. These may include: junction improvements, capacity improvements and Intelligent Transport Systems.

Oxfordshire Local Transport Plan 3 2011-2030



2.2.56 The Oxfordshire LTP sets out the County's transport vision and strategy for the period 2011 to 2030. The plan recognises existing locations on the road network which are operating under stress. This includes the following junctions:

- M40 Junctions 9 and 10 and approaches to Junction 11;
- A34/A44 Junction at Peartree; and
- A34 Hinksey Hill interchange and Kennington, Heyford Hill and Littlemore roundabouts on the Oxford Ring Road.

2.2.57 In addition to this, the plan identifies a number of links under stress, including the:

- A34:
  - Between Milton Interchange and Marcham Interchange; and
  - Between Lodge Hill and M40.
- M40:
  - Between Junctions 9 (Bicester) and 10 (Ardley).
- A43:
  - Approaching M40.

2.2.58 The plan reports on the results of the Central Oxfordshire Transport Model for the future year of 2026. This concluded that by 2026 there will be an increase in the number of links operating at capacity; these include the A34 in the peak periods and M40 between Junctions 9 and 10 in both directions.

2.2.59 The plan identifies areas where major network development is required; this includes the A34, particularly on the northern and southern approaches to Oxford on the ring road.

2.2.60 The A34 is identified as particularly congested and adversely effecting journey time reliability. Whilst it is a two lane dual carriageway, it has a high proportion of HGV movements (20 percent of daily trips and higher at other times of the day). Congestion is caused by the high number of junctions and frequent incidents. The number of HGVs overtaking on the A43 also causes considerable delay.

2.2.61 A high number of incidents were recorded along the A43. There were a large number of sites along the A43 with more than 15 accidents over the 5 year period between 2006 and 2010.

Greater Cambridge City Deal

2.2.62 The Greater Cambridge City Deal seeks to deliver innovation growth through the delivery of new infrastructure, housing and skills and build established technology cluster within the city. A number of transport schemes have been identified as helping to drive this growth within the Greater Cambridge and South Cambridge region and includes major infrastructure projects along key strategic corridors into the city.

2.2.63 In particular, the Greater Cambridge City Deal includes new bus priority / busway along the A428 to the M11 and a new 1,000 space A428 corridor Park & Ride near Bourne Airfield/ Cambourne. It is intended that this will be delivered within the first 5 years of the City Deal.

Oxford and Oxfordshire City Deal

2.2.64 The Oxford and Oxfordshire City Deal seeks to grow the local economy and create 19,000 jobs. The City Deal will establish four innovation hubs along Oxfordshire's 'knowledge spine' from Harwell and Culham in the south to the BioEscalator in Oxford and the advanced engineering hub at Begbroke in the north.

2.2.65 Central Government has provided £55.5 million with the deal expected to be worth £1.2 billion with private sector investment. The funding will support business, skills training, transport infrastructure and the delivery of 7,000 dwellings.

2.2.66 The major transport improvements including the A34 and the A40 'Northern Gateway' with a new link road from the A40 to the A44 along with roundabout improvements (Cuttleslowe and Wolvercote). An Oxford Science Transit scheme along the knowledge spine with 'smart' ticketing is also proposed.

2.3 Study Area Transport Networks

Introduction

2.3.1 In order to gain an understanding of the strategic baseline situation and the potential success of interventions, it is necessary to evaluate and understand the existing transport networks and travel patterns within the study area.

2.3.2 This section provides a description and 'gap analysis' of the current transport networks associated with the primary east-west corridor within the study area as shown in Figure 1-1. A high level review of the following study area transport networks has been undertaken:

- Strategic Highways Overview;
- Strategic Freight Network;
- Airports;
- National Rail Network;
- Bus and Coach Network;
- Public Rights of Way Network; and
- Cycle Network.

Strategic Highways Overview

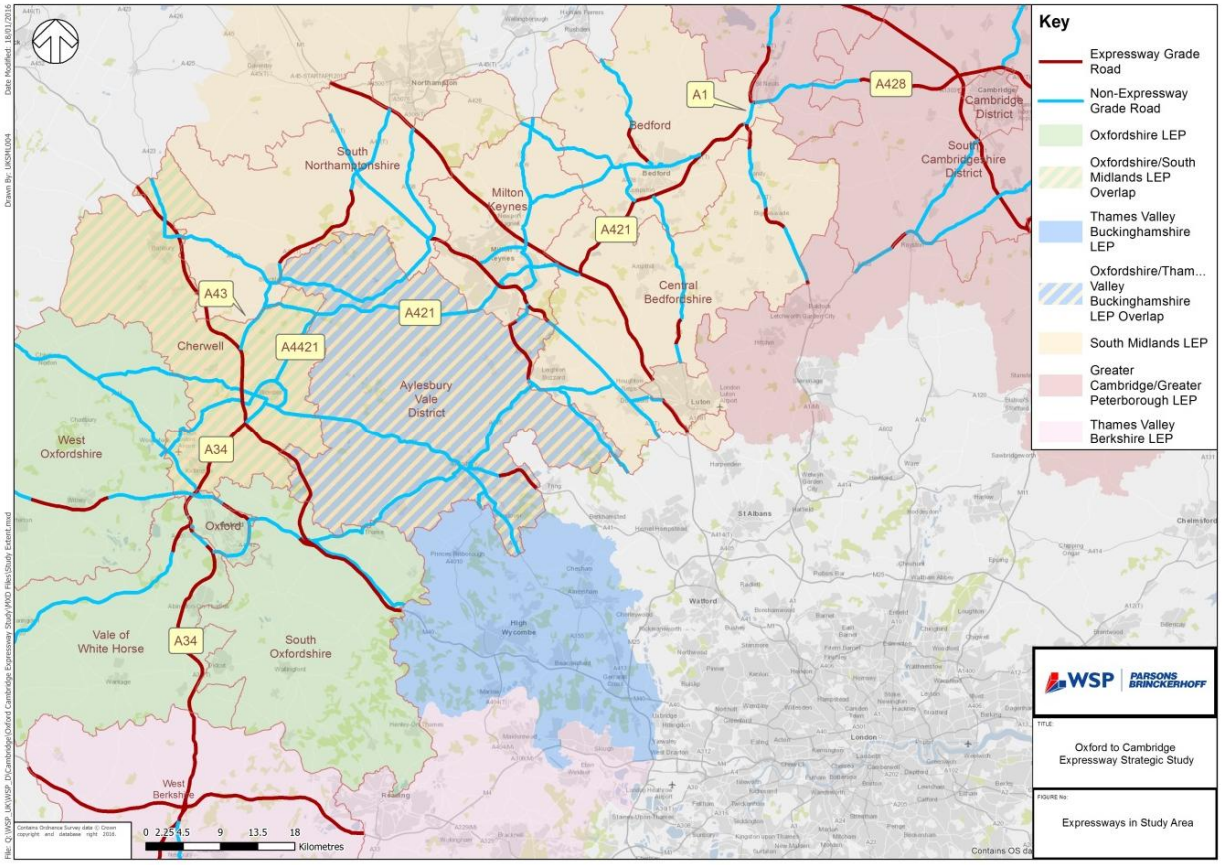
Route Description

2.3.3 The primary road route between Oxford and Cambridge is via Milton Keynes and Bedford. The full scope of roads which are considered in this report are presented in Figure 1-1. The study area consists of the broad ark from Didcot to Cambridge inclusive of Oxford, Milton Keynes and Bedford with a focus on the A34 between the M4 and the M40, the A421 between the M40 and the A1 and the A428 between the A1 and the Girton Interchange (M11/A14).

2.3.4 At present, there, is no continuous Expressway standard route available between Oxford, Milton Keynes, Bedford and Cambridge (Figure 2-1) by any route, leading to congestion within the corridor during peak travel periods. For the purposes of this study an Expressway as defined in the RIS Investment Plan (p7) is:

> *"a consistently good road which is largely or entirely dual carriageway, with grade-separated junctions, giving most users a motorway-quality journey."*

Figure 2-1: Study Area: Existing Expressway Standard Roads



2.3.5 The primary east-west corridor route from the M4 via the A34, A421, A428 to the A14 is approximately 108 -111 miles in length depending on the route via the M40 and A43 or the A41 and A4421 (Bicester). Figure 2-1 shows there are gaps in Expressway standard roads as follows:

- **A34:** A423 Eastern Bypass to the A420 and the Wytham southern access junction;
- **A43:** M40 to the A421;
- **A421**: A43 to the M1 (including the A43 and A4421); and
- **A428:** A1 Black Cat Roundabout to the A1198.

2.3.6 Figure 2-1 shows that the A34 is deemed to be Expressway standard on the basis that it is a high speed dual carriageway, generally with grade separated junctions. It is noted however that, particularly on the section past Oxford, there is significant local at-grade access off the route to residential properties which is contrary to the Expressway philosophy. A similar situation exists on the section of the A1 between the Black Cat Roundabout and the A428 St Neots junction. The non-expressway sections of the A421 and A428 have regular at grade local access junctions along their lengths.

2.3.7 As shown on Figure 2-1, around Oxford it is also identified that the following sections of carriageway are not at Expressway standards:

- The A423/A4142 Eastern Bypass as it has direct accesses which are not grade separated e.g. Sandy Lane West and signalised junctions including Horspath Road;
- Similarly the A40 Northern Bypass has central median cross overs for farm vehicles and direct access which is not grade separated e.g. Jackson Road; and

- The A40 London Road from the A40 Bypass to the M40 has residential accesses, side roads (e.g. Church Hill, Wheatley Road, access to Holton), pedestrian crossing of the central median and signalised junctions e.g. Park and Ride access at Merewood Avenue.

2.3.8 The east-west route has been divided into six main sections which are shown graphically in Figure 2-2. A summary of the six main sections is provided in Table 2-2. The sections highlighted in grey in Table 2-2 provide a continuous Expressway standard route.

Figure 2-2: Study Area: Main Route Sections

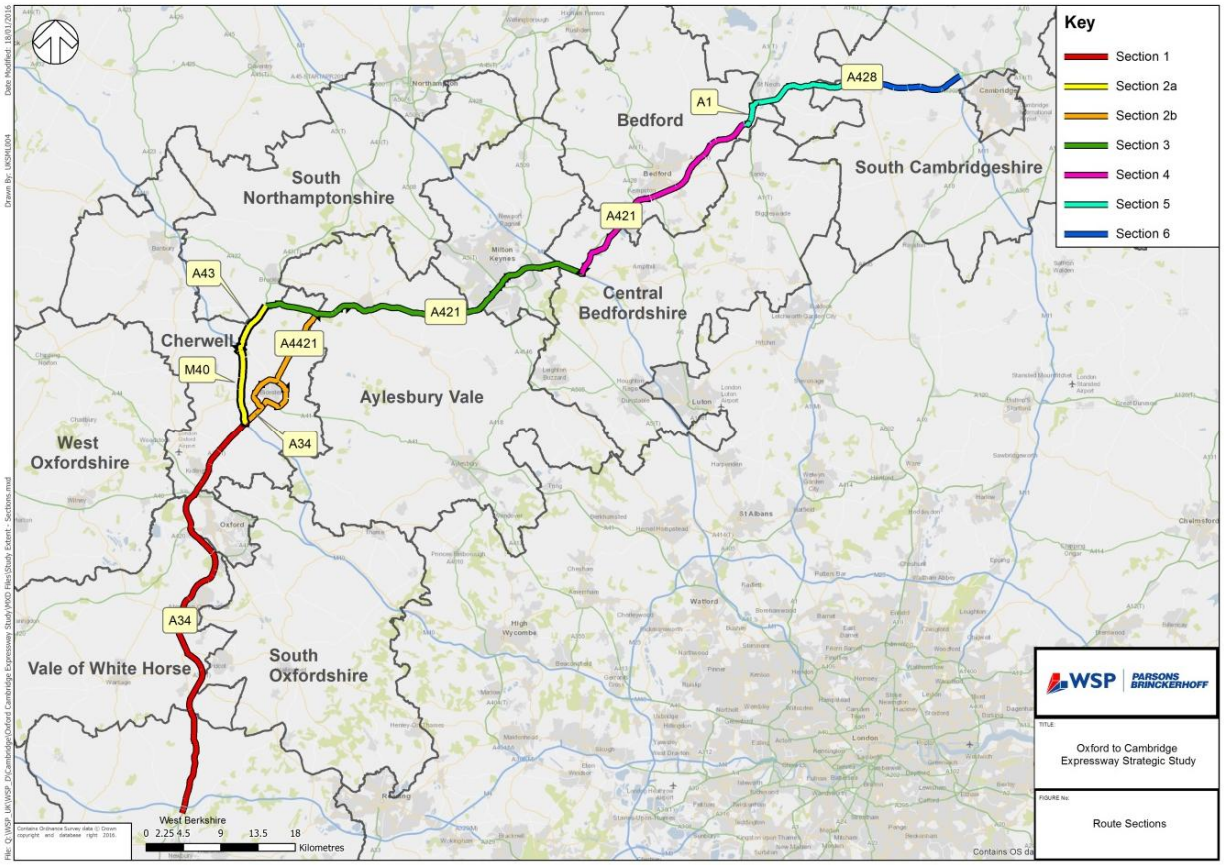


Table 2-2: Route Classification Summary

SECTION	DESCRIPTION	ROAD	CARRIAGEWAY STANDARD	MAIN JUNCTION STANDARD	LENGTH	OPERATOR
1	A34: M4 to M40	A34	Dual Carriageway	Grade separated	33.2 miles	Highways England
2a*	M40/A43 to A421	M40	3 Lane Motorway	Grade separated	5.6 miles	
		A43	Dual Carriageway	At Grade	3.9 miles	
2b*	A41/A4421 to A421	A41	Dual carriageway M40 to Oxford Road.	At Grade	2.3 miles	Oxfordshire County Council
			Wide single carriageway Oxford Road to A4421	At Grade	1.0 miles	
		A4421	Dual carriageway A41 to Peregrine Way	At Grade	0.2 miles	
			Wide single carriageway: Peregrine Way to Buckingham Road.	At Grade	2.4 miles	
			Rural single carriageway: Buckingham Road to A421	At Grade	5.9 miles	
3	A421: A4421 to M1	A421	Single Carriageway: A43 to A4421	At Grade	4.0miles	Oxfordshire County Council
			Dual Carriageway: A4421 to Main Street	At Grade	1.8 miles	Buckinghamshire County Council
			Single Carriageway: Main Street to Whaddon Road	At Grade	10.2 miles	
			Urban Dual Carriageway: Milton Keynes	At Grade	8.0 miles	Milton Keynes Council
			Single Carriageway: Eastern Edge Milton Keynes to M1	At Grade	1.9 miles	Central Bedfordshire Council
4	A421: M1 to A1	A421	Dual Carriageway	Grade separated	17.8 miles	Highways England
5	A428: A1 to A1198	A1	Dual Carriageway	At Grade	1.9 miles	
		A428	Single Carriageway	At Grade	8.6 miles	
6	A428: A1198 to A14	A428	Dual Carriageway	Grade separated	7.8 miles	

*Alternative route options via M40 or Bicester.

Section 1: A34: M4 to M40

Route

2.3.9 The A34 trunk road provides a direct link between the M40, M4 and onwards to the M3 and south coast. Within the study area, the A34 provides a direct connection between the M4 at Junction 13 and the M40 at Junction 9 (a distance of approximately 34 miles).

2.3.10 Starting from the M4 and running in a generally northerly direction, the A34 is a dual carriageway immediately north of the M4 junction 13 to junction 9 of the M40 at Bicester.

2.3.11 From the M4, the A34 routes northwards through a rural setting and then, veers to the northwest in a curve to pass to the west of Didcot. The route crosses an area east and north of Steventon which is criss crossed with surface water features and then the River Ock. Continuing on a long loop, the route then passes to the west and north of Abingdon.

2.3.12 The route continues in a generally northerly direction passing through the heavily wood area of Bagley Woods to the west of Kennington which has a section of deep cut. With various tributaries of the River Thames to the east and the main river itself, the route starts to pass the west of Oxford. As the road continues north, it cross the River Thames on the Wolvercote Viaduct, passes over a railway line and the A40.

2.3.13 The northern section of the route from Oxford to the M40 is the most recent section to be improved and is a combination of off line and on line improvements past Kidlington, Islip and Weston on the Green to meet the motorway at M40 Junction 9. The section includes a crossing of the River Cherwell and its associated floodplain.

Main Junctions

2.3.14 The main junctions on the A34 are:

- Beedon: Limited access junction with north facing slips;
- East Ilsley: All movement junction with southbound on and off slips which are 1 mile apart and northbound movements are by a left in left out connection for Compton, East and West Ilsley;
- Bury Lane: A full grade separated junction, which has northbound service facilities immediately before it;
- Chilton: Limited movements junction which provides south facing slip roads serving the research facilities at Harwell and related activities;
- Milton Interchange: Full grade separated junction onto the A4130 serving Didcot;
- Marcham Interchange: Full grade separated junction onto the A415 serving Abington;
- Lodge Hill: Limited movements junction onto the A4183 Oxford Road by means of north facing slip roads only;
- Hinksley Hill: Full grade separated junction onto Hinksey Hill (serving Boar's Hill and Wootton) and Oxford Eastern Bypass Road providing access to the southern part of Oxford City, the football stadium and park and ride facilities;
- Botley Interchange: Full grade separated junction onto the A420 serving Oxford itself, Botley and Swindon to the west.
- Wytham: Left in left out junction on the northbound carriageway with a restricted weight limit access into Godstow and Wytham;
- Peartree Interchange: Full grade separated junction with the A44 which serves Oxford, a service station, and the area to the north and west including Kidlington, Woodstock, Chipping Norton and on into the Cotswolds;
- Kidlington: Limited movements junction to serve the north of Kidlington;
- Islip: All movement junction using a left in left out and single overbridge on the B4027 Bletchington Road; and
- Weston-on-the-Green: All movement junction using a left in left out and single overbridge on the B430 Oxford Road.

<u>Section 2a: M40 and A43 to A421</u>

2.3.15 Two main options are available to the A421 east-west route towards Milton Keynes from the A34. The main options are:

- M40 and A43 (Section 2a); or
- A41 and A4421 via Bicester (Section 2b).

Route

2.3.16 The M40 is a three lane motorway connecting London and Birmingham. It provides an alternative route from Southern England to the West Midlands, to the M1 and the A34. Within the study area the M40 routes in a north-westerly direction between Junctions 9 and 10 (Cherwell Valley Interchange).

2.3.17 From Junction 10 of the M40, the A43 dual carriageway routes northwards to the A421/B4031 roundabout. The section of the A43 is not to Expressway standards owing to the provision of a number of at grade access junctions, although the main junction on this section is grade separated with an elongated junction at Tusmore. From the aforementioned A43 roundabout, the A421 travels in an easterly direction as a single carriageway road.

2.3.18 From the A43 to Finmere, the A421 is in a rural setting and has a local distributer function with direct access to properties, local side road connections and parking facilities. Junctions are at grade with localised widening to facilitate turning traffic.

Main Junctions

2.3.19 Junction 9 of the M40 is a full grade separated roundabout. Junction 10 of the M40 is also a full grade separated junction and also serves the Cherwell motorway service area as well as the local road to Ardley. To complete the manoeuvre from M40 northbound to A43, four roundabouts have to be negotiated, including that with the B4100.

2.3.20 As part of the Pinch Point Programme, Junction 10 of the M40 was upgraded by Highways England in 2015. The £2 million scheme involved closing the M40 southbound slip road from the Padbury roundabout and reconnecting a southbound entry slip road onto the M40 from the Cherwell Roundabout and modifying the roundabout including the installation of traffic signals.

Section 2b: A41 and A4421 to A421

Route and Junctions

2.3.21 The alternative route to the A421 uses the A41 from M40 Junction 9 to Bicester. The A41 is a dual carriageway to the outskirts of Bicester, but not Expressway standard owing to direct accesses onto it including roundabout junctions with the B4030 and the town centre.

2.3.22 The A41 routes eastwards and passes the Bicester Village retail outlet, and then over the Bicester to Oxford railway line and local water courses.

2.3.23 The road is a single carriageway is generally straight and relatively flat. The A4421 joins the A41 at an at grade roundabout before completing a loop around the east and north of Bicester to act as a bypass. There are a further five roundabouts to be negotiated until the A4421 starts to head north after the junction with the A4095 and Buckingham Road back into the town centre.. Direct access is available at multiple points along the route in addition to the formal roundabouts.

2.3.24 Leaving Bicester the A4421 travels in a generally northerly direction through farm land with multiple points of access onto the route.

Section 3: A421: A4421 to M1

Route and Junctions

2.3.25 The A421, from the A4421 to the M1 is a local road, with sections managed by Buckinghamshire County Council, Milton Keynes Council and Central Bedfordshire Council. This section of the A421 provides the primary east-west route between Milton Keynes and the west, including Buckingham, Bicester and Oxford. The route also links the M1 with the M40 via the A43.

2.3.26 The A421 is a dual carriageway to the south of Tingewick and then continues as a single carriageway east of the roundabout with Main Street. The A421 continues through a further five roundabouts to the west, south and east of Buckingham. Multiple accesses are provided onto the route towards greater Bletchley area, although some side roads are bridged over.

2.3.27 As the A421 enters the built-up area of Milton Keynes it becomes an urban dual carriageway, but not at Expressway standards due to the at grade accesses. The characteristics of the A421 Standing Way change from rural to semi-urban to urban as a series of 14 roundabouts are negotiated. This section passes through Bletchley, Milton Keynes passing over the A5 and the London Milton Keynes railway line before continuing to the M1.

2.3.28 The eastern end is characterised by extensive warehousing and a reduction in cross section between the last roundabout and the motorway from dual to single carriageway. This link road section of the A421 suffers from traffic congestion as a result of the dual carriageway section of the A421 to the north-east of the M1 merging into the single carriageway section approaching Milton Keynes.

2.3.29 A pinch point funded scheme has been completed to increase capacity on the A421 at the Kingston roundabout and dualling the A421 from Fen Park Farm to Eagle Farm North roundabout at the eastern edge of Milton Keynes. These improvements have been implemented to unlock development in the eastern Expansion Area (utilising developer contributions for infrastructure improvements) and accommodate traffic growth.

2.3.30 The SEMLEP have been awarded a Local Growth Deal of £64.4 million, of which £23.5 million has been committed to dualling the remaining stretch of the A421 from Junction 13 of the M1 to Fen Farm.

Section 4: A421: M1 to A1

Route and Junctions

2.3.31 The A421 dual carriageway Expressway routes from the M1 via Junction 13 to the A1. The A421 Expressway dual carriageway was opened in 2010. The new road has full grade separated junctions at Marston Moretaine, Bedford Southern Bypass and the new Western Bypass (A428) at Kempston.

2.3.32 The short section of the A421 between and the A428 and the A6 is three lanes in each direction as it crosses the railway lines to Milton Keynes/Bletchley and London. The two lane dual carriageway continues east around Bedford to Water End, where it meets the A4280 from Bedford at a full grade separated junction. In between, there are grade separated junctions with the A600 (west facing slips only) and Cardington on the A603 (full). Before reaching Water End, the A421 crosses the floodplain and channel of the River Great Ouse.

2.3.33 From Bedford the A421 continues eastwards as a dual Expressway to the A1 at the Black Cat Roundabout.

2.3.34 The Black Cat Roundabout located at the eastern end of this section of the A421 forms a large at grade roundabout with the A1. The northbound and southbound A1 and A421 approaches to the Black Cat Roundabout regularly suffer from queuing in peak periods.

2.3.35 An improvement scheme at the Black Cat roundabout was completed by Highways England in 2015 as part of the Pinch Point Programme. The roundabout has been increased in size so there are four circulatory lanes on the eastern side of the roundabout. Traffic signals have also been installed at the junction of the circulatory carriageway and the A1 southbound and A1 northbound approaches.

Section 5: A428: A1 to A1198

Route and Junctions

2.3.36 At the Black Cat Roundabout, the Oxford to Cambridge route turns north on the A1 dual carriageway to St Neots with the grade separated junction with the A428. The junction is elongated in form with significant distance between the two southbound slip roads. This section of the A1 is not Expressway standard owing to the existing accesses off it. Immediately east of the A1, there is an at grade roundabout on the A428 serving local road and business connections. From here to Caxton Gibbet, the A428 is a single carriageway road, with an historical alignment, crossing the floodplain and channel of the River Great Ouse before passing into a rural setting of flattish countryside. It has multiple side road accesses onto and off it and there are two roundabouts at the more major junctions – Barford and Bedford Roads.

2.3.37 A scheme is being developed by Highways England to dual this section of the A428 which would create an Expressway standard dual carriageway from Cambridge to Bedford and Milton Keynes. This is a separate but obviously connected commission to the Oxford to Cambridge Strategic Study. In a similar view, the A1 East of England Expressway Study is being undertaken by others looking at the A1 from the M25 to Peterborough which also overlaps with the Oxford to Cambridge study in this area.

Section 6: A428: A1198 to A14/M11

Route and Junctions

2.3.38 At Caxton Gibbet, immediately west of the new town of Cambourne, the A421 intersects with the A1198 at an at-grade roundabout and departs the junction as a dual carriageway to Expressway standard. There is a grade separated junction servicing Cambourne and the route continues eastwards towards Cambridge and the M11/A14 in a rural setting. Another grade separated junction provides access to Hardwick before the limited junction with the A1303 at Madingley is reached. This has west facing slip roads only.

2.3.39 After the junction, the A428 continues to the A14 with a limited junction provided to/from the M11 – with the ability to join the A428 eastbound from the M11 northbound and from A428 westbound to M11 northbound with the large Girton Interchange. It is noted that for eastbound A428 traffic, there is no option but to join the A14 eastbound and for westbound A14 traffic the exit options are to go to M11 southbound, A428 northbound or M11 (becoming the A14) northbound.

2.3.40 The A14 between Cambridge and Huntingdon is subject to a committed £1.5 billion improvement scheme. The Development Consent Order (DCO) application has been approved, giving the go ahead for construction. The scheme includes improvements to the Girton Interchange but does not include interchange access between the A428 and M11 and A14 towards Huntingdon.

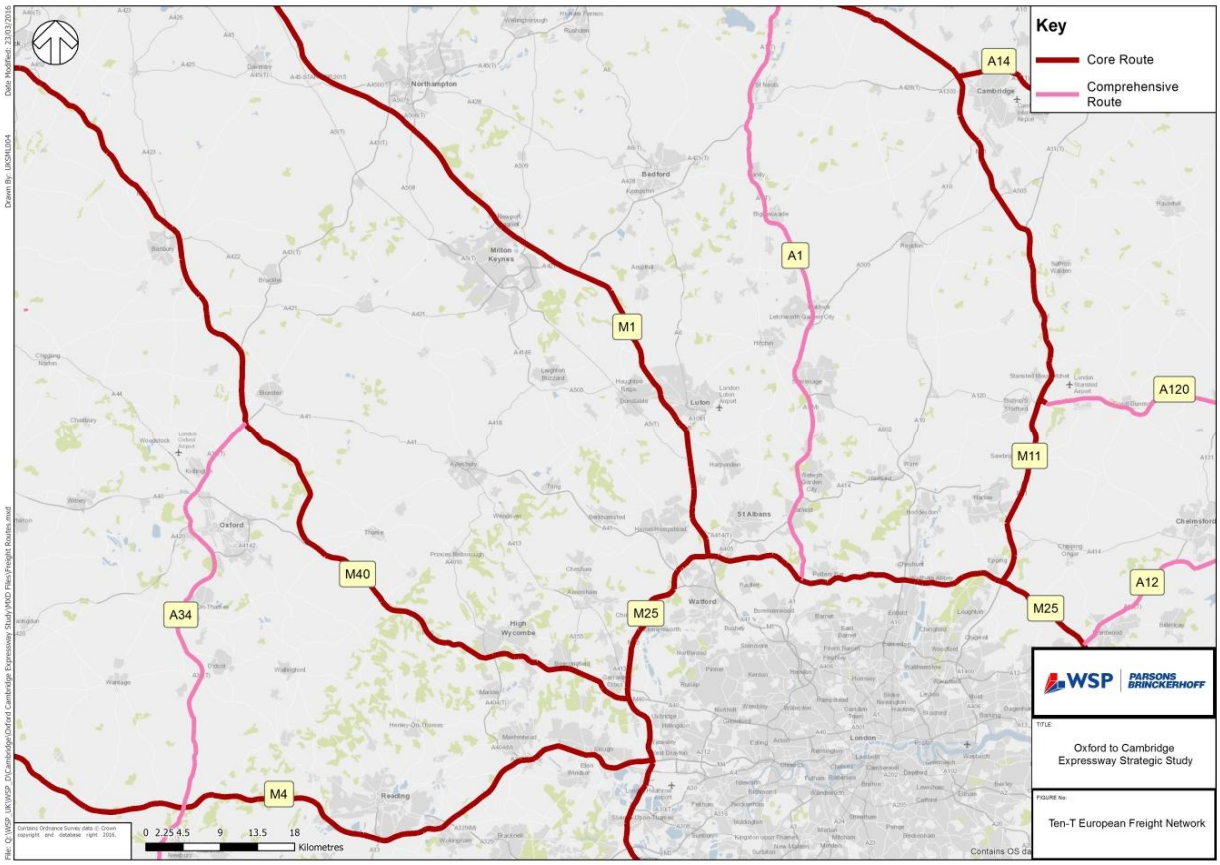
Strategic Freight Network

Network Description

2.3.41 The main east-west route through the study area provides an important national freight route and provides access to a number of national and Trans-European (TEN-T) routes providing the core freight route connections to the main container ports and Europe.

2.3.42 Within the study area, there are a number of ‘comprehensive’ and ‘core’ TEN-T routes. Figure 2-3 provides a plan of the TEN-T routes within the study area.

Figure 2-3: Study Area TEN-T Road Network



2.3.43 Figure 2-3 shows that the study area includes the following TEN-T routes:

- Core Routes:
  - M4;
  - M40;
  - M1; and
  - A14.
- Comprehensive Routes:
  - A34;
  - A1; and
  - M11.

2.3.44 The study area provides an attractive location for freight distribution centres to locate as well as accommodating National and European freight movements. This is evident from extensive distribution centres in the greater Bicester, Milton Keynes, Bedford and Northampton areas.

2.3.45 The ports play an important role in the UK freight network and result in strategic HGVs movements routing through the study area. In South East England, the largest ports are London, Felixstowe and Southampton which generate HGVs movements within the region. London, Southampton and Felixstowe are the second, fourth and seventh busiest ports respectively.

2.3.46 The primary east-west route through the study area provides an alternative long-distance freight route to the M25 for HGVs travelling to and from Felixstowe from the west. HGVs travelling from Southampton with northern destinations will route along the A34 and A43 to access the M4, M40 and M1 within the study area.

Freight Travel Demand

2.3.47 Historically the total amount of freight traffic has increased into UK Ports. Between the early 1980s and 2000, the total amount of freight traffic has increased by 35 percent (UK Port Freight Statistics 2014, August 2015). Since 2012, the total amount of freight traffic has remained broadly stable.

2.3.48 The volume of Heavy Goods Vehicle (HGV) traffic on the primary east-west route through the study area varies greatly. Information on current Annual Average Daily HGV Traffic flows (AADT) have been obtained from DfT traffic count points located on the primary route. A plan showing the locations of the DfT count points is provided in Appendix 1.

2.3.49 The DfT data shows that HGVs account for 2 percent to 12 percent of the AADT vehicle flows along the main east-west primary route. Along the route under examination in this report, it is the sections of the A34, A43, A1 and A14 which have the highest proportion of HGVs, in addition to the other radial motorway routes not specifically recorded in Table 2-3. Table 2-3 summarises the DfT count locations along the primary Oxford to Cambridge east-west route with the highest recorded HGV AADT flows.

Table 2-3: Ranked AADT HGV Traffic Flows – DfT Count Sites

ROUTE SECTION	ROAD	LINK	HGV 2014 (AVG. VEHICLES ALONG SEGMENT)	HGV 2014 (PERCENT OF VEHICLES)	HGV 5 YEAR CHANGE 2010 – 2014 (ABSOLUTE)	HGV 5 YEAR CHANGE 2010 – 2014 (PERCENTAGE)
2a	M40	Junction 9 to Junction 10	11,526	11.5%	-1,573	-15.8%
1	A34	A40 to M40	6,767	10.3%	-275	-4.2%
1	A34	A4142 (Oxford Southern by-pass) to A40	6,538	9.4%	+884	+11.9%
5	A1	A421 to A428	6,017	11.3%	+1,066	+15.1%
1	A34	A415 (Abingdon) to A4142	5,837	10.8%	-276	-5.0%
1	A34	M4 to A417 (Didcot)	5,651	10.3%	-1,077	-23.5%
1	A34	A417 (Didcot) to A415 (Abingdon)	5,321	9.6%	-731	-15.9%
4	A421	A428 – A4280 (Bedford)	3,912	9.0%	+718	+15.5%
2a	A43	M40 to A421	3,833	11.0%	-2	-0.1%
4	A421	M1 to A428 (Bedford)	3,647	9.2%	+246	+6.3%

2.3.50 Table 2-3 shows that the M40 carries the highest volumes of HGV traffic. As this is the only motorway grade road in the data set, it is to be expected. A large volume of HGV traffic on the A1 can also be similarly attributed to the radial direction of travel connecting London to elsewhere in the UK.

2.3.51 Along the primary study area route, the A34 carries the highest volumes of HGV traffic compared to the A421 and A428. This section of the route forms a part of the TEN-T European Freight Network and connects the port of Southampton to the M40 and subsequently to Birmingham. Indirectly, the A43 off the M40 connects to the M1 and onwards to the West Midlands, Northwest and North. All sections of the A34 except for the section which passes to the west of Oxford have experienced a decrease in HGV movements in the period 2010 to 2014. In the one section that did show growth, the growth was significant at 11.9 percent.

2.3.52 HGV traffic flows along the A421 between Bedford and Milton Keynes are also a significant component of the total traffic flows. In contrast to the A34, HGV volumes on the A421 around Bedford have grown between 2010 and 2014, indicating an increase in east-west freight movements through this section of the study area. This increase will in part be due to the upgrade of the A421 between the M1 and Bedford in 2010/2011.

Airports

2.3.53 There are a number of commercial airports (London Luton and London Stansted) and local airfields within or close to the study area. Every airport and airfield has a recommended safeguarding zone which may restrict development within the zone. The airports and airfields within the study area are listed below with the safeguarding zones shown in Appendix 2.

- Andrewsfield;
- Blackbushe;
- Bourn;
- Cambridge;
- Chalgrove;
- Cranfield;
- Duxford;
- Farnborough;
- Finmere;
- London Luton;
- London Stansted;
- Oxford/Kidlington;
- Peterborough/Conington;
- Peterborough/Sibson;
- Turweston; and
- White Waltham.

2.3.54 The majority of the identified sites are small local airfields with limited trip generation. Of the identified airports, London Luton and London Stansted are the airports which offer regular national and international flights.

National Rail Network

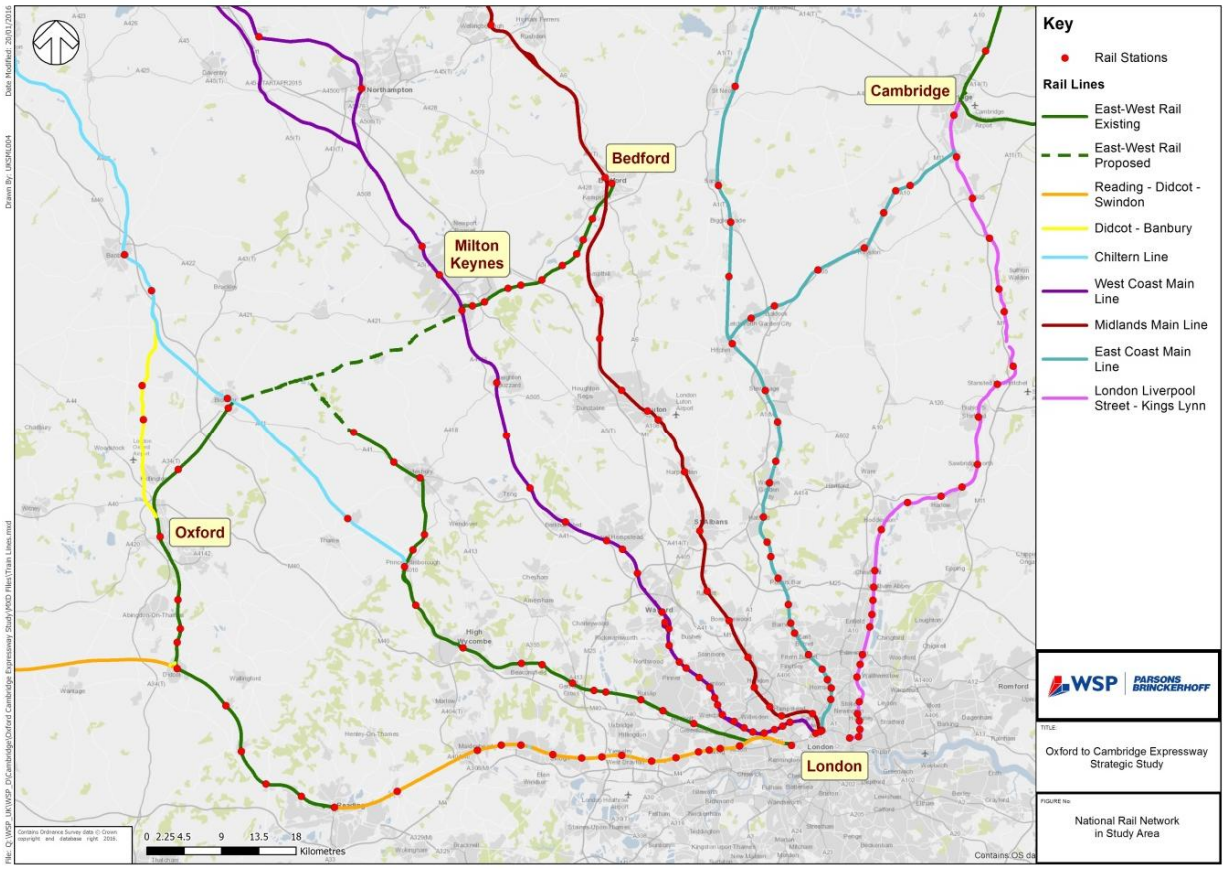
Strategic Imperative

Currently there is poor east-west rail connectivity in the study area. Improving east-west rail connectivity is important in driving forward economic growth in the study area and will complement the transport interventions proposed by this strategic study.

Network Description

2.3.55 The suitability of the existing rail network to provide a valid alternative to road based trips within the study area has been assessed by analysing the existing routes, stations and service frequencies. A plan showing the national rail network within the study area is provided in Figure 2-4.

Figure 2-4: National Rail Network



2.3.56 Figure 2-4 shows that the main rail routes within the study area are radial into London including:

- Oxford: Rail services into London Paddington and London Marylebone;
- Milton Keynes: West Coast Mainline services into London Euston;
- Bedford Station: Rail services into London St Pancras, Farringdon and Blackfriars; and
- Cambridge Station: Rail services into London Kings Cross and Liverpool Street.

2.3.57 Figure 2-4 shows that the existing east-west connectivity is limited to:

- Bedford and Bletchley; and
- Oxford and Bicester (which then continues into London Marlyebone).

2.3.58 The Oxford to Bicester rail link opened in 2015 with two new stations created at Oxford Parkway and Bicester Village.

2.3.59 A summary of the main national rail routes serving the four main stations (Oxford, Milton Keynes, Bedford and Cambridge) within the study area is provided in Table 2-4.

Table 2-4: Main Study Area Rail Routes

STATION	OPERATOR	START	END
Oxford	Great Western Railway	Hereford	London Paddington
		Banbury	
	Cross Country	Birmingham International	Bournemouth
	Chiltern Railways	Oxford	London Marleybone
Milton Keynes	Southern	Milton Keynes	East Croydon
	Virgin Trains	Edinburgh/Glasgow	London Euston
		Shrewsbury	
		Holyhead/Wrexham	
		Liverpool	
		Manchester	
	London Midland	Milton Keynes	
Bedford	London Midland	Bedford	Bletchley
	Thames Link		Brighton
	East Midlands Trains	Leicester	London St Pancras
Cambridge	Great Northern	Kings Lynn	London Kings Cross
	Abellio Greater Anglia	Kings Lynn Cambridge	London Liverpool Street
	Abellio Greater Anglia Cross Country		Norwich
		Cambridge Stansted Airport	Ipswich
			Birmingham New Street

2.3.60 In addition to the radial and east-west rail routes shown in Figure 2-4, Table 2-4 identifies a number of additional routes including cross country routes from Cambridge to Norwich and Ipswich, Stansted to Birmingham (via Cambridge) and Birmingham to Bournemouth.

2.3.61 The analysis shows that east-west rail connectivity within the study area is poor. At present, it is not possible to directly travel by rail between Oxford, Milton Keynes and Cambridge, meaning that those wishing to undertake this journey will most likely opt to do so by road in preference to the relatively costly option of into London and out again or time consuming journeys requiring interchanges.

2.3.62 In order to address the lack of east-west rail services, a new strategic east-west rail connection between Oxford and Cambridge is being promoted by the East West Rail Consortium. More detailed information on this scheme is provided in Section 3.3.

2.3.63 The proposed East West Rail section from Bicester to Bedford is a committed scheme and is due for completion by 2022. The section from Bedford to Cambridge requires the construction of an entirely new rail line as the previously existing one was closed in the 1960s with much of the land now developed for other uses.

2.3.64 This means that in the medium to long term, Bedford and Cambridge, whilst separated by some 27 miles will have a rail connection which takes typically between 2 hours to 3 hours to complete depending on the route (into London and out again or via Leicester) or the time of day.

2.3.65 The committed East West Rail rail scheme has significant implications for this study as it is will provide an attractive transport connection between Oxford, Milton Keynes and Bedford. The delivery of the East West Rail scheme will therefore attract vehicle trips from the local and strategic routes within the study area. As part of this study, the mode shift impact of East West Rail will be considered along with the east-west rail corridor and access to the proposed new station at Winslow (between Bicester and Bletchley).

Journey Time

2.3.66 TRACC rail journey time plots from Oxford, Milton Keynes and Cambridge stations have been undertaken for the period 0500-1000 hours and are provided in Appendix 3. TRACC is an accessibility tool which accurately calculates travel time using public transport timetables to give accurate journey times from a range of origins and destinations.

2.3.67 The journey time plots provided in Appendix 3 demonstrate the high rail travel journey times between Oxford, Milton Keynes and Cambridge, especially when compared to journey times in and out of London. The TRACC journey time analysis shows low journey times into London (less than 60 minutes) compared to a 3 hour journey time between Oxford and Cambridge and vice versa. It should be noted that the TRACC journey time plots do not take account of the recently opened Oxford Parkway to Bicester link as this was not in operation at the time of the release of the most up to date dataset. Journey time information has also been extracted from existing timetables for the four main stations within the study area and is presented in Table 2-5.

Table 2-5: Existing East-West Rail Average Peak Period Journey Time Matrix (minutes)

ORIGIN/DESTINATION	OXFORD			MILTON KEYNES			BEDFORD		CAMBRIDGE	
OXFORD				80*	145**	155+	155**	160**	165**	180++
MILTON KEYNES	80*	150**	160+				55++		135**	
BEDFORD	160**		155**	60++					135**	
CAMBRIDGE	170**		175++	135**			145**			

Source: thetrainline.com – January 2016

* via Coventry (or Coventry & Rugby)
** via London
+ via Oxford Parkway & London
++ via Bletchley

2.3.68 Table 2-5 confirms that to travel between Oxford and Milton Keynes by rail, the efficient route in terms of cost and time is via Coventry, which takes approximately 1 hour 20 minutes. Via London, this journey takes approximately 2.5 hours. The journey time to Bedford is also approximately 2.5 hours via London and to Cambridge 2.75 to 3 hours.

2.3.69 From Milton Keynes, Bedford can be reached in just under an hour and Cambridge in 2 hours 15 minutes via London. From Bedford, there is the same rail journey time to Cambridge via London at 2 hours 15 minutes. From Cambridge the journey time to Oxford is just under 3 hours, to Milton Keynes and Bedford around 2.5 hours. Travelling from Cambridge to either Milton Keynes or Oxford by rail, the quickest route is to travel into Kings Cross and then change to other primary lines. These journeys require a station change in London e.g. Kings Cross or Liverpool Station to London Marylebone, Euston, St Pancras or Paddington.

2.3.70 Due to the necessity to interchange in London, there is little difference travelling from either Oxford or Cambridge to Milton Keynes and traveling from Oxford to Cambridge which has a much greater linear distance between cities.

2.3.71 The train route from Oxford to Milton Keynes via Coventry offers the lowest journey times, however it operates at the lowest frequency. Milton Keynes to London Euston has the highest frequency of services due to the fact that is served by two separate operators compared to all other services listed in Table 2-6 which are only served by one operator.

Table 2-6: Rail Timetables

JOURNEY	OPERATOR	PEAK HOUR FREQUENCY	FIRST TRAIN	LAST TRAIN
Oxford – London Paddington	Great Western Railway	3/4 services	04:00	00:27
London Paddington – Oxford	Great Western Railway	4 services	05:12	00:22
Oxford - Coventry	Cross-country	1 service	06:38	22:30
Coventry – Oxford	Cross-country	1 service	06:25	22:25
Oxford Parkway – London Marylebone	Chiltern Railways	3/1 services	05:42	22:45
London Marylebone – Oxford Parkway	Chiltern Railways	2 services	06:09	23:10
Milton Keynes – London Euston	London Midland & Virgin Trains	3/8 services	03:30	00:24
London Euston – Milton Keynes	London Midland & Virgin Trains	9/8 services	05:26	01:34
Cambridge – London Kings Cross	Great Northern	4/5 services	05:14	23:22
London Kings Cross – Cambridge	Great Northern	4 services	05:43	00:05

Source: thetrainline.com – January 2016

Summary

2.3.72 In summary, the review of the existing study area rail network shows good radial connectivity into London, but east-west connectivity between Oxford, Milton Keynes and Cambridge is poor resulting in long journey times via London/Coventry/Leicester depending on the origin and destination. The lack of east-west rail connectivity will be partially addressed by the committed East West Rail scheme between Oxford and Bedford. However, in the medium to long term, no rail connection between Bedford and Cambridge is likely to be implemented.

Bus and Coach Network

Strategic Imperative

Sections of the existing east-west road route suffer from congestion during the peak travel periods which impacts on local, regional and national bus journey time reliability, particularly along the A428, A421 and A34 corridors. Improving the east-west road network will reduce congestion and improve bus journey time reliability, as well as facilitate improved accessibility into and between the study area conurbations.

2.3.73 In order to understand the current availability and standard of bus travel along the study network, the bus options have been assessed.

Local Buses

2.3.74 There are a number of local bus services which operate along sections of the study area network. These include:

- X1 – Oxford to Wantage via Abingdon, Milton Park, Didcot and Harwell Campus (Thames Travel);
- X3 – Oxford Rail Station to Abingdon via Oxford City Centre (Oxford Bus Company);
- S5 – Oxford to Anrcott/Langford via Bicester;
- 4B – Oxford: Wood Farm – Abingdon via Oxford City Centre and Cumnor (Oxford Bus Company);
- X13 – John Radcliffe Hospital – Abingdon via Oxford City Centre (Oxford Bus Company);
- 31 – Oxford to Wantage via Abingdon and Grove (Stagecoach);
- X32 – Oxford to Wantage via Milton Park, Didcot, Chilton and Harwell Campus (Thames Travel);
- 1 – Cambridge to Huntingdon via Cambourne and St Ives (Whippet);
- 3/X3 – Cambridge to Huntingdon via Cambourne (Whippet); and

- Citi 4 – Cambridge to Cambourne (Stagecoach).

2.3.75 These local bus services are confined primarily to the A34 and the A428, highlighting the importance of these two roads for local commuter services.

Long Distance Coach Services

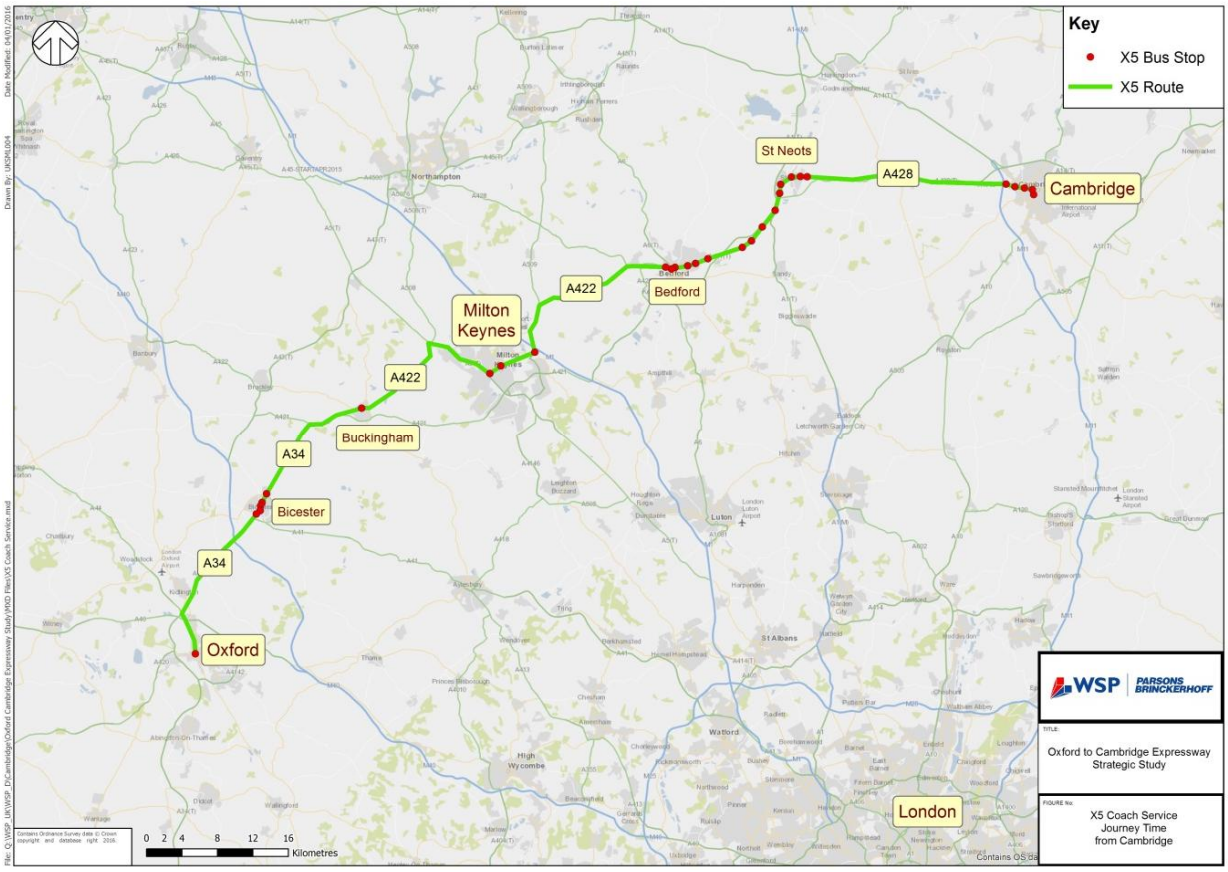
2.3.76 There are a number of National Express Coach services which travel along sections of the study area network. These are shown in Table 2-7 below, highlighting the national importance of certain roads in the study.

Table 2-7: National Coach Services

ROUTE SECTION	NATIONAL EXPRESS SERVICE
A34 between M40 and Oxford	040 – Burnham-on-Sea to London
	202 – Swansea to Heathrow Airport (T5):
	302 – Northampton to Bristol
	406 – Newquay to London
	509 – Cardiff to London
M40 between junctions 9 and 10	210 – Wolverhampton to Gatwick Airport (Sth)
	409 – Aberystwyth University to London
	410 – Shrewsbury to London
	420 – Wolverhampton to London
	461 – Lichfield to London
	550 – Southport to London
	560 – Barnsley to London
	561 – Skipton to London
	571 – Whitehaven to London
	592 – Aberdeen to London
A34 between M40 and Oxford and M40 between junctions 9 and 10	304 – Weymouth to Liverpool
	421 – Blackpool to London
	460 – Coventry to London
	544 – Glasgow to London
A34 from A40 to A420	444 – Hereford to London
	445 – Hereford to London
A421 between M1 and A1 and A1 between Black Cat and St Neots	425 – Ashington (Northumberland) to London
	426 – South Shields to London
	447 – Hull to London
	449 – Mablethorpe to London
	563 – Scarborough to London
A1 between Black Cat and St Neots	448 – Hull to London
	465 – Huddersfield to London

2.3.77 The X5 service, operated by Stagecoach, is the only coach service which serves the entirety of the primary east-west route, from Cambridge to Oxford, via Milton Keynes. The route and stop locations are shown on the plan provided in Figure 2-5.

Figure 2-5: X5 Route



2.3.78 Figure 2-5 shows that the X5 route serves Oxford, Bicester, Buckingham, Milton Keynes, Bedford, St Neots and Cambridge. It uses the primary east-west road route through the study area, except where the coaches travel through Bicester, Milton Keynes, St Neots and between Milton Keynes to Bedford.

Journey Time

2.3.79 The typical X5 journey times from Oxford, Milton Keynes and Cambridge from 0700-1900 hours have been analysed using TRACC with journey time plots are provided in Appendix 4. Due to the more direct routing of the X5 between Oxford and Milton Keynes and Cambridge and Milton Keynes, the journey time is quicker by coach compared to rail. However when travelling between Oxford and Cambridge, it is quicker to do so by train inclusive of an interchange in London. A journey time matrix for the four main conurbations is provided in Table 2-8.

Table 2-8: X5 Coach: Average Peak Period Journey Time Matrix (minutes)

ORIGIN/DESTINATION	OXFORD	MILTON KEYNES	BEDFORD	CAMBRIDGE
OXFORD		110	135	220
MILTON KEYNES	115		25	110
BEDFORD	135	30		75
CAMBRIDGE	215	110	70	

Source: National Express – January 2016

2.3.80 Table 2-8 shows that the journey time from Oxford to Cambridge and vice versa is typically 3 hours 35-40 minutes. The journey time to Milton Keynes is 1 hour 50 minutes from Oxford and Cambridge respectively. The relatively high journey time makes this route unattractive to long distance travellers. However, along the X5 route there are number of conurbations that are within reasonable travel times (less than 60 minutes). Table 2-9 summarises the viable commuter routes provided by the X5.

Table 2-9: X5 Commuter Routes and Average Timetabled Journey Times (minutes)

ROUTE	AM PEAK JOURNEY TIME	OFF PEAK JOURNEY TIME	PEAK DELAY
Cambridge to St Neots	40	40	+0
St Neots to Cambridge	55	43	+12
St Neots to Bedford	40	29	+11
Bedford to St Neots	29	29	+3
Bedford to Milton Keynes Central	48	43	+5
Milton Keynes Central to Bedford	71	56	+25
Buckingham to Oxford	73	53	+20
Oxford to Buckingham	52	52	+0

Source: Traveline – January 2016

2.3.81 Table 2-9 shows that the X5 provides a viable commuter service between:

- Cambridge and St Neots;
- St Neots and Bedford;
- Bedford and Milton Keynes; and
- Buckingham/Bicester and Oxford.

2.3.82 Stagecoach recognise that the X5 is a viable commuter route, with peak period commuter services provided inbound to Cambridge from Bedford in the morning and outbound in the evening and inbound services to Oxford from Bedford in the morning and then outbound in the evening. These peak period services do not route from Oxford to Cambridge but are serving commuter travel demands in the morning and evening periods.

2.3.83 The timetabled journey times provided in Table 2-9 show that journey times along sections of the X5 route can be extended by as much as 25 minutes during the peak travel period compared to the off peak periods to account for congestion along the route. Therefore improvements to the east-west road network could improve journey time reliability for the X5 route and increase the attractiveness of the service to commuters.

2.3.84 A summary of the current timetabled journey times and frequencies for the main sections of the X5 route are provided in Table 2-10.

Table 2-10: X5 Weekday Timetables

ROUTE SECTION	AM PEAK BUSES PER HOUR	PM HOUR BUSES PER HOUR	FIRST BUS	LAST BUS
Cambridge – St Neots	3	3	06:20	23:30
St Neots –Bedford	2	2	07:00	00:10
Bedford – Milton Keynes	2	2	04:35	20:00
Milton Keynes - Oxford	2	2	05:06	20:31
Buckingham-Oxford	2	2	05:52	20:17
Cambridge – Milton Keynes	2	1	06:50	18:40
Cambridge – Oxford	2	1	06:50	18:40
Oxford-Buckingham	2	2	07:00	22:30
Oxford – Milton Keynes	2	3	07:00	22:30
Milton Keynes – Bedford	2	2	07:00	23:50
Bedford-St Neots	2	2	04:51	21:56
St Neots - Cambridge	2	2	05:22	22:27
Milton Keynes – Cambridge	2	2	07:00	20:50
Oxford – Cambridge	2	1	07:00	19:30

Source: Traveline – January 2016

2.3.85 Table 2-10 shows that typically there are two services per hour along the route. The long distance X5 service between Cambridge and Oxford and vice versa runs from 0700-1930 hours. There are additional early and evening services running between Bedford and Oxford and Cambridge and Oxford.

Summary

2.3.86 In summary, the review of the existing bus and coach routes show that sections of the primary east-west route are used by a range of local buses providing important commuter routes into Cambridge and Oxford and national coach services. The X5 route is the only service that directly links Oxford, Milton Keynes and Cambridge. The X5 currently provides an unattractive journey time between Oxford and Cambridge. Within the study area the X5 provides an important public transport route between Cambridge and St Neots, Bedford and Milton Keynes and Buckingham/Bicester and Oxford. The X5 uses the primary east-west route between these conurbations (except from Milton Keynes and Bedford) and therefore the peak period journey times are significantly affected by existing route congestion.

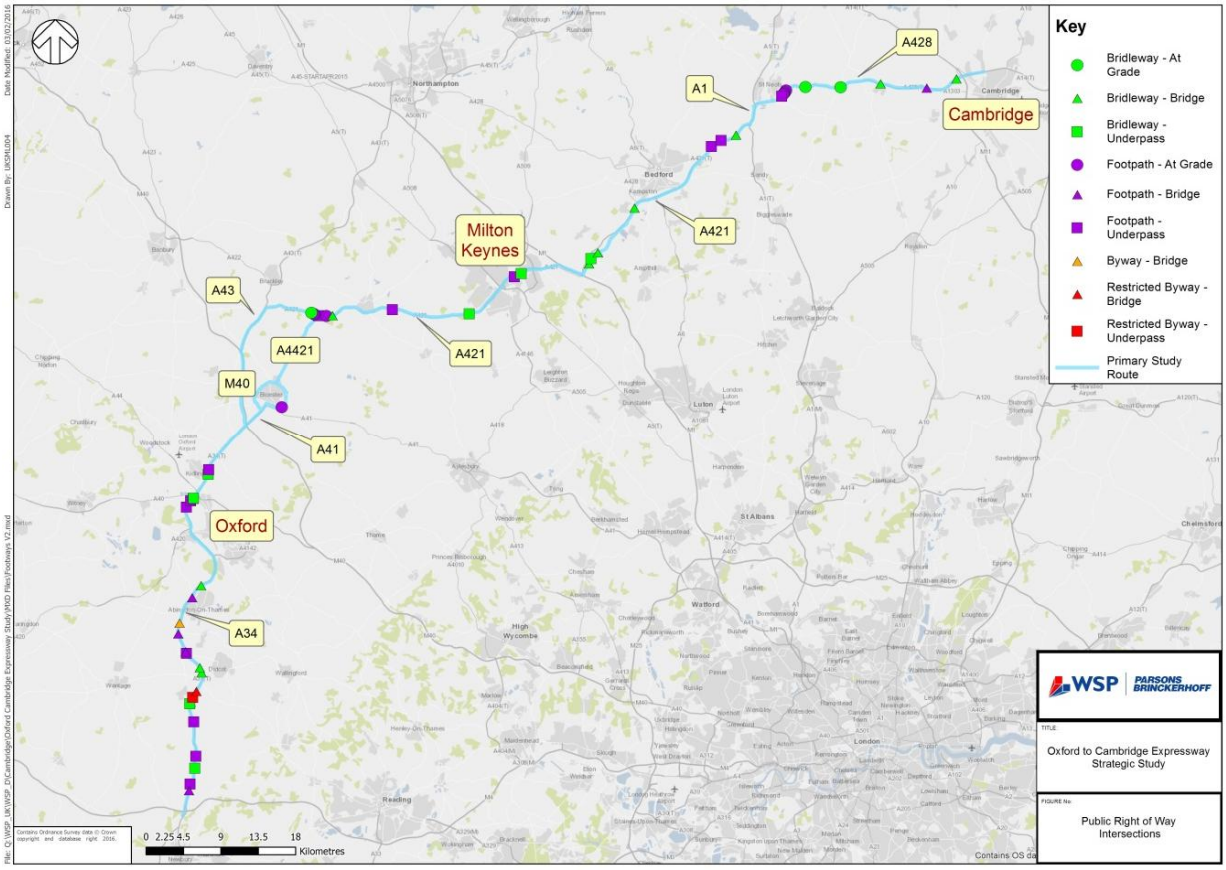
Public Rights of Way

Strategic Imperative

Improving east-west transport infrastructure in the study area will consider potential interactions with the existing Public Rights of Way (PRoW) networks and potential opportunities to improve connectivity and facilitate enhanced PRoW access.

2.3.87 A high-level review has been undertaken of the existing Public Rights of Way (PRoW) network that intersects with the existing primary east-west route under consideration. The review identifies that the majority of the existing PRoW crossings are grade separated either by a bridge or underpass, but some intersect the road network at-grade. The locations where the existing PRoW network intersects with the primary east-west route are shown in Figure 2-6.

Figure 2-6: Public Right of Way Intersections



2.3.88 In total, 51 PRoW routes have been identified which intersect the primary study area east-west route. The highest concentration of PRoWs is along the A34 south of Oxford, however these are all grade separated. The majority of at-grade crossings are located along the A428 in Cambridgeshire and along the A421 near the A4421 intersection. A breakdown of crossings by type of PRoW is provided in Table 2-11.

Table 2-11: Summary of PRoWs by Classification

CLASSIFICATION	CROSSING TYPE	NUMBER
Footpath	At Grade	8
	Bridge	6
	Underpass	14
	Total	**28**
Bridleway	At Grade	3
	Bridge	10
	Underpass	7
	Total	**20**
Byway	At Grade	0
	Bridge	2
	Underpass	1
	Total	**3**

2.3.89 Table 2-11 shows that there are 8 and 3 at grade footpath and bridleway crossings along the primary east-west route respectively. Many of these designated PRoWs are considered to mainly function as leisure routes and are unlikely to be heavily trafficked.

Cycle Network

2.3.90 A high-level review of the existing cycle networks within the study area has been undertaken. The review identifies that the National Cycle Network (NCN) routes within the study area as well as a high level review of Oxford, Milton Keynes and Cambridge.

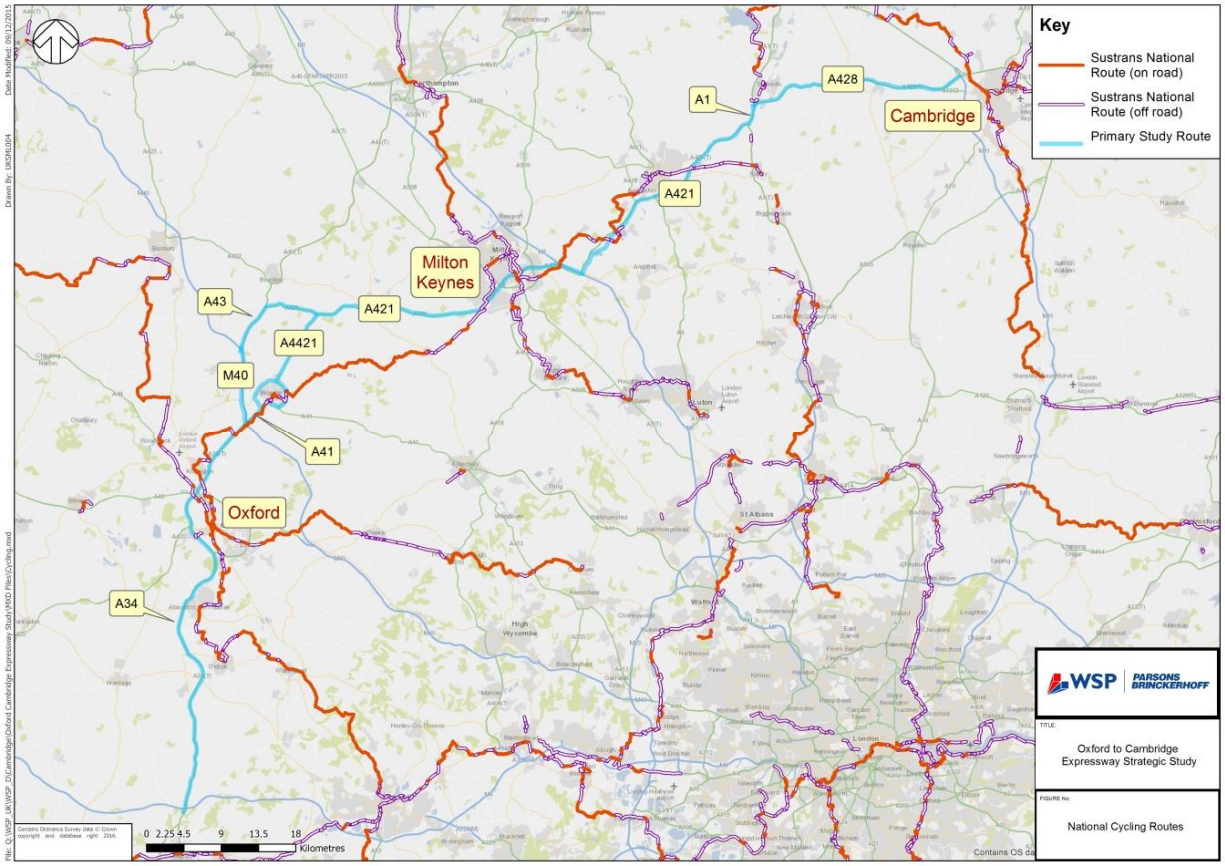
National Cycle Network

Strategic Imperative

Improving east-west transport infrastructure in the study area will consider potential interactions with the existing NCN routes and potential opportunities to improve connectivity and facilitate enhanced cycle access.

2.3.91 Within the study area, there are a number of NCN routes that run adjacent to and intersect with the primary east-west route. A plan showing the main National Cycle Network (NCN) routes within the study area is provided in Figure 2-7.

Figure 2-7: Study Area National Cycle Network



2.3.92 Figure 2-7 shows the primary long-distance NCN routes within the study area. The main NCN routes within the study area are:

- NCN 5: Linking Didcot and Oxford, before continuing north towards Banbury and south towards Reading; and
- NCN 51: Is the main east-west cycle route through the study area connecting Oxford, Bicester, Milton Keynes, Bedford, St Neots, Huntingdon and Cambridge, before continuing east towards Ipswich.

2.3.93 More detailed plans of the NCN routes located in each of the six main sections of the primary east-west route are provided in Appendix 5. Figure 2-7 shows that the NCN interfaces with the existing primary east-west road route under consideration. A summary of the main locations where the NCN crosses the primary east-west route is provided in Table 2-12.

Table 2-12: National Cycle Route Crossing Locations – East-West Route

SECTION	NATIONAL CYCLE ROUTE	DESCRIPTION	CROSSING TYPE	GRADE SEPARATED	LOCATION
1: A34 (M4 to M40)	Route 544	Didcot, Wantage and The Ridgeway	A34 cycle bridge	Yes	South of Harwell
	Route 5	West Midland Route	Bridleway under A34	Yes	North of Oxford
	Route 51	South Midlands Route	A34 road bridge	Yes	North of Oxford
			A34 road bridge	Yes	South of Weston-on-Green
2: A41-A4421	Route 51	South Midlands Route	A34 road bridge	Yes	South Junction9 M40
			A41 staggered Toucan crossing	No	A41 east of Oxford Road roundabout
			A4421 uncontrolled at-grade crossing	No	A4421/Bicester Road roundabout
3: A421 (A4421 to M1)	Route 50 (To be implemented)	Leicester	A421 on-road at-grade roundabout	No	A421/Gawcott Road roundabout
	Route 51	South Midlands Route	A421 underpass	Yes	A421/Tattenhoe Street roundabout
	Route 6	Watford to Lake District	On-road under A421	Yes	Newport Road
	Route 51	South Midlands Route	A421 underpass	Yes	West of Ladbroke Grove
			A421 road bridge	Yes	Granfield Road
4: A421 (M1 to A1)	Route 51	South Midlands Route	A421 road bridge	Yes	West of Marston Moretaine
			A421 underpass	Yes	Lower Shelton
			A421 cycle bridge	Yes	North of Cambridge Road
			A421 road bridge	Yes	West of Black Cat Roundabout

2.3.94 Table 2-12 shows that where the NCN intersects with the primary east-west route, in most cases the crossings are grade separated via cycle or road bridges and underpasses. The main locations where at grade cycle crossing is required is across the A41 and A4421 around Bicester. In the future when NCN Route 50 is implemented, the A421 at Buckingham will also be crossed at grade at the Gawcott Road roundabout.

2.3.95 In summary, the analysis shows that the NCN network is well separated from the primary east-west road route. Where the national cycle routes cross the existing primary east-west route, the crossings are typically grade separated from the road either via a bridge or underpass.

Local Cycle Network

Strategic Imperative

Improving east-west transport infrastructure in the study area will consider potential interactions with the existing main conurbation cycle routes and potential opportunities to improve connectivity and facilitate enhanced cycle access.

2.3.96 Due to the distance between the adjacent communities along the existing route from Oxford to Cambridge, commuting by bicycle between the main centres of population is likely to be limited. It is considered that the following conurbations are within reasonable cycling distance:

- Didcot to Abingdon and Oxford;
- Abingdon and Oxford;
- Oxford and Bicester;
- Bicester and Buckingham;
- Buckingham and Milton Keynes;
- Milton Keynes and Bedford;
- Bedford and St Neots;
- St Neots and Cambourne; and
- Cambourne and Cambridge.

2.3.97 It is considered that due to greater cycling distances between the next conurbations in the above list of journeys, long distance cycling trips are unlikely. Longer distance leisure cycling journeys within the study area are likely to be made on quiet county roads due to (perceived) safety issues on the high speed major road network.

2.3.98 Further cycling catchment analysis has also been undertaken for the three main urban areas, Oxford, Milton Keynes and Cambridge. This analysis is presented in Appendix 5.

Transport Network Summary

Key Points

Road Network

- The main 'gaps' in Expressway standard carriageway between Oxford and Cambridge are:
  - A34: A423 Eastern Bypass to the A420 and the Wytham southern access junction;
  - A43: M40 to the A421;
  - A421: A43 to the M1 (including the A43 and A4421); and
  - A428: A1 Black Cat Roundabout to the A1198.
- The primary east-west route provides interchange access to a number of national strategic roads including the M4, M40, M1, A1, A14 and M11; and
- The route passes through the urban area of Milton Keynes which has a high frequency of at-grade roundabout junctions.

Freight Network

- The A34 section of the east-west route is a 'Comprehensive' TEN-T European freight route providing access to the southern ports and therefore accommodates a high proportion of HGV movements; and
- The east-west route provides access to a number of national and European freight routes including the M4, M40, M1, A1, A14 and M11 and is therefore an attractive location for large distribution centres.

Passenger Rail Network

- Existing east-west connectivity between Oxford and Cambridge is poor resulting in high and unattractive journey times; and
- East West Rail will in part improve connectivity between Oxford, Milton Keynes and Bedford with this route predicted to be completed by 2022. However, Cambridge to Bedford is likely to remain without a rail connection for the medium to long term.

Coach Network

- There is one service (X5) that links Oxford, Milton Keynes and Cambridge;
- The route offers a viable commuter route between a number of conurbations, however the timetabled journeys times increase by up to 25 minutes in the peak periods compared to the off peak periods due the congestion in the study area; and
- The journey time from Oxford to Cambridge and vice versa is high and unattractive.

PRoW Network

- There are 51 locations where the PRoW network crosses the primary east-west route within the study area; and
- 11 are at grade, 18 are bridges and 22 route under the carriageway.

Cycle Network

- Where the local and NCN routes interface with the primary east-west road route, the majority of crossings are grade separated via bridges or underpasses;
- The main NCN route through the study area is Route 51, which connects Oxford, Bicester, Milton Keynes, Bedford and Cambridge; and
- The main locations where at grade crossings are required are around Bicester (Route 51) and through Buckingham (Route 50 when completed).

2.4 Study Area Travel Patterns

Introduction

2.4.1 This section provides a strategic overview of existing travel demands and patterns within the study area. The analysis is primarily based on 2011 Census data and focuses on the three main conurbations within the study area, Oxford, Milton Keynes and Cambridge. However, where appropriate analysis has also been undertaken for conurbations along the primary east-west route including Bicester, Buckingham, Bedford and St Neots to understand the level of commuting between these settlements.

Census 2011 Work Trips: Oxford, Milton Keynes and Cambridge

Strategic Imperative

The evidence base shows that these three main urban areas are key attractors of commuter trips. Improving east-west transport infrastructure in the study area will improve access into and between these important functional economic areas, supporting economic growth and the delivery of new jobs and homes.

2.4.2 Oxford, Milton Keynes and Cambridge are the three main urban conurbations within the study area and have relatively large labour market catchments areas. A summary of existing work trips from the 2011 Census Travel for Work data is presented in Table 2-13. Table 2-13 summarises the work trips to/from the districts within the study area.

Table 2-13: 2011 Census Travel to Work Trips by Mode from within the Study Area

CITY	CAR TRIPS	BUS TRIPS	TRAIN TRIPS	TOTAL TRIPS
To Oxford	25,554	6,326	1,260	33,140
From Oxford	7,411	1,244	237	8,892
To Milton Keynes	21,389	539	348	22,276
From Milton Keynes	9,954	447	128	10,529
To Cambridge	19,450	3,375	458	23,283
From Cambridge	5,654	856	114	6,624

2.4.3 Table 2-13 shows that the conurbations of Oxford, Milton Keynes and Cambridge are net attractors of work trips. In terms of total trips, Oxford attracts the highest number of car trips from districts within the study area, however a relatively high proportion also travel by bus (19 percent and train (4 percent). This compares to Milton Keynes where only 2 percent of the commuters into the urban area from within the study area travel by train and bus. For Cambridge, 19,450 work trips into the City were made by car with 15 percent travelling by bus and 2 percent by train. This analysis shows that both Oxford and Cambridge have achieved higher levels of public transport trips into their conurbations from districts within the study area compared to Milton Keynes.

2.4.4 Table 2-13 shows that Cambridge, Oxford and Milton Keynes combined attract 66,393 in-commuting car trips from within the study area, putting pressure on the local road network and SRN including the primary east-west route. This analysis does not take into account some of the main employment sites which are located outside the urban conurbations including the Science Vale south of Oxford and Cambridge Science Park, Genome Campus and Granta Park located in South Cambridgeshire.

2.4.5 A series of thematic maps identifying the existing origin and destination of work trips to/from Oxford, Milton Keynes and Cambridge within the study area have been produced and are provided in Appendix 6. A summary of the data is provided below.

Cambridge

2.4.6 The majority of study area journeys to work into Cambridge are from South Cambridgeshire, Huntingdonshire, Bedford and Central Bedfordshire. There are a low number of work trips to/from Cambridge west of Bedford. The data indicates that very few people travel to work by train along the corridor. This is not surprising given the poor east-west rail connections between Cambridge, Milton Keynes and Oxford.

2.4.7 Outside of Cambridgeshire very few people travel to work into Cambridge by bus. Similarly few people travel to work to destinations outside of Cambridgeshire by bus. A small number of people residing in Bedford travel by bus and are likely to be users of the X5 bus service.

Milton Keynes

2.4.8 The majority of study area journeys to work into Milton Keynes are from South Northamptonshire, Aylesbury Vale, Central Bedfordshire and Bedford. However a small number of workers commute from settlements along the Oxford to Cambridge corridor and reflects the central location of the settlement within the corridor. Similarly, the majority of residents of Milton Keynes also work in these settlements.

2.4.9 Train travel to Milton Keynes is predominately from Leighton Buzzard and Bedford reflecting the existing rail connections into Milton Keynes. A small number of people commute by bus along the corridor, with clusters of people commuting from key urban settlements along the corridor including Oxford, Bicester, Bedford and Buckingham. This reflects the route of an express bus services that operate along the Oxford to Cambridge corridor.

Oxford

2.4.10 The majority of study area journeys to work into Oxford are from Cherwell, West Oxfordshire, Vale of White Horse, West Berkshire, South Oxfordshire, Aylesbury Vale, South Northamptonshire and Milton Keynes. A small number of people commute from destinations east of Milton Keynes.

2.4.11 The majority of journeys to work into Oxford by bus are from the districts immediately surrounding the city. A small number of trips by bus are made from Milton Keynes, Bedford and Cambridge and reflects the route of the X5 bus service that runs between these settlements.

2.4.12 A relatively large number of people commute by train from destinations to the north and south of Oxford, with very few people travelling by train from destinations to the east and is a reflection of the existing rail provision along the corridor.

2.4.13 East of Milton Keynes, the majority of journeys to work in Oxford by car are from settlements near strategic roads that run along the corridor.

East-West Corridor Movements: Local Commuting Patterns

Strategic Imperative

The evidence base shows there are strong commuter linkages between the urban conurbations along the east-west corridor. Improving east-west transport connectivity in the study area will improve local labour market access into and between the urban conurbations to drive economic growth by ensuring employers have access to large and skilled labour pools.

2.4.14 The 2011 Census analysis has identified that there are low levels of commuting between Oxford, Milton Keynes and Cambridge. However, within the study area there are a number of urban conurbations that generate commuter trips along the primary east-west route. Therefore, further detailed analysis of the 2011 Census Travel to Work data has been undertaken to identify the scale of existing commuter movements between the main conurbations within the study area. This analysis has been conducted at the Middle Layer Super Output Areas (MSOA) spatial scale with the details of the areas selected provided in Appendix 7. Table 2-14 summarises the number of car driver commuter movements between the main urban conurbations within the study area.

Table 2-14: 2011 Census Travel to Work Origin and Destination Matrix – Car Driver

O\D	DIDCOT	ABINGDON	OXFORD	KIDLINGTON	BICESTER	BRACKLEY	BUCKINGHAM	MILTON KEYNES	BEDFORD	ST NEOTS	CAMBRIDGE
DIDCOT		657	993	17	40	1	1	13	1	0	0
ABINGDON	1,240		2,286	20	62	6	2	23	0	0	1
OXFORD	181	705		117	271	37	19	119	4	0	9
KIDLINGTON	27	76	1,050		137	13	5	11	2	0	0
BICESTER	47	119	1,794	81		128	69	178	6	0	0
BRACKLEY	5	8	193	7	248		171	249	8	1	0
BUCKINGHAM	1	4	103	4	127	93		999	15	0	3
MILTON KEYNES	2	17	120	3	158	85	560		1,220	44	70
BEDFORD	1	0	11	0	3	28	9	1,889		251	150
ST NEOTS	0	0	0	0	1	0	0	121	436		521
CAMBRIDGE	0	1	10	0	1	0	1	41	68	96	

2.4.15 Table 2-14 shows that the main car driver commuter flows along the east-west route occur from:

- Abingdon to Oxford (2,286) and to Didcot (1,240 people);
- Bicester to Oxford (1,794);
- Kidlington to Oxford (1,050);
- Didcot to Abingdon (657 people) and to Oxford (993 people);
- Milton Keynes to Bedford (1,220 people) and vice versa (1,889 people);
- Buckingham to Milton Keynes (999 people) and vice versa (560 people), and
- St Neots to Cambridge (521 people) and Bedford (436 people).

2.4.16 Table 2-14 identifies that although there are very low levels of long distance car commuting along the primary east-west route (9 and10 people between Oxford and Cambridge and Cambridge and Oxford respectively), there are sections of the route which provide an important local commuter function including the:

- A34 – connecting Didcot, Abingdon, Oxford and Kidlington;
- A4421/A41/A43 – connecting Bicester and Oxford;
- A421 – connecting Buckingham and Milton Keynes and Milton Keynes and Bedford; and
- A428 – connecting St Neots and Cambridge.

2.4.17 This 2011 Census analysis has been repeated for bus and train modes and summarised in Tables 2-15 and 2-16 respectively.

Table 2-15: 2011 Census Travel to Work Origin and Destination Matrix – Bus

O\D	DIDCOT	ABINGDON	OXFORD	KIDLINGTON	BICESTER	BRACKLEY	BUCKINGHAM	MILTON KEYNES	BEDFORD	ST NEOTS	CAMBRIDGE
DIDCOT		48	36	0	0	0	0	0	0	0	0
ABINGDON	26		941	3	7	0	0	1	0	0	0
OXFORD	15	139		44	76	2	4	17	0	0	5
KIDLINGTON	0	6	904		30	0	1	0	0	0	0
BICESTER	0	3	437	2		2	3	7	0	0	0
BRACKLEY	0	0	2	0	3		11	2	0	0	0
BUCKINGHAM	0	0	12	0	20	1		40	0	0	0
MILTON KEYNES	0	0	22	0	15	3	46		76	7	2
BEDFORD	0	0	4	0	0	37	0	98		104	30
ST NEOTS	0	0	0	0	0	0	0	1	21		118
CAMBRIDGE	0	1	6	0	0	0	0	0	5	6	

2.4.18 Table 2-15 shows that the main bus commuter flows within the study area occur from:

- Abingdon to Oxford (941 people);
- Kidlington to Oxford (904 people);
- Bicester to Oxford (437 people);
- Bedford and Milton Keynes (98 people);
- Bedford to St Neots (104 people); and
- St Neots to Cambridge (118 people).

2.4.19 The relatively high level of bus patronage along the A34 corridor is due to Abingdon and Kidlington being served by a number of high frequency local bus services into Oxford. Abingdon is served by approximately 12 buses per hour and Kidlington by approximately 19 buses per hour. Between Bicester and Oxford there are typically 7 buses per hour (S5, X5 and 25A).

2.4.20 Between Buckingham and Milton Keynes there are two main services (X5 and X60) operating at a typical frequency of three buses per hour. Bedford and Milton Keynes are served by approximately 5-6 buses per hour including the X5, 53, C20 and 40. Bedford to St Neots and St Neots to Cambridge are served by the X5 route only which provides 2 buses per hour. The number of bus commuter trips between these conurbations suggests that the X5 is a popular commuter service during the peak travel periods.

Table 2-16: 2011 Census Travel to Work Origin and Destination Matrix – Train

O\D	DIDCOT	ABINGDON	OXFORD	KIDLINGTON	BICESTER	BRACKLEY	BUCKINGHAM	MILTON KEYNES	BEDFORD	ST NEOTS	CAMBRIDGE
DIDCOT		5	286	0	4	0	0	0	0	0	0
ABINGDON	1		25	0	0	0	0	0	0	0	0
OXFORD	17	4		4	13	0	0	0	0	0	2
KIDLINGTON	0	0	3		0	0	0	0	0	0	0
BICESTER	2	0	83	0		0	0	0	0	0	0
BRACKLEY	0	0	6	0	0		0	1	0	0	0
BUCKINGHAM	0	0	2	0	0	0		1	0	0	0
MILTON KEYNES	0	0	0	0	0	2	1		29	1	2
BEDFORD	0	0	0	0	0	0	0	47		0	1
ST NEOTS	0	0	0	0	0	0	0	0	3		8
CAMBRIDGE	0	0	6	0	0	0	0	0	0	0	

2.4.21 Table 2-16 shows that the main train commuter flows within the study area occur from:

- Didcot to Oxford (286 people); and
- Bicester to Oxford (83 people).

2.4.22 Table 2-16 demonstrates that rail commuting within the study area is limited to the existing direct rail connections into Oxford and between Bedford and Milton Keynes. The lack of east-west rail connections between Oxford, Milton Keynes and Cambridge, the unattractive journey times and interchange requirements by existing routes, means rail commuting is not a viable travel option between these main urban areas.

2.4.23 The analysis provided in this section uses 2011 Census Travel to Work data to establish the level of commuting between the main conurbations within the study area. These commuter trips generate car trips along sections of the primary east-west route, particularly during the peak travel periods. The primary east-west route also accommodates strategic east-west movements which will be undertaken for a range of purposes including leisure, retail and personal business.

East-West Corridor: Strategic Movements

Strategic Imperative

The evidence base shows there are low levels of strategic long distance journey to work movements along the primary east-west corridor within the study area, including between the main urban areas of Oxford, Milton Keynes and Cambridge. Improving east-west transport connectivity in the study area could address this by reducing the unattractive journey times between Cambridge and Oxford, Oxford and Milton Keynes and Cambridge and Milton Keynes, encouraging wider economic benefits including productivity and investment benefits, allowing skilled workers to access jobs and improving business to business connectivity.

2.4.24 The Oxford to Cambridge Expressway Strategic Study will be informed by origin and destination data from the South East Regional Transport Model (SERTM). The SERTM is currently under development, including the base model origin and destination matrices. Once available, the SERTM base matrices will be used to identify the strategic movements using the primary east-west corridor.

2.4.25 This study will also utilise the National Freight Model to identify existing strategic freight movements through the study area and along the primary east-west route. The use of the National Freight Model will be consistent with the approach adopted in other RIS Strategic Studies.

2.4.26 To inform this Stage 1 report, a combination of 2011 Census origin and destination data and DfT traffic count data has been used to identify the main local and strategic travel patterns. The analysis of the 2011 Census data shows that within the study area there are important 'local' commuter travel demands along the A34 corridor between Oxford and the Science Vale, along the A421 corridor between Buckingham/Milton Keynes and Milton Keynes/Bedford and along the A428 corridor between St Neots and Cambridge.

2.4.27 The 2011 Census data shows there is a very low commuter travel demand for longer-distances trips within the study area, for example between Oxford and Cambridge, and Oxford/Cambridge to Milton Keynes and vice versa.

2.4.28 The DfT AADT traffic flows along the primary east-west route show significant variability, demonstrating that sections on the route perform important local and regional functions but a relatively limited strategic end-to-end function. The study area AADT flow diagram in Appendix 8 shows the A34 provides an important strategic north-south route between the southern ports and the M4 and the M40 as well as serving the local communities along the route.

2.4.29 The AADT flows on the A421 northeast of Bicester and east of the M40 are significantly lower (8,000-11,250 AADT) compared to the 65,500-78,000 AADT using the A34. The traffic flow data therefore shows there is a relatively low strategic travel demand to/from the A34 and M40 to the A421 and A428 corridors within the study area.

2.4.30 The flow diagram in Appendix 8 shows that the AADT on the A421 Expressway between Bedford and M1 is significantly higher that the AADT flows on the A421 west of Milton Keynes and east of Bedford. The AADT traffic flow data there shows that the A421 Expressway is performing and important local function between Bedford and the M1/Milton Keynes.

2.4.31 On the A428 corridor the AADT flows on the single carriageway section are significantly lower (17,400-22,400 AADT) when compared to flow levels on the A421 Expressway. Again this data suggests that existing strategic east-west movements via the A421 and A428 and vice versa are relatively small compared to proportion of local movements on the A34, on the A421 between the M1 and Bedford and on the A428 between St Neots and Cambridge.

2.4.32 In summary, the 2011 Census and DfT traffic count data shows that currently there is a low strategic travel demand between the main functional economic areas of Cambridge, Milton Keynes and Oxford. However within the study area there are sections of the primary east-west route that are providing important local and regional functions, in particular the A34 between the M4 and the M40, the A421 between the M1 and Bedford and the A428 between St Neots and Cambridge.

Travel Patterns Summary

Key Points

Car Commuting

- The 2011 Census Origin and Destination analysis identifies that:
  - There are low levels of commuting by car between the three main conurbations of Oxford, Milton Keynes and Cambridge;
  - Within the study area there are important local commuter routes along the primary east-west route including:
    - Into Oxford, from Didcot, Abingdon, Kidlington and Bicester;
    - From Bedford, to Milton Keynes and vice versa;
    - From Buckingham, to Milton Keynes and vice versa; and
    - From St Neots, into Cambridge.

Bus Commuting

- The 2011 Census Origin and Destination analysis identifies that:
  - There are low levels of commuting by bus between the three main conurbations of Oxford, Milton Keynes and Cambridge;
  - There are good bus links between the main conurbations (Didcot, Abingdon, Kidlington, Bicester) around Oxford which attract relatively high levels of patronage; and
  - The X5 route between Bedford and St Neots, and St Neots to Cambridge is also well used by commuters between these settlements.

Train Commuting

- The 2011 Census Origin and Destination analysis identifies that:
  - There are very low levels of commuting by train between the three main conurbations of Oxford, Milton Keynes and Cambridge; and
  - Rail commuting is limited to conurbations (Didcot and Bicester) located on routes into Oxford and the east-west rail link between Milton Keynes/Bletchley and Bedford.

Strategic Movements

- There are low levels of strategic long distance movements along the primary east-west route within the study area, including between the main functional economic areas of Oxford, Milton Keynes and Cambridge.

Freight Movements

- The A34 is an important freight route from the southern ports and sections of the primary east-west route provide local access to the SRN resulting in a concentration of distribution centres in Milton Keynes and Northamptonshire in particular.

2.5 Transport Network Operation

Introduction

2.5.1 This section provides an overview of the operation of the existing road network within the study area. The analysis is focused on the network performance of the existing primary east-west route linking Oxford, Milton Keynes and Cambridge.

Existing Traffic Flows

Strategic Imperative

The evidence base shows sections of the east-west route accommodate high traffic flows, particularly the A34, M40 and sections of the A428 and A421 that accommodate commuter generated traffic to and from the urban conurbations and employment centres. The evidence base demonstrates that the dualled A421 and A428 sections of the east-west route have experienced significant levels of traffic growth, demonstrating the impact of improving study area east-west road capacity.

2.5.2 In order to establish the current situation on the primary east-west route, traffic flow data has been obtained from DfT traffic count sites within the study area. The DfT count sites provide AADT flows for the period 2010 to 2014. A plan showing the location of the DfT count sites is provided in Appendix 1.

2.5.3 A number of count points are present on most sections of the east-west route and therefore the average AADT flow across all relevant count points was determined. The average AADT for each of the main sections of the route are summarised in Table 2-17.

Table 2-17: DfT AADT Traffic Flow Summary: Six Main Route Sections

SECTION	ROAD	AMV* 2014 AADT	RANK	HGV 2014 AADT	AMV 5 YEAR CHANGE (AADT)	HGV 5 YEAR CHANGE (AADT)	AMV 5 YEAR CHANGE (%)	HGV 5 YEAR CHANGE (%)
1	A34	60,792	2	6,070	614	-188	1.0%	-3.0%
2A	M40	100,501	1	11,526	-11,039	-1,573	-9.9%	-12.0%
	A43	34,870	5	3,833	3,247	-2	10.3%	-0.1%
2B	A41	27,641	6	1,766	145	67	0.5%	3.9%
	A4421	11,903	10	721	-22	-88	-0.2%	-10.8%
3	A421	22,714	7	1,325	3,972	383	18.8%	40.7%
4	A421	41,081	4	3,552	11,911	551	40.8%	18.4%
5	A1	53,267	3	6,017	3,892	1,066	7.9%	21.5%
	A428	21,616	9	1,777	661	-38	3.2%	-2.1%
6	A428	21,237	8	1,444	2,504	-201	13.4%	-12.2%

* All Motor Vehicles

2.5.4 Table 2-17 shows that the M40 is the most heavily trafficked section of road on the main study area route, carrying 100,500 vehicles per day. Along the primary east-west route, Sections 1 (A34), 4 (A421) and 5 (A1) currently accommodate the highest AADT vehicle flows. The A34 (Section 1) carries the second highest level of vehicle movements per day with an average of 60,800 vehicle movements. As identified earlier, this dual carriageway serves both an important local, regional and national function. Over the period 2010-2014 the AADT flow on the A34 has remained relatively stable.

2.5.5 The DfT data shows that high levels of traffic growth have occurred on Section 4 (A421 between the M1 and A1). Section 3 (A421 between A43 and Milton Keynes) has seen the second highest level of traffic growth, followed by Section 6 (A428 between Caxton Gibbet and M11).

2.5.6 In the period 2010-2014, traffic levels grew on average by 41 percent on the A421 from the Black Cat Roundabout to the M1. In part this significant level of traffic growth is due to the opening of the A421 dual carriageway between Bedford and Milton Keynes. Traffic volumes have also increased in this period by an average of 19 percent on the A421 between Milton Keynes and the A43. This growth in part will be related to the increased east-west movements using the A421 corridor east of the M1.

2.5.7 Traffic levels on the A428 have grown by 13 percent between Caxton Gibbet and the M11. This growth will be due in part to the ongoing development of Cambourne and people avoiding the congested A14 corridor and routing via the A1198 and A428 in the peak travel periods.

2.5.8 The 2014 and 2010-2014 change in All Motor Vehicles (AMV) AADT and HGV AADT flows from the DfT traffic count points have been plotted along the primary east-west route for the study area. The study area plots along with more detailed section analysis are provided in Appendix 8.

Network Performance

Network Delay

Strategic Imperative

The evidence base shows that network delays occur on the primary east-west route during the peak travel periods which impacts on the accessibility to, from and between the main urban and employment centres along the corridor. Congestion and network delays restrict economic growth and the delivery of new jobs and homes within the study area.

Investment in east-west strategic road infrastructure could reduce congestion and network delays by increasing strategic east-west road capacity.

2.5.9 In order to establish the current levels of network delay, annual average traffic speeds and journey times along the primary east-west route, recorded by Trafficmaster between September 2014 and August 2015 have been analysed. The average Trafficmaster data along the primary east-west route has been analysed for the following periods:

- AM Peak Hour – 0800-0900 hours;
- PM Peak Hour – 1700-1800 hours;
- Average Daily Period (24 hours); and
- Overnight – 0000-0500 hours.

2.5.10 For the purposes of this assessment the time period 0800-0900 hours and 1700-1800 hours have been used to identify the average primary east-west route journey speeds and journey times during the peak travel periods. These time periods are considered to cover the peak commuter periods into the main conurbations within the study area.

2.5.11 The annual average overnight Trafficmaster speed and journey time data has been used as an indicator of the average route speeds and travel times under free flow traffic conditions. The annual average vehicle speeds and journey times in the peak hours has then been compared against the overnight average speeds and journey times respectively to highlight the locations along the primary east-west route where peak period congestion occurs.

2.5.12 The annual average vehicle speed and journey time data recorded by Trafficmaster has been plotted for the primary east-west route. Maps showing the AM, PM, Daily and Overnight annual average vehicle speeds and journey times along the route are provided in Appendix 9 and 10 respectively.

Average Route Section Journey Times and Speeds

2.5.13 Analysis of the Trafficmaster data has been carried out in order to understand the existing journey time and average speed along the primary east-west route. The start and end points of the primary east-west route within the study area are the M4 Junction 13 (Chieveley), approximately 19 miles to the south of Oxford and the M11 Junction 14 (Girton Interchange) to the west of Cambridge. Two route options have been considered; the first is to the northwest of Bicester via the M40 and A43 and second is to the southeast of Bicester via the A41 and A4421.

2.5.14 The annual average journey time and vehicle speed along the six main sections of the primary east-west route for all vehicle types is summarised in Table 2-18 below.

Table 2-18: East-West Road Route Annual Average Journey Time and Speed (all vehicle types)

VIA BICESTER (ROUTE 1)														
TIME PERIOD	EASTBOUND							WESTBOUND						
	1 A34: M4 to M40	2b A41/A4421: A34 to A421	3 A421: A4421 to M1	4 A421: M1 to A1	5 A428: A1 to A1198	6 A428: A1198 to A14	TOTAL	6 A428: A14 to A1198	5 A428: A1198 to A1	4 A421: A1 to M1	3 A421: M1 to A4421	2b A4421/A41: A421 to A34	1 A34: M40 to M4	TOTAL
AM Peak Hour (0800-0900)	00:35:53	00:17:51	00:41:43	00:18:21	00:21:04	00:08:29	**02:23:22**	00:07:32	00:19:11	00:18:20	00:38:18	00:18:29	00:43:10	**02:25:00**
	54.8mph	39.9mph	31.6mph	58.2mph	29.8mph	55.4mph	**43.0mph**	62.3mph	32.3mph	58.0mph	34.4mph	38.3mph	45.7mph	**42.4mph**
PM Peak Hour (1700-1800	00:40:00	00:18:24	00:39:25	00:21:17	00:17:00	00:07:08	**02:23:14**	00:09:04	00:17:25	00:17:00	00:37:38	00:17:47	00:37:26	**02:16:20**
	49.1mph	38.7mph	33.4mph	50.2mph	37.0mph	65.9mph	**43.0mph**	51.8mph	35.6mph	62.6mph	35mph	39.8mph	52.7mph	**45.1mph**
Average Day (24 Hour)	00:34:49	00:17:26	00:35:04	00:18:15	00:15:42	00:07:23	**02:08:40**	00:07:31	00:15:24	00:16:54	00:35:43	00:17:15	00:34:12	**02:07:00**
	56.5mph	40.9mph	37.5mph	58.5mph	40.0mph	63.7mph	**47.9mph**	62.4mph	40.2mph	62.9mph	36.9mph	41.1mph	57.6mph	**48.4mph**
Overnight (0000-0500)	00:31:27	00:16:14	00:29:56	00:16:36	00:12:37	00:07:32	**01:54:22**	00:07:36	00:13:19	00:17:22	00:29:24	00:15:35	00:33:17	**01:56:31**
	62.5mph	43.9mph	44.0mph	64.3mph	49.8mph	62.3mph	**53.9mph**	61.8mph	46.5mph	61.3mph	44.8mph	45.5mph	59.2mph	**52.8mph**

VIA M40 (ROUTE 2)														
TIME PERIOD	EASTBOUND							WESTBOUND						
	1 A34: M4 to M40	2a M40/A43: A34 to A421	3 A421: A4421 to M1	4 A421: M1 to A1	5 A428: A1 to A1198	6 A428: A1198 to A14	TOTAL	6 A428: A14 to A1198	5 A428: A1198 to A1	4 A421: A1 to M1	3 A421: M1 to A4421	2a A43/M40: A421 to A34	1 A34: M40 to M4	TOTAL
AM Peak Hour (0800-0900)	00:35:53	00:11:07	00:46:36	00:18:21	00:21:04	00:08:29	**02:21:30**	00:07:32	00:19:11	00:18:20	00:43:10	00:13:11	00:43:10	**02:24:35**
	54.8mph	52.2mph	33.5mph	58.2mph	29.8mph	55.4mph	**44.3mph**	62.3mph	32.3mph	58.0mph	36.0mph	43.5mph	45.7mph	**43.3mph**
PM Peak Hour (1700-1800)	00:40:00	00:12:58	00:44:12	00:21:17	00:17:00	00:07:08	**02:22:36**	00:09:04	00:17:25	00:17:00	00:42:24	00:12:08	00:37:26	**02:15:27**
	49.1mph	44.8mph	35.3mph	50.2mph	37.0mph	65.9mph	**44.0mph**	51.8mph	35.6mph	62.6mph	36.7mph	47.4mph	52.7mph	**46.2mph**
Average Day (24 Hour)	00:34:49	00:11:12	00:39:46	00:18:15	00:15:42	00:07:23	**02:07:07**	00:07:31	00:15:24	00:16:54	00:40:24	00:11:38	00:34:12	**02:06:03**
	56.5mph	51.9mph	39.2mph	58.5mph	40.0mph	63.7mph	**49.3mph**	62.4mph	40.2mph	62.9mph	38.5mph	49.4mph	57.6mph	**49.6mph**
Overnight (0000-0500)	00:31:27	00:11:04	00:34:22	00:16:36	00:12:37	00:07:32	**01:53:39**	00:07:36	00:13:19	00:17:22	00:33:34	00:11:18	00:33:17	**01:56:25**
	62.5mph	52.5mph	45.4mph	64.3mph	49.8mph	62.3mph	**55.2mph**	61.8mph	46.5mph	61.3mph	46.4mph	50.8mph	59.2mph	**53.7mph**

2.5.15 Table 2-18 shows that there is no significant difference in the end-to-end journey times via Bicester (Route 1) or the M40 (Route 2). Route 2, via the M40 is shown to be typically 1-2 minutes (1 mph) quicker than the route via Bicester. Table 2-18 shows that the end-to-end journey time takes up to 2 hours 25 minutes during the peak travel periods. The average daily travel time takes up to 2 hours 8 minutes, with the overnight travel time taking up to 1 hour 57 minutes.

2.5.16 Table 2-18 shows that the average daily end-to-end journey speed is relatively slow at 48-50 mph. The route journey speed typically reduces to 42-46 mph during the peak hours. The overnight route speed ranges from 53 mph to 55 mph. The relatively low average routes speeds are a result of a number of factors including the single carriageway sections of the A421 and A428 and the frequent at-grade junctions through Milton Keynes and along the A428 and A421.

2.5.17 Table 2-18 shows that in the peak periods, the highest average speeds were recorded on the Expressway sections of the A428 (Section 6) and A421 (Section 4). On the A428 between the A14 and A1198 average speeds of between 52 mph and 66 mph were recorded and on the A421 between the A1 and M1 average speeds of between 50 mph and 63 mph were recorded. By contrast, the lowest average speeds are recorded on the single carriageway sections of the A428 (Section 5) and A421 (Section 3). On the A428 between the A1 and A1198 average speeds of between 30 mph and 35 mph were recorded and on the A421 between the A4421 and M1 average speeds of between 32 mph and 37 mph were recorded.

2.5.18 To understand the relative increases in section and end-to-end route journey times and reduction in speeds during the peak travel periods, the AM and PM peak hour Trafficmaster data has been compared to the overnight period (0000-0500 hours) data. The difference between AM and PM peak hour journey times/speeds and the overnight journey times/speeds are summarised in Table 2-19.

Table 2-19: East-West Road Route Peak Hour Journey Delay Compared to Overnight Period

VIA BICESTER (ROUTE 1)														
TIME PERIOD	EASTBOUND							WESTBOUND						
	1 A34: M4 to M40	2b A41/A4421: A34 to A421	3 A421: A4421 to M1	4 A421: M1 to A1	5 A428: A1 to A1198	6 A428: A1198 to A14	TOTAL	6 A428: A14 to A1198	5 A428: A1198 to A1	4 A421: A1 to M1	3 A421: M1 to A4421	2b A4421/A41: A421 to A34	1 A34: M40 to M4	TOTAL
AM Peak Hour (0800-0900)	00:04:26	00:01:38	00:11:47	00:01:45	00:08:27	00:00:57	**00:28:59**	-00:00:04	00:05:52	00:00:58	00:08:54	00:02:54	00:09:53	**00:28:29**
	-7.7 mph	-4.0 mph	-12.4mph	-6.1 mph	-20.0mph	-6.9mph	**-10.9mph**	0.5 mph	-14.2 mph	-3.3 mph	-10.4mph	-7.1 mph	-13.6mph	**-10.4mph**
PM Peak Hour (1700-1800)	00:08:33	00:02:10	00:09:29	00:04:41	00:04:23	-00:00:25	**00:28:51**	00:01:28	00:04:06	-00:00:22	00:08:14	00:02:13	00:04:09	**00:19:49**
	-13.4mph	-5.2 mph	-10.6mph	-14.2mph	-12.9mph	3.6mph	**-10.9mph**	-10.0 mph	-11.0 mph	1.3 mph	-9.8 mph	-5.7 mph	-6.6 mph	**-7.7 mph**

VIA M40 (ROUTE 2)														
TIME PERIOD	EASTBOUND							WESTBOUND						
	1 A34: M4 to M40	2a M40/A43: A34 to A42[illegible]	3 A421: A4421 to M1	4 A421: M1 to A1	5 A428: A1 to A1198	6 A428: A1198 to A14	TOTAL	6 A428: A14 to A1198	5 A428: A1198 to A1	4 A421: A1 to M1	3 A421: M1 to A4421	2a [illegible]43/M40: A421 to A3[illegible]	1 A34: M40 to M4	TOTAL
AM Peak Hour (0800-0900)	00:04:26	00:00:03	00:12:14	00:01:45	00:08:27	00:00:57	**00:27:52**	-00:00:04	00:05:52	00:00:58	00:09:36	00:01:54	00:09:53	**00:28:10**
	-7.7 mph	-0.2 mph	-11.9 mph	-6.1 mph	-20.0 mph	-6.9 mph	**-10.9 mph**	0.5 mph	-14.2 mph	-3.3 mph	-10.3 mph	-7.3 mph	-13.6 mph	**-10.5 mph**
PM Peak Hour (1700-1800)	00:08:33	00:01:54	00:09:50	00:04:41	00:04:23	-00:00:25	**00:28:57**	00:01:28	00:04:06	-00:00:22	00:08:51	00:00:50	00:04:09	**00:19:02**
	-13.4 mph	-7.7 mph	-10.1 mph	-14.2 mph	-12.9 mph	3.6 mph	**-11.2 mph**	-10.0 mph	-11.0 mph	1.3 mph	-9.7 mph	-3.5 mph	-6.6 mph	**-7.6 mph**

2.5.19 Table 2-19 shows that, compared to overnight period, there is a 28-29 minute increase in eastbound end-to-end journey times during the AM and PM peak hour respectively. This equates to a reduction of 11 mph average speed along the route. Westbound, typically there is a 28 minute increase in end-to-end journey times in the AM peak hour. In the PM peak hour there is a lower increase in journey times, with a typical increase of 19-20 minutes compared to the overnight period. The difference in journey times occurs as a result of additional delay in the AM peak on approach to the Black Cat Roundabout and additional delay the A34 Oxford bypass compared to the PM peak hour.

2.5.20 Table 2-19 shows that in the peak periods, the lowest average speed reductions were recorded eastbound on Section 2a/b (M40/A43 and A41/A4421) (Section 6 (A428 Expressway). Westbound, the lowest average speed reductions were recorded on the Expressway sections of the A428 (Section 6) and A421 (Section 4).

2.5.21 By contrast, the highest average speed reductions eastbound were recorded on the A34 (Section 1), A421 (Section 3 and 4) and the single carriageway section of the A428 (Section 5). Westbound, the highest average speed reductions were recorded on A34 (Section 1) and A428 (Sections 5 and 6).

Pinch Point Analysis

2.5.22 The change in AM and PM peak hour average vehicle speeds and journey times compared to the overnight period have been plotted graphically. For the average vehicle speeds, the Trafficmaster data has been plotted for each individual Trafficmaster link along the primary east-west route. For the average journey times, the individual Trafficmaster links have been combined into 20 main route sections so that the total journey time delay can be clearly identified on the plans. The 20 route sections used for the journey time analysis are shown graphically in Figure 2-8. The change in overnight to AM and PM peak hour average speeds and journey times are presented in Figures 2-9 to 2-12.

Figure 2-8: Trafficmaster Journey Time Route Sections

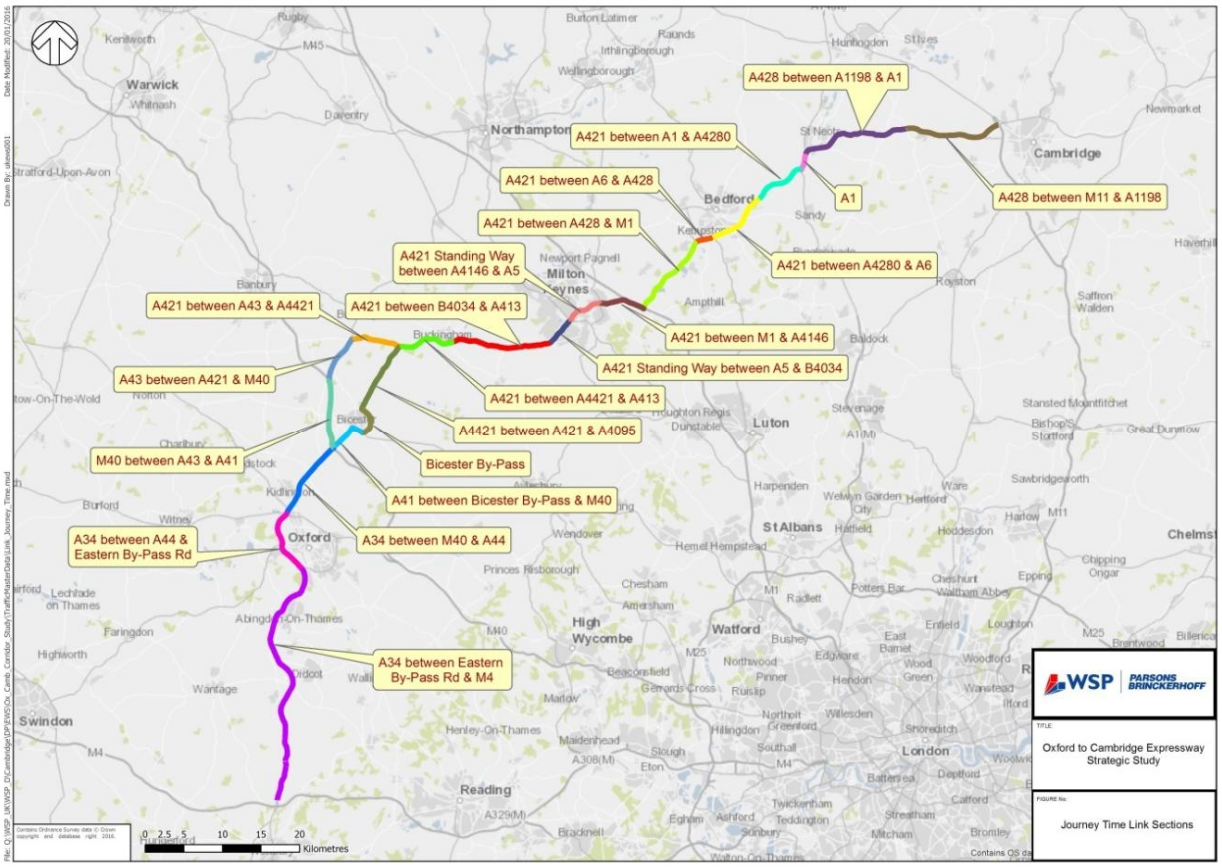
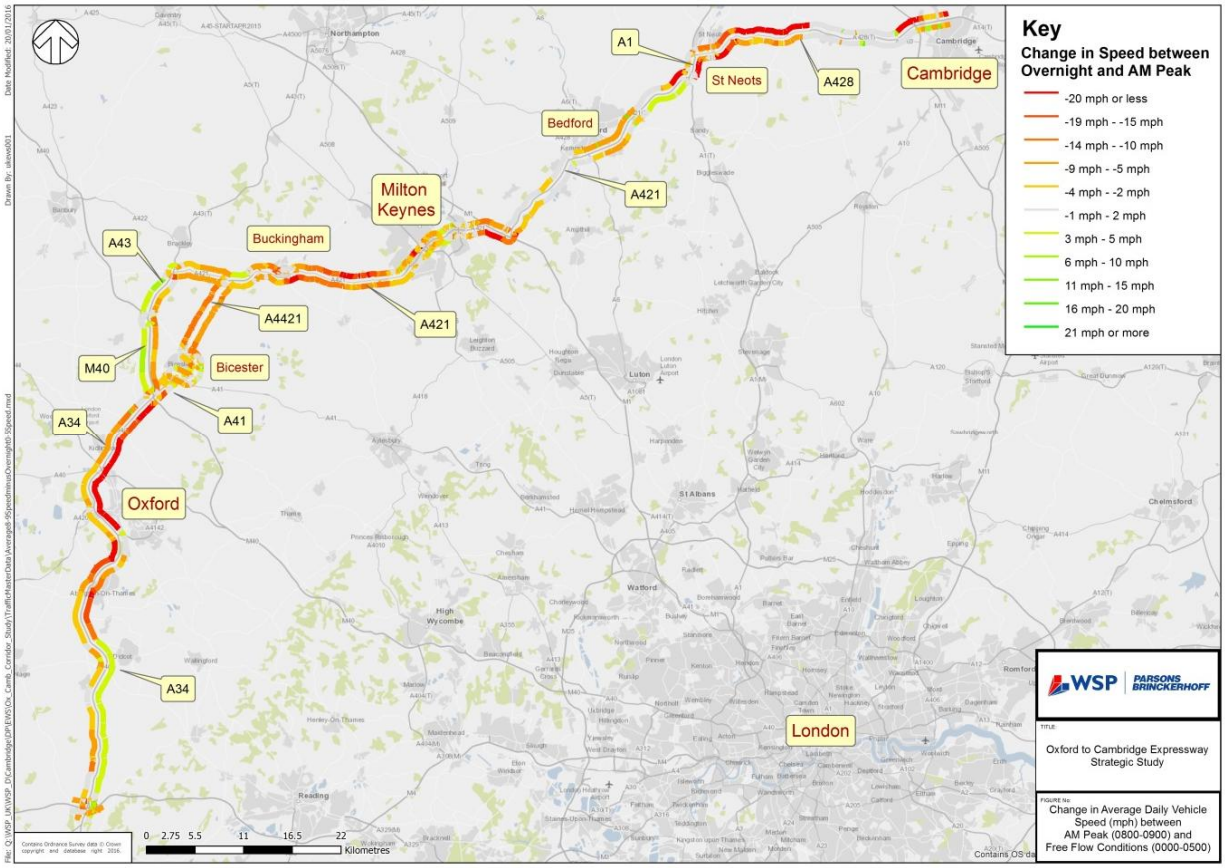


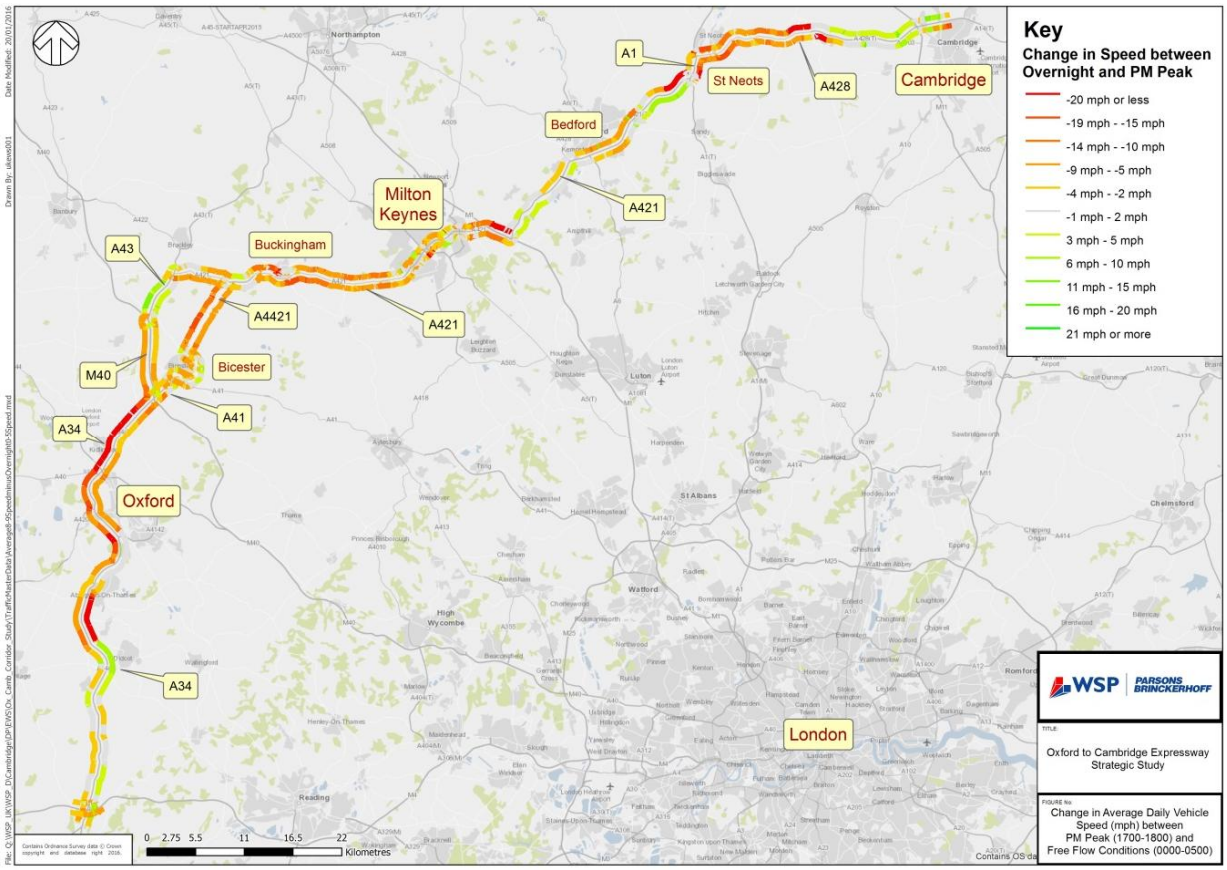
Figure 2-9: Annual Average Vehicle Speeds: AM Peak Hour Minus Overnight Period



2.5.23 Figure 2-9 shows the locations on the primary east-west route where AM peak hour annual average speeds vary to the overnight annual average speeds. Figure 2-9 shows the main locations where reduced AM peak hour vehicle speeds occur are:

- Southbound on the A34, between the M40 and the A4142 Southern Bypass and between the Marcham and Milton Interchanges south of Oxford;
- Northbound on the A34, on approach to the A4142 Southern Bypass;
- East and westbound on the single carriageway section of the A421 and A4421, between the A43/M40 and Milton Keynes;
- East and westbound on the single carriageway section of the A421, between the M1 and Milton Keynes;
- Eastbound approach on the A421 and the southbound approach on the A1 to the Black Cat Roundabout;
- East and westbound on the single carriageway section of the A428, between the A1 and the A1198; and
- A428 eastbound approach to the A14 Cambridge Northern Bypass.

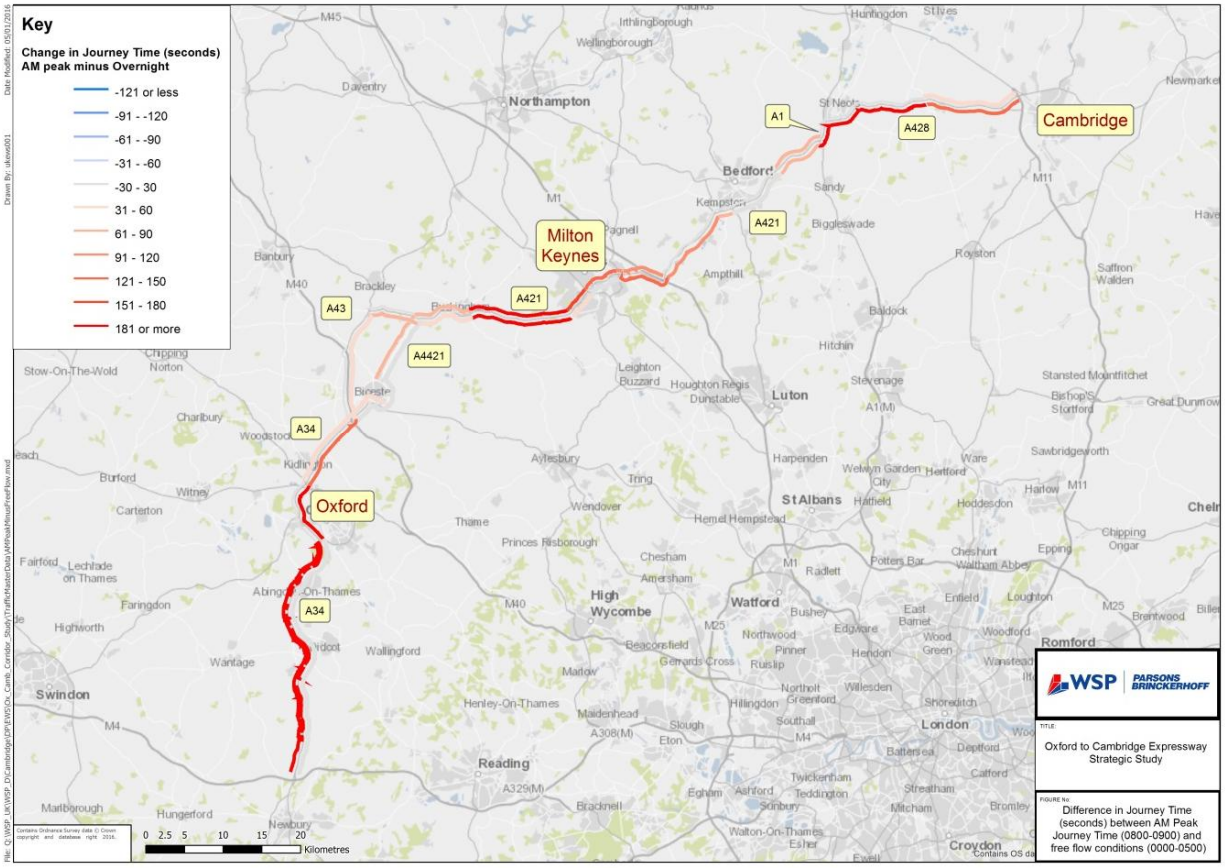
Figure 2-10: Annual Average Vehicle Speeds: PM Peak Hour Minus Overnight Period



2.5.24 Figure 2-10 shows the locations on the primary east-west route where PM peak hour annual average speeds vary to the overnight annual average speeds. Figure 2-10 shows the main locations where reduced PM peak hour vehicle speeds occur are:

- Northbound on the A34, between the A4142 Southern Bypass and the M40 and southbound between the Marcham and Milton Interchanges south of Oxford;
- East and westbound on the single carriageway sections of the A421 and A4421, between the A43/M40 and Milton Keynes;
- East and westbound on the single carriageway section of the A421, between the M1 and Milton Keynes;
- Eastbound approach on the A421 and the southbound approach on the A1 to the Black Cat Roundabout; and
- East and westbound on the single carriageway section of the A428, between the A1 and the A1198.

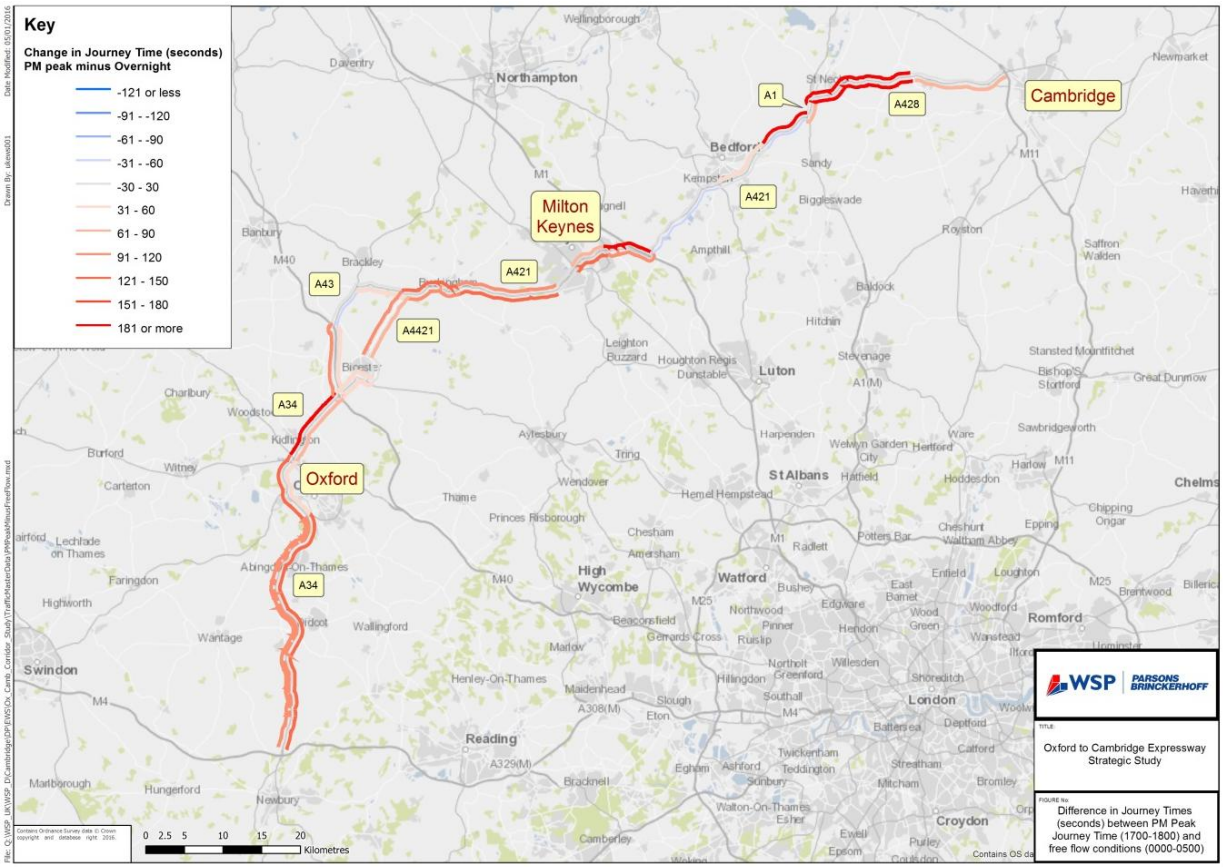
Figure 2-11: Annual Average Vehicle Delay: AM Peak Hour Minus Overnight Period



2.5.25 Figure 2-11 shows the 20 main combined sections on the primary east-west route where AM peak hour annual average journey times vary to the overnight annual average speeds. Figure 2-11 shows the main locations where increased AM peak hour journey times occur are:

- Southbound on the A34, between the M40 and the A4142 Southern Bypass and northbound between the M4 and the A4142 Southern Bypass;
- East and westbound on the single carriageway section of the A421, between Buckingham and Milton Keynes; and
- Westbound on the single carriageway section of the A428, between the A1198 and the Black Cat Roundabout.

Figure 2-12: Annual Average Vehicle Delay: PM Peak Hour Minus Overnight Period



2.5.26 Figure 2-12 shows the 20 main combined sections on the primary east-west route where PM peak hour annual average journey times vary to the overnight annual average speeds. Figure 2-12 shows the main locations where increase PM peak hour journey times occur are:

- Northbound on the A34, between the A4142 Southern Bypass and the M40;
- Eastbound on the single carriageway section of the A421, between Milton Keynes and the M1;
- Eastbound on the A421 approach to the Black Cat Roundabout; and
- East and westbound on the single carriageway section of the A428, between the A1198 and the Black Cat Roundabout.

2.5.27 To quantify the level of increased journey time delay along the east-west route and identify the main locations where peak period congestion is occurring detailed analysis of the change in peak hour and overnight journey times/speed for the 20 main route sections has been undertaken. The absolute and percentage change in the AM and PM peak hour link journey times/speeds in comparison to the overnight journey times/speeds is provided in Appendix 11.

2.5.28 In summary, the ten highway sections with the highest percentage increase in peak hour journey times compared to the overnight period by direction are summarised in Table 2-20 below.

Table 2-20: Ten Highway Sections with the Largest Percentage Increase in Peak Hour Journey Times compared to the Overnight Period

RANK	EASTBOUND M4 TO A14		WESTBOUND A14 TO M4	
	AM	PM	AM	PM
1	A421 Standing Way between B4034 & A5	A421 Between A4280 & A1	A1	A1
2	A428 Between A1 & A1198	A34 between A44 & M40	A34 between A44 & Eastern By-Pass Rd	A421 Standing Way between A4146 & A5
3	A421 Standing Way between A5 & A4146	A421 Between A4146 & M1	A421 between M1 & A4146	A421 between M1 & A4146
4	A421 between A413 & B4034	A428 Between A1 & A1198	A34 between M40 & A44	A428 between A1198 & A1
5	A421 Between A4280 & A1	A34 between Eastern By-Pass Rd & A44	A428 between A1198 & A1	A421 between A413 & AA421
6	A421 Between A4146 & M1	A421 between A4421 & A413	A421 between A413 & AA421	A421 between B4034 & A413
7	A421 between A4421 & A413	A421 Standing Way between A5 & A4146	A421 between B4034 & A413	A428 between M11 & A1198
8	A4421 between Bicester Bypass & A421	M40	A41 between Bicester Bypass & M40	A41 between Bicester Bypass & M40
9	A43 between M4 & Eastern By-Pass Rd	A4421 between Bicester Bypass & A421	A421 between A4280 & A6	A4421 between A421 & A4095
10	A34 between A44 & M40	A421 between A413 & B4034	A4421 between A421 & A4095	A34 between A44 & Eastern By-Pass Rd

2.5.29 Table 2-20 shows that eastbound, in the AM peak hour the A421 through central Milton Keynes has the largest percentage increase in journey time compared to the overnight period. The second highest percentage increase occurs on the single carriageway section of the A428 between the A1 and the A1198. In the PM peak hour, the largest increase in journey time occurs on the A421 on approach to the A1. The second largest increase in journey time occurs on the A34, on the approach to the M40.

Journey Time Reliability

Strategic Imperative

The evidence base shows that journey times along the east-west route are unreliable during the peak travel periods. Unreliable journey times and resultant increased travel times lead to driver (car and HGV) and bus passenger frustration, resulting in increased personal and business costs as a result of extra driver hours, increased vehicle operating costs and less productive employees. Journey time reliability restricts business efficiency and investment, and the ability for people to access a full range of services.

Investment in east-west strategic road infrastructure could improve journey reliability by increasing strategic east-west road capacity.

2.5.30 The Trafficmaster data recorded daily variability in journey speeds between Oxford and Cambridge via Bicester (Route 1) and the M40 (Route2). The variability in journey speeds for the eastbound and westbound directions have been plotted Figures 2-13 to 2-20. The graphs show the recorded variation in average link journey speeds in the peak hours between September 2014 and August 2015, average daily speed and speed limit. It should be noted that for some links the speed limit changes a number of times along a link, for these links the speed limit that is set for the majority of the link is presented.

2.5.31 Figure 2-13 and Figure 2-14 shows the recorded average link speeds for vehicles travelling in a Westbound direction in the AM peak period (0800-0900 hours) via Bicester and the M40.

Figure 2-13: Westbound AM Peak Hour Journey Speeds via Bicester (Sept 2014 to Aug 2015)

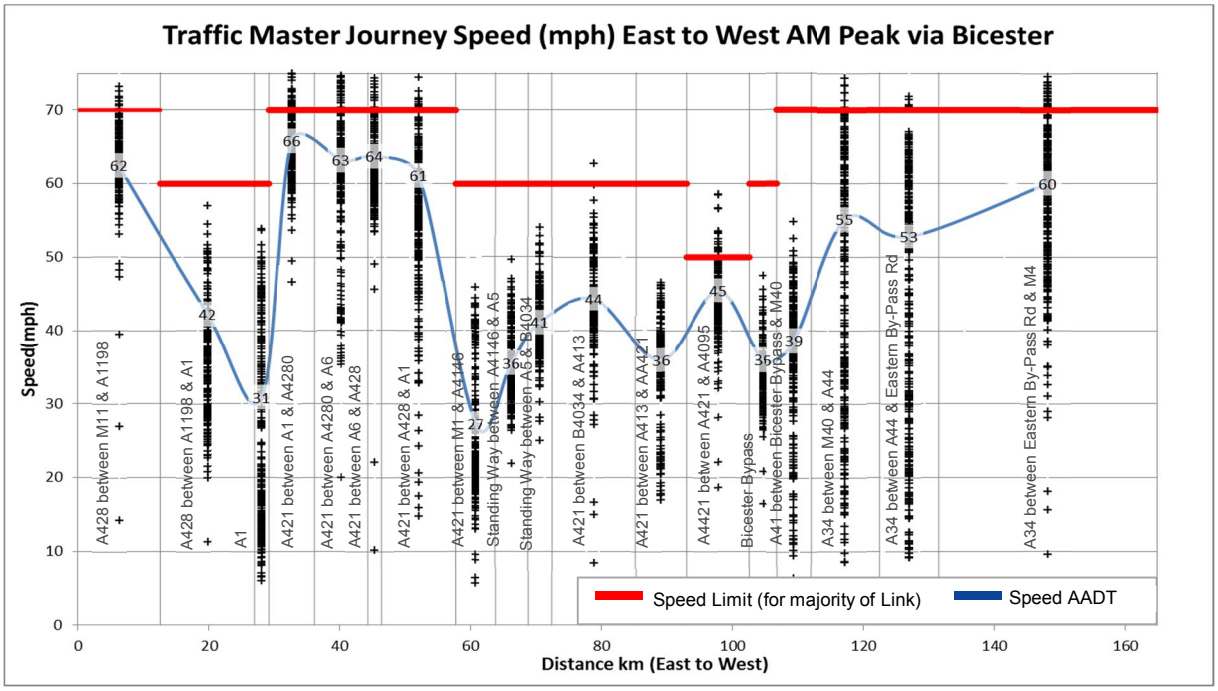
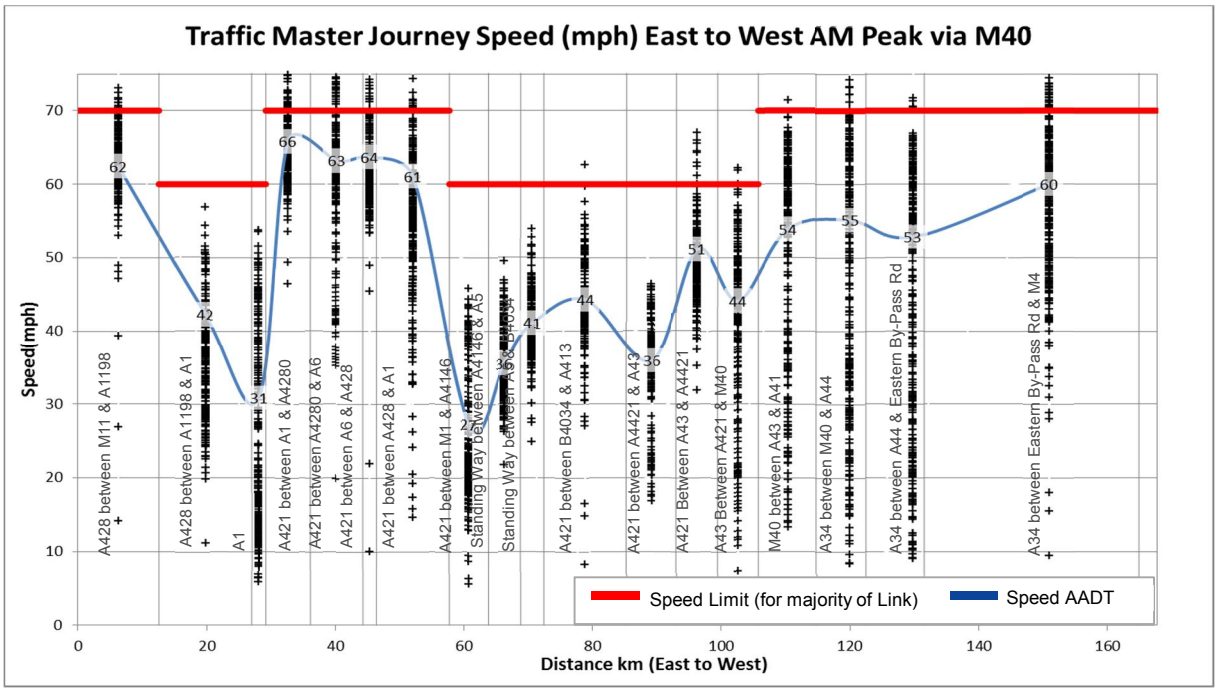


Figure 2-14: Westbound AM Peak Hour Journey Speeds via M40 (Sept 2014 to Aug 2015)



2.5.32 Figure 2-13 and 2-14 generally show that the AM peak average westbound link speeds to be highest along the A428, A421, M40 and A43 and lowest along the A1 and along links through Milton Keynes. On the A428 and A421 average AM peak link speeds tend to be clustered closely to the average daily speed suggesting little variation in journey speed.

2.5.33 The greatest variation in recorded average AM peak link speeds is along the A1, A41 between Bicester Bypass and M40, and A34. Along these links the spread of recorded average links speeds is much greater than other links along the route. The variation suggests that the journey times along these links in the peak periods is likely to be unpredictable.

2.5.34 Figure 2-15 and Figure 2-16 shows the recorded average link speeds for vehicles travelling in a westbound direction in the PM peak period (1700-1800 hours) via Bicester and the M40.

Figure 2-15: Westbound PM Peak Hour Journey Speeds via Bicester (Sept 2014 to Aug 2015)

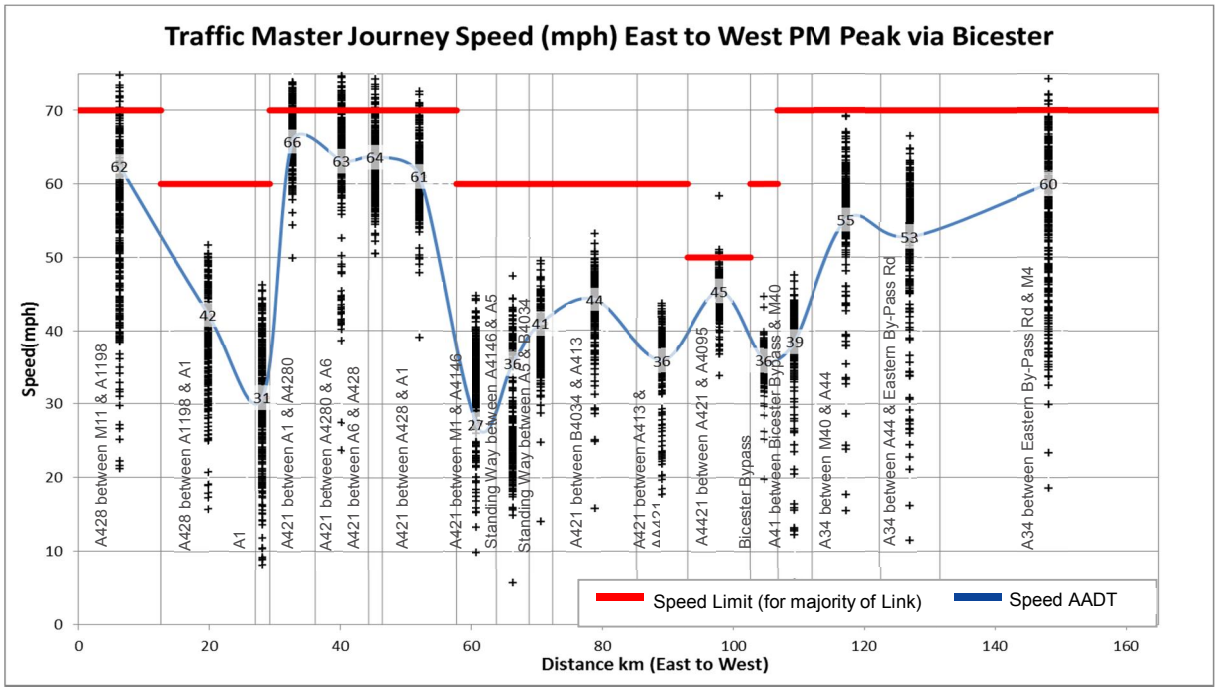
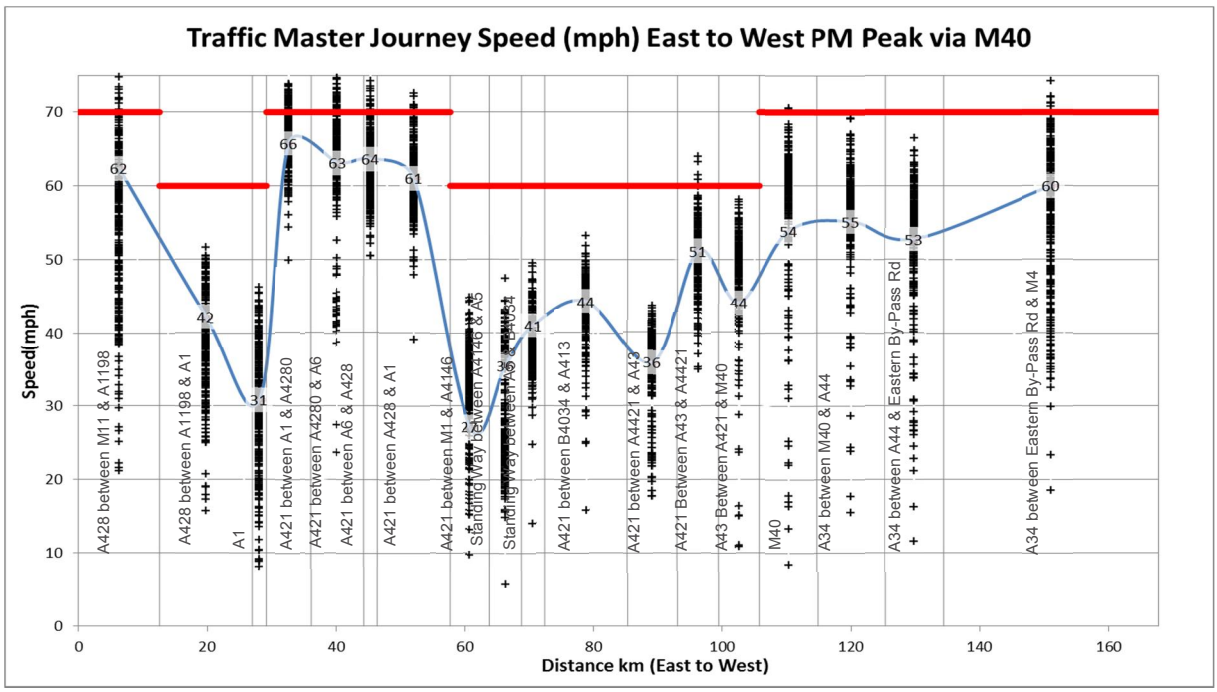


Figure 2-16: Westbound PM Peak Hour Journey Speeds via M40 (Sept 2014 to Aug 2015)



2.5.35 Figure 2-15 and 2-16 show the PM peak average westbound link speeds to be clustered closely to the average daily speed. The greatest variability in average link speed is on the A1, Standing Way and A34 between Easter Bypass Road and the M4.

2.5.36 Figure 2-17 and Figure 2-18 shows the recorded average link speeds for vehicles travelling in an Eastbound direction in the AM peak period (0800-0900 hours) via Bicester and the M40.

Figure 2-17: Eastbound AM Peak Hour Journey Speeds via Bicester (Sept 2014 to Aug 2015)

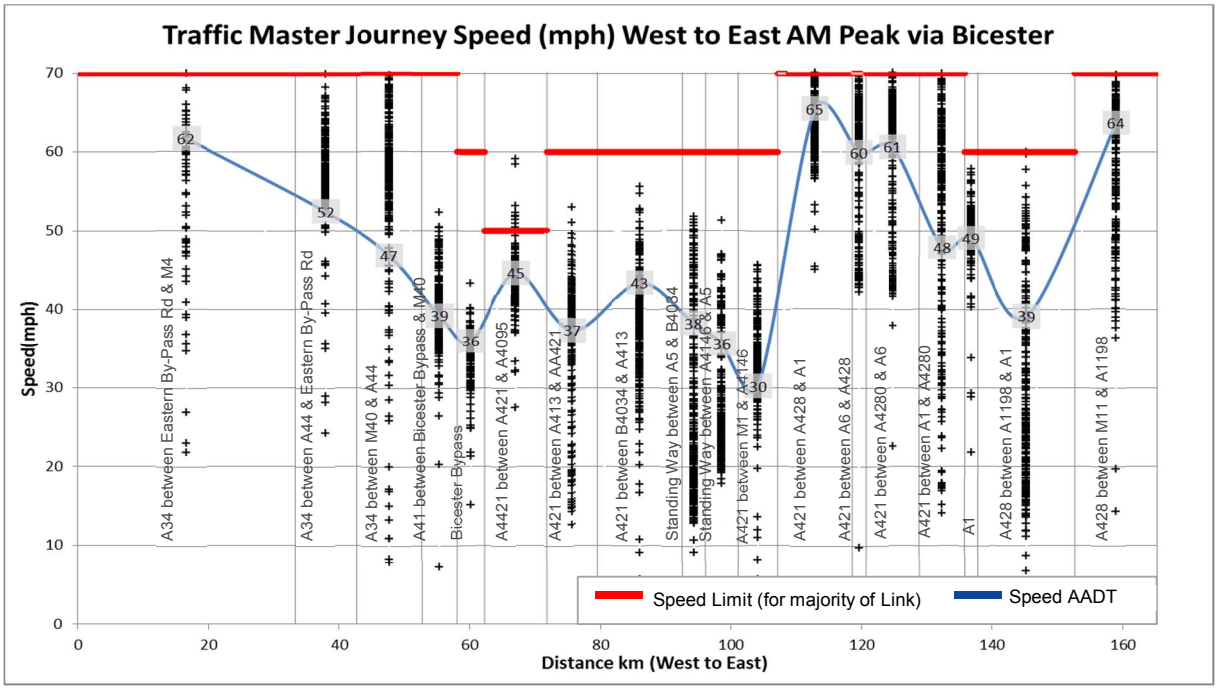
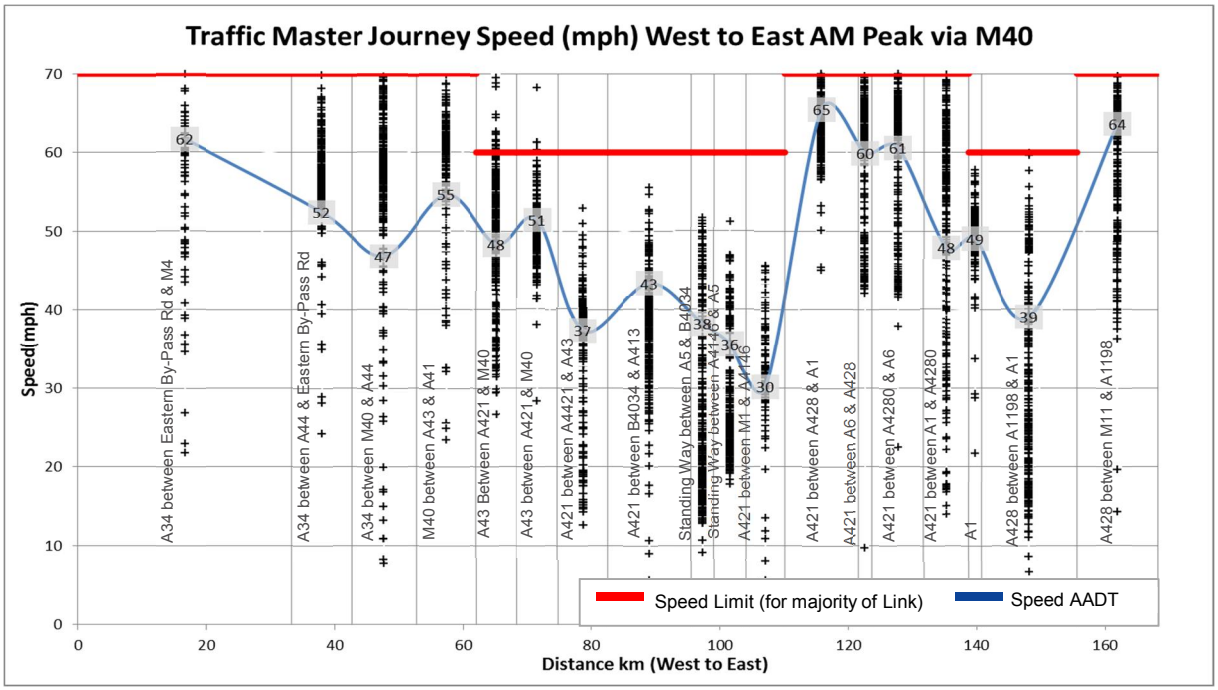


Figure 2-18: Eastbound AM Peak Hour Journey Speeds via M40 (Sept 2014 to Aug 2015)



2.5.37 Figure 2-17 and 2-18 shows average link speeds to be highest in the AM peak along the A34, A421 and A248 between the M11 and A1198. Along the A34 the recorded average PM peak link speeds are generally higher than the average daily link speed. This is likely to be as a result of the lower average link speeds recorded in the PM peak periods. The greatest variability in recorded average PM peak link speeds is on Standing Way in Milton Keynes and the A428 between the A1 and A1198.

2.5.38 Figure 2-19 and Figure 2-20 shows the recorded average link speeds for vehicles travelling in an eastbound direction in the PM peak period (1700-1800) via Bicester and the M40.

Figure 2-19: Eastbound PM Peak Hour Journey Speeds via Bicester (Sept 2014 to Aug 2015)

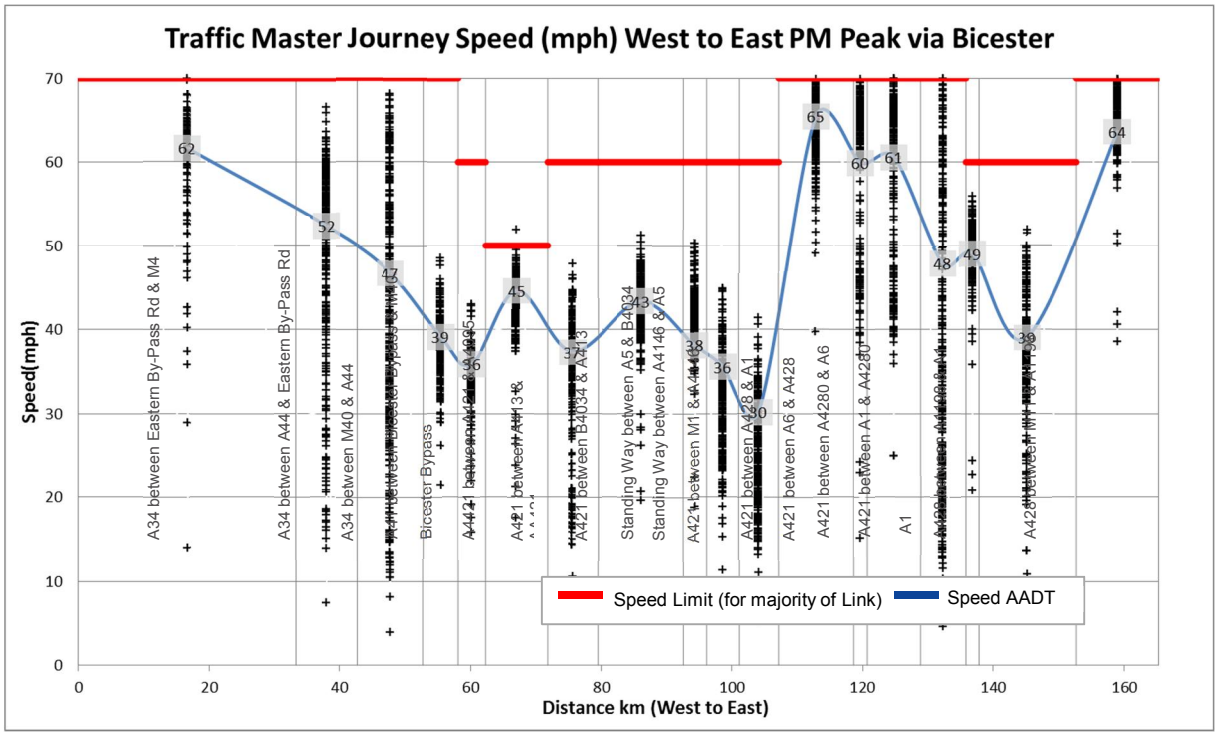
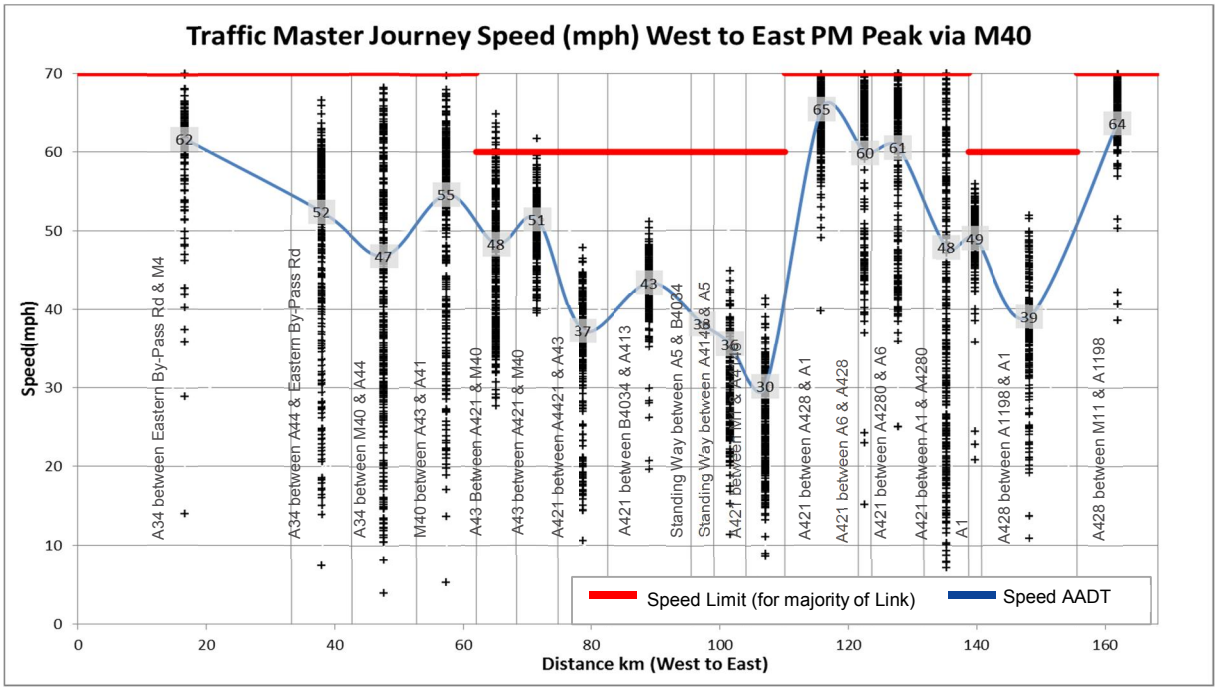


Figure 2-20: Eastbound PM Peak Hour Journey Speeds via M40 (Sept 2014 to Aug 2015)



2.5.39 There is greater variation in average eastbound link speeds in the PM peak than AM peak. The greatest variability in average PM peak link speeds occurs along the A34, M40, A421 and A428 between the A1 and A1198. Average PM peak link speeds tend to be clustered close to the average link speed along the A421 between the M1 and A6 and A428 between the A1198 and M11.

2.5.40 The above figures show the greatest variation in average link journey speeds to occur in the AM peak in the westbound direction and PM peak in the eastbound direction. Journey speeds tend to vary the most between Oxford and Bicester, along Standing Way in Milton Keynes and along approaches to the A1 Black Cat Roundabout. Links that tend to have the least variation in journey speed are the A428 between the A1198 and the M11 and A421 Bedford bypass. Both of these sections are relatively new dual carriageway sections of the corridor.

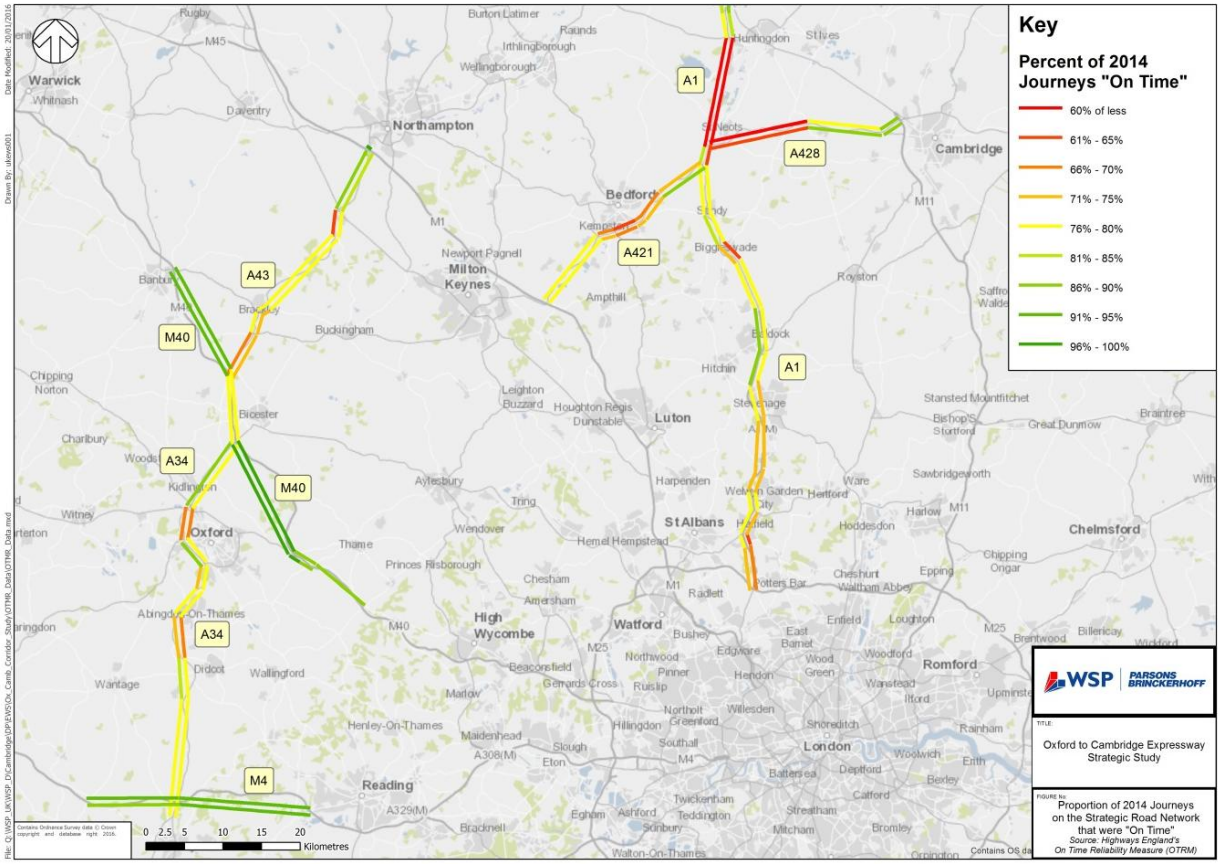
Highways England Journey Reliability Data

2.5.41 Information on journey time reliability has also been obtained from Highways England for the year 2014. Up until March 2015, Highways England measured journey time reliability using the “On Time Reliability Measure” (OTRM) which monitors the percentage of journeys on the SRN that are on time. An on time journey is one that is completed within a set reference time. This reference time is based on historical data and includes a fixed tolerance to reflect the typical journey on that part of the network for that time and day.

2.5.42 The OTRM is based on journey time information obtained from Trafficmaster in-vehicle GPS. The OTRM performance of a link is calculated in three stages: First the observed journey time is compared with the corresponding reference time for that link, time period and day type; second, for those time periods affected by road works, an adjustment is made to the reference time before the observed journey time comparison is made; and third, a calculation stage applies to those time periods where observed journey time estimates are not available to estimate reliability.

2.5.43 Figure 2-21 shows the proportion of 2014 journeys on the SRN that were on time, with red representing the least reliable links and green representing the most reliable links.

Figure 2-21: 2014 Proportion of SRN Journeys that were 'On Time'



2.5.44 Figure 2-21 shows that SRN journeys along the Oxford to Cambridge corridor typically have a reliability of between 60 percent and 80 percent. The least reliable sections of the Oxford to Cambridge corridor are the A1 north of the Black Cat Roundabout and the single carriageway section of the A428 east of the A1. Both of these links have journey time reliability of 65 percent or less.

2.5.45 A higher percentage of journeys were recorded on time along the dual carriageway sections of the corridor. On the A34 west of Oxford the percentage of journeys on time varies between 65 percent and 80 percent and along the A428 west of the M11 the percentage of journeys on time is between 85 percent and 95 percent.

2.5.46 The section of the A421 corridor between the M1 and A34 is not part of the SRN and as such Highways England does not collect information on the reliability of these links.

Route Capacity Assessment

Strategic Imperative

The evidence base shows that sections of the east-west route suffer from capacity issues, particularly during the peak travel periods. Route congestion results in increased and unpredictable journey times for car drivers, bus users and freight movements, creating constraints to economic productivity and growth.

New east-west strategic road infrastructure will improve route capacity by potentially improving existing routes and creating a new strategic link between the M40 and M1. New strategic east-west road infrastructure will improve route capacity between the main urban areas and thus support economic and housing growth within the study area.

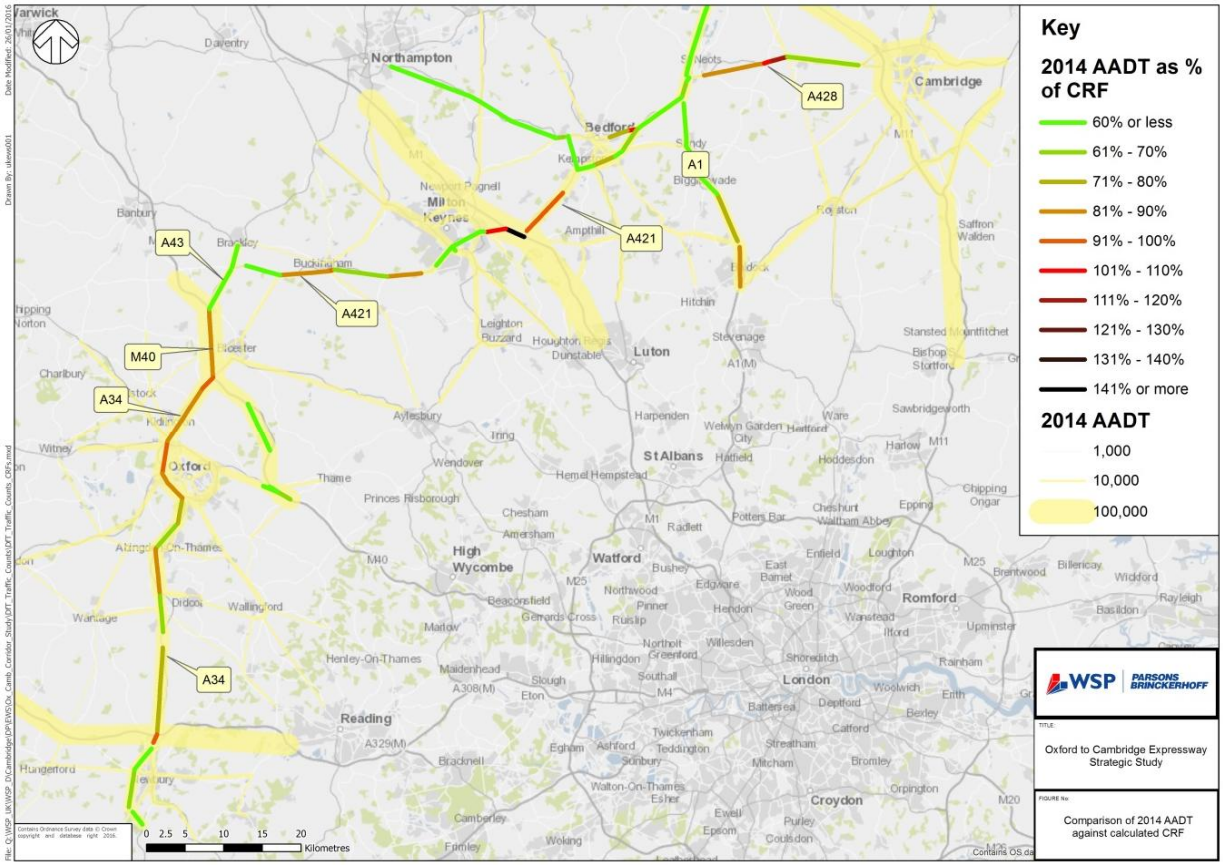
2.5.47 In order to understand route capacity, the Congestion Reference Flow (CRF) has been calculated for road links within the Oxford to Cambridge corridor. The CRF is an estimate of the AADT flow at which the hourly traffic demand is likely to exceed the maximum sustainable hourly throughput of the link. The CRF has been calculated using Design Manual for Roads and Bridges (DMRB) 46/97 Traffic Flow Ranges for Use in the Assessment of New Rural Roads.

2.5.48 This assessment considers performance of carriageway links along the Oxford to Cambridge corridor and therefore does not take into account junction delays. This CRF assessment should therefore be treated as a high level appraisal of congestion as the capacity in the network is a product of both link and junction capacity.

2.5.49 The CRF for each link has been calculated using the latest 12 hour traffic flows released by the DfT. For links where 2014 traffic flow data was not available, older traffic flow data has been used. It should be noted that older traffic flow data may not necessarily reflect recent changes in the composition or profile of traffic along any particular link (e.g. increase in the proportion of HGVs or increase in traffic along the link at the weekend) and as such the CRF may not be representative of current travel patterns along the link.

2.5.50 A comparison of the 2014 AADT against the calculated CRF for road links along the Oxford to Cambridge corridor is shown in Figure 2-22 below. Links that are likely to be operating at their maximum sustainable hourly throughput are identified in red and links that are significantly higher than the maximum sustainable hourly throughput of the link are shown in black.

Figure 2-22: 2014 AADT as a Percentage of the Calculated CRF



2.5.51 Figure 2-22 generally shows the 2014 AADT to be less than the CRF for the majority of links along the Oxford to Cambridge corridor. The only sections of the corridor where the 2014 AADT is at or exceeding the calculated CRF is the single carriageway section of the A421 between Milton Keynes and the M1 and the single carriageway section of the A428. The above analysis does not consider junction delay and as such particular links along the network that are prone to junction delay are not identified in Figure 2-22 above.

Network Operation Summary

Key Points

Existing Traffic Flows

- The M40 is the most heavily trafficked road in the east-west corridor, followed by the A34, A1 and A421 Expressway;
- The dualled section on the A421 has experienced significant levels of traffic growth (41 percent) from 2010-2014. The A421 (Milton Keynes to the A43), A428 dualled section and A43 have also experienced significant levels of traffic growth (13 percent -19 percent) during this period; and
- The traffic flow analysis demonstrates that upgrading single carriageway sections along the east-west corridor (A421 and A428) results in significant traffic growth along the widened sections.

Journey Time Reliability

- The journey time from the M4 to the A14 and vice versa typically takes 2 hours 25 minutes during the peak travel periods which is 30 minutes longer when compared to the average overnight journey time.
- In the peak hours significant levels of delay occur at the following locations:
  - **A34**: Tidal congestion inbound to Oxford in the morning and outbound in the evening, and between the Marcham and Milton interchanges;
  - **A4421/A421 (A43 to M1):** East and westbound delays on the single carriageway sections;
  - **Black Cat Roundabout:** Congestion on the A421 and A1 approaches to the roundabout; and
  - **A428 (A1 to A1198):** East and westbound delays on this single carriageway section including significant delays on approach to the Caxton Gibbet roundabout.
- The duall carriageway sections of the A428 and A421 have good levels of network resilience, with minor changes in journeys times/speed during the peak periods compared to the overnight period.
- Highways England OTRM data shows the A1 north of the Black Cat Roundabout and the single carriageway section of the A428 east of the A1 suffer from a journey time reliability of 65 percent or less.

Capacity Assessment

- The majority of links along the Oxford to Cambridge corridor have a 2014 AADT less than the calculated CRF for that particular link.
- 2014 AADTs exceed the calculated CRF on the single carriageway section of the A421 between Milton Keynes and the M1 and single carriageway section of the A428.
- There is likely to be a breakdown of traffic flows and delay due to the volumes of traffic using the single carriageway section of the A421 between Milton Keynes and the M1 and single carriageway section of the A428.

2.6 Network Safety

Strategic Imperative

The evidence base shows that sections of the east-west route suffer from a relatively poor safety record when compared to national trends. In particular, the single carriageway sections of the A421 and A428 have a higher accident rate when compared to the dual carriageway standard route sections.

New Expressway standard east-west strategic road infrastructure will result in corridor safety benefits by accommodating traffic movements on a higher standard route which provides a lower accident rate when compared to the existing single carriageway route sections.

2.6.1 This section provides a summary of the current network safety context associated with operational conditions on the primary east-west route. Personal injury accident records along the primary Oxford to Cambridge route have been reviewed for the five year period between January 2010 and December 2014, the latest period for which STATS 19 personal injury accident data has been released by DfT.

2.6.2 Only personal injury accidents recorded on A Roads and Motorways along the Oxford to Cambridge route have been reviewed. Plans showing the location, number and severity of personal injury accidents along the primary east-west route are provided in Appendix 12, with a summary by section provided in Tables 2-21 to 2-27.

Table 2-21: Section 1 A34 (M4 to M40) Personal Injury Accident Summary

YEAR	FATAL	SERIOUS	SLIGHT	TOTAL
2010	12	66	230	308
2011	3	104	392	499
2012	3	66	379	448
2013	4	74	300	378
2014	10	37	303	350
5 Year Annual Average	**6.4**	**69.4**	**320.8**	**396.6**

2.6.3 Table 2-21 shows that overall the total number of accidents has increased on the A34 from 2010 to 2014. During the 5 year period, the total number of accidents increased from 2010 to 2012 and has since been reducing. The number of fatal accidents increased significantly in 2014 compared to the number recorded in the period 2011 to 2013 and is almost as high as the number of fatal accidents recorded in 2010. Serious and slight accidents have shown a steadily declining trend since the 2011 peak of 104 and 392 respectively.

Table 2-22: Section 2a M40 (Junction 9 to 10) and A43 (M40 Junction 10 to A421) Personal Injury Accident Summary

YEAR	M40				A43			
	FATAL	SERIOUS	SLIGHT	TOTAL	FATAL	SERIOUS	SLIGHT	TOTAL
2010	3	17	150	170	0	0	37	37
2011	9	5	63	77	0	0	34	34
2012	0	17	39	56	0	0	29	29
2013	0	6	31	37	0	0	21	21
2014	2	0	74	76	0	2	27	29
5 Year Annual Average	**2.8**	**9.0**	**71.4**	**83.2**	**0**	**0.4**	**29.6**	**30.0**

2.6.4 Table 2-22 shows that on the M40 (Junction 9 to 10), the number of fatal accidents peaked in 2011 and has since declined to 2 accidents in 2014. The number of serious accidents per year has varied during the analysis period, ranging from 17 in 2010 and 2011 to 0 in 2014. Slight severity accidents have declined between 2010 and 2013, but then increased significantly in 2014.

2.6.5 There have been no recorded fatal accidents on the A43 within the study area, in the five year analysis period. There were two serious accidents in 2014, but none in the previous four years. Over the 5 year period the number of slight severity accidents has reduced from 37 to 27.

Table 2-23: Section 2b – A41 (M40 Junction 9 to A4421) and A4421 (A41 to A421) Personal Injury Accident Summary

YEAR	A41				A4421			
	FATAL	SERIOUS	SLIGHT	TOTAL	FATAL	SERIOUS	SLIGHT	TOTAL
2010	0	0	29	29	1	3	15	19
2011	0	8	41	49	0	0	27	27
2012	0	1	34	35	2	12	26	40
2013	0	9	43	52	0	3	34	37
2014	0	0	32	32	0	13	15	28
5 Year Annual Average	**0**	**3.6**	**35.8**	**39.4**	**0.6**	**6.2**	**23.4**	**30.2**

2.6.6 Table 2-23 shows that there have been no fatal accidents recorded on the A41 during the assessment period. There have been a number of serious accident in 2011 (8) and 2013 (9) but none recorded in 2014. For slight accidents, the number of accidents has increased slightly from 2010 (29 accidents) to 2014 (32 accidents).

2.6.7 The number of serious severity accidents on the A4421 has fluctuated during the analysis period. In 2010 there were 3 recorded serious accidents, 12 in 2012, 3 in 2013 and then 13 in 2014. The number of slight severity accidents has also fluctuated year to year and in 2014 reached to same number as 2010 (15 accidents).

Table 2-24: Section 3 – A421 (A43 to M1 Junction 13) Personal Injury Accident Summary

YEAR	FATAL	SERIOUS	SLIGHT	TOTAL
2010	0	66	148	214
2011	1	27	238	266
2012	2	52	231	285
2013	0	62	238	300
2014	0	30	230	260
5 Year Annual Average	**0.6**	**47.4**	**217.0**	**265.0**

2.6.8 Table 2-24 shows that on the A421 (A43 to M1) there have been no fatal accidents between 2013 and 2014. Overall the number of serious severity accidents has halved from 66 in 2010 to 30 in 2014. The number of slight severity accidents has remained relatively consistent between 2011 and 2014.

Table 2-25: Section 4 – A421 (M1 Junction 13 to A1 Black Cat Roundabout) Personal Injury Accident Summary

YEAR	FATAL	SERIOUS	SLIGHT	TOTAL
2010	0	35	79	114
2011	6	8	64	78
2012	0	15	101	116
2013	4	3	43	50
2014	0	20	111	131
5 Year Annual Average	**2.0**	**16.2**	**79.6**	**97.8**

2.6.9 Table 2-25 indicates that the section of the A421 (M1 to A1) has seen a fluctuations in the number of accidents per year. In 2010, 2011 and 2014 a higher number of accidents were recorded compared to 2011 and 2013. Over all the number of accidents has increased from 2010 to 2014. Generally the number of serious accidents has decreased, whilst the number of slight severity accidents has increased.

Table 2-26: Section 5 – A1 (Black Cat Roundabout to A428) and A428 (A1 to A1198) Personal Injury Accident Summary

YEAR	A1				A428			
	FATAL	SERIOUS	SLIGHT	TOTAL	FATAL	SERIOUS	SLIGHT	TOTAL
2010	0	16	22	38	0	31	46	77
2011	0	2	24	26	0	2	42	44
2012	0	0	13	13	3	14	71	88
2013	0	0	37	37	0	6	32	38
2014	0	0	36	36	0	20	50	70
5 Year Annual Average	**0**	**3.6**	**26.4**	**30.0**	**0.6**	**14.6**	**48.2**	**63.4**

2.6.10 Table 2-26 shows that there have been no fatal accidents on this short stretch of the A1 in the five year period from 2010 to 2014 and no serious accidents between 2012 and 2014. However, the number of slight accidents has shown an upward trend from 22 accidents in 2010 to 36 in 2014.

2.6.11 The single carriageway section of the A428 has seen a fluctuation in the number of accidents per year during the analysis period. In 2010, 2012 and 2014 the total number of accidents was significantly higher than 2011 and 2013. From 2013 to 2014 there has been an upward trend in the number of serious and slight severity accidents.

Table 2-27: Section 6 – A428 (A1198 to A14 Girton Interchange) Personal Injury Accident Summary

YEAR	FATAL	SERIOUS	SLIGHT	TOTAL
2010	8	10	29	47
2011	0	2	11	13
2012	0	2	23	25
2013	0	0	15	15
2014	0	2	33	35
5 Year Annual Average	**1.6**	**3.2**	**22.2**	**27.0**

2.6.12 Table 2-27 shows that from 2010 to 2014 there has been a significant reduction in the number fatal and serious accidents on the A428 Expressway. The number of slight severity accidents has not shown a consistent downward trend. Over the 5 year period the number of slight severity accidents has increased from 29 in 2010 to 33 in 2014.

2.6.13 In order to determine the relative safety performance of the primary east-west route, taking into account traffic flows, the number of accidents per billion vehicle kilometres travelled have been calculated and compared to an average value for Great Britain (GB) per road classification. Where the value in each section of road is in excess of the GB average, the values are highlighted in red. A summary of the accident rates per billion vehicle kilometres (bvkm) for each of the six main route sections are shown in Tables 2-28 to 2-33.

Table 2-28: Section 1 Comparison of GB and Route Section Accident Rate per Billion Vehicle Km.

SECTION	ROAD	YEAR	GB AVERAGE			ROAD SECTION AVERAGE		
			Fatal accidents per bvkm	Serious accidents per bvkm	Slight accidents per bvkm	Fatal accidents per bvkm	Serious accidents per bvkm	Slight accidents per bvkm
1	A34	2010	8.0	73.2	519.9	10.1	55.6	193.9
		2011	8.7	75.8	511.0	2.5	87.3	329.2
		2012	7.4	74.5	497.1	2.6	57.6	330.5
		2013	7.5	71.5	476.3	3.3	61.2	248.3
		2014	7.4	74.1	495.3	8.3	30.9	252.9
		Avg	**7.8**	**73.8**	**499.9**	**5.4**	**58.5**	**271.0**

2.6.14 Table 2-28 shows that for the A34 the fatal accident rate was in excess of the GB average for this type of road in 2010 and 2014. The serious accident rate was in excess of the GB average in 2011. Taking into consideration the high flow volumes on the A34, the slight severity accident rate is below the GB average. Over the 5 year review period the average accident rate has been below the GB average.

Table 2-29: Section 2a and 2b Comparison of GB and Route Section Accident Rate per Billion Vehicle Km.

SECTION	ROAD	YEAR	GB AVERAGE			ROAD SECTION AVERAGE		
			Fatal accidents per bvkm	Serious accidents per bvkm	Slight accidents per bvkm	Fatal accidents per bvkm	Serious accidents per bvkm	Slight accidents per bvkm
2a	M40	2010	2.7	14.2	126.5	8.2	46.4	409.4
		2011	2.3	12.4	115.0	27.7	15.4	194.2
		2012	1.8	11.4	110.0	0.0	46.3	106.2
		2013	2.1	11.4	103.4	0.0	16.9	87.1
		2014	1.8	12.5	106.9	6.1	0.0	224.1
		Avg	**2.1**	**12.4**	**112.3**	**8.4**	**25.0**	**204.2**
	A43	2010	8.0	73.2	519.9	0.0	0.0	534.3
		2011	8.7	75.8	511.0	0.0	0.0	493.3
		2012	7.4	74.5	497.1	0.0	0.0	440.1
		2013	7.5	71.5	476.3	0.0	0.0	318.5
		2014	7.4	74.1	495.3	0.0	26.2	353.6
		Avg	**7.8**	**73.8**	**499.9**	**0.0**	**5.2**	**427.9**
2b	A41	2010	8.0	73.2	519.9	0.0	0.0	577.9
		2011	8.7	75.8	511.0	0.0	161.0	825.3
		2012	7.4	74.5	497.1	0.0	20.2	686.8
		2013	7.5	71.5	476.3	0.0	182.4	871.3
		2014	7.4	74.1	495.3	0.0	0.0	634.4
		Avg	**7.8**	**73.8**	**499.9**	**0.0**	**72.7**	**719.1**
	A4421	2010	8.0	73.2	519.9	16.4	49.2	246.2
		2011	8.7	75.8	511.0	0.0	0.0	438.2
		2012	7.4	74.5	497.1	33.5	201.0	435.5
		2013	7.5	71.5	476.3	0.0	50.5	572.4
		2014	7.4	74.1	495.3	0.0	213.7	246.6
		Avg	**7.8**	**73.8**	**499.9**	**10.0**	**102.9**	**387.8**

2.6.15 Table 2-29 shows that for Section 2a (M40) the fatal, serious and slight accident rates exceed the GB average in 2010 and 2011. In 2012 and 2013 the serious accident rate exceeded the GB average. In 2014, the fatal and slight severity accident rate exceeded the GB average. The average accident rate along the M40 (Junction 9 to 10) for the 5 year review period exceeds the GB average. Table 2-32 shows that for Section 2a (A43) that only the slight severity average GB accident rate was exceeded in 2010. Since 2010 the accident rate has generally improved on the A43.

2.6.16 Table 2-29 shows that for Section 2b (A41) the slight accident rate exceeds the GB average for every year between 2010 and 2014. In 2011 and 2013 the serious accident rate exceeded the GB average, For Section 2b (A4421) there is a sporadic pattern of accident rates resulting in the GB average being exceeded in 2010 and 2012 for fatal severity accidents, 2012 and 2014 for serious severity accidents and 2013 for slight severity accidents.

Table 2-30: Section 3 Comparison of GB and Route Section Accident Rate per Billion Vehicle Km.

SECTION	ROAD	YEAR	GB AVERAGE			ROAD SECTION AVERAGE		
			Fatal accidents per bvkm	Serious accidents per bvkm	Slight accidents per bvkm	Fatal accidents per bvkm	Serious accidents per bvkm	Slight accidents per bvkm
3	A421	2010	8.0	73.2	519.9	0.0	205.6	460.9
		2011	8.7	75.8	511.0	3.0	80.5	709.8
		2012	7.4	74.5	497.1	5.4	140.9	626.1
		2013	7.5	71.5	476.3	0.0	162.5	624.0
		2014	7.4	74.1	495.3	0.0	78.7	603.0
		Avg	**7.8**	**73.8**	**499.9**	**1.7**	**133.6**	**604.8**

2.6.17 Table 2-30 shows that for the A421, the serious accident rate was in excess of the GB average for this type of road in all five assessment years. The slight accident rate was also in excess of the GB average for this type of road in all four of the five assessment years. This section of the route is mainly single carriageway (except through Milton Keynes where it as an urban dual carriageway) and has a high frequency of at grade junctions.

Table 2-31: Section 4 Comparison of GB and Route Section Accident Rate per Billion Vehicle Km.

SECTION	ROAD	YEAR	GB AVERAGE			ROAD SECTION AVERAGE		
			Fatal accidents per bvkm	Serious accidents per bvkm	Slight accidents per bvkm	Fatal accidents per bvkm	Serious accidents per bvkm	Slight accidents per bvkm
4	A421	2010	8.0	73.2	519.9	0.0	113.4	255.9
		2011	8.7	75.8	511.0	17.0	22.7	181.5
		2012	7.4	74.5	497.1	0.0	39.2	263.7
		2013	7.5	71.5	476.3	9.2	6.9	98.9
		2014	7.4	74.1	495.3	0.0	46.0	255.3
		Avg	**7.8**	**73.8**	**499.9**	**5.2**	**45.6**	**211.0**

2.6.18 Table 2-31 shows that the A421 Expressway has a good safety record with the serious and fatal accident rate only exceeding the GB average in 2010 and 2010 and 2013 respectively. Compared to the A421 single carriageway section (Table 2-30), there is a significant reduction in the accident rate per billion vehicle km on an Expressway standard route for all severity of accidents.

Table 2-32: Section 5 Comparison of GB and Route Section Accident Rate per Billion Vehicle Km.

SECTION	ROAD	YEAR	GB AVERAGE			ROAD SECTION AVERAGE		
			Fatal accidents per bvkm	Serious accidents per bvkm	Slight accidents per bvkm	Fatal accidents per bvkm	Serious accidents per bvkm	Slight accidents per bvkm
5	A1	2010	8.0	73.2	519.9	0.0	295.9	406.9
		2011	8.7	75.8	511.0	0.0	37.0	443.6
		2012	7.4	74.5	497.1	0.0	0.0	261.5
		2013	7.5	71.5	476.3	0.0	0.0	653.5
		2014	7.4	74.1	495.3	0.0	0.0	617.2
		Avg	**7.8**	**73.8**	**499.9**	**0.0**	**66.6**	**476.6**
	A428	2010	8.0	73.2	519.9	0.0	289.5	429.6
		2011	8.7	75.8	511.0	0.0	18.5	388.4
		2012	7.4	74.5	497.1	27.7	129.3	655.7
		2013	7.5	71.5	476.3	0.0	55.4	295.5
		2014	7.4	74.1	495.3	0.0	181.1	452.7
		Avg	**7.8**	**73.8**	**499.9**	**5.5**	**134.8**	**444.4**

2.6.19 Table 2-32 shows that for the A1, the serious accident rate was in excess of the GB average for this type of road in 2010. The slight accident rate was also in excess of the GB average for this type of road from 2013 to 2014. This section of the A1 (Black Cat to St Neots) has experienced an increased in the slight severity accident rate in the 2013-2014 period.

2.6.20 Table 2-32 shows that for the A428 single carriageway section, the fatal and slight accident rates were in excess of the GB average in 2012 only. The serious accident rate was also in excess of the GB average for this type of road in 2010, 2012 and 2014.

Table 2-33: Section 6 Comparison of GB and Route Section Accident Rate per Billion Vehicle Km.

SECTION	ROAD	YEAR	GB AVERAGE			ROAD SECTION AVERAGE		
			Fatal accidents per bvkm	Serious accidents per bvkm	Slight accidents per bvkm	Fatal accidents per bvkm	Serious accidents per bvkm	Slight accidents per bvkm
6	A428	2010	8.0	73.2	519.9	90.0	112.5	326.3
		2011	8.7	75.8	511.0	0.0	22.5	124.0
		2012	7.4	74.5	497.1	0.0	20.4	234.1
		2013	7.5	71.5	476.3	0.0	0.0	152.9
		2014	7.4	74.1	495.3	0.0	19.8	327.5
		Avg	**7.8**	**73.8**	**499.9**	**18.0**	**35.1**	**232.9**

2.6.21 Table 2-33 shows that for the A428 Expressway section has a good safety record, with the GB average accident rate only being exceeded in 2010 for fatal and serious accidents. Since 2010 the accident rate for all severity of accidents has remained below the GB average. Compare to the single carriageway section of the A428 (Table 2-32), it can be seen that the Expressway achieves a significantly lower average serious and slight accident rate per billion vehicle Km.

2.6.22 The DfT data does not include information on the contributory factors of personal injury accidents; as such the cause of these accidents cannot be inferred from this data. However, given the relatively high number of fatal accidents, it is suggested that further assessment is carried out to understand the nature of these accidents and consider whether safety improvements can be delivered as a part of the proposed options.

Network Safety Summary

Key Points

Highway Safety

- The total number of accidents on the primary east-west route has generally remained static (1,053 in 2010 and 1,047 in 2014);
- A relatively high number of fatal accidents (32) has been recorded on the A34 and the M40 (14) within the study area between 2010-2014;
- The M40 has the worst accident rate in the study area. The M40 average 5 year accident rate bvkm for slight, serious and fatal accidents exceeds to GB average;
- The A421 single carriageway has a slight and serious accident rate significantly higher than the GB average; and
- The serious and slight severity average accident rates per bvkm for the A421 and A428 single carriageways sections are significantly higher when compared to the Expressway standard sections.

2.7 Socio-Economic Context

Strategic Imperative

The evidence base shows the study area has experienced substantial growth in population. In particular the growth in working age population in Milton Keynes, Cambridge and Oxford has increased substantially when compared to the national average.

The evidence base also shows the districts within the study area are among the most economically prosperous in the UK. In particular Cambridge, Oxford and Milton Keynes are home to strong, dynamic economies generating greater value added per hour worked than the national average. These functional economic areas have a reliance on knowledge-intensive sectors, such as scientific research and advanced manufacturing which contributes disproportionately towards economic output.

The study area is a nationally important economic powerhouse that can drive forward the national economic growth agenda. Investment in the study area corridor will encourage businesses to invest in the study area, enable the delivery of new jobs and homes to the benefit of the residents, communities and the national economy as a whole.

Introduction

2.7.1 In order to gain an understanding of how the communities may potentially benefit from strategic transport investment, consideration has been given to the socio-economic characteristics of the study area. This section is structured as follows:

- Socio-Demographic Study Area Overview; and
- Oxford, Milton Keynes and Cambridge Economic Performance.

2.7.2 The socio-demographic characteristics of the study area have been reviewed at a district level to understand the broad characteristics of the population within this area. This section then focuses on the economic performance of the three main functional economic areas, Oxford, Milton Keynes and Cambridge which are located at the eastern, central and western ends of the primary east-west route under consideration.

2.7.3 Detailed analysis of the three main functional economic areas has been undertaken due to their demographic and economic significance within the study area. Oxford, Milton Keynes and Cambridge combined form the most successful and economically productive regions in the UK. A summary factsheet on key social, demographic and economic indicators for Oxford, Milton Keynes and Cambridge is provided in Appendix 13. The data presented in Appendix 13 is sourced from the Centre for Cities, Cities Outlook 2016 Research Report.

Study Area

Population and Dwellings

2.7.4 Within the districts that make up the study area there is a total population of 2,169,757 people as of 2011. Of this population, 1,421,214 or approximately two thirds of people are of working age (16 to 64 inclusive). A summary of the population for each study area district is provided in Table 2-34. The districts have been ranked in order of highest historical population growth.

Table 2-34: Study Area Districts Population – 2001 and 2011 Census

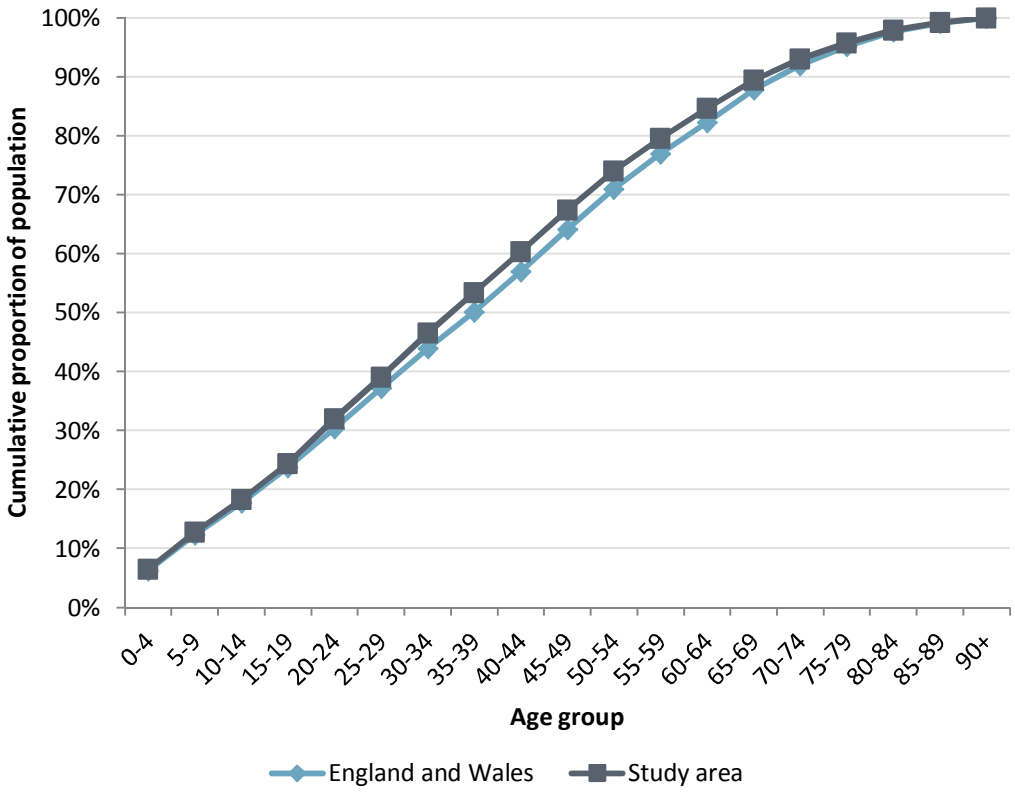
DISTRICT	POPN 2001	POPN 2011	WORKING AGE POPN 2001 (16-64)	WORKING AGE POPN 2011 (16-64)	POPN CHANGE	WORKING AGE POPN CHANGE
Milton Keynes	207,057	248,821	138,354	165,918	+ 20.2%	+ 19.9%
South Cambridgeshire	130,108	148,755	84,728	94,640	+ 14.3%	+ 11.7%
Cambridge	108,863	123,867	78,482	91,406	+13.8%	+ 16.5%
Oxford	134,248	151,906	95,315	110,085	+13.2%	+ 15.5%
West Oxfordshire	95,640	104,779	60,880	66,050	+ 9.6%	+ 8.5%
Central Bedfordshire*	233,611*	254,381	151,848	164,713	+ 8.9%	+ 8.5%
Huntingdonshire	156,954	169,508	102,567	109,857	+ 8.0%	+ 7.1%
Cherwell	131,785	141,868	86,327	91,723	+ 7.7%	+ 6.3%
South Northamptonshire	79,293	85,189	51,522	54,225	+ 7.4%	+ 5.2%
Bedford	147,911	157,479	95,248	101,003	+ 6.5%	+ 6.0%
West Berkshire	144,483	153,822	95,208	99,105	+ 6.5%	+ 4.1%
Aylesbury Vale	165,748	174,137	108,930	112,531	+ 5.1%	+ 3.3%
South Oxfordshire	128,188	134,257	82,703	83,852	+ 4.7%	+ 1.4%
Vale of White Horse	115,627	120,988	74,062	76,106	+ 4.6%	+ 2.8%
Study Area Total	**1,979,566**	**2,169,757**	**1,306,174 (66.0%)**	**1,421,214 (65.5%)**	**+ 9.6%**	**+ 8.8%**
England & Wales	**52,041,916**	**56,075,912**	**33,240,406 (63.9%)**	**36,273,707 (64.6%)**	**+ 7.8%**	**+ 9.2%**

* Formerly South and Mid Bedfordshire

2.7.5 Table 2-34 shows that historically there has been substantial population growth within the study area between 2001 and 2011, in particular Milton Keynes (+20 percent), South Cambridgeshire (+14 percent), Cambridge (+14 percent), Oxford (+13 percent) and West Oxfordshire (10 percent). There has also been substantial levels of working age population growth in Milton Keynes (+20 percent), Cambridge (+17 percent), Oxford (+16 percent) and South Cambridgeshire (+12 percent). The Census data highlights the economic importance of Cambridge, Oxford and Milton Keynes within the study area.

2.7.6 To demonstrate the age structure of the study area population, a comparison of the cumulative proportion of the population by age group within the study area has been compared to age group proportions for the population of England and Wales (Figure 2-23).

Figure 2-23: Study Area Population by Age Group



2.7.7 Figure 2-23 shows that the study area population includes a higher proportion of people aged from 20-69 years old compared to the age structure of England and Wales. This analysis demonstrates the high proportion of 'working age' people living within the study area, due to the employment opportunities available in the corridor.

2.7.8 Patterns of net internal migration have also been investigated for the main urban areas within the study area. The net migration data shows that for Oxford and Cambridge there has been a net out-migration of people aged 20-44 and a net in-migration to the surrounding districts. In Milton Keynes there has been a net in-migration of people aged 20-44.

2.7.9 The migration data shows people within the working age cohort are leaving Cambridge and Oxford to the surrounding districts. This is likely to be due to a lack of affordable housing, forcing workers to move out of these cities to purchase a property. The data for Milton Keynes shows that housing affordability is less of an issue when compared to Oxford and Cambridge, as the population of 20-44 year olds has risen. Access to affordable housing for the local labour markets within the study area is therefore considered to be an important influence on commuting patterns within the study area.

2.7.10 The historical growth in number of dwelling is presented in Table 2-35. This table has been ranked by percentage change in dwellings from 2001 to 2011.

Table 2-35: Dwellings in Study Districts – 2001 and 2011 Census

DISTRICT	NUMBER OF DWELLINGS 2001	NUMBER OF DWELLINGS 2011	CHANGE IN DWELLINGS 2001-2011
Milton Keynes	86,370	102,048	+ 18.2%
South Cambridgeshire	53,428	61,751	+ 15.6%
West Oxfordshire	39,626	45,597	+ 15.1%
Central Bedfordshire*	96,774*	108,733	+ 12.4%
Cambridge	43,793	48,835	+ 11.5%
South Northamptonshire	32,493	36,048	+ 10.9%
West Berkshire	58,473	64,657	+ 10.6%
Bedford	61,293	67,653	+ 10.4%
Huntingdonshire	64,929	71,414	+10.0%
Vale of White Horse	46,716	51,036	+ 9.2%
Aylesbury Vale	65,987	72,072	+ 9.2%
Oxford	53,156	57,695	+ 8.5%
Cherwell	54,571	59,079	+ 8.3%
South Oxfordshire	53,565	56,663	+ 5.8%
Total	**811,174**	**903,281**	**+ 11.4%**
England & Wales	**22,387,923**	**24,429,618**	**+ 9.1%**

* Formerly South and Mid Bedfordshire

2.7.11 Table 2-35 shows that Milton Keynes has experienced substantial growth in the number of dwellings (18 percent) within the study area between 2001 and 2011. Substantial levels of housing growth have also occurred in South Cambridgeshire (16 percent), West Oxfordshire (15 percent), Central Bedfordshire (12 percent) and Cambridge (12 percent). In total, 11 of the 14 districts that make up the study area have experienced a percentage growth in dwellings higher than the percentage change for England and Wales.

Employment and Affluence

2.7.12 The districts within the study area are among the more economically prosperous in the UK and an indication of this is the number of people in employment. Table 2-36 details the number of people in employment in each district ordered by percentage of working aged population in employment at the time of the 2011 Census.

Table 2-36: Employment Levels - 2011 Census

DISTRICT	POPN EMPLOYED	% POPN EMPLOYED*	EMPLOYED BY DISTANCE OF TRAVEL TO WORK			
			UNDER 10KM	10-30KM	30-60KM	OVER 60KM
West Oxfordshire	56,515	85.6%	22,123	16,631	2,839	2,563
South Northamptonshire	45,740	84.4%	15,413	13,438	3,538	2,789
South Cambridgeshire	79,139	83.6%	33,168	21,665	3,952	4,272
South Oxfordshire	70,087	83.6%	27,709	18,124	4,968	3,093
Vale of White Horse	63,181	83.0%	29,361	15,082	3,078	2,893
West Berkshire	81,679	82.4%	37,004	17,189	5,824	4,124
Cherwell	74,829	81.6%	34,219	17,251	5,450	3,768
Huntingdonshire	88,991	81.0%	34,678	25,412	6,081	6,143
Aylesbury Vale	90,724	80.6%	33,336	23,703	9,776	3,834
Central Bedfordshire	132,061	80.2%	47,175	38,851	13,363	6,048
Milton Keynes	127,783	77.0%	76,224	14,929	5,548	8,819
Bedford	75,810	75.1%	38,495	14,668	3,989	4,858
Cambridge	59,437	65.0%	39,308	4,742	1,910	3,620
Oxford	69,807	63.4%	45,564	5,886	2,949	3,478
Total	**1,115,783**	**78.5%**	**513,777 (46.0%)**	**247,571 (22.2%)**	**73,265 (6.6%)**	**60,302 (5.4%)**
England & Wales	**26,526,336**	**73.1%**	**13,850,450 (52.2%)**	**5,598,554 (21.1%)**	**1,296,748 (4.9%)**	**822,306 (3.1%)**

* % of working aged population who are in employment

2.7.13 Table 2-36 shows that 78.5 percent of the working age population within the study area were in employment in 2011, compared to 73.1 percent across England and Wales. The study area therefore benefits from high levels of economic activity. Within the study area, very high percentages of the working age population in employment occur in West Oxfordshire, South Northamptonshire, South Cambridgeshire and South Oxfordshire.

2.7.14 Cambridge and Oxford show relatively low percentage of the working age population in employment due the high number of full-time students not in employment. In Cambridge and Oxford there were 21,919 and 26,449 full time students not in employment respectively, substantially higher that the study area average of 7,547 students.

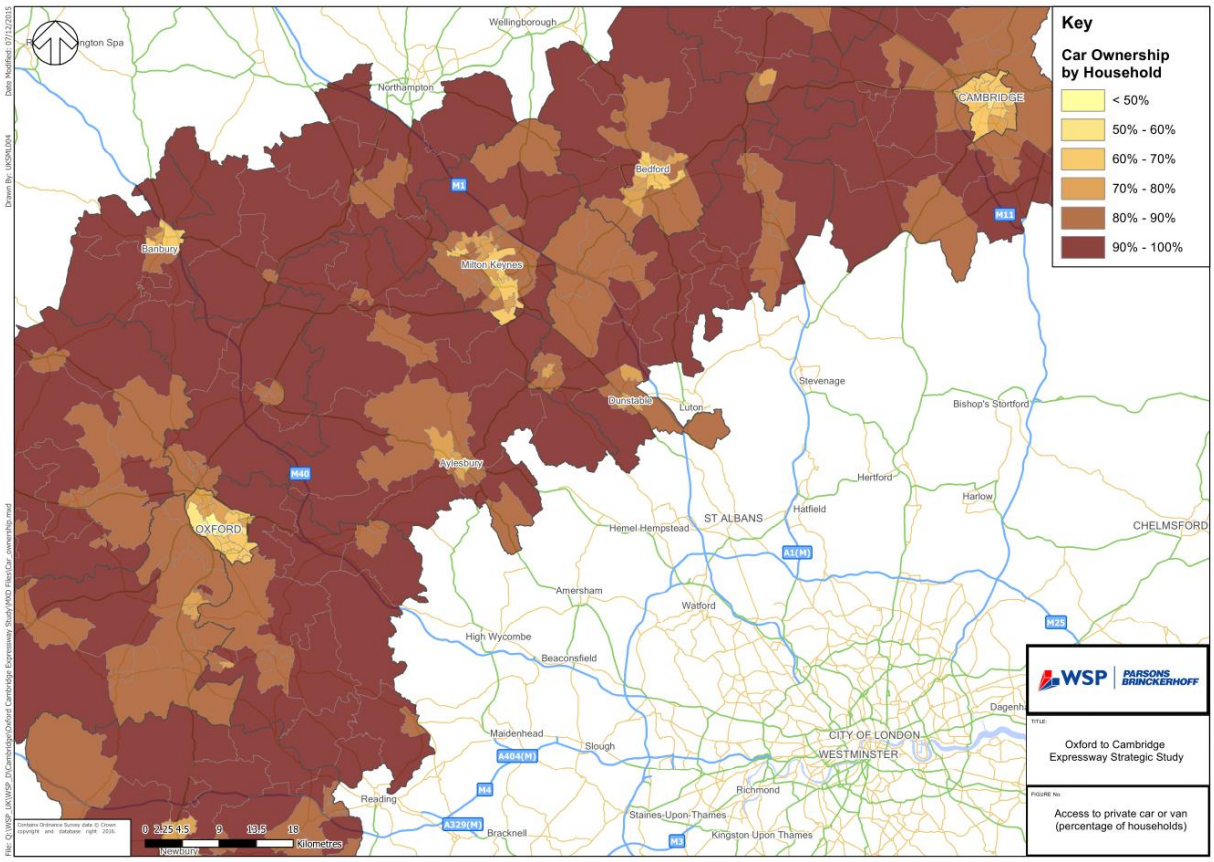
2.7.15 Table 2-36 shows that 46 percent of the employed population within the study area travel less than 10km to work. In total, 22 percent travel 10-30km and 12 percent over 30 km. Compared to the commuting distances for England and Wales, the employed population within the study area have a greater propensity to travel longer distances for work.

2.7.16 Within the study area people living in Central Bedfordshire (44 percent), South Northamptonshire (43 percent) Huntingdonshire (42 percent), Aylesbury Vale (41 percent), and South Cambridgeshire (38 percent) have the highest proportion of people travelling over 10 km to work, substantially higher than the national average (29 percent)

Car Ownership

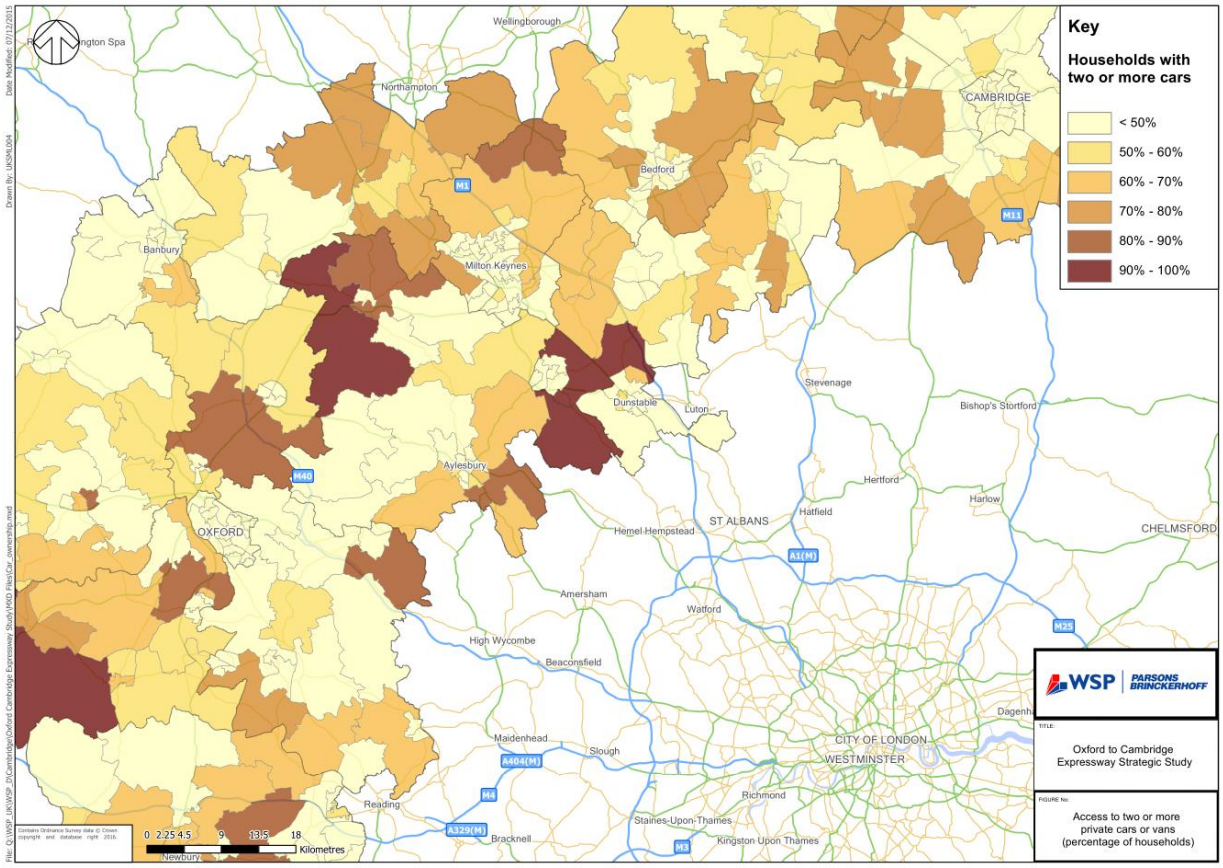
2.7.17 Levels of car ownership provide a good indicator of both wealth and travel demand. Typically, levels of car ownership are lower within cities/towns compared to rural areas due to greater access to public transport and opportunities to walk and cycle. Figures 2-24 and 2-25 show the percentage of households which have access to at least one car and two cars respectively.

Figure 2-24: Percent of Households with Access to at least One Private Car



2.7.18 Figure 2-24 shows that as expected the rural areas within the study area have a high percentage of households with access to at least one car (90 percent -100 percent). Within the main built-up areas of Oxford, Milton Keynes, Bedford and Cambridge, car ownership levels are lower due to increased opportunities to travel locally by non-car modes.

Figure 2-25: Percent of Households with Access to at least Two Private Cars



2.7.19 Figure 2-25 shows that a high proportion of households have access to at least two cars in the rural areas surrounding Oxford, Buckinghamshire, Central Bedfordshire and South Cambridgeshire. Within the urban areas of Oxford, Milton Keynes, Bedford and Cambridge, there are less than 50 percent of households with access to two cars.

Table 2-37: Car Ownership by Non-Vacant Household – 2011 Census

AREA	HOUSEHOLDS WITH ACCESS TO 1 OR MORE CARS	HOUSEHOLDS WITH ACCESS TO 2 OR MORE CARS
Study Districts	725,231 (84%)	319,626 (37%)
England & Wales	17,376,274 (74%)	7,514,632 (32%)

2.7.20 Table 2-37 shows that in total, there are 725,231 non-vacant households (84 percent) within the study area districts which have access to at least one privately owned car. In contrast, 319,626 households (37 percent) within the same districts have access to at least two privately owned cars, the majority of which are located outside of the main urban centres. The level of car ownership within the study area is above the average for England and Wales, suggesting a relatively high reliance on car travel.

Oxford, Cambridge and Milton Keynes

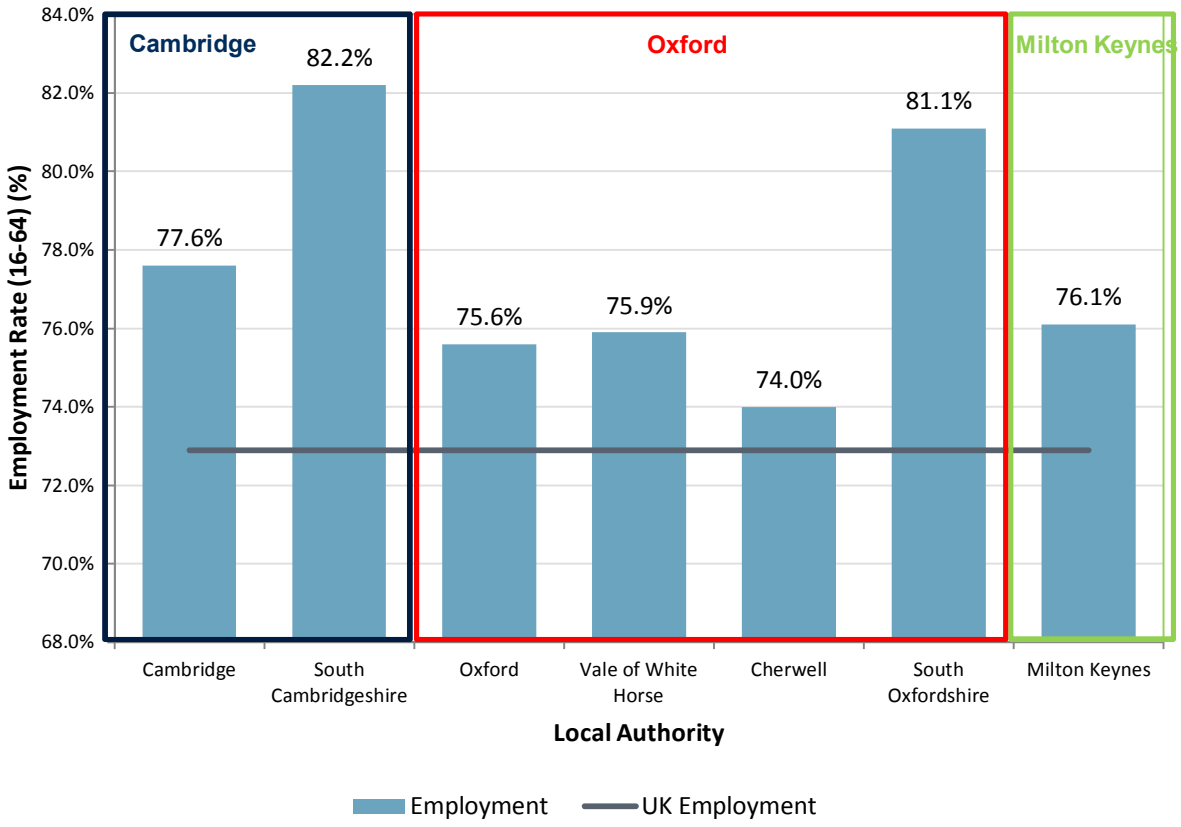
2.7.21 Analysis of 2011 Census data demonstrates that Oxford, Cambridge and Milton Keynes have experienced substantial levels of population and housing growth from 2001 to 2011. Residents within these locations also typically commute further to work, and have better accessibility to private cars, than the national average.

2.7.22 The three main functional economic areas within the study area therefore play a pivotal role in generating travel demand along the strategic road network. The definition of the functional economic areas for the purposes of this analysis is included in Appendix 14. This section of the report provides a more detailed analysis of the economies of Cambridge, Oxford and Milton Keynes in order to understand their underlying economic drivers and their importance within the national and sub-national context.

Labour Market Indicators

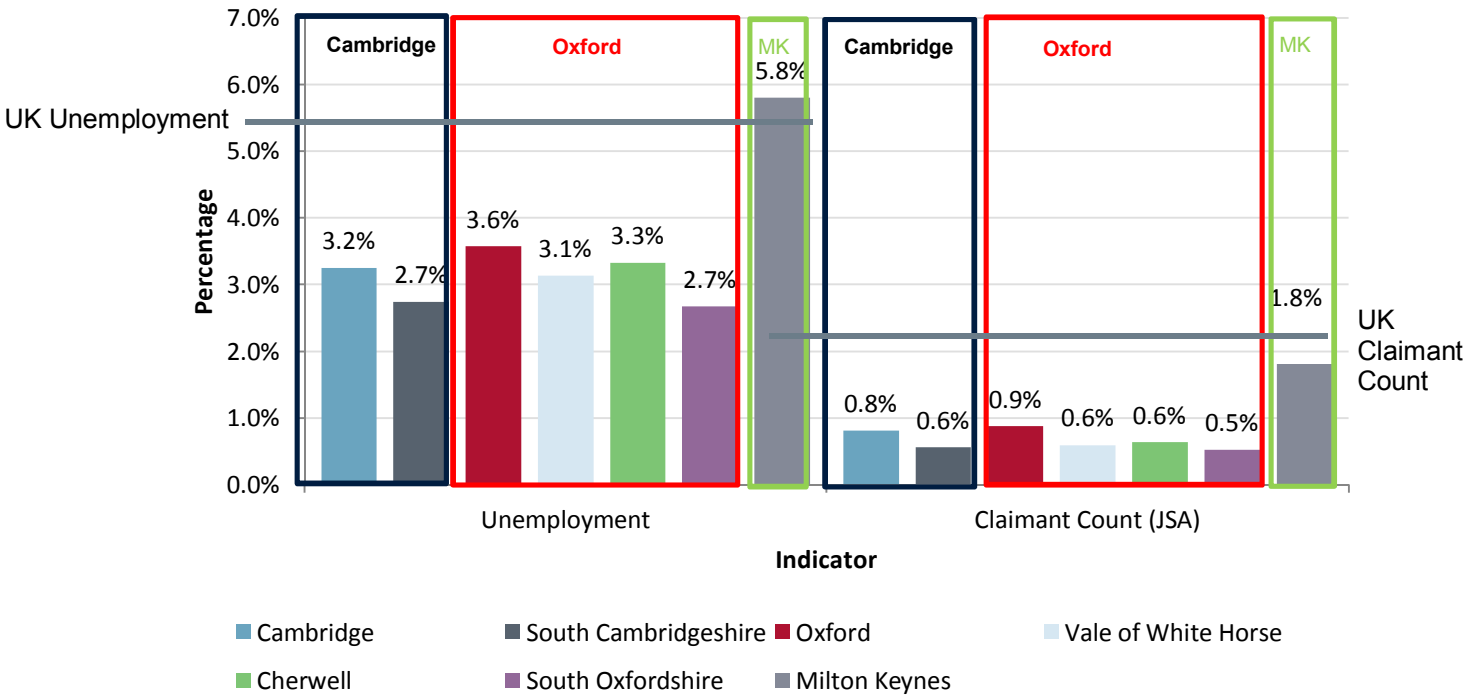
2.7.23 The employment rates for the local authorities that have been included within the Oxford, Milton Keynes and Cambridge functional economic areas are presented in Figure 2-26.

Figure 2-26: Employment Rate by Local Authority, Labour Force Survey, July 2014 – June 2015



2.7.24 Figure 2-26 demonstrates that Oxford, Milton Keynes and Cambridge possess strong labour markets, with high employment rates compared to the UK national average. The highest levels of employment occur within South Cambridgeshire and South Oxfordshire. These two districts include a range of towns and villages, popular with commuters who travel into the main urban areas of Cambridge and Oxford respectively and their 'out-of-town' Science Parks. Unemployment indicators for each local authority are presented in Figure 2-27.

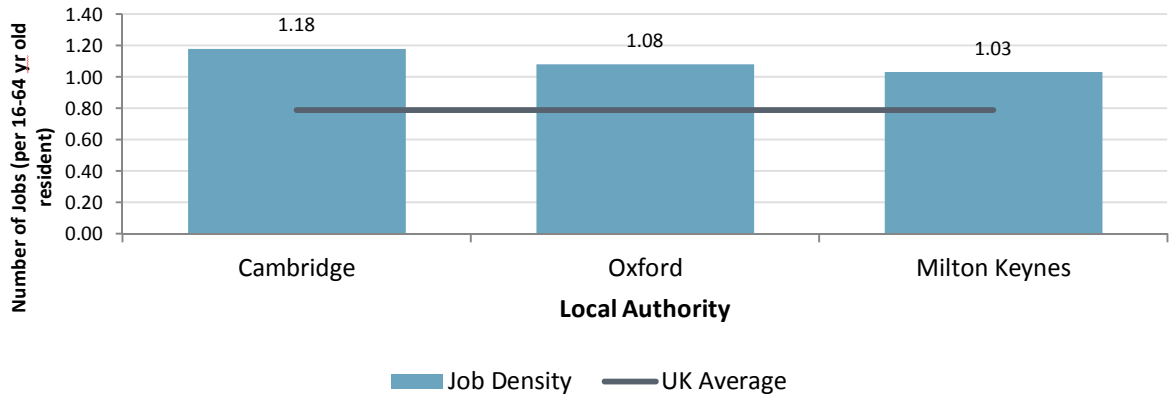
Figure 2-27 Unemployment Indicators by Local Authority, Labour Force Survey, July 2014 – June 2015



2.7.25 Both unemployment rates and Jobseeker's Allowance claimant counts within Oxford and Cambridge are well below the national average of 5.7 percent and 2.1 percent respectively. Equivalent figures for Milton Keynes are broadly in line with the national average, suggesting a weaker labour market and increased barriers to employment for local people.

2.7.26 The importance of the urban areas (see definition provided in Appendix 14) of Oxford, Milton Keynes and Cambridge as key employment centres for their hinterlands is demonstrated in Figure 2-28. Job density refers to the number of jobs per resident aged 16 to 64 within that local authority; a figure greater than 1.0 therefore indicates a significant level of inbound commuting in the area. Figure 2-28 summarises the job density of each of the three main conurbations.

Figure 2-28: Job Density by Local Authority, Labour Force Survey, July 2014 – June 2015

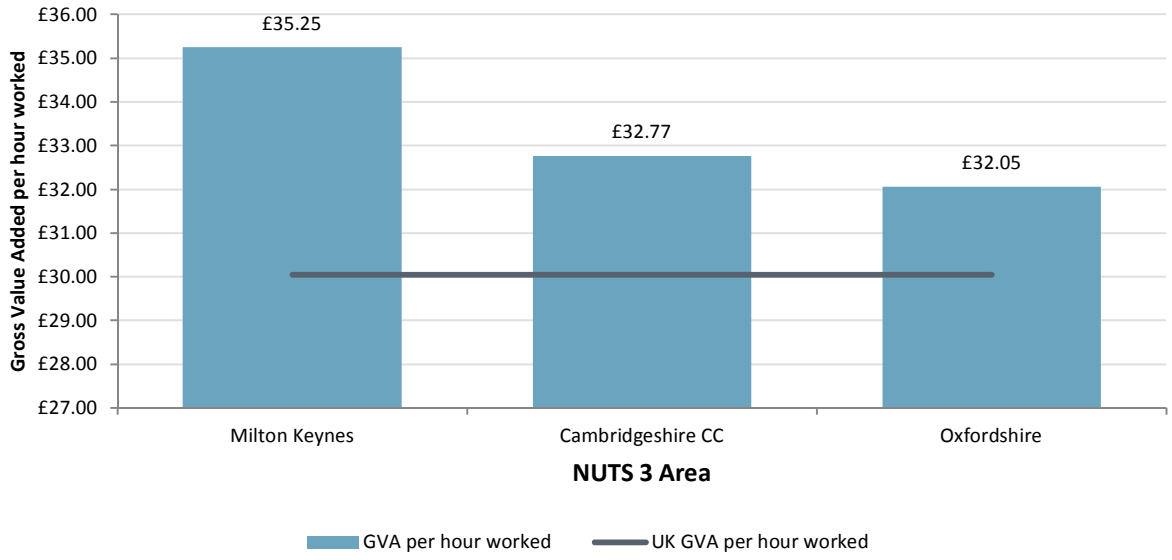


2.7.27 Figure 2-28 shows that the urban areas of Oxford, Cambridge and Milton Keynes each have more jobs than the local population aged 16-64, resulting in net in-commuting from the surrounding areas. The highest imbalance in jobs and population occurs in Cambridge, followed by Oxford and Milton Keynes.

Productivity and Affluence

2.7.28 Gross Value Added (GVA) provides an indicator of the contribution of each region to the economy. This data is only available by NUTS 3 sub-region level, as defined by the European Union. Figure 2-29 below shows the GVA per hour worked within Milton Keynes, Cambridgeshire and Oxfordshire.

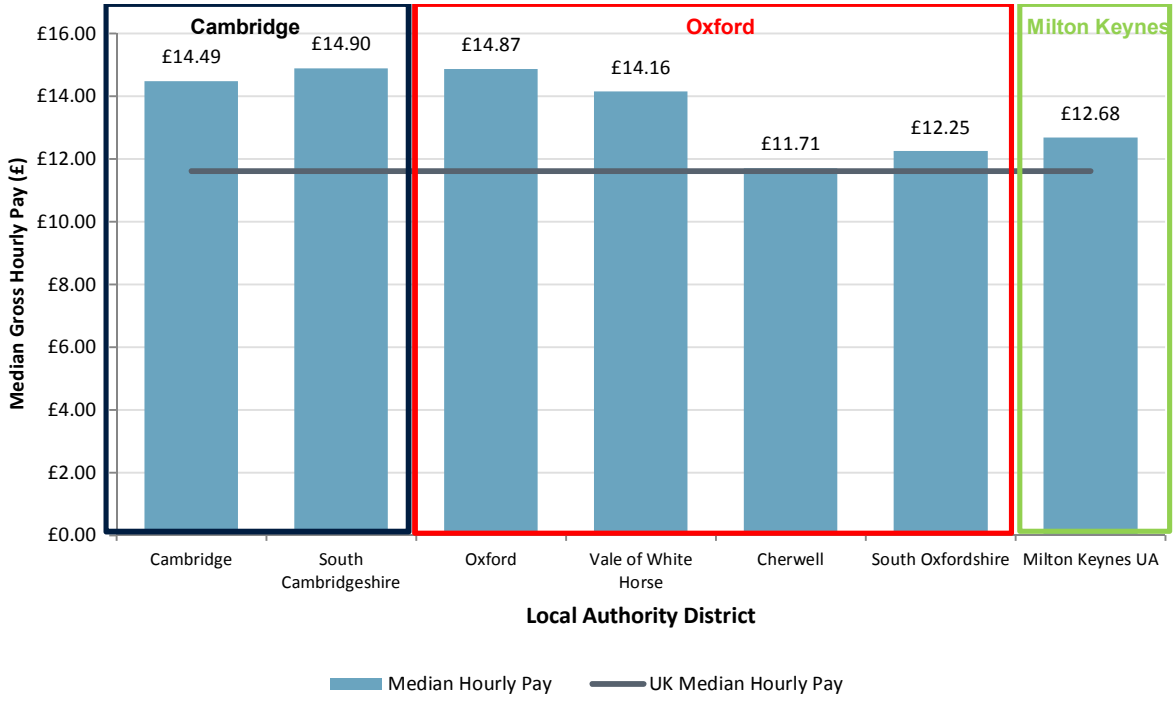
Figure 2-29: GVA per hour worked by NUTS 3 sub-region, Office for National Statistics, 2004-2013



2.7.29 Figure 2-29 shows that Cambridgeshire, Oxfordshire and Milton Keynes are home to strong, dynamic economies generating greater value added per hour worked than the national average. Within Milton Keynes, GVA per hour worked is approximately 17 percent higher than the UK average; furthermore, such increased productivity is likely to contribute towards higher wages across all local authorities which comprise the three functional economic areas.

2.7.30 The median hourly pay for the districts included within the Oxford, Milton Keynes and Cambridge functional economic regions is presented in Figure 2-30. The median hourly pay provides a good indicator for the level of workforce affluence within these three important functional economic regions.

Figure 2-30: Median Hourly Pay by Local Authority, Annual Survey of Hours and Earning, Office for National Statistics, 2014



2.7.31 Figure 2-30 demonstrates that in most cases the median hourly pay within the districts that make up the functional economic areas is higher than the UK national average. South Cambridgeshire has the highest median hourly pay, where median wages are approximately 28 percent higher than the national average, indicating the predominance of well-paid, high-skilled employment within the three functional economic regions.

Knowledge Economy

2.7.32 The economies of Cambridge, Oxford and Milton Keynes can be considered strong, with high employment rates and economies primarily consisting of well-paid, productive jobs. Much of this success can be ascribed to their strengths in the 'knowledge economy': high-value, high-skill jobs in knowledge-intensive sectors such as life sciences, advanced manufacturing and scientific research. Such roles tend to have higher wages than average employment, with employees higher up the occupational ladder in managerial, senior and director roles.

2.7.33 This section provides a more detailed analysis of the knowledge economy within the functional economic areas of Oxford, Milton Keynes and Cambridge. Fourteen 'knowledge sectors' were defined from the Business Register and Employment Survey (BRES) classification, at the 2-digit 'division' level, out of a total of 88 2-digit divisions. Such a categorization was adopted through analysis of the Strategic Economic Plans of the LEPs of each functional economic area, and identification of the core knowledge sectors which they target.

2.7.34 Since 2-digit BRES data was available at a Middle Layer Super Output Area (MSOA) scale, bespoke definitions of each functional economic area (Appendix 14) was developed based on MSOAs, equivalent to approximately 10,000 people each, which better represent the true geographical extent of each functional economic area. These were used where possible during the analysis of BRES data, and were defined for each city as follows:

- Cambridge – the functional economic area was defined as both Cambridge and South Cambridgeshire local authorities, based on the region defined in the Greater Cambridge City Deal;
- Oxford – the functional economic area included the entirety of Oxford and MSOAs along a 'knowledge spine' from Bicester to Didcot, as outlined by OxLEP; and
- Milton Keynes – the functional economic area was defined as all of the Milton Keynes local authority, excluding two MSOAs to the north comprised entirely of small rural villages.

2.7.35 Table 2-38 summarises the combined number of Knowledge Economy jobs by sector in Oxford, Milton Keynes and Cambridge functional economic areas, and identifies the fourteen knowledge sectors defined for the study.

Table 2-38: Number of Knowledge Jobs per Sector in the Three Functional Economic Areas, Business Register and Employment Survey, 2014

CODE	SECTOR	TOTAL JOBS (OXFORD, MILTON KEYNES, CAMBRIDGE)
26	Manufacture of computer, electronic and optical products	5,037
28	Manufacture of machinery and equipment n.e.c.	2,842
29	Manufacture of motor vehicles, trailers and semi-trailers	3,717
30	Manufacture of other transport equipment	1,645
58	Publishing activities	7,488
61	Telecommunications	4,355
62	Computer programming, consultancy and related activities	20,533
63	Information service activities	2,354
71	Architectural and engineering activities; technical testing and analysis	13,380
72	Scientific research and development	17,200
73	Advertising and market research	3,098
74	Other professions, scientific and technical activities	3,128
75	Veterinary activities	789
90	Creative, arts and entertainment activities	1,117

2.7.36 Clearly, the knowledge economy forms a key source of employment across the three functional economic areas, employing in excess of 86,000 people. Employment is especially focused within scientific research and development, computer programming and telecommunications activities, and architecture and engineering, which collectively account for 60 percent of employment within the knowledge economy.

2.7.37 Figure 2-31 highlights the percentage of the workforce employed in the fourteen 'knowledge sectors' by local authority level for England and Wales. Almost every local authority within the Oxford – Cambridge study area, an arc north-west of London broadly following the strategic corridor, more than 10 percent of the population – above the national average – is employed within a knowledge sector under the BRES classification. Within South Cambridgeshire, 29.6 percent of workers are employed within a knowledge sector, the highest figure for a local authority within England and Wales.

Figure 2-31: Percentage of Workforce Employed in Knowledge Jobs by Local Authority, Business Register and Employment Survey, 2014

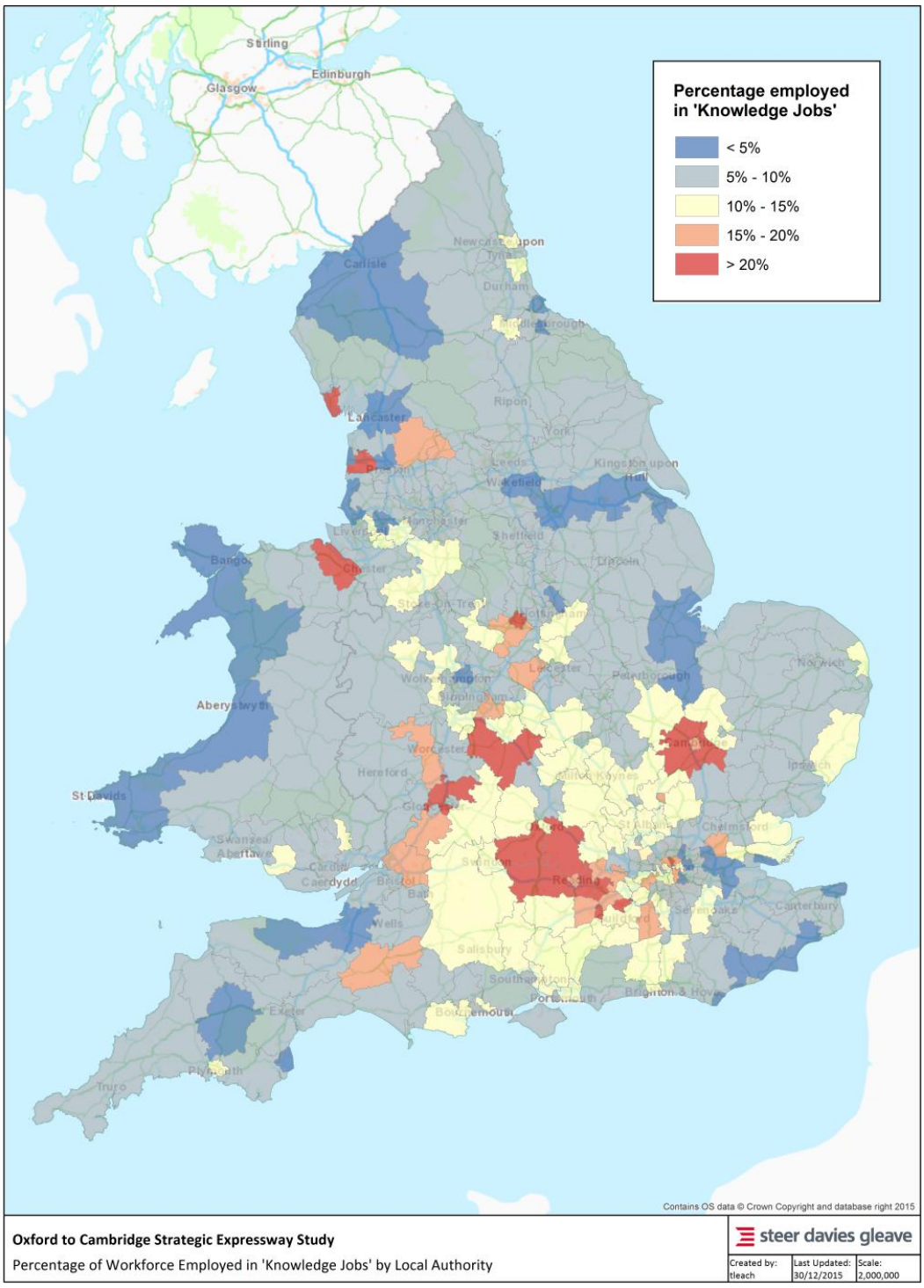
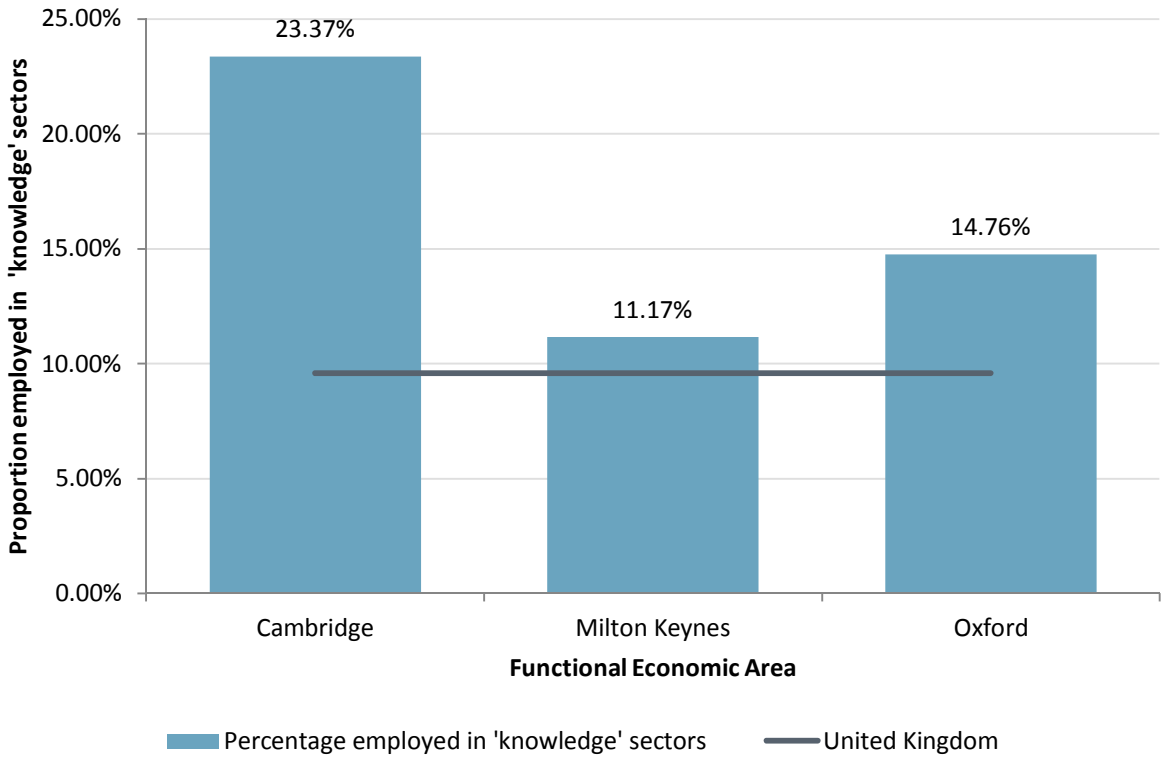


Figure 2-32: Percentage of Workforce Employed in Knowledge Jobs in Cambridge, Milton Keynes and Oxford, Business Register and Employment Survey, 2014



2.7.38 Similarly, Figure 2-32 highlights that the percentage of the workforce employed within the knowledge economy within the Oxford and Cambridge functional economic areas is substantially above – in the latter case more than double – the national average of 9.6 percent. Both cities benefit greatly from their world-leading universities, which contribute towards a clustering of high-skilled talent within both cities. Graduates of both Oxford and Cambridge Universities frequently move permanently to both cities following their studies in order to seek employment in knowledge-intensive sectors, and the research associated with the universities directly similarly contributes towards a pool of talent.

2.7.39 Figures 2-33 to 2-35 outline the sectoral breakdown of the knowledge economy in each of the three functional economic areas. Each figure highlights the location quotient of each BRES sector – the percentage employed in each BRES sector weighted against the national average – together with the total number employed in each BRES sector.

Figure 2-33: Location Quotients of Knowledge Sectors within the Cambridge Functional Economic Areas, Business Register and Employment Survey, 2014

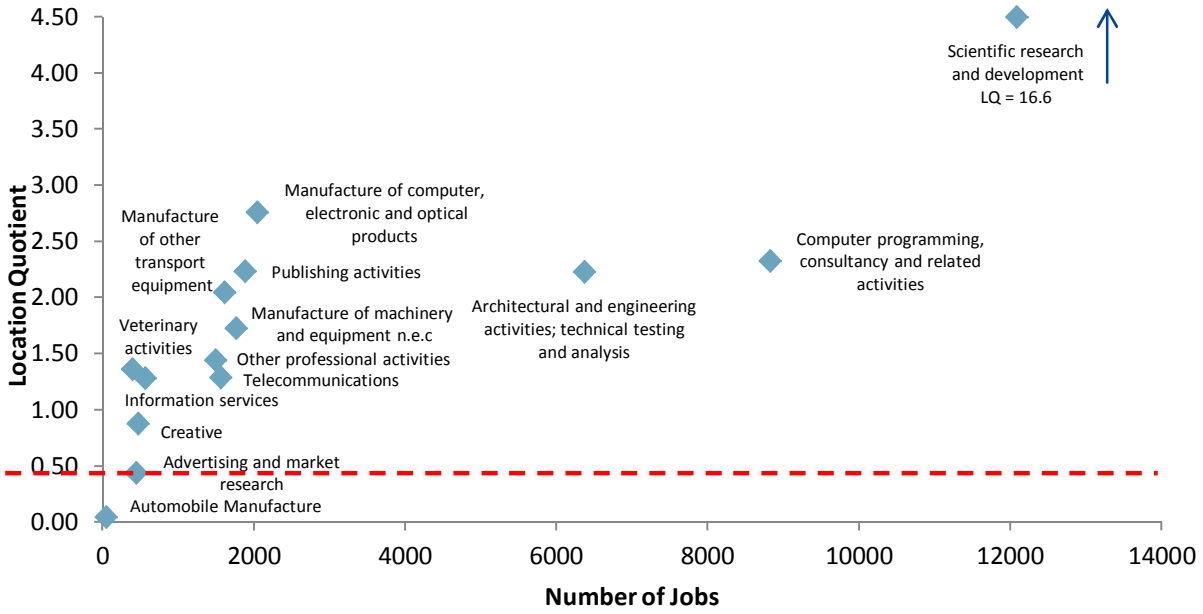


Figure 2-34: Location Quotients of Knowledge Sectors within the Oxford Functional Economic Areas, Business Register and Employment Survey 2014

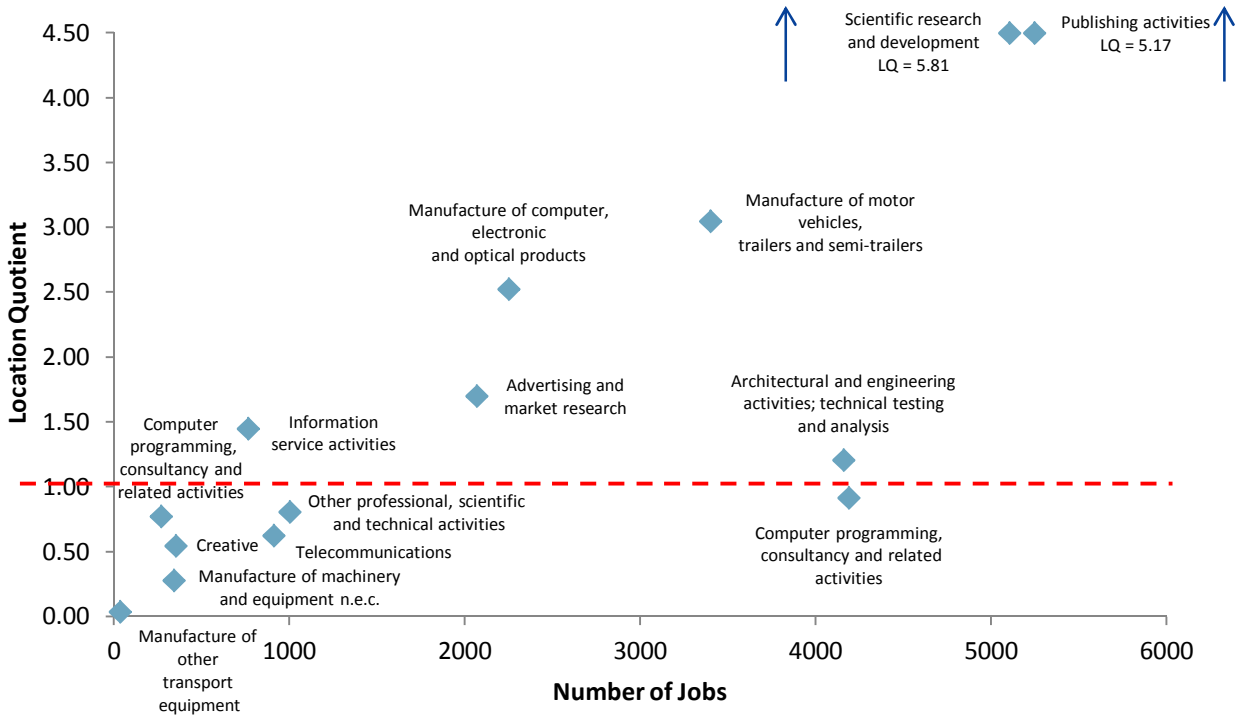
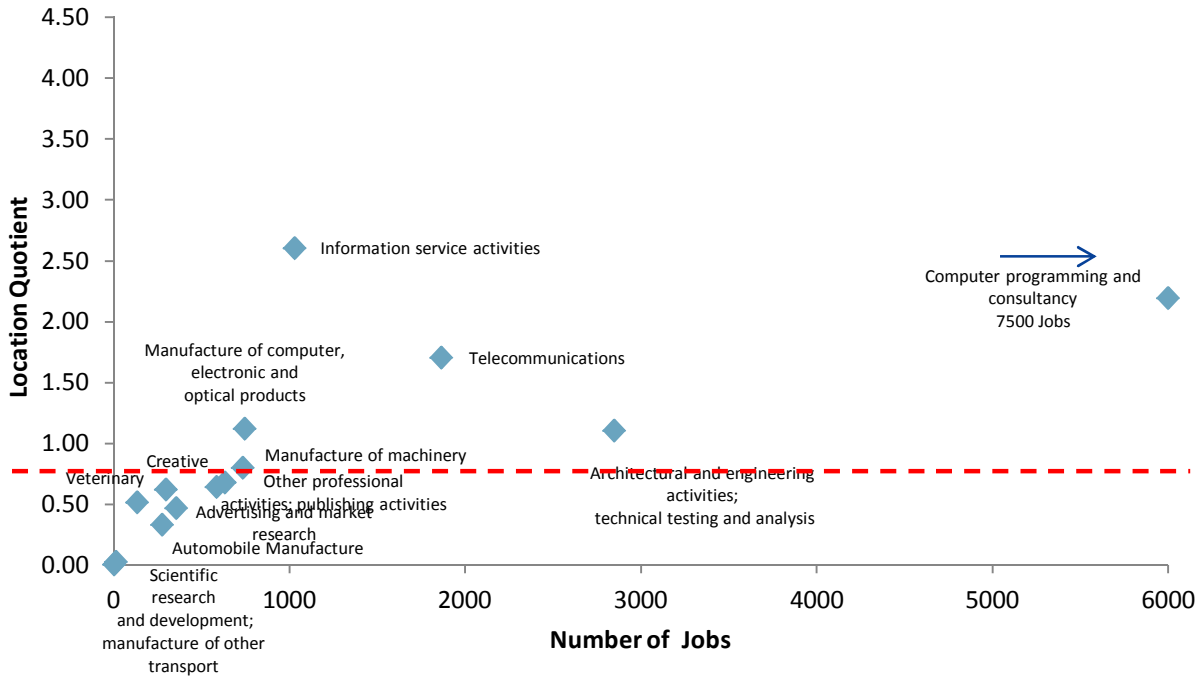


Figure 2-35: Location Quotients of Knowledge Sectors within the Milton Keynes Functional Economic Areas, Business Register and Employment Survey, 2014



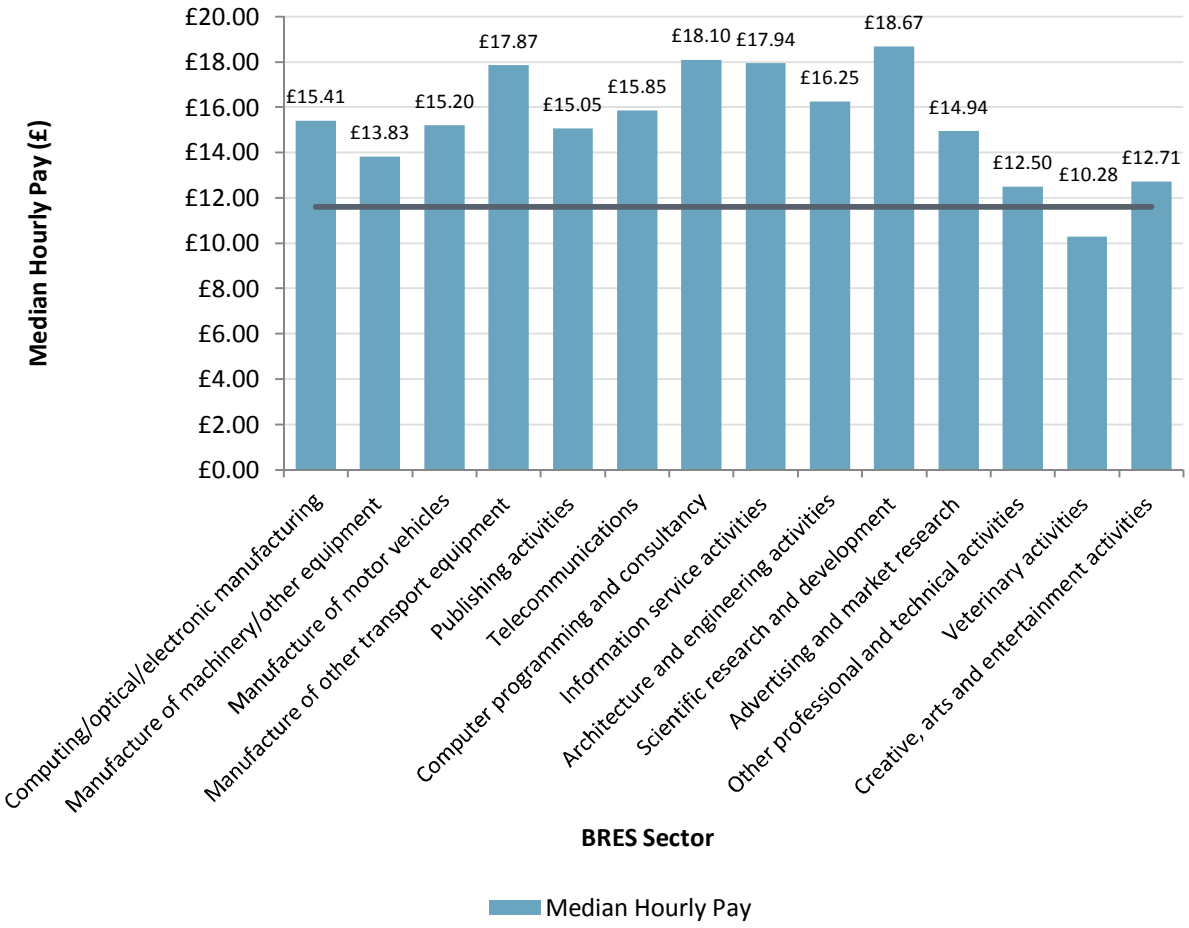
2.7.40 Within the Cambridge functional economic area, key knowledge sectors include scientific research and development, with approximately 12,000 employees, computer programming, consultancy and related activities with 8,900 employees, and architectural and engineering activities, technical testing and analysis with 6,300 employees. Key employment sites include the Cambridge Science Park – established by Trinity College – located to the north-east of Cambridge, and the Cambridge Biomedical Campus, an extension of the existing biomedical cluster centred on Addenbrooke's Hospital to the south-east of the city. Scientific research and development is especially concentrated within these out-of-town sites, in close proximity to strategic road links, together with the office park at Granta Park, near the A11/M11 motorway junction.

2.7.41 Oxford is also home to a diverse knowledge sector, albeit one less dominated by scientific research than Cambridge. Approximately five times the national average proportion of employment is within scientific research (compared to 16 times in Cambridge) and the publishing sector, with 5,200 and 5,100 employed within each respectively. Employment within scientific research is dominated by the Harwell Science and Innovation Campus and 'Science Vale' located in the south of the region neighbouring the A34, home to the UK Atomic Energy Authority, the European Space Agency and the Medical Research Council, while publishing is focused within the MSOA containing New Botley, immediately to the west of the City Centre. Motor vehicle manufacturing, employing approximately 3,400 people, also forms a key sector, focused at the BMW Mini manufacturing plant in Cowley in South Oxford.

2.7.42 While Milton Keynes is home to fewer 'knowledge' jobs (17,055) compared to Cambridge (39,515) and Oxford (30,093), key sectors include IT and telecommunications. 7,600 are employed within computer programming, consultancy and related activities, 1,900 within telecommunications and 3,000 within architectural and engineering activities, and technical testing. Knowledge-intensive employment is spread across the city, within numerous small business parks and industrial estates, with the City Centre also playing an important role.

2.7.43 Crucially, knowledge sectors contribute disproportionately towards economic output, producing high-value, high-skill jobs that tend to have higher wages than average employment, with employees higher up the occupational ladder in managerial, senior and director roles. Figure 2-36 summarises the median hourly pay by BRES knowledge sector:

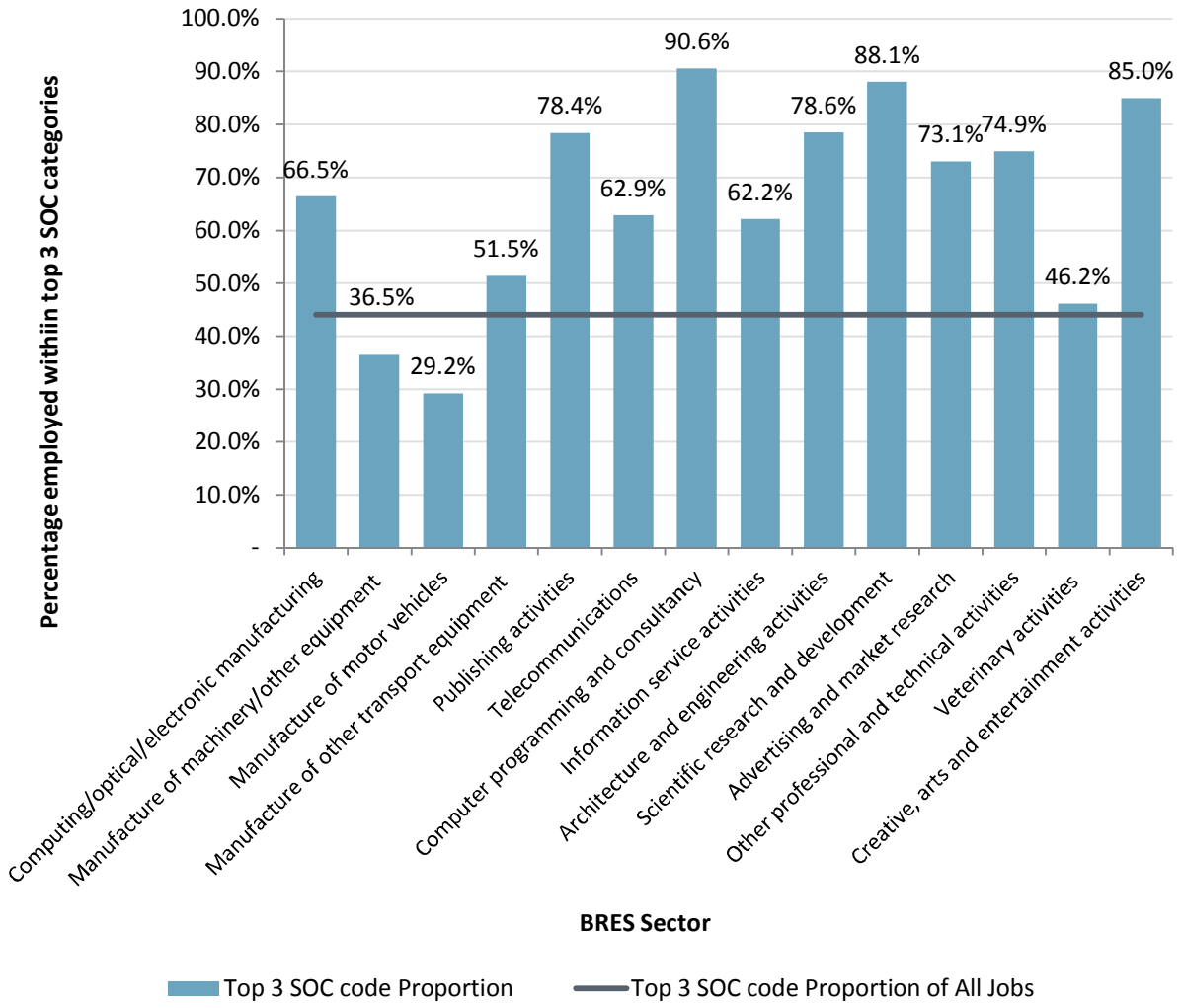
Figure 2-36: Median Hourly Pay by Knowledge Sector, Annual Survey of Hours and Earnings, Office for National Statistics, 2014



2.7.44 Clearly, knowledge sectors tend to have higher average wages than average UK employment; scientific research and development has a median hourly pay rate approximately 60 percent greater than the national average of £11.64. Only veterinary activities, with a median hourly pay rate of £10.28, have lower hourly wages than average employment.

2.7.45 While data is not available on GVA by BRES sector, it appears likely that high pay refers a greater value added per hour worked, and hence such BRES sectors are highly productive, partly explaining the above average regional GVA and median hourly pay levels outlined in Sections 2.7.28 and 2.7.31. Figure 2-37 outlines the proportion of employed within the upper three occupational categories – those in managerial, professional and technical occupations – in the standard occupation classification.

Figure 2-37: Percentage employed within managerial, professional and technical occupational categories by BRES industry, Business Register and Employment Survey, 2013/14

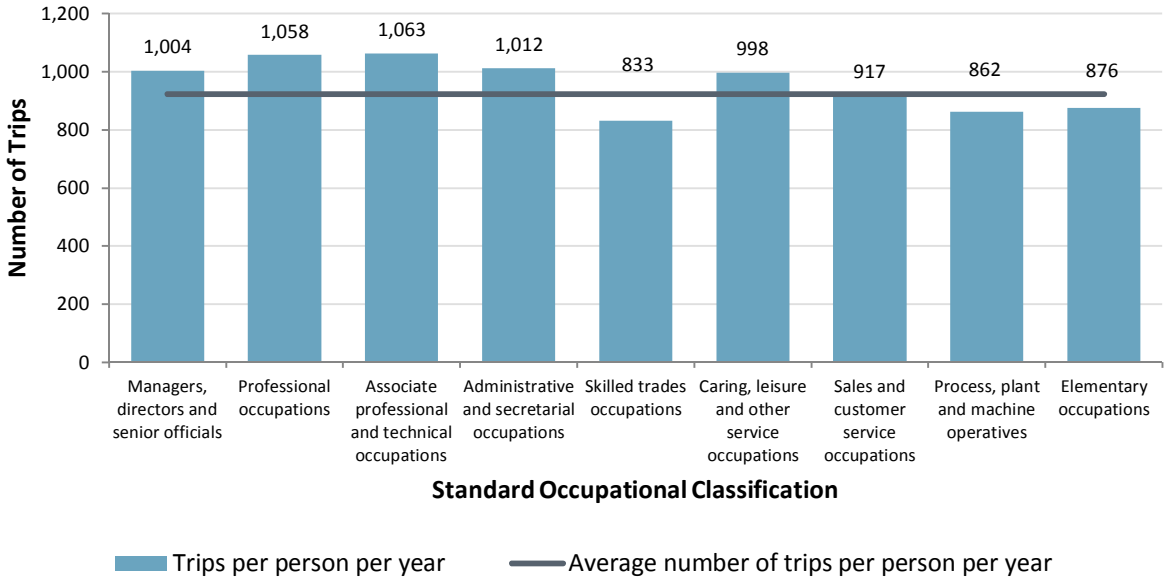


2.7.46 Employees within knowledge sectors therefore tend to be disproportionately higher up the occupational ladder, with a higher proportion of "Managers, Directors and Senior Officials", "Professional Occupations" and "Associate Professional and Technical Occupations". More than 90 percent of those employed in computer programming and consultancy are within the upper three categories, compared to 44.1 percent for average UK employment.

Propensity to Travel

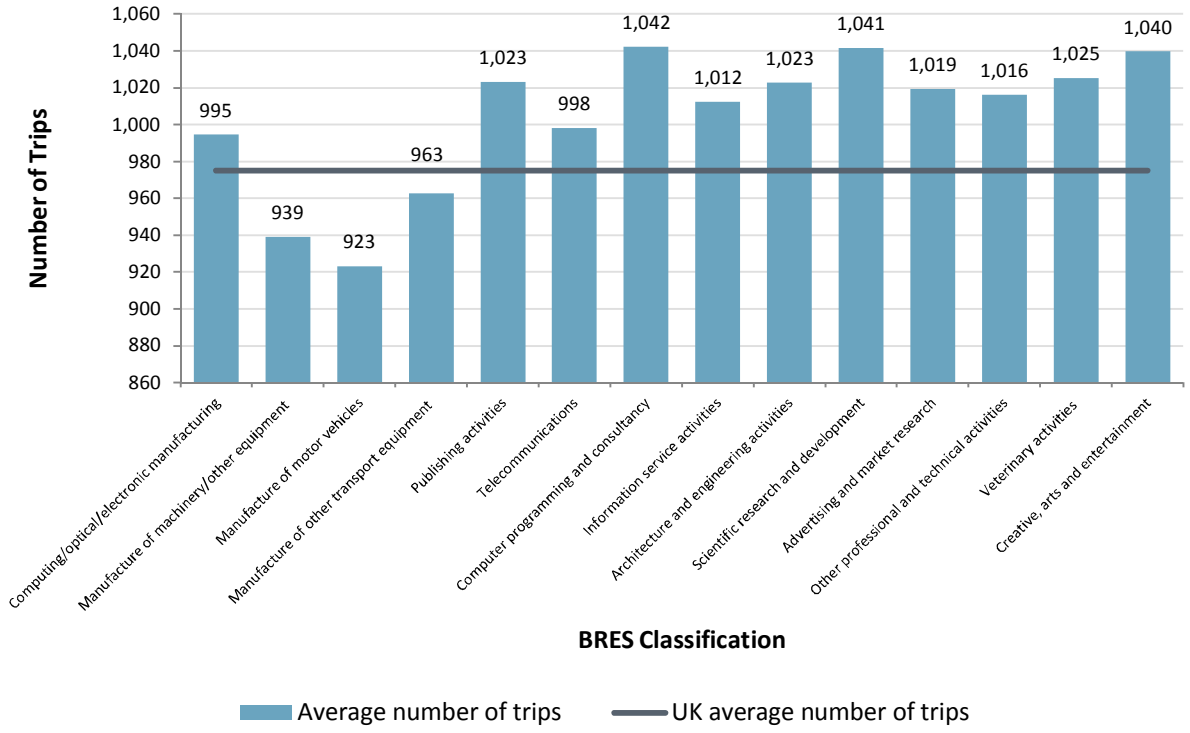
2.7.47 National Travel Survey data demonstrates that those in employed in managerial, professional and technical occupations broadly tend to travel more, taking a greater average number of trips per year, and making longer-distance trips when compared to the average. Managers, directors and senior officials, for example, on average make approximately 9 percent more trips annually than the average number of trips taken by an individual in England, as shown in Figure 2-38:

Figure 2-38: Average annual number of trips by standard occupational classification in England, National Travel Survey, 2013



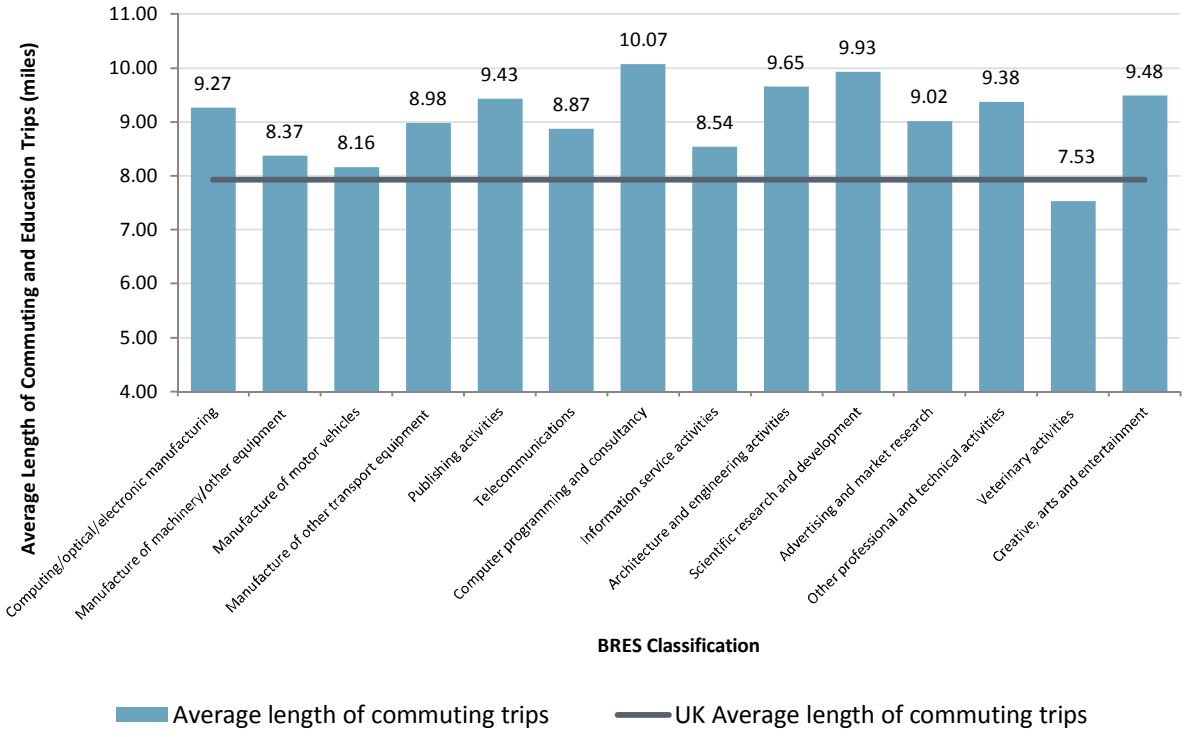
2.7.48 Since those employed in knowledge sectors tend to have higher occupational statuses (Section 2.7.45), one would expect those employed in such sectors to similarly make longer, more frequent journeys, both for leisure and commuting purposes. Figure 2-39 and Figure 2-40 estimate the average annual number of trips, and the length of commuting trips, for each knowledge sector by considering the proportion employed within each occupational category and their propensity to travel.

Figure 2-39: Estimated Average Number of Trips per employee per year by BRES Sector, National Travel Survey and Business Register and Employment Survey, 2013/14



2.7.49 Figure 2-39 demonstrates that all but one of the BRES Knowledge sector jobs are estimated to generate a higher number of trips per year per employee than the national average. Those employed in computer programming and consultancy, scientific research and development and the creative sector undertaking an estimated 1,040 trips, compared to the average number of trips taken by an individual in England of 923[1]. Estimated lengths of commuting (and educational) trips by sector is shown in Figure 2-40.

Figure 2-40: Estimated Average Length of Commuting (& Educational) Trips by BRES Sector, National Travel Survey and Business Register and Employment Survey, 2013/14



2.7.50 Similarly, Figure 2-40 shows that employees working in the Knowledge Sector (defined in Table 2-38) make commuting trips with an average length greater than the average commuting trip length of an individual in England[2], with those employed in computer programming and consultancy having the longest estimated commuting length. This is likely to be a contributing factor to the travel demand patterns outlined in Section 2.4.

[1] Note that this average includes those who are not classified into a socio-economic classification

[2] Ibid

Socio-Economic Summary

Key Points

Population and Dwellings

- Total population of 2,169,757 across the study area in 2011, approximately two thirds of which are people of working age;
- Rapid population growth, averaging 8.7 percent across the study area from 2001 to 2011, with a corresponding increase in the number of dwellings by 9.1 percent;
- High employment levels, and a greater propensity to travel long distances to work;
- High levels of car ownership, especially in rural areas - 84 percent have access to at least one car, compared to a national average of 74 percent

Functional Economic Areas

- High employment rates across the three functional economic areas of Oxford, Cambridge and Milton Keynes, reaching as high as 80 percent within some rural local authorities compared to a national average of 72.9 percent, with correspondingly low unemployment rates.

Knowledge Economy

- Highly productive economies, with high GVA per hour worked (in Milton Keynes 17 percent greater than the national average) and median hourly wages (South Cambridgeshire 28 percent greater than the national average;
- Strong reliance on knowledge-intensive sectors, such as scientific research and advanced manufacturing relative to the national average;
- Cambridge forms the largest knowledge cluster of the three cities, especially focused in scientific research and development, centered in the Cambridge Science Park and Biomedical Campus. Oxford has a slightly smaller, more diverse knowledge sector, with strengths in scientific research, publishing and vehicle manufacturing. Milton Keynes has a smaller knowledge sector (although still employing a greater proportion of the workforce than the national average), especially focused in IT, computer programming and information services;
- Such sectors contribute disproportionately towards economic output, with higher average hourly wages and greater proportions of the workforce employed in managerial, professional and technical occupations; and
- Based on the greater proportion employed in such occupations, it is estimated that those employed in knowledge sectors have a greater propensity to travel, both in terms of number and length of trips.

2.8 Current Opportunities and Constraints

Environment

Review of Existing Conditions and Constraints

2.8.1 This section provides an insight into the current environmental context associated with the study area adjacent to the existing Oxford to Cambridge route. The specific details are presented in accordance with the following structure:

- Review of Existing Conditions and Constraints;
- Summary Tables; and
- Opportunities.

Air Quality and Greenhouse Gases

2.8.2 There are seven Air Quality Management Areas (AQMAs) within 3 miles of the study area route. Three are located on the study area route and the remainder are greater than a kilometre away. There are two Pollution Climate Mapping (PCM) links, both on the A34, which are in exceedance (2013) (above 40µg m-3). One is located on the Oxford Western Bypass Road either side of the A420 and the other is at the junction with the A40.

Cultural Heritage

2.8.3 Blenheim Palace World Heritage Site is located 3.5 miles to the north west of the existing route to the north of Oxford, outside of the study area. There are 205 Scheduled Monuments within 3 miles of the east-west route and 13 Scheduled Monuments are located within 100m of the east-west route. There are 48 Registered Parks and Gardens and no Registered Battlefields within 3 miles of the scheme corridor. There are 7,321 listed buildings within 3 miles of the scheme corridor, of which 850 are Grade I or Grade II*, and 6,474 Grade II. There are 144 Conservation Areas within 3 miles of the scheme corridor.

Landscape

2.8.4 The existing route passes through the North Wessex Downs Area of Outstanding Natural Beauty. There are no National Parks within the study area. The route also passes through both the Cambridge and Oxford Greenbelts and within 200 m of the London Greenbelt.

Nature Conservation/Biodiversity

2.8.5 There are seven Special Areas of Conservation (SAC) and no Special Protection Areas (SPA) within 3 miles of the existing route. Oxford Meadows SAC traverses the A34 Western Bypass Road near the junction with the A40 in north Oxford. There are 53 Sites of Special Scientific Interest (SSSI), one National Nature Reserve and 28 Local Nature Reserves lie within 3 miles of the scheme corridor. There is also one RSPB Reserve within 3 miles of the existing route, the Otmoor Reserve, which is situated approximately 2 miles from the A34 carriageway to the north of Oxford, at the closest point. There are 626 sites of Ancient Woodland within 3 miles of the existing route; fourteen of these are immediately adjacent to the route.

Noise and Vibration

2.8.6 The existing route runs through or directly adjacent to, 53 Noise Important Areas (NIAs) and there are a total of 217 within 3 miles of this route.

Road Drainage and Water Environment

2.8.7 The majority of the scheme corridor is located within the Flood Zone 1, which indicates a low risk of flooding from fluvial sources. However, sections of the existing route are situated within a mixture of Flood Zones 2/3 indicating a medium/high risk of fluvial flooding. The Environment Agency's Risk of Flooding from Surface Water Map shows the majority of the scheme corridor is at very low and low risk of flooding. However, there are isolated areas, where a medium to high risk of surface water flooding has been identified.

2.8.8 The most significant main rivers located in the vicinity of the existing route are the Upper and Bedford Ouse and its tributaries which runs across the route in numerous locations,the River Cherwell that flows under the A34 to the west of Oxford and the River Thames that flows under the A34 to the northwest of Oxford. Further to these, there are also a number of ordinary watercourses which are within or immediately adjacent to the existing route. The existing route does not pass over any Groundwater Source Protection Zones however; all zones can be found in isolated locations within 3 miles of the existing route.

People and Communities

2.8.9 There are many long distance footpaths and cycle routes within 1 mile of the baseline route, in particular National Cycle Route 51(South Midlands) that passes through Oxfordshire, Buckinghamshire, Bedfordshire, Cambridgeshire, Suffolk and Essex. More detailed information is provided in Section 2.3.

Geology, Soils and Materials

2.8.10 There are 20 SSSIs designated for geological or mixed (biological and geological) reasons within 3 miles of the existing route. Three are within 200 metres.

Summary

2.8.11 A summary table outlining the key environmental constraints on a topic by topic basis with a Red/Amber/Green rating is provided below. The methodology and criteria are detailed in The Oxford to Cambridge Expressway Strategic Study – Appraisal Summary Report.

Table 2-39: Key Environmental Constraints

TOPIC	SECTION						
	1: A34 (M4 to M40	2a: M4 & A43 to A421	2b: A41 & A4421 to A421	3: A421 (A4421 to M1)	4: A421 (M1 to A1)	5 A428 (A1 to A1198)	6: A428 (A1198 to A14/M11)
Air Quality & Greenhouse Gases							
Cultural Heritage							
Landscape							
Nature Conservation / Biodiversity							
Noise & Vibration*							
Road Drainage & Water Environment							
Peoples & Communities**							
Geology, Soils & Materials***							

* Note some NIAs relate to individual properties

**Refers to national trails and national and regional cycle routes only.

*** Geological SSSIs only.

Key:

- Red – avoidance or minimisation of impact is a key consideration in developing potential scheme options;
- Amber – avoidance or minimisation of impact is an important consideration in developing potential scheme options and all options should be designed to facilitate mitigation where avoidance cannot be achieved; and
- Green – avoidance or minimisation of impact is desirable but is a lesser consideration in development of potential scheme options.

2.8.12 A list of the 'red' criteria designations are provided in Appendix 15.

Opportunities

2.8.13 There are a range of opportunities for environmental improvements and enhancements including:

- Improve existing connections across the study area to unlock economic development, provide greater connectivity between and greater access to the countryside;
- Working with the East West Rail programme to maximise efficient movement along the route and minimise environmental effects;
- Improve localised air quality through reducing congestion along the route;
- Reduce and mitigate noise pollution experienced at existing receptors including some NIAs;
- Enhance and establish habitats to create coherent and resilient ecological networks and preserve, restore and re-create priority habitats to protect and facilitate the recovery of priority species;
- In the event that the land is found to be contaminated, development provides the opportunity to remediate the land;
- Opportunities to improve the existing drainage using modern techniques such as the implementation of Sustainable Drainage Systems (SuDS) and provide greater protection against flooding in extreme events;
- For potential on-line improvements, the replacement of existing structures with those more suited to the landscape character of the area and are more sympathetic to the natural and historic environment; and
- Improve existing long distance footpaths and national and regional cycling routes through reducing 'disjuncture's' and improving connectivity.

Physical Constraints

2.8.14 A key consideration in looking at the existing corridor between the M4 and Cambridge and possible alternative route options within it is the physical constraints. These can be broadly broken down into natural and manmade.

Natural Constraints

Natural Environment

2.8.15 In terms of natural constraints, these are typically mountains, steep sided valleys, escarpments, large rivers, extensive flood plains, etc. In the case of the Oxford to Cambridge Expressway Strategic Study area, there are no significant areas of upland as whilst there is relatively high ground in the A34 corridor and the Chilterns Area of Outstanding Natural Beauty, these are significant locally but not on a macro scale. It is noted that the interaction with the Chilterns would likely be limited to its northern extent e.g. north of Luton, away from the prominent escarpments which form the adjacent border to the study area in Oxfordshire.

Water Courses

2.8.16 Major rivers exist within the study area – Thames, Ouse, Cam - but the ability to cross these would relate to aesthetics and cost rather than being significant physical barriers caused by their size. Associated with these rivers will be flood plains, some of which are extensive e.g. the area north of Wallingford/Abingdon/Oxford area on the Thames. Again floodplains are not insurmountable constraints providing suitable engineering – culverts, viaduct structures, compensation land, etc. – are provided. The majority of large water masses in the study area are drowned sand and gravel borrow pits or storage associated with topping up of the canal network.

Underground Features

2.8.17 Underground natural features would include swallow holes and the like associated with chalk and marl which will underlie part of the study area. Appropriate geotechnical and geophysical investigations can identify their possible interface with route options in future. Historical mining may be present in isolated locations within the study area and consultation with the Coal Board will identify such areas. Again, their presence, if proven, can be counteracted through engineering solutions.

Land Use

2.8.18 It is noted that the vast majority of the study area is given over to farming, with all types represented e.g. diary, beef, arable, forestry, etc. Care will be taken to avoid the best classified land when the mapping of such assets is completed and the route options are being assessed in general terms.

Manmade Constraints

2.8.19 Much greater constraints are imposed by the manmade environment. Under this heading such items as utilities, railways, roads, commercial premises, residential housing, airports, etc. will be discussed.

Above Ground Utilities

2.8.20 The obvious utilities within the study area are the overhead high voltage power lines belonging to National Grid and the energy supply companies. Overhead pylon networks – with generation site away from the South East and the maximum demand in that area, the provision of high voltage electricity using overhead pylon systems (33kV, 66kV, 132kV and 400 kV) are common place. These are located on the OS mapping as they are an above ground feature and can be extremely concentrated e.g. east of Sandford-on-Thames (south of Oxford) and Sundon, south of Toddington (between Luton and Milton Keynes).

2.8.21 A critical concept to be retained for more detailed corridor studies is the need to place any route options close to but not immediately adjacent to pylons and to cross beneath the cables at as close as possible right angles. This avoids expensive diversion routes by maximising the clearance to catenaries and impact on maintenance works associated with the high voltage networks. It is noted that diversion of 400 kV lines is an exception rather than the rule – the only recent occurrence being for the 2012 Olympics.

Underground Utilities

2.8.22 Underground there will be a significant network of pipelines carrying fuel, gas and water across the study area.

2.8.23 Fuel pipeline – Britain is criss-crossed by a network of pipelines, some of them owned by individual oil companies dedicated to supplying their own terminals, some - for example United Kingdom Oil Pipelines - being joint ventures and others belonging to the Government.

2.8.24 Pipelines are an efficient and safe means of moving large volumes of refined products from a refinery to a storage terminal. Although the initial capital costs of building a line are high, the operating costs are far lower than other means of transport, particularly when set against the expected life span of a pipeline. Once installed underground, pipelines offer substantial environmental and safety benefits, not least from the elimination of road tanker journeys or transportation by rail or sea. Pipelines usually transport petrol, diesel and jet fuel but some transport crude oil.

2.8.25 In the case of the Oxford to Cambridge Expressway Strategic Study, it is inevitable that pipelines will be crossed on the basis of those going north from Fawley and those in the M1/M6 corridor from Buncefield to places to the north including Kingsbury off the M42 between Junction 9 and 10 and Liverpool docks.

2.8.26 Gas mains – National Grid operate large diameter high and medium pressure gas mains across the country providing direct routes and resilience network for the transportation of gas. With such a wide network, it is inevitable that some conflict will occur with any widening or greenfield construction.

2.8.27 Water supply across the study area is via large diameter pipe networks which connect to key reservoirs e.g. Grafham Water, Thorpe Malsor west of Kettering to the large urban demand centres – London, Luton/Dunstable/Houghton Regis, Aylesbury, etc. It is noted that with the chalk present in the Chiltern Hills and further south and east, little storage opportunities exist across the southern portions of the study area or beyond.

Transport Infrastructure

2.8.28 Details of the railway lines, currently in operation and the planned work on East West Rail, are provided earlier in the report. Crossing under or over these corridors will need to be a consideration as the route options develop but there presence is not regarded as a significant constraint. It is noted that route option may have the ability to follow existing rail corridors to reduce impacts.

2.8.29 Similarly the road network in the study area has been described above (concentrating on motorways, trunk roads and A class roads operated by the local highway authorities) and again their presence is a consideration but not a constraint. For convenience and to minimise disruption to the travelling public, careful choice of bridge options and locations will be part of any later assessment.

Commercial and Residential Properties

2.8.30 Commercial premises and residential properties are widespread across the study area, concentrated in the previously referred to urban centres, in towns and villages and in isolated locations. At this time, with due regard to the scale at which route options are being looked at, only the larger concentrations are treated as constraints. The counter argument is that the route option should service the concentrated population areas as they are the origin and destination for journeys and so will inevitably need to be close to them.

Airports

2.8.31 Airports, by their nature, are large areas within which and adjacent to which development is not usually encouraged. The location of airports in the study area has been highlighted earlier in the report and they need to be treated as constraints to route options.

Miscellaneous

2.8.32 From a review of the Ordnance Survey Mapping, there are a series of manmade constraints which exist within the study area which are worthy of inclusion as constraints. They include:

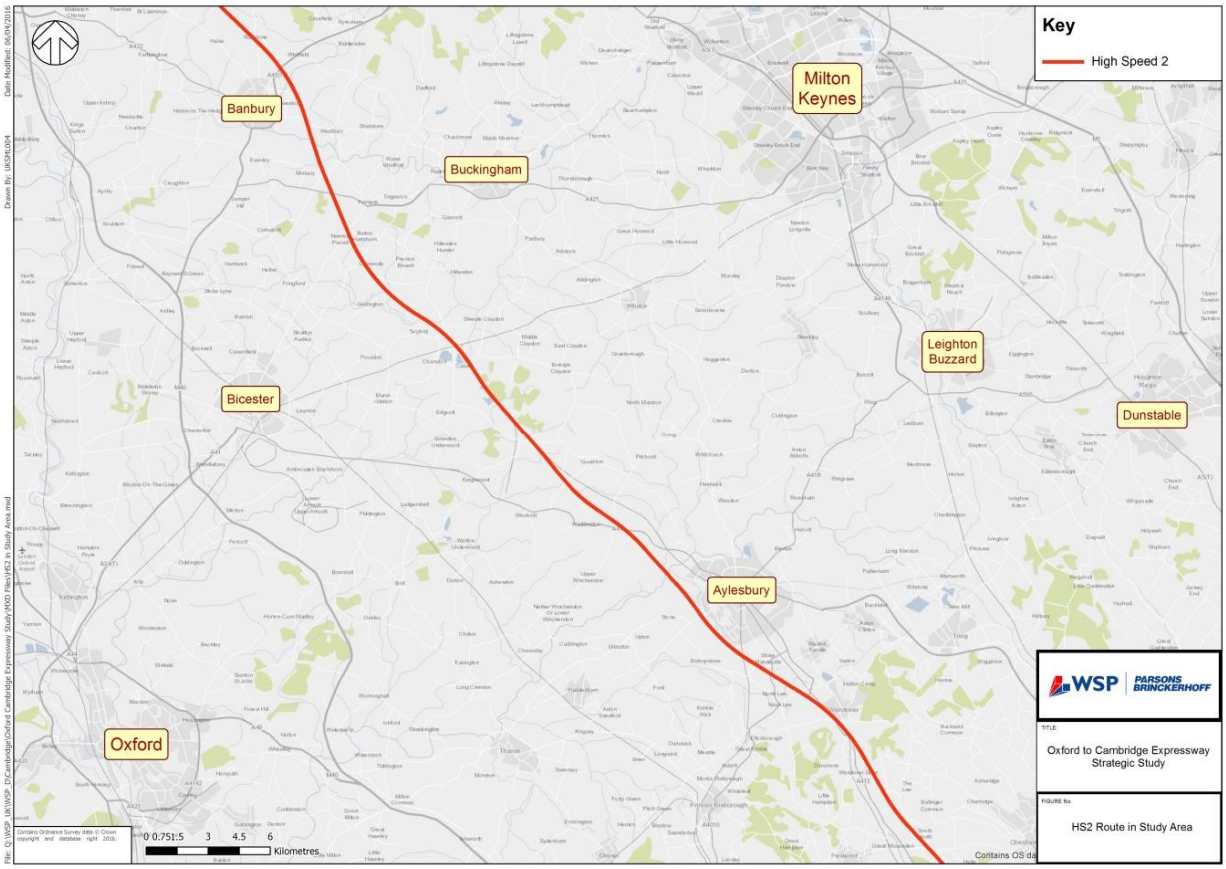
- Radio telescopes southeast of Comberton, southwest of Cambridge;
- Rifle ranges and danger areas to the northeast of same village;
- Bassingbourne barracks – danger areas;
- Danger area south of Wendy/west of A1118;
- Harwell and Rutherford laboratories complex in Oxfordshire; and
- The American cemetery et al off the A1303 Madingley Road, west of M11 Junction 13.

Future Constraints

2.8.33 As expected in a large study area, there are significant planned activities to improve the infrastructure to support continued economic growth that need to be considered. On the rail front, details in relation to East West Rail have been provided above along with the planned route in Figure 2-4. Additionally High Speed Two (HS2), a high speed rail link from London to the Midlands and then subsequently to the north of England will cross the study area, subject to its successful passage through its statutory process via an Act of Parliament. Further details on both these schemes are provided in Section 3.3. The main constraint of these two rail schemes will be the alignment of the proposed rail routes.

2.8.34 The proposed route of HS2 is shown in Figure 2-41 below and goes from the area to the south and west of Aylesbury to east and north of Bicester. It would cross the proposed East West Rail at Calvert junction.

Figure 2-41: Published line of the Proposed HS2 within the Study Area



2.8.35 Any route option will interface with HS2 but the extent of interface will depend on the route option alignment and how it is developed. At this stage, no provision can be made within the HS2 Hybrid Bill for the Oxford to Cambridge Expressway on the basis that the study is too early in its potential procurement life cycle and the Bill is already in front of Parliament. It is noted that there are no proposals for stations on the HS2 line in the study area and so it is unlikely to be a driver for change in travel patterns.

2.8.36 In terms of the SRN, planned activities by Highways England, on behalf of DfT, are included in the RIS for the 2015/16 – 2019/20 Road Period. From a local highway authority perspective, the LTPs relating to Highways and Transport contain the proposed planned activities. Details on the relevant planned road schemes are provided in Section 3.3. The planned Highways England and local highway authority schemes predominately involve upgrades and improvements to existing junctions and routes within the study area and therefore do not introduce significant new future constraints that require further consideration. Summarised below are Highways England and local highway authority planned new road schemes that need to be considered as potential future constraints.

2.8.37 At the local level, new road schemes are proposed in Oxfordshire. In particular new access roads and junction improvements are proposed in the Science Vale area (Didcot and Harwell) to improve the accessibility of the Enterprise Zone.

2.8.38 Within Milton Keynes, the Bletchley Transport Strategy includes the potential for a Southern Bypass and Southern Distributor Road. At this stage the provision of a bypass/distributor route to the southern side of Bletchley has no defined, final route and a business case quantifying the benefits is yet to be developed.

2.8.39 Within the southern area of the study area the A5-M1 Link, Woodside Connection and M1 Junction 11a all under construction, linking the A505 and the M1. This new road is located to the north of Houghton Regis. To the east of this scheme, the Luton Northern Bypass is being promoted. A feasibility study has been undertaken that looks at a number of route options, linking the M1 Junction 11A with the A6 and A505.

2.8.40 In Leighton Buzzard, a 2,500 dwellings urban extension is proposed to the east of the town. A Leighton Buzzard Eastern Relief Road is proposed as part of the masterplan to support the residential development. At Biggleswade, an Eastern Relief Road is to be delivered as part of the urban expansion to the east of the town.

2.8.41 To the south of Bedford a potential Ampthill – Flitwick - Westoning Bypass has been proposed. In 2009 a western and eastern alignment were considered which would remove through traffic from the A5120. However the economic case for the scheme is weak and therefore the scheme is not currently feasible.

2.8.42 Within the northern area of the study area a relief road will be constructed as part of the Towcester Southern Extension development. This relief road will link the A5 and A43 to the south of Towcester.

Opportunities

2.8.43 A key consideration in relation to opportunities in regard to the Oxford to Cambridge Expressway Strategic Study is the potential to link with schemes planned by the local highway authorities and form a joined up approach to the overall corridor provision. Linked to this would be:

- a better awareness of the approach by the public;
- evidence of joined up thinking to Treasury et al;
- the ability to work jointly with the local councils and Network Rail/Train Operating Companies;

- the opportunity to use construction materials between adjacent sites through cross agency macro planning (HS2 being in a potential similar time frame for example, potential work by Network Rail, Environment Agency, etc); and
- the opportunity for possible combined transport corridors e.g. a highway route adjacent to East West Rail with non-motorised facilities between the two from Bicester to Bletchley for example.

2.8.44 Linked to local highway authority proposals will be those being brought forward by developers to address opportunities within the local planning provisions and this may be a source of monetary contributions should the development be in line with policy and the programmes for potentially discrete items of work be favourable in terms of timescales.

2.8.45 Should the route options so facilitate, the ability to use the existing infrastructure asset e.g. existing railway track bed or public highway must be retained as an influence on the cost of new provision, linked to construction productivity and disruption to users of all modes of transport.

2.9 Stakeholder views

2.9.1 A first Stakeholder Reference Group meeting was held on the 12th November 2015 to introduce the study and seek views on the strengths, weaknesses, opportunities and threats against the following headings:

- Economy;
- Environment;
- Safety; and
- Resilience.

2.9.2 A brief summary of the views from the 12th November 2015 are included below.

Strengths	Weaknesses
Facilitating significant spatial and economic growth (and tourism)	Congestion on current routes – and poor JT reliability (e.g. A34 Oxford)
Maintain economic advantage – brain belt and unlock growth	Potential environmental impact through Bucks
Growing population and strength of economies already in Cam, Oxford and MK	Risk of facilitating growth in wrong areas
Part of route at Expressway standard (A421 and A428 sections between M1 and A1)	Route
Address local authority issues	Safety issues with single carriageway sections
	At grade junctions through MK (15 roundabouts)
	Lack of east – west routes

Opportunities	Threats
Role with East West Rail (similar corridor)	How define benefits (versus other modes)
Links into settlements (role with local roads)	Widening of study area (e.g. Luton)
Relief to other routes (inc M25)	Role of freight (ports)
Wider measures (e.g. Park and Ride)	Environmental impact (climate change) versus role of roads in delivering growth
Use of technology	Modal choice and level playing field (case)
Improve freight access/safety	How we predict 2041 traffic (common approach across studies)
Integration	

2.9.3 This feedback has played an important part of our evidence base. Further stakeholder views will be included as the strategic study progresses.

Current Opportunities and Constraints Summary

Key Points

Environment

- Congestion on the existing route impacts on Air Quality and Noise, especially in populated areas;
- Scheduled monuments, Listed Buildings and Listed Parks and Gardens exist along the route that may affect the development of route realignment or dual carriageways;
- The North Wessex Downs Area of Outstanding Natural Beauty, and Oxford, London Area and Cambridge Greenbelts may constrain the development of new road solutions; and
- Protection of areas of Natural and Geological interest as well as the water environment is likely to affect route proposals and construction processes.

Physical Constraints

- No significant physical constraints within the study area including topography, water courses, flood plains and underground features; and
- Manmade constraints including utilities (electricity and pipelines) will be considered, existing and planned (East West Rail, HS2) transport infrastructure will need to be considered but is not a significant constraint.

Opportunities

- The potential to link with national, regional and local infrastructure schemes will be investigated;
- The possibility of combined transport corridors will be considered e.g. a highway route adjacent to the East West Rail route; and
- The opportunity to use existing infrastructure assets will also be investigated.

3 Future Situation

THE CASE FOR CHANGE
The evidence base shows the study area LEPs and local authorities are planning for ambitious housing and job growth by 2031 in order to cater for regional demand. Within the study area, the total number of dwellings, jobs and population is predicted to increase by 230,000, 270,000 and 400,000 respectively over the next plan period to 2031. To deliver this level of growth it is crucial to consider appropriate transport interventions that address challenges and provide a resilient transport network for the future. There is a forecast growth in trips of 32 percent to 40 percent by 2035 travelling along the primary east-west corridor which will result in a substantial increase in congestion, journey time delay and journey time variability without investment in new strategic infrastructure. For example the A34 serves a number of functions. It is an important commuter route into Oxford and the Science Vale, as well as a national and European freight route. If left unchecked the congestion and unreliability of journeys could waste an extra £22 billion worth of time, and add an extra £10 billion in annual costs to business, by this time (*Roads – Delivering Choice and Reliability, Department for Transport*). The economies of Cambridge, Oxford and Milton Keynes and the wider study area can be considered strong, with high employment rates and economies primarily consisting of well-paid, productive jobs. Much of this success can be ascribed to their strengths in the 'knowledge economy': high-value, high-skill jobs in knowledge-intensive sectors such as life sciences, advanced manufacturing and scientific research. To enable future growth it is essential to overcome the restricted access to labour markets and improve business connectivity and while there is low unemployment and high GVA across the areas there is a lack of local skills for prevalent types of employment. This is also linked to the location of affordable housing.

3.1 Introduction

3.1.1 This section of the study draws together evidence from a variety of sources to understand the growth aspirations and transport improvements planned within the study area. This section also establishes the future operation of the primary east-west route if no strategic improvements are delivered. Building on the transport and socio-economic context outline in Chapter 2, this chapter provides an overview of:

- Future Socio-economic context;
- Future changes to the transport system; and
- Future travel demands and levels of service.

3.2 Socio-Economic Context

Strategic Imperative
The evidence base shows the study area LEPs Growth Deals and Local Plans produced by the local authorities are planning for ambitious housing and job growth by 2031 in order to cater for regional demand. Investment in the study area east-west corridor will act as an enabler for the delivery of new jobs and homes, directly supporting the growth aspirations of the LEPs and local authorities.

Housing Growth

3.2.1 This section provides a review of the housing growth aspirations within the study area. A review of the main study area LEP Growth Deals and local authority Local Plan documents has been undertaken to understand the projected increases in dwellings. High levels of housing growth experienced along the corridor since 2001 are expected to continue, with each of the three main LEPs Strategic Economic Plans including ambitious housing plans as follows:

- **Oxfordshire (OxLEP) LEP**: The local authorities that make up the OxLEP propose to deliver between 93,560 to 106,560 new homes by 2031;
- **South East Midlands (SEMLEP) LEP**: The 11 local authorities that form the SEMLEP have in place ambitious plans to deliver 86,700 new homes by 2020/21. The SEMLEP Strategic Economic Plan will aim to deliver an additional 24,400 homes by 2020; and
- **Greater Cambridge/Greater Peterborough (GCGP) LEP:** The 12 local authorities that form the GCCP have in place ambitious plans to deliver 156,610 new homes by 2031.

3.2.2 The local housing growth plans for the fourteen district/unitary planning authorities within the Oxford to Cambridge Expressway Strategic Study area have also been reviewed. The most recently available Local Plans have been reviewed and therefore for a number of districts/unitary authorities this includes their Draft Local Plans which are yet to be adopted as formal planning policy.

3.2.3 To understand future demographic trends along the Oxford to Cambridge corridor data from the National Trip End Model (NTEM) Planning Data Version 6.2 for the period 2016 to 2041 has also been reviewed. This dataset is reliant upon a 2001 base year and projections made in 2008; naturally this brings with it a large degree of uncertainty. Since the preparation of this dataset many local authorities have, or are in the process of, preparing new Local Plans to guide future growth in their local area and is likely to differ from projections previously made.

3.2.4 A full update of NTEM is currently underway by DfT and is scheduled to complete early in 2016. The NTEM planning data set has been reviewed, not to identify absolute growth along the corridor, rather to identify trends and where growth is likely to occur or be concentrated.

3.2.5 A summary of the housing growth forecasts for each district/unitary authority is provided in Table 3-1. The Local Plan housing growth has been compared against the Trip End Model Presentation Programme (TEMPRO) district boundaries forecast household growth for 2016 to 2041.

Table 3-1: Housing Growth within the Study Area

AREA	DISTRICT	PLAN STATUS	GROWTH PERIOD	NEW DWELLINGS	TEMPRO H'HOLDS 2016-2041
Oxfordshire	Cherwell	Adopted	2011 - 2031	22,800	12,264
	Oxford	Adopted	2006 - 2026	8,000	10,095
	South Oxfordshire	Adopted	2006 - 2026	10,940	12,068
	Vale of White Horse	Draft/Proposed	2011 - 2031	20,560	17,145
	West Oxfordshire	Adopted	2011 - 2026	4,300	6,041
Sub Total				**66,600**	**57,613**
Berkshire	West Berkshire	Adopted	2006 - 2026	10,500	8,056
Northamptonshire	South Northamptonshire	Adopted	2001 - 2029	13,183	8,908
Buckinghamshire	Aylesbury Vale	Draft/Proposed	2006 - 2026	26,890	41,399
Milton Keynes	Milton Keynes	Adopted	2010 - 2026	28,000	41,825
Bedfordshire	Bedford	Adopted	2006 - 2021	16,270	26,767
	Central Bedfordshire	Adopted	2001-2026	17,950	37,034*
Sub Total				**34,220**	**63,801**
Cambridgeshire	Cambridge	Draft/Proposed	2011 - 2031	14,000	25,993
	South Cambridgeshire	Draft/Proposed	2011 - 2031	19,000	27,714
	Huntingdonshire	Draft/Proposed	2011 - 2031	21,000	14,977
Sub Total				**54,000**	**68,684**
Total				**233,393**	**290,286**

* Combined Mid and South Bedfordshire TEMPRO Districts

3.2.6 Table 3-1 shows that ambitious housing growth forecasts are proposed across the study area. The locations where the highest levels of housing growth are proposed include Cherwell, Vale of White Horse, Aylesbury Vale, Milton Keynes, Huntingdonshire and South Cambridgeshire. Combined, the 14 districts/unitary authorities propose a total of 233,393 new dwellings within the study area.

3.2.7 The TEMPRO household data for 2016 to 2041 is also provided in Table 3-1 and shown graphically in Appendix 16. The data shows that the NTEM model forecasts significant household growth in Aylesbury Vale, Milton Keynes and Central Bedfordshire from 2014 to 2041. High levels of household growth are also forecast for Cambridge and South Cambridgeshire and Bedford. The NTEM household forecasts for Cherwell, Vale of White Horse, West Berkshire, South Northamptonshire and Huntingdonshire are lower than the their Local Plan housing growth plans.

3.2.8 To enable a consistent comparison of each of the districts Local Plans and NTEM housing and household growth plans, a consistent future year of 2021 has been selected (Table 3-2). It has been assumed that houses are built out at a constant rate each year.

Table 3-2: Dwelling 2021 Forecast

DISTRICT	EST DWELLING 2021	DWELLINGS CHANGE 2011-2021 (%)	TEMPRO H'HOLD CHANGE 2011-2021	TEMPRO H'HOLD CHANGE 2011-2021 (%)
Vale of White Horse	10,280	+ 20.1%	6,879	+13.8%
Cherwell	11,400	+ 19.3%	6,964	+12.0%
Aylesbury Vale	13,445	+ 18.7%	15,733	+22.0%
Milton Keynes	17,500	+ 17.1%	20,491	+20.6%
Bedford	10,847	+ 16.0%	11,691	+17.5%
South Cambridgeshire	9,500	+ 15.4%	11,022	+18.1%
Huntingdonshire	10,500	+ 14.7%	9,486	+13.4%
Cambridge	7,000	+ 14.3%	11,538	+23.6%
South Northamptonshire	4,708	+ 13.1%	4,078	+11.4%
South Oxfordshire	5,470	+ 9.7%	5,357	+9.7%
West Berkshire	5,250	+ 8.1%	4,505	+7.1%
Oxford	4,000	+ 6.9%	4,417	+7.6%
Central Bedfordshire	7,116	+ 6.6%	17,587*	+6.9%
West Oxfordshire	2,867	+ 6.3%	2,721	+6.1%
Total	119,883	**+ 13.3%**	**132,469**	**+14.3%**

* Combined Mid and South Bedfordshire TEMPRO Districts

3.2.9 Table 3-2 shows that using a common future year of 2021 the Vale of White Horse, Cherwell, Aylesbury Vale, Milton Keynes, Bedford and South Cambridgeshire could experience an increase in dwellings greater than 15 percent within their respective districts. The NTEM household data shows that the largest increases are forecast for Cambridge, Aylesbury Vale, Milton Keynes, South Cambridgeshire and Bedford.

Growth Areas

3.2.10 Tables 3-1 and 3-2 show that significant levels of housing growth are forecast for the study area including Oxfordshire, Milton Keynes, Bedford and Cambridgeshire. Further details on the growth plans for these areas are provided below.

Oxfordshire

3.2.11 The Oxfordshire Strategic Housing Market Assessment (SHMAA) 2014, states that 100,000 new homes will be needed between 2011 and 2031 within the county as follows:

- Cherwell – 22,800;
- Oxford City – 28,000 (cannot be facilitated within the city boundary);
- South Oxfordshire – 15,500;
- Vale of White Horse – 20,560; and
- West Oxfordshire – 13,200.

3.2.12 Table 3-1 shows that approximately 67,000 dwellings have been allocated in the five district Local Plans and further work is underway to allocate additional housing in the area which cannot be accommodated within Oxford.

Milton Keynes

3.2.13 In the Milton Keynes Core Strategy document adopted in July 2013, land for 28,000 new homes will be made available throughout the borough between 2010 and 2026, only 1,760 of which will be in sustainable settlements in the rural areas in the northern reach of the borough.

Bedford and Central Bedfordshire

3.2.14 The Bedford Core Strategy and Rural Issues Plan, adopted in April 2008, is the principle document detailing growth projection for the district. A Local Plan for 2032 is currently being prepared. The Core Strategy aims to create an additional 16,270 dwellings between 2001 and 2021 within designated growth areas, which include Bedford town, accessed from the A421 Expressway, as well as Kempston and the northern Marston Vale.

3.2.15 The Central Bedfordshire Core Strategy and Development Management Policies, November 2009, provides the long term vision and the direction for future development in the district over the period 2001 – 2026. The Core Strategy makes provision for an additional 17,950 dwellings between 2001 and 2021, with development focused in the Major Service Centres (Biggleswade, Sandy, Ampthill, Flitwick and Wixams.

Cambridgeshire

3.2.16 The SHMAA for the Cambridge Housing Sub-region 2013 forecasts between 2011 and 2031, an additional 14,000 dwellings will be required in Cambridge. This would represent an increase 29 percent on the number of dwellings which stood at 48,288 in 2011.

3.2.17 The number of new dwellings needed by 2031 for the county is 75,000, broken down by district as follows:

- Cambridge – 14,000;
- East Cambridgeshire – 13,000;
- Fenland – 12,000;
- Huntingdonshire – 17,000; and
- South Cambridgeshire – 19,000.

Employment Growth

3.2.18 This section provides a review of the projected employment growth at the national, regional and local level. Employment growth across the corridor is expected to remain strong, with the 'knowledge economy' expected to generate significant employment growth over the coming decades.

National Level

3.2.19 At the national level, public finances are likely to come under pressure over the longer term, primarily as the result of an ageing population. Increasing life expectancy, low fertility rates, and the retirement of the post-war 'baby boom' will lead to an increase in the ratio of the elderly to those of working age. Trends in net migration (318,000 net arrivals in 2014) will offset the impact of an ageing population over the short to medium term, but are not sufficient to reverse the long-term trend[3].

3.2.20 As described in the Office for Budget Responsibility's *Fiscal Sustainability Report* (2015) in the absence of offsetting tax rises or spending cuts this would widen budget deficits over time and eventually put public sector net debt on an unsustainable upward trajectory. As a consequence, additional fiscal tightening might be needed beyond 2019-20 with consequences for size of the public sector, and the quantity of public sector employment outside ring-fenced sectors such as health and education.

[3] Office for National Statistics, Migration Statistics Quarterly Report, May 2015

3.2.21 To complement the local projections of additional employment described later in this section, we have considered long-term employment forecasts published by the Department for Business, Innovation and Skills. While they are not directly comparable with local employment forecasts or those used as an input to the NTEM, the *UK labour market projections: 2012 to 2022* provide a helpful breakdown according to industry, occupation and skill level[4].

3.2.22 Overall employment growth prospects for the UK economy are somewhat more positive than historic performance, although the rate of recovery is forecast to be modest relative to the pre-recession picture, with no quick return to long term trends as observed following previous recessions. In the period from 2017-2022, UK output is forecast to grow by around 2.3 per cent per annum (OBR, 2015). This is expected to be driven by a recovery in business and other services, and the construction sector. There will also be support from public administration, health and education which should begin to grow again when cuts in spending on public services come to an end. All sectors aside from primary sector and utilities are expected to pass pre-recession levels of output before 2022.

Regional Level

3.2.23 Regionally, the three main study area LEP's Strategic Economic Plans state ambitious employment growth forecasts including:

- **OxLEP**: Create 85,600 new jobs by 2031, a 1 percent increase per annum compared to a 0.8 percent per annum achieved between 2001 and 2011;
- **SEMLEP**: The 11 local authorities that form the SEMLEP have in place ambitious plans to deliver 111,200 new jobs by 2020/21. The Strategic Economic Plan will create 41,500 net increase in jobs by 2020; and
- **GCGP LEP:** The Strategic Economic Plan will support the delivery of 70,000 new jobs in the region.

3.2.24 Oxfordshire has a successful economy, recognised nationally for its strength in science based knowledge industries. OxLEP have ambitious plans to drive economic growth to meet the needs of the science and knowledge rich economy. The Strategic Economic Plan programme seeks to deliver 85,600 new jobs by 2031, many in the high value knowledge rich sectors.

3.2.25 South East Midlands is a national growth area which includes Milton Keynes, the UK's fastest growing city. Milton Keynes is a regional economic powerhouse in the South East Midlands with strengths in business services. SEMLEP have ambitious plans to drive economic growth to meet the needs of its diverse local economy.

3.2.26 Cambridgeshire has a successful economy, recognised nationally for its strength in research and development and technology based industries. GCGP have ambitious plans to drive economic growth in one of the most innovative business locations.

3.2.27 The following section summarises employment projections taken from *UK labour market projections: 2012 to 2022*, split by LEP area.

[4] See https://www.gov.uk/government/publications/local-enterprise-summary-reports

Oxfordshire LEP

3.2.28 Overall, the number of jobs in the *O*xLEP area is projected to rise by around 17,000 over the period 2012-2022, an average annual rate of growth of 0.4 per cent. This is somewhat lower than the UK average rate (0.6 per cent). Private sector services as a whole are expected to contribute around 95 per cent of net job growth in the OxLEP area, higher than the UK average of 85 per cent. The leading sources of employment growth in the OxLEP area (in absolute terms) are forecast to be professional services (+4,000), support services (+4,000) and Information Technology (+4,000). Manufacturing is projected to see a continued decline in jobs (with a loss of 3,000 jobs – the equivalent of a fall of 11 per cent - over the decade in the LEP area). This decline reflects the wider picture in the UK.

3.2.29 The occupational projections for the LEP area are for:

- 27,000 additional high level jobs (for managers, professionals and associate professionals), with around half of these in professional roles. Higher skilled jobs are expected to grow at a slightly lower rate than in the UK as a whole (14 per cent compared with 17 per cent over the course of the decade);
- 14,000 fewer jobs in middle ranking administrative, secretarial and skilled trades occupations. Nevertheless, these areas of decline are expected to remain significant sources of employment by the end of the decade. For example, there are still expected to be around 37,000 administrative and secretarial jobs in 2022 in the LEP area, despite the loss of around 9,000 jobs in the previous decade; and
- Around 9,000 additional jobs in caring or leisure roles.

3.2.30 As a result of supply and demand factors, the qualification profile of employment is expected to shift markedly in the LEP area:

- The proportion of jobs held by people qualified at a higher level (level 4 and above) is projected to increase from 43 per cent to 53 per cent between 2012 and 2022; and
- Workers with low qualifications (below level 2) are expected to decline from 17 per cent to 12 per cent of the total workforce over this period.

South-East Midlands LEP

3.2.31 Overall, the number of jobs in the SEMLEP area is projected to rise by around 60,000 over the period 2012-2022, an average annual rate of growth of 0.7 per cent. Private sector services as a whole are expected to contribute around 90 per cent of net job growth in the LEP area between 2012 and 2022. The leading sources of employment growth in the South East Midlands area (in absolute terms) are forecast to be professional services (+11,000), support services (+10,000), information technology (+9,000), wholesale and retail trades (+9,000), health and social work (+9,000) and transport and storage (+8,000). Public administration is projected to see a net decline in its level of employment between 2012 and 2022 in the LEP area (loss of 3,000 jobs, equivalent to a fall of 7 per cent). A decline in agriculture is also projected in the LEP area (loss of 2,000 jobs, equivalent to a fall of 23 per cent). Manufacturing is projected to see a continued decline in jobs with a loss of 8,000 jobs.

3.2.32 As with the wider UK picture, we expect to see job growth concentrated in higher occupational roles, as well as in lower level roles relating to care. The projections for the LEP area are for:

- 63,000 additional high level jobs (for managers, professionals and associate professionals), with almost half of these in professional roles. Higher skilled jobs are expected to grow at the same rate as the UK as a whole (17 per cent over the course of the decade);

- 21,000 fewer jobs in middle ranking administrative, secretarial and skilled trades occupations. Nevertheless, these areas of decline are expected to remain significant sources of employment by the end of the decade. For example, there are still expected to be around 97,000 administrative and secretarial jobs in 2022 in the LEP area, despite the loss of around 11,000 jobs in the previous decade; and
- Around 24,000 additional jobs in caring or leisure roles.

3.2.33 The qualification profile of employment is expected to shift markedly in the LEP area:

- The proportion of jobs held by people qualified at a higher level (level 4 and above) is projected to increase from 36 per cent to 47 per cent between 2012 and 2022; and
- Workers with low qualifications (below level 2) are expected to decline from 20 per cent to 14 per cent of the total workforce over this period.

Greater Cambridge and Greater Peterborough LEP

3.2.34 Overall, the number of jobs in the GCGPLEP area is projected to rise by around 50,000 over the period 2012-2022, an average annual rate of growth of 0.7 per cent. Private sector services as a whole are expected to contribute around 83 per cent of net job growth in the LEP area between 2012 and 2022. The leading sources of employment growth in the Greater Cambridge and Greater Peterborough area (in absolute terms) are forecast to be health and social work (+11,000), support services (+10,000), professional services (+8,000), wholesale and retail (+8,000) and construction (+7,000). Public administration is projected to see a net decline in its level of employment between 2012 and 2022 in the LEP area (loss of 2,000 jobs, equivalent to a fall of 8 per cent). A decline in agriculture is also projected in the LEP area (loss of 3,000 jobs, equivalent to a fall of 20 per cent). Manufacturing is projected to see a continued decline in jobs (with a loss of 6,000 jobs – the equivalent of a fall of 9 per cent - over the decade in the LEP area). This decline is again in line with the UK as a whole.

3.2.35 The occupational projections for the LEP area are for:

- 50,000 additional high level jobs (for managers, professionals and associate professionals), with almost half of these in professional roles. Higher skilled jobs are expected to grow at the same rate as the UK as a whole (17 per cent over the course of the decade);
- 17,000 fewer jobs in middle ranking administrative, secretarial and skilled trades occupations. Nevertheless, these areas of decline are expected to remain significant sources of employment by the end of the decade. For example, there are still expected to be around 74,000 administrative and secretarial jobs in 2022 in the LEP area, despite the loss of around 8,000 jobs in the previous decade; and
- Around 20,000 additional jobs in caring or leisure roles

3.2.36 The qualification profile of employment is expected to shift markedly in the LEP area:

- The proportion of jobs held by people qualified at a higher level (level 4 and above) is projected to increase from 38 per cent to 48 per cent between 2012 and 2022; and
- Workers with low qualifications (below level 2) are expected to decline from 20 per cent to 14 per cent of the total workforce over this period

Growth in Knowledge Based Sectors

3.2.37 As highlighted in Section 2.7.32, the economies of the core functional economic areas of Cambridge, Milton Keynes and Oxford are strong and dynamic, with key strengths in the 'knowledge economy'. In comparison to the rest of the country, the cities specialise in high-value, high-skill jobs in sectors such as life sciences, advanced manufacturing and scientific research. Projected growth in knowledge-based sectors is expected to result in growing demand for high-skilled employees, especially within city centre sites and specialist out-of-town research parks (such as Harwell or the Cambridge Science Park). Such employees are characterised by longer than average commuting distances and more business travel, both in terms of the number of business trips and their average length. Increased affluence associated with such jobs also tends to result in increased travel for leisure purposes.

3.2.38 However, not all knowledge-based sectors have predominantly urban locations. Advanced manufacturing and logistics firms often require premises for which city centre locations are both too expensive and inaccessible for freight movements. These locations need to have high-quality connectivity for freight, particularly via road to their supply chain and to global markets by sea and air. They also need good links for business travel to connect with suppliers, clients and their research base. If located in urban areas, these kinds of firms are typically located on the periphery of towns and cities, close to the primary road network. However, some are located at sites some distance from the nearest town or city. Because of this, along with their low labour intensity, such industries have a requirement for appropriate road-based connectivity.

3.2.39 In order to flourish, collectively these knowledge-based sectors depend upon high quality support from 'enabling' sectors such as financial and professional services and other business services which are predominantly, but not exclusively, located in London. As a consequence, high-quality transport links into London will allow firms located along the Oxford to Cambridge axis to access world-class business support in London.

Local Level

3.2.40 To understand the local future economic trends along the Oxford to Cambridge corridor, data from the NTEM Planning Data Version 6.2 for the period 2016 to 2041 has been reviewed. The NTEM planning data set has been reviewed, not to identify absolute growth along the corridor, rather to identify trends and where growth is likely to occur or be concentrated. A summary of the NTEM forecast job and worker growth is provided in Table 3-3 and graphically in Appendix 16. The data has been ranked by forecast job growth.

Table 3-3: TEMPRO Jobs and Worker Forecast: 2016-2041

DISTRICT	JOBS			WORKERS		
	2016	2041	% Change	2016	2041	% Change
Cambridge	88,931	107,734	+21%	61,489	77,987	+27%
South Cambridgeshire	86,176	68,818	+19%	74,878	87,502	+17%
Aylesbury Vale	84,119	96,419	+15%	97,125	118,655	+22%
Vale of White Horse	66,994	75,506	+13%	63,794	71,529	+12%
Milton Keynes	168,918	188,246	+11%	138,249	155,020	+12%
South Northamptonshire	39,777	44,253	+11%	42,698	39,966	+6%
Huntingdonshire	85,234	94,176	+10%	87,758	84,157	-4%
West Berkshire	98,630	107,056	+9%	82,182	84,929	+3%
Oxford	112,229	121,335	+8%	75,845	86,984	+15%
Cherwell	80,100	84,498	+5	78,465	81,391	+4%
Bedford	84,204	87,686	+4%	86,055	94,664	+10%
Central Bedfordshire*	99,494	103,477	+4%	142,162	151,471	+7%
South Oxfordshire	66,720	68,818	+3%	68,807	72,153	+5%
West Oxfordshire	55,484	56,349	+2%	54,063	53,431	-1%
Total	**1,217,010**	**1,338,126**	**+10%**	**1,153,570**	**1,259,840**	**+9%**
GB	**31,021,032**	**33,911,441**	**+9%**	**28,327,440**	**30,655,402**	**+8%**

* Combined Mid and South Bedfordshire TEMPRO Districts

3.2.41 Table 3-3 shows that Cambridge (21 percent) and South Cambridgeshire (19 percent) are forecast to experience a significant increase in jobs compared to the national average (9 percent). Aylesbury Vale, Vale of White Horse, Milton Keynes and South Northamptonshire are all forecast to experience job growth above 10 percent in the period 2016 to 2041. The largest percentage increases in workers is also forecast to be in Cambridge, Aylesbury Vale, South Cambridgeshire and Oxford.

3.2.42 The plots provided in Appendix 16 provide a more detailed analysis of the NTEM data. The plans demonstrate high levels of job creation forecast for Cambridge city, South Cambridgeshire, Milton Keynes and Oxford. Relatively high levels of job growth are also predicted from Aylesbury northwards into Northamptonshire, Bedford and Huntingdonshire. The plots also demonstrate that the main locations forecast to experience growth in the number of workers are Oxford, Aylesbury and Cambridge. The arc between Aylesbury, Milton Keynes, Bedford and South Cambridgeshire is also predicted to experience relatively high levels of worker growth between 2016 and 2041.

3.2.43 Information on the Local Plan forecast economic growth in Oxfordshire, Milton Keynes, Bedford and Cambridgeshire is provided below.

Oxfordshire

3.2.44 The Oxford Core Strategy forecasts jobs growth between 11,000 and 14,000 by 2026, 11 percent and 14 percent respectively on 2001 baselines (101,900 jobs). The Oxfordshire Economic Forecasting Report 2014 forecasts jobs growth in the county of 88,200 by 2031 with jobs growth of 24,300 within Oxford City. The jobs growth is broken into district as follows:

- Cherwell – 21,600;
- Oxford City – 24,300;
- South Oxfordshire – 11,500;
- Vale of White Horse – 23,000; and
- West Oxfordshire – 7,900.

Milton Keynes

3.2.45 At present there are approximately 139,000 jobs in the borough of Milton Keynes, of which 30 percent are carried out by workers who commute from outside of the city. The Milton Keynes Core Strategy, 2013 seeks to continue the current employment growth rate of 1.5 new jobs for every new home which equates to 42,000 new jobs, or a 30 percent increase.

Bedford

3.2.46 The Bedford Core Strategy and Rural Issues Plan aims to facilitate the creation of 16,000 new jobs within the strategy time frame, which is roughly equal to the forecasted population increase.

Cambridgeshire

3.2.47 Population, Housing and Employment Forecasts Report, April 2013 forecast that from 2011 to 2031 71,000 jobs will be created in the county as follows:

- Cambridge – 22,000;
- East Cambridgeshire – 7,000;
- Fenland – 5,000;
- Huntingdonshire – 15,000; and
- South Cambridgeshire – 22,000.

Strategic Development Locations

3.2.48 The location of Local Plan proposed future strategic development site allocations within the study area are shown geographically in Appendix 17. Developments which have been completed to date or have almost reached completion have been excluded. Strategic development site allocations form a major part of the development strategies for several of the districts/unitary authorities within the study area. The plan provided in Appendix 17 shows that:

- Strategic residential sites are proposed along the A428 corridor (Bourn airfield and Cambourne) in South Cambridgeshire,
- Employment and mixed-use sites are proposed around Bedford on the A421 corridor; and
- Mixed-use development is planned around Bicester and Cherwell district.

Growth Plans Summary

Key Points

Housing Growth

- Ambitious housing growth plans have/are being set by the LEPs and local authorities within the study area with approximately 235,000 new dwellings to be delivered in the future; and
- High levels of housing growth are forecast for Oxfordshire, Aylesbury Vale, Milton Keynes, Bedford and Cambridgeshire.

Employment Growth

- Ambitious employment growth plans have/are being set by the LEPs and local authorities within the study area with approximately 270,000 new jobs to be delivered in the future; and
- High levels of job growth are forecast for Cambridgeshire, Aylesbury Vale, Vale of White Horse, Milton Keynes and South Northamptonshire.

Strategic Development Locations

- A number of strategic developments are planned along the east-west corridor including expansion of Cambourne and Bourn airfield in Cambridgeshire, urban extensions to Bedford and Bletchley and along the A34 corridor in Oxfordshire.

3.3 Future Changes to the Transport System

Strategic Imperative

The evidence base shows that the LEPs, local and unitary authorities and county councils are planning to deliver a range of transport schemes over their respective plan periods. These schemes will support specific local housing and employment developments and address local access issues, but will not address the strategic cross-boundary transport issues affecting the study area.

A number of national and regional schemes are also planned, the most significant being East West Rail. The future reintroduction of rail services will help address the lack of strategic east-west transport infrastructure. However, given the strategic economic importance of this corridor (linking Oxford, Milton Keynes and Cambridge) complementary investment in new east-west road infrastructure is also considered a requirement to unlock further development and economic growth in the study area.

3.3.1 This section provides a review of the national, regional and local plans to identify relevant planned and committed transport infrastructure schemes within the study area.

National and Regional Transport Schemes

3.3.2 A summary of the main relevant national and regional transport schemes is provided in Table 3-4.

Table 3-4: Study Area: Planned and Committed National and Regional Transport Schemes

LEVEL	DOCUMENT	TRANSPORT SCHEME	STATUS
National	Road Investment Strategy 2014 (RIS 1 2015 to 2020)	M4 Junctions 3 to 12	Committed
		A34 Junction Improvements	
		A34 Technology Improvements	
		A43 Abthorpe Junction	
		A5 Towcester Relief Road	
		A5-M1 Link Road	
		M1 Junctions 13-19	
		M11 Junctions 8 to 14 Technology Upgrade	
		A428 Black Cat to Caxton Gibbet	
		A14 Cambridge to Huntingdon Scheme	
	Road Investment Strategy (RIS 2) Research Phase	A1 East of England (M25 to Peterborough)	Research Phase
	Network Rail/ East West Rail Consortium	East West Rail – Western Section (Bedford, Milton Keynes, Aylesbury, Oxford)	Committed
		East West Rail – Central Section (Bedford to Cambridge)	Route Options
	High Speed Rail (London - West Midlands) Bill	HS2	Committed
	Network Rail	Great Western Route Modernisation	
		Thameslink	
		Midlands Mainline Electrification	
Regional	Greater Cambridge Greater Peterborough Strategic Economic Plan	St Neots to Cambridge public transport capacity	Committed
	South East Midlands LEP Strategic Economic Plan	Dualling A421 in Milton Keynes (Fen Farm to Junction 13 M1)	
		Bedford Western Bypass, Northern Section	
		A421 Corridor Bedford	
	Oxfordshire LEP Strategic Economic Plan	Kennington and Hinksey roundabout improvements	
		Northern Gateway roundabout improvements	
		A40/A44 Link Road	
		New Bicester Park and Ride	
	Crossrail Ltd	East-west underground rail across London	

3.3.3 Table 3-4 summarises the main relevant national and regional transport infrastructure improvement schemes planned within the study area. The main schemes are shown geographically on the plan provided in Appendix 18. A summary of the relevant schemes is also provided in Appendix 18.

Local Transport Schemes

3.3.4 A summary of the main relevant local transport schemes is provided in Table 3-5. The review of the relevant LTP documents has focused on single schemes valued in excess of £5.0 million.

Table 3-5: Study Area: Planned and Committed Local Transport Schemes

DOCUMENT	TRANSPORT SCHEME
Cambridgeshire Local Transport Plan	None applicable in immediate study area with the exception of City Deal funded schemes.
Central Bedfordshire Local Transport Plan	A5-M1 Link (detailed above)
	Luton Northern Bypass
	New parkway station in the vicinity of M1 J11A
	Luton Dunstable Busway and possible extensions
	Park & Ride – A5/A505 to the north of Dunstable & the A6 north of
	East of Leighton Distributor Road
	Biggleswade Eastern Relief Road
	Flitwick –Westoning Bypass
	Bedford to Milton Keynes Waterway
	The Wixams Station
Bedford Borough Council	Bedford western bypass Northern Section
Milton Keynes Local Transport Plan	Dualling of A421 to M1 Junction 13
	Olney Bypass (A509, north east of Milton Keynes)
	Bletchley Southern Bypass
	Bletchley Southern Distributor Road
Buckinghamshire Local Transport Plan	None applicable in study area except general Improvements should be made to the A421 through Buckingham.
Oxfordshire Local Transport Plan	Hinksey Hill Northbound Slip Road
	Harwell Link Rd Section 1 B4493 to A417
	Featherbed Lane and Steventon Lights
	Didcot Station Car Park Expansion
	Milton Interchange
	A34 Chilton Junction Improvements
Northamptonshire County Council	Dualling of the A43 Northampton to Kettering
	A43 North and South of Northampton
	A5 Bypass for Towcester (detailed above)
	A45 Nene Valley Way
	A45 Northampton to Wellingborough
	A45 Wellingborough to the A14 – including improvements to the A6 Chown's Mill Roundabout and dualling of the A45 between Stanwick and Thrapston
	A45 Northampton to Daventry – including Flore/ Weedon/ Upper Heyford Bypass
	North-west Northampton – including Sandy Lane Relief Road, Northampton North West Bypass
South East Perimeter Road, Bicester: Conclusion of Options Assessment Work – Recommendation of Preferred Route	South East Perimeter Road, Bicester
Greater Cambridge City Deal	A428 bus priority and new Park and Ride
Oxford and Oxfordshire City Deal	Northern Gateway(A40/A44 Link Road and Cuttleslowe and Wolvercote roundabout improvements)
	Oxford Science Transit (detailed above)
	Harwell Phase 1 Access Road

3.3.5 Table 3-5 summarises the main local transport infrastructure improvement schemes planned within the study area. A description of the most relevant schemes is provided in Appendix 18.

Local Road Studies

3.3.6 A number of studies have been commissioned to investigate strategic road improvements within the study area including:

- A34 Baseline Report (September 2013) and Strategy Elements Report (2014);
- Alternatives to the A418 Improvements (2007); and
- A421 Corridor Transport Study Buckingham to Milton Keynes (2015).

3.3.7 The main findings of these studies are summarised in Appendix 18.

Port and Airport Growth

3.3.8 The two primary ports which have an impact on the existing primary Oxford to Cambridge route are Southampton (approx. 36 million tonnes of freight in 2013) and Felixstowe (approx. 26 million tonnes of freight in 2013). Freight traffic to and from Southampton from the West Midlands travels along the A34 and as such this route is a designated European freight route. Freight traffic to Felixstowe typically uses the A14 to connect to the UK SRN and also similarly functions as a European freight route.

3.3.9 According to "Update of UK Port Demand Forecast to 2030" by MDS Transmodal Ltd, without further infrastructure improvements Felixstowe is predicted to grow in capacity by 9.3 percent (2,835 to 3,100 Twenty-Foot Equivalent Unit shipping containers) by 2030 on 2005 volumes and Southampton by 20.3 percent (1,377 to 1,657 Twenty-Foot Equivalent Unit shipping containers). This could lead to significant increases in the number of HGVs on the A34, A14 and their distributor roads.

3.3.10 The airports with regular domestic and/or international flights which have an impact on the study area road network are London Luton and London Stansted.

- Luton lies to the southern extreme of the study area and road commuters from either Milton Keynes or Bedford travelling to this airport would do so by the A5 or A6 which intersected the east-west roads of the A421 in Milton Keynes and the A421 to the south of Bedford; and
- London Stansted is to the east of the M11 south of Cambridge. Most traffic travelling to this airport would do so via this road as there is little in the way of east-west connections to the airport. For example if someone were to travel to Stansted from Milton Keynes by road they would need to do so either via Cambridge or the M25 or A10/A120 routes to the south.

3.3.11 Airport growth has previously been predicted by the DfT within the UK Aviation Forecast (January, 2013) and is summarised in Table 3-6. The table below provides unconstrained and constrained values from a central case estimate for growth. Unconstrained forecasts exclude the impact of any runways or terminals reaching capacity in order to mimic unlimited airport expansion to meet demand. Constrained forecasts limit the estimate to current airport capacities, eliminating the possibility of any expansion.

Table 3-6: Airport Growth Forecast

SCENARIO	AIRPORT	TERMINAL PASSENGERS (MILLION PASSENGERS PER ANNUM)		
		2011	2030	2050
Un-constrained	London Luton	9.5	13.9	20.8
	London Stansted	18.0	26.3	37.9
Constrained	London Luton	9.5	18.5	17.7
	London Stansted	18.0	28.1	55.2

Future Changes to the Transport System Summary

Key Points

Planned/Committed Transport Schemes

- Strategic Road Schemes include:
  - M1, M4 and M11 Smart motorway interventions,
  - A34 junction and technology improvements,
  - A5-M1 link road;
  - A428 Black Cat to Caxton Gibbet Dualling;
  - A14 Improvement Scheme.
- National Rail Schemes include:
  - East West Rail and HS2.
- Local Schemes include:
  - A421 dualling, Milton Keynes, Fen Farm to the M1;
  - Completion of the Bedford Western Bypass;
  - Oxford Science Transit;
  - A428 public transport corridor improvements.

Previous Studies

- A34 Baseline Study identified a number congestion issues with the A34 and recommended a long list of potential measures including travel planning, ramp metering, HGV overtaking bans, technology solutions, hard shoulder running, public transport improvements, widening and new routes;
- A418 Study looked at alternative to new dual carriageway provision including investment in public transport, travel planning and walking and cycling measures which could result in significant behavioural change impacts;
- A421 Corridor Study identified that potential residential growth of 9,630 dwelling in Milton Keynes will have a significant impact on the operation of the A421 corridor by 2031.

3.4 Future Travel Demands and Levels of Service

Strategic Imperative

The evidence base shows that high levels of traffic growth are forecast to occur on the primary east-west road route within the study area. AADT flows are forecast to increase by 32 percent to 40 percent by 2035. If no strategic road improvements are delivered in this period sections of the A34, M40, A421 and A428 are forecast to operate overcapacity resulting in substantial congestion, delays and journey time variability, particularly during the peak travel periods.

Investment in new east-west road infrastructure will help address future road capacity constraints, particularly along the A43 and A421. A new Expressway link between Oxford and Milton Keynes will provide new road capacity to support economic growth and enable the delivery of new jobs and homes in Oxfordshire, Buckinghamshire and Milton Keynes.

3.4.1 This section provides a high level assessment of the future travel demands and operation of the primary east-west route through the study area. The main driver for increased travel demand will be an increase in population within the study area. The predicted population growth in the study area is presented below along with a high level capacity assessment of the primary corridor route.

Travel Demand

Population Growth

3.4.2 This section provides a review of the projected increase in population at the local level. Each planning authorities Local Plan documents have been reviewed to identify the level of forecast population growth. The most recently available Local Plans have been reviewed and therefore for a number of districts/unitary authorities this includes their Draft Local Plans which are yet to be adopted as formal planning policy. A summary of the population growth forecasts for each district/unitary authority is provided in Table 3-7. The Local Plan population growth has been compared against the NTEM district boundaries forecast population growth for 2016 to 2041.

Table 3-7: Population Growth within the Study Area

AREA	DISTRICT	PLAN STATUS	GROWTH PERIOD	POPN INCREASE	TEMPRO POPN INCREASE 2016-2041
Oxfordshire	Cherwell	Adopted	2011 - 2031	8,180*	21,606
	Oxford	Adopted	2006 - 2026	25,100	20,397
	South Oxfordshire	Adopted	2006 - 2026	13,320	18,612
	Vale of White Horse	Draft/Proposed	2011 - 2031	14,739	26,192
	West Oxfordshire	Adopted	2011 - 2026	38,900	13,935
Sub Total				**100,239**	**100,742**
Berkshire	West Berkshire	Adopted	2006 - 2026	15,975	19,234
Northamptonshire	South Northamptonshire	Adopted	2001 - 2029	28,070	17,517
Buckinghamshire	Aylesbury Vale	Draft/Proposed	2006 - 2026	38,900	63,240
Milton Keynes	Milton Keynes	Adopted	2010 - 2026	57,460	79,379
Bedfordshire	Bedford	Adopted	2006 - 2021	21,000	41,709
	Central Bedfordshire	Adopted	2011 – 2021*	31,700	65,629**
Sub Total				**52,700**	**107,338**
Cambridgeshire	Cambridge	Draft/Proposed	2011 - 2031	27,000	43,766
	South Cambridgeshire	Draft/Proposed	2011 - 2031	38,000	50,249
	Huntingdonshire	Draft/Proposed	2011 - 2031	25,500	24,313
Sub Total				**90,500**	**118,328**
Total				**385,664**	**505,778**

* Population taken from draft report

** Combined Mid and South Bedfordshire TEMPRO Districts

3.4.3 Table 3-7 shows that the population forecasts contained with the study area Local Plans result in a total increase in population of 385,700 people. The population increase forecast by NTEM for the period 2016 to 2041 is 505,778. The Local Plan and NTEM data shows that the population of Milton Keynes is predicted to grow significantly during these periods. High levels of population growth are also forecast for Aylesbury Vale, West Oxfordshire (Local Plan), South Cambridgeshire and Central Bedfordshire.

3.4.4 To enable a consistent comparison of each of the districts Local Plans and NTEM population growth forecasts, a consistent future year of 2021 has been selected (Table 3-8). It has been assumed that the population increases at a constant rate each year.

Table 3-8: Population 2021 Forecast

DISTRICT	LOCAL PLAN EST POPN CHANGE 2021	POPN CHANGE 2011-2021 (%)	TEMPRO EST POPN CHANGE 2021	POPN CHANGE 2011-2021 (%)
West Oxfordshire	25,933	+ 24.8%	5,154	+4.9%
Milton Keynes	35,913	+ 14.4%	38,041	+15.8%
South Cambridgeshire	19,000	+ 12.8%	20,510	+14.2%
Central Bedfordshire	31,700	+ 12.5%	31,430*	+8.9%
South Northamptonshire	10,025	+ 11.8%	7,505	+8.7%
Aylesbury Vale	19,450	+ 11.2%	26,416	+15.0%
Cambridge	13,500	+ 10.9%	20,379	+18.7%
Bedford	14,000	+ 8.9%	19,583	+12.3%
Oxford	12,550	+ 8.3%	8,645	+6.2%
Huntingdonshire	12,750	+ 7.5%	15,470	+9.0%
Vale of White Horse	7,370	+ 6.1%	11,100	+9.2%
West Berkshire	7,988	+ 5.2%	9,190	+6.0%
South Oxfordshire	6,660	+ 5.0%	8,461	+6.4%
Cherwell	4,090	+ 2.9%	12,047	+8.6%
Total	220,928	**+ 10.2%**	**233,931**	**+10.5%**

* Combined Mid and South Bedfordshire TEMPRO Districts

3.4.5 Table 3-8 shows that using a common future year of 2021, West Oxfordshire is forecast to experience the highest level of population growth. High levels of population growth are also forecast for Milton Keynes, South Cambridgeshire and Central Bedfordshire. The NTEM population data shows that the largest increases in population are forecast for Cambridge, Milton Keynes, Aylesbury Vale, South Cambridgeshire and Bedford.

3.4.6 Appendix 19 provides plans showing the NTEM forecast increase in working age population within the study area. The plans in Appendix 19 show relatively high working age population increases are forecast in Cambridge, Northampton, Oxford, Milton Keynes, Aylesbury, Bedford and South Cambridgeshire. The plans is Appendix 19 also show the largest percentage increases in working age population are forecast in Cambridgeshire, Bedford, Central Bedfordshire, Northamptonshire and the areas surrounding Dunstable, Luton and Aylesbury.

Car Ownership Changes

3.4.7 In order to understand future car ownership within the corridor TEMPRO has been interrogated. The TEMPRO forecast growth in car ownership by district and percentage change in cars per household is summarised in Table 3-9 below. The data has been ranked by high levels of forecast car ownership.

Table 3-9: TEMPRO forecast change in Car Ownership 2016 to 2041

DISTRICT	CAR OWNERSHIP					CARS PER HOUSEHOLD		
	No Car	1 Car	2 Cars	3+ Cars	Total Cars	2016	2041	% Change
Aylesbury Vale	18.7%	21.8%	92.3%	33.6%	53.0%	1.50	1.44	-3.8%
	(4,814)	(23,251)	(8,980)	(4,351)	(55,135)			
Cambridge	37.4%	30.9%	66.4%	36.1%	46.5%	1.04	1.10	6.0%
	(3,858)	(14,644)	(5,449)	(2,041)	(32,074)			
South Cambridgeshire	19.0%	22.7%	79.4%	32.7%	41.8%	1.50	1.49	-0.1%
	(2,321)	(14,295)	(7,057)	(4,042)	(41,344)			
Milton Keynes	15.9%	18.9%	108.9%	30.6%	38.0%	1.31	1.34	2.1%
	(4,701)	(21,906)	(9,577)	(5,642)	(59,114)			
Bedford	13.8%	16.5%	63.9%	24.1%	36.1%	1.32	1.33	0.8%
	(3,181)	(14,462)	(6,148)	(2,976)	(36,281)			
Vale of White Horse	15.0%	11.1%	57.1%	20.8%	32.6%	1.48	1.46	-1.6%
	(1,704)	(9,633)	(3,696)	(2,109)	(23,773)			
Central Bedfordshire*	12.3%	13.7%	75.9%	24.3%	32.4%	1.46	1.47	0.7%
	(1784)	(9,964)	(3,932)	(2,840)	(26,915)			
South Northamptonshire	2.6%	5.2%	83.5%	19.5%	23.6%	1.57	1.59	1.2%
	(373)	(4,255)	(2,612)	(1,670)	(14,823)			
South Oxfordshire	5.4%	3.8%	51.7%	13.6%	20.8%	1.53	1.52	-0.1%
	(864)	(6,689)	(2,368)	(2,151)	(18,308)			
Cherwell	4.7%	2.9%	68.1%	14.6%	19.4%	1.41	1.43	1.7%
	(802)	(6,482)	(2,731)	(2,247)	(19,134)			
Oxford	15.0%	11.3%	31.8%	14.2%	16.4%	1.07	1.18	11.0%
	(-443)	(4,659)	(3,586)	(2,292)	(19,165)			
West Oxfordshire	0.1%	-1.9%	67.9%	12.9%	13.1%	1.47	1.52	3.1%
	(49)	(2,941)	(1,208)	(1,843)	(11,254)			

* Combined Mid and South Bedfordshire TEMPRO Districts

3.4.8 Table 3-9 shows that the largest growth in car ownership is forecast to occur in Aylesbury Vale and Cambridge where car ownership is anticipated to increase by between 53.0 percent and 46.5 percent respectively. The forecast growth in car ownership in Aylesbury Vale, Cambridgeshire and Milton Keynes is significantly higher than Cherwell, Oxford and West Oxfordshire.

3.4.9 In the urban areas of Oxford and Cambridge in 2016, the number of cars per household is relatively low at 1.07 and 1.04 respectively. In the more rural Districts of South Northamptonshire and South Oxfordshire the number of cars per household is significantly higher at 1.57 and 1.53 respectively.

3.4.10 In most districts the number of cars per household is anticipated to increase between 2016 and 2041. The largest increase in car ownership per household is forecast to occur in Oxford. Here, car ownership is expected to increase from 1.07 in 2016 to 1.18 in 2041. Conversely there is expected to be a -3.8 percent reduction in cars per household in Aylesbury Vale.

3.4.11 Figure 3-1 below shows the TEMPRO forecast increase in car ownership within the study area between 2016 and 2041.

Figure 3-1: TEMPRO Forecast percentage change in car ownership 2016 to 2041

Travel Demand

3.4.12 Future travel demand along the Oxford to Cambridge corridor has been forecasted using TEMPRO and is summarised in Table 3-10 below. This is the average growth in production and attraction trip ends within each district for all modes of travel. The districts have been ranked by forecast increase in travel demand.

Table 3-10: TEMPRO Trip End Growth Factors 2016 to 2041 (Average Production & Attraction)

DISTRICT	TRAVEL DEMAND GROWTH (COMBINED MODES)
Cambridge	28.2%
South Cambridgeshire	26.3%
Milton Keynes	21.6%
Aylesbury Vale	21.4%
Central Bedfordshire*	17.0%
South Northamptonshire	16.6%
Vale of White Horse	16.1%
Bedford	15.9%
Mid Bedfordshire	10.9%
Oxford	10.3%
West Berkshire	9.9%
Cherwell	8.9%
South Oxfordshire	7.3%
West Oxfordshire	6.0%

* Combined Mid and South Bedfordshire TEMPRO Districts

3.4.13 Table 3-10 shows the largest growth in travel demand is forecast to occur within Cambridge and South Cambridgeshire where a 28 percent and 26 percent increase in trips in anticipated between 2016 and 2041. The lowest growth in trips is forecast in West Oxfordshire where growth of 6.0 percent is expected.

Network Operation

3.4.14 In order to establish the future situation on the study area east-west corridor, TEMPRO has been interrogated to establish the background traffic growth from 2014 and 2035. TEMPRO calculates traffic growth factors through the use of a dataset from DfT's National Transport Model (NTM). The latest dataset is NTM 2009 and is based on the 2009 National Transport Model forecasts and has a maximum forecast year of 2035.

3.4.15 Growth factors for Rural Principal Roads and Rural Motorways for counties along the Oxford to Cambridge corridor have been extracted from TEMPRO and are summarised in Table 3-11 below.

Table 3-11: TEMPRO Traffic Growth Factors 2014 to 2035

COUNTY	RURAL PRINCIPAL	RURAL MOTORWAY
Bedfordshire	1.321	1.372
Cambridgeshire	1.398	1.452
Essex	1.325	1.376
Hertfordshire	1.282	1.332
Northamptonshire	1.425	1.471
Berkshire	1.345	1.390
Buckinghamshire	1.403	1.450
East Sussex	1.326	1.371
Hampshire	1.313	1.357
Oxfordshire	1.320	1.364
West Sussex	1.313	1.356
Wiltshire	1.345	1.409

3.4.16 The growth factors shown in Table 3-11 have been applied to 2014 AADT flows along the Oxford to Cambridge route. The change in traffic flows along the Oxford to Cambridge primary east-west route are summarised in Table 3-12 and shown graphically in Appendix 20.

Table 3-12: Forecast Traffic Increase 2014 to 2035

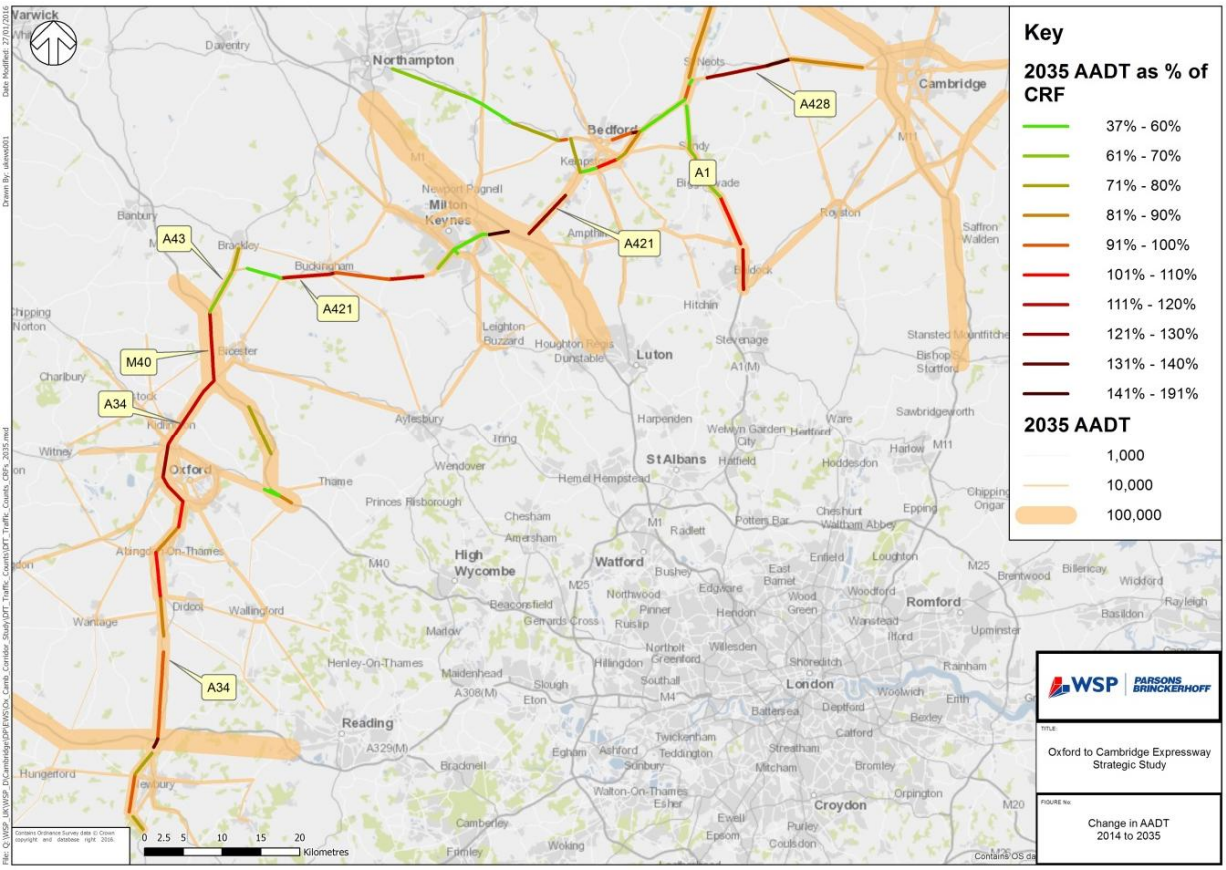
SECTION	2014 AADT	2035 AADT	CHANGE	% CHANGE
A428 (M11 to Caxton Gibbet)	29,360	41,036	11,676	39.8%
A428 (Caxton Gibbet to A1)	20,765	28,360	7,595	36.6%
A1	53,267	73,078	19,811	37.2%
A421 (A1 to A6)	41,920	55,367	13,447	32.1%
A421 (A6 to M1)	35,506	46,895	11,389	32.1%
A421 (Milton Keynes)	25,829	34,115	8,285	32.1%
A421 (Milton Keynes to A4421)	19,055	26,422	7,366	38.7%
A421 (A4421 to A43)	8,018	11,004	2,986	37.2%
A43 (A421 to M40)	34,870	47,855	12,985	37.2%
M40	100,501	137,113	36,612	36.4%
A34 (M40 to A40)	65,416	86,366	20,950	32.0%
A34 (A40 to A4142)	69,612	91,906	22,294	32.0%
A34 (A4142 to A415)	54,271	71,651	17,381	32.0%
A34 (A415 to M40)	55,127	73,120	17,994	32.6%

3.4.17 Table 3-12 shows that between 2014 and 2035, the AADT traffic flows along the Oxford to Cambridge primary route are forecast to increase by 32 percent to 40 percent. The largest level of traffic growth is forecast along the A428 between the M11 and Caxton Gibbet Junction and equates to an increase of 11,676 vehicles. The lowest level growth is forecast on the A34 between the M40 and A4421.

3.4.18 To create an initial picture of the future growth along the east-west corridor a model using the forecast 2035 AADT traffic flows across the corridor has been created. The model compares the forecast 2035 AADT flows to the theoretical link capacity of the primary east-west corridor. The theoretical link capacity uses the calculated CRF flows. The purpose of this model is to provide a high level assessment or the potential future performance of the corridor (without improvement) to identify which sections will be under the highest levels of stress.

3.4.19 Links that are likely to be operating at their maximum sustainable hourly throughput of the link are identified in red and links that are significantly higher than the maximum sustainable hourly throughput of the link are coloured in black. Figure 3-2 shows the 2035 AADT flows as a percentage of the calculated CRF.

Figure 3-2: 2035 AADT as a Percentage of the Calculated CRF



3.4.20 Figure 3-2 shows that significant sections of the primary east-west route under consideration are predicted to be operating overcapacity in 2035 with an AADT exceeding the CRF. On these links in peak hours there will be a breakdown in traffic flows. The following route sections are forecast to be operating overcapacity:

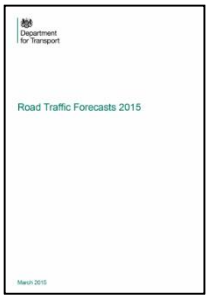
- A34, south of Oxford, around the western side of Oxford and to the M40;
- M40, Junction 9 to 10;
- A421 single carriageway east of the A4421;
- A421 Expressway between Bedford and Milton Keynes; and
- A428 single carriageway section.

3.4.21 It is also evident from the information presented in Figure 3-2 that the following route sections under consideration are forecast to continue operating within their theoretical link capacities:

- A421 approach to the A43
- A421 though Milton Keynes, east of Bedford; and
- A421 Expressway.

3.4.22 A number of targeted transport improvement schemes are proposed to be implemented along the Oxford to Cambridge Corridor by 2035 (A421 dualling in Milton Keynes and the A428 dualing). Whilst this would increase capacity along the corridor, traffic flows are still likely to exceed the maximum sustainable traffic flow.

Road Traffic Forecast 2015



The Road Traffic Forecasts 2015 (RTF15) were released by the DfT in March 2015 and is a high level strategic view of future traffic flows in England. The report brings together components of the NTM and is intended to help shape the DfT's long term strategic view.

3.4.23 The model contemplates what the future situation may be like based on available evidence and seeks to address concern over the significant level of traffic growth predicted in previous forecasts (e.g. Road Traffic Forecasts 2013).

3.4.24 The report considered future traffic conditions for five scenarios. These differ from one another based on their trip rate assumptions, income relationships and outlook on macroeconomic conditions. A summary of the scenarios tested as a part of the 2015 forecasts is given in Table 3-13 below.

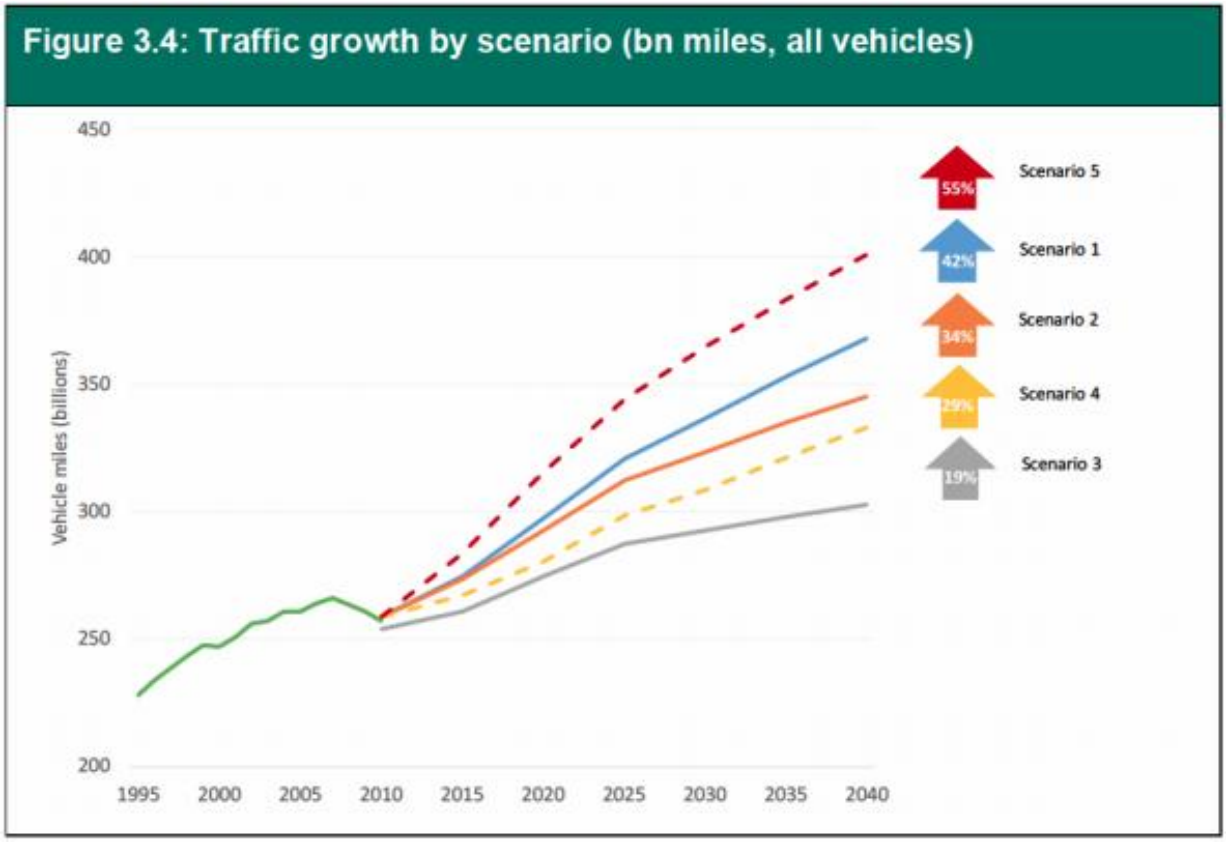
Table 3-13: Road Traffic Forecast 2015 Scenarios

SCENARIO	TRIP RATES	INCOME RELATIONSHIP	MACROECONOMICS
Scenario 1	Historic Averages	Positive and Declining	Central
Scenario 2	Historic Averages	Zero	Central
Scenario 3	Extrapolated trend	Positive and Declining	Central
Scenario 4	Historic Average	Positive and Declining	High Oil, Low GDP
Scenario 5	Historic Average	Positive and Declining	Low Oil, Low GDP

3.4.25 In all of the scenarios assessed by the DfT, traffic growth is assumed to increase; however the level of traffic growth between 2010 and 2040 varies between 19 percent and 55 percent dependent on the scenario.

3.4.26 Growth on the SRN is expected to be strong, between 29 percent and 60 percent from 2010 to 2040, whilst it is 12 percent to 51 percent on other principal roads. In the lower end of the forecasts a reduction of vehicle trips in urban centres is expected. Figure 3-3 below summarises the forecast level of growth under each scenario.

Figure 3-3: 2035 AADT as a Percentage of the Calculated CRF



Source: Road Traffic Forecasts 2015 (RTF15)

3.4.27 The lowest level of traffic growth is forecast in Scenario 3 (19 percent). This scenario extrapolates observed (declining) trip rates. The highest levels of growth are expected under a low oil and high GDP scenario, i.e. the cost of driving is low and incomes are high, and thus encouraging driving and car ownership

3.4.28 The variation in the scenarios tested above highlights the uncertainty associated with predicting future traffic flows. The central scenarios of the report however do support the level of growth forecast using TEMPRO along the Oxford to Cambridge corridor.

Future Travel Demands and Level of Service Summary

Key Points

Population Growth

- Local Authority Local Plans within the study area looking to support a 386,000 increase in population; and
- High levels of population growth are forecast for Oxfordshire, Cambridgeshire, Central Bedfordshire, South Northamptonshire and Aylesbury Vale.

Car Ownership

- High levels of car ownership growth forecast in the study area, particularly in Aylesbury Vale, Cambridgeshire, Milton Keynes and Bedford.

Travel Demand

- High levels of travel demand forecast in Cambridgeshire, Milton Keynes, Aylesbury Vale, and Central Bedfordshire by 2041.

Network Operation

- Traffic flows forecast to grow across the east-west corridor network by 32 percent -40 percent by 2035. However there is significant uncertainty in forecasting traffic growth into the future; and
- Sections of the A34 to the south and around Oxford, M40 Junction 9 to 10, single carriageway sections of the A421 and A428 and the A421 Expressway are all forecast to be operating overcapacity by 2035.

4 Need for Intervention

CASE FOR INTERVENTION

This study has demonstrated that that there is a lack of strategic east-west transport connectivity across the study area. The existing primary east-west road route performs important strategic functions, connecting urban conurbations and employment centres, accommodating freight movements and providing access to national freight routes.

This study has identified that sections of the primary east-west road route currently suffer from congestion during the peak travel periods, resulting in journey time variability and delays, which inhibit strategic connectivity and create a barrier to economic development in key growth areas including the Oxford, Milton Keynes and Cambridge functional economic areas.

Within the study area local and regional authorities are planning for substantial levels of population and job growth. In particular, substantial housing and job growth in the Cambridge, Oxford and Milton Keynes functional economic areas is required to support their expanding, strong, dynamic, innovative and successful knowledge based economies which contribute disproportionately towards the national economic output.

The local, regional and national authorities have identified that congestion, unreliable journey times and poor east-west connectivity are barriers to delivering future housing development and economic growth within the study area. If strategic east-west transport improvements are not delivered, traffic growth on the existing primary road route is predicted to result in additional sections of the network operating over-capacity during the peak travel periods, further increasing journey time variability and delays. Delays as a result of increased congestion will be a cost borne by businesses, further restricting business efficiency, investment and access to local, regional and global markets.

In order to flourish, collectively knowledge-based sectors depend upon high quality support from 'enabling' sectors such as financial and professional services and other business services which are predominantly, but not exclusively, located in London. As a consequence, existing high-quality radial transport links into London allow firms located along the Oxford to Cambridge to access world-class support in London and improved east-west connectivity along the corridor, such as journey times of around 45 minutes between Oxford/Cambridge and Milton Keynes could enable such support in the corridor, further boosting economic growth.

East-west transport interventions could therefore address:

- Limited commuting/interaction between Oxford and Cambridge (each has zone of influence) and the urban and rural areas in between;
- Improved connectivity along the Oxford to Cambridge Expressway corridor is likely to increase the number of people commuting between local areas and may lead to better matching between skills and employment opportunities; and
- Improved connectivity is likely to deliver increased economic interaction (with associated impacts on trade, specialisation, productivity etc.) between the local areas.

The potential to integrate east-west transport interventions with national (East West Rail and HS2), regional and local infrastructure schemes is essential to the regional and national growth agenda and creating wider opportunities for growth and economic performance.

Interventions that deliver improved east-west connectivity within the study area will therefore have a positive impact on travel reliability, network reliance and enhance future local, regional and national connectivity and support economic growth.

4.1 Introduction

4.1.1 This section of the study establishes the case for intervention with regards to improving the primary east-west corridor within the study area, based on an understanding of the current and future:

- Route function;
- Route performance; and
- Study area growth agenda.

4.1.2 This study identifies that there is currently a lack of east-west connectivity across this part of the UK north of London and south of the Midlands. The evidence demonstrates the potential for improving connectivity by addressing this missing link in the national infrastructure. There is also an opportunity for benefits at three levels for any improvements in east-west connectivity:

- **Strategic** – the role of the corridor in the context of the national rail and strategic road network;
- **Regional** – addressing significant growth planned along the corridor and the contribution that this areas has to the UK economy and international markets; and
- **Local** – sections of the corridor will have potential positive impacts in their own right, such as access between homes and jobs.

4.1.3 Detailed consideration of the overall case for intervention for the primary east-west road corridor is provided in Sections 4.2 to 4.5 below.

4.2 Route Function

4.2.1 The primary east-west road route serves a predominantly regional and sub-regional function. It is the most direct route for journeys between Oxford, Milton Keynes and Cambridge, whilst also providing a route to the south-west of England. Sections of the corridor also provide important strategic freight routes, including the A34 (linking the southern ports with the M4 and M40) and providing access to the SRN including the M1, A1, A14 and M11. Local access to the SRN has resulted in a concentration of distribution centres within the study area, in particular in Milton Keynes and Northamptonshire.

4.2.2 Analysis of the current travel demand patterns in Chapter 2 demonstrated that currently there are very low levels of strategic commuter travel demand between Oxford, Cambridge and Milton Keynes, suggesting the route has a limited strategic function. These functional economic areas are playing an increasingly important role in the national economy and good transport connectivity is vital to support their continuing economic success.

4.2.3 New transport infrastructure could address the low level of strategic movements between the main functional economic areas, and in particular potentially reduce the current unattractive journey times between Cambridge and Oxford, of over two and half hours by road and rail by an hour or more. This equivalent to being able to travel between Oxford and Milton Keynes in around 45 minutes and a similar time between Cambridge and Milton Keynes. This is in line with transport and economic performance guidance where a journey time of up to 45 minutes is acknowledged as encouraging wider economic benefits to occur in terms of productivity and investment benefits, allowing skilled workers to access jobs and improving business to business connectivity.

4.2.4 Chapter 2 has also demonstrated that these functional economic areas generate substantial in-commuting flows, including from a number of communities located along the route (Didcot, Abingdon, Bicester, Buckingham, Bedford, St Neots and Cambourne). The travel demand data therefore shows that within the study area, the main east-west route provides an important regional function connecting the main conurbations with their surrounding labour pool.

4.2.5 For example the A34 is an important commuter route into Oxford and the Science Vale, the A421 (between Buckingham and Milton Keynes) is an important commuter route, as is the A421 between Milton Keynes and Bedford. The A428 also provides an important commuter route between St Neots and Cambridge. Good transport access into the functional economic areas and between these communities is vital to support growth in the study areas highly skilled knowledge-based economy which contributes disproportionally to the UK economy.

4.2.6 This study has demonstrated that the primary east-west route performs important regional, sub-regional and local functions. The importance of regional, sub-regional and local connectivity into and between the nationally important functional economic areas of Oxford, Milton Keynes and Cambridge make the strategic case for intervention, ensuring that the east-west route does not constrain the future economic growth associated with these functional economic areas.

4.3 Route Performance

4.3.1 Chapters 2 and 3, and the following sections of this Chapter, show that there are problems and issues which affect the performance of sections of the primary road route connecting Oxford, Milton Keynes and Cambridge. It is considered that the scale of the existing and future traffic flows and congestion levels on sections of the route will be a significant impediment to route performance and merit further investigation of potential interventions for both Expressway and other modes and measures.

4.3.2 A corridor Red, Amber, Green (RAG) high level assessment has been undertaken to summarise the current and forecast performance of the route. The RAG route performance plan is provided in Appendix 21 with a summary provided in the sections below.

Route Standard

4.3.3 This report has identified that the carriageway standards vary significantly along the primary east-west road route. The only sections of the route that are considered to be of an Expressway standard are:

- A34: To the south and north of Oxford;
- M40: Junction 9 to 10;
- A421: From the M1 to the A1; and
- A428: From the A1198 to the A14.

4.3.4 The A421 between the A43 and Milton Keynes and the A428 between the A1 and A1198 are both single carriageway sections with frequent at grade minor access junctions which suffer from relatively low average speeds, poor journey time reliability and higher accident collision rates compared to Expressway standard sections of the corridor. The RIS investment includes the dualling of the A428 between the A1 and Caxton Gibbet junction to an Expressway standard. However, the primary strategic east-west road connection between Oxford and Milton Keynes (linking the A34, M40 and M1) will remain the single-carriageway section of the A421.

Public Transport Alternatives

4.3.5 The public transport alternatives to the primary east-west road route are limited. Currently there is no direct east-west rail route linking Oxford, Milton Keynes and Cambridge. This will be addressed by the East West Rail scheme although the section linking Bedford and Cambridge is not committed at this stage. The X5 also links the three main urban areas and provides a viable commuter route for communities within 45 minutes- 60 minute journey time of these urban areas.

4.3.6 However, due the lack of alternatives, communities within the study area generally have a high car dependency and are reliant on the local and strategic road network to access jobs and services. The socio-economic demographic of the study area population also consists of a high proportion of employed, highly educated, highly skilled and well paid professionals who have greater propensity to travel further to access the range of high value and skilled employment opportunities, than the national average. The primary east-west road route is therefore an essential transport link for communities within the study area, particularly given the poor standard of the alterative road links.

4.3.7 The potential to link with national, regional and local public transport schemes with improved east-west connectivity is therefore essential to the UK. Relationships to East West Rail and HS2 routes together with other regional and local planned infrastructure are important. This will integrate with planned infrastructure and create wider opportunities for growth and economic performance.

Traffic Flows

4.3.8 The traffic flow analysis presented in this study shows that sections of the primary east-west route accommodate relatively high traffic flows. The A34 accommodates some of the highest traffic and HGV flows along the primary east-west route as it forms an important national and European freight route. The traffic flows along the A421 vary significantly and have experienced high levels of growth from 2010-2014. During this period traffic levels on the A421 between the A43 and Milton Keynes have grown by 19 percent and on the Expressway south of Bedford by 41 percent. Traffic volumes have also grown significantly on the A428 Expressway from Cambourne to the A14 (13 percent). The increase in traffic flow on the A421 and A428 Expressway sections demonstrate the potential impact of upgrading a single carriageway to an Expressway standard road within the study area.

4.3.9 Within the study area there are ambitious housing and employment growth plans for the current Local Plan periods. As a result traffic flows along the primary east-west route are forecast to increase substantially between 2014 and 2035. Traffic growth during this period is forecast to increase by over 30 percent which if realised would significantly affect the performance of the majority of the route. Further details on the potential impact of 'doing nothing' is provided below.

Route Congestion

4.3.10 The RAG assessment identifies several sections of the primary east-west route suffer from congestion which impacts on journey times and reliability. The A43 suffers from journey time reliability issues and relatively high journey times during the peak periods as a result of link and junction capacity problems. The A34 around Oxford to the M40 is forecast to be operating overcapacity by 2035. The main capacity issues are related to tidal inbound and outbound movements to Oxford and the Science Vale.

4.3.11 The M40 between Junction 9 and 10 suffers from journey time reliability and reduced average speeds during the peak periods. This section of the M40 is predicted to be overcapacity by 2035. The 50 mph section of the A43 suffers from journey time reliability, low average speeds during the peak periods and a poor safety record.

4.3.12 The A421 single carriageway section between the A4421 and Milton Keynes has low average journey speeds during the peaks and is forecast to be operating overcapacity by 2035. The A421 through central Milton Keynes has regular at grade roundabout junctions resulting in very low average speeds and a high accident rate. The A421 approaching the M1 suffers from significant journey time reliability, capacity and safety issues.

4.3.13 The A421 Expressway overall performs very well, with relatively high average speeds being maintained during the peak periods, has a good safety record and this section is predicted to accommodate the forecast levels of traffic growth.

4.3.14 The A1 suffers from poor journey time reliability and low average speeds, particularly during the peak periods on approach to the Black Cat Roundabout.

4.3.15 The A428 single carriageway section suffers from significant journey time reliability issues and low average speeds particularly during the peak periods. This section of the route currently suffers from link capacity issues which will be significantly worse by 2035.

4.3.16 The A428 Expressway overall performs very well, with relatively high average speeds being maintained during the peak periods, a good safety record and this section is predicted to accommodate the forecast levels of traffic growth.

4.3.17 In summary, the high level route RAG route performance assessment shows that the A34 and non-Expressway sections of the A421 and A428 suffer from congestion, journey time reliability and highway safety issues.

4.4 Growth Agenda

4.4.1 The study demonstrates that the study area LEPs and Local Plans produced by the local authorities are planning for ambitious housing and job growth by 2031 in order to cater for regional demand.

4.4.2 Within the study area approximately 235,000 new dwellings and 270,000 new jobs are planned to be delivered in the future; with high levels of housing and employment growth are forecast in Oxfordshire, Aylesbury Vale, Milton Keynes, Bedford, South Northamptonshire and Cambridgeshire.

4.4.3 A number of strategic developments are planned along the east-west corridor including the expansion of Cambourne and Bourn airfield in Cambridgeshire, urban extensions to Bedford and Milton Keynes and along the A34 corridor in Oxfordshire.

4.4.4 This study has identified to importance of supporting growth of the knowledge-based economies centred on the Oxford, Milton Keynes and Cambridge city-regions. These city-regions have high employment rates and highly productive economies, with high GVA per hour worked (in Milton Keynes 17 percent greater than the national average) and median hourly wages (South Cambridgeshire 28 percent greater than the national average).

4.4.5 Cambridge forms the largest knowledge cluster of the three city-regions, especially focused in scientific research and development. Oxford has a more diverse knowledge sector, with strengths in scientific research, publishing and vehicle manufacturing. Milton Keynes has a knowledge sector focused in IT, computer programming and information services.

4.4.6 These knowledge-based economies contribute disproportionately towards economic output, with higher average hourly wages and greater proportions of the workforce employed in managerial, professional and technical occupations.

4.4.7 Investment in the study area east-west corridor will act as an enabler for the delivery of new jobs, homes and wider economic benefits, directly supporting the growth aspirations of the LEPs and local authorities. Improved east-west connectivity will deliver more reliable journey times between these major city-regions, ensuring that transport connectivity does not constrain the future economic growth potential of these nationally important city-regions.

4.5 Strategic Case for Intervention

4.5.1 Failure to address the challenges identified in Chapters 2 and 3, and invest accordingly in east-west transport links within the study area, is likely to constrain economic growth along the Oxford to Cambridge corridor, and preclude the significant development opportunities highlighted by the LEPs. In the absence of transport interventions, congestion along the existing highway network is expected to intensify, leading to increased journey times for commuters and businesses.

4.5.2 Longer and less reliable commutes would, in effect, lead to the labour pools of Oxford and Cambridge shrinking. Residents of towns such as St Neots or Bicester will find it increasingly difficult to access opportunities in Cambridge and Oxford respectively, undermining the ability for companies to recruit and retain staff. In the longer term, households may choose to relocate closer to employment opportunities and placing pressure on the local housing market. Alternatively, businesses may choose to relocate to locations which support a deeper pool of labour, and which have better links to suppliers and customers.

4.5.3 Firms within the 'knowledge economy' also benefit greatly from economic agglomeration, relying on recruiting workers with highly specific skill sets to work within localised clusters of economic activity. Worsening transport links will undermine the effective density of the cities along the corridor, and limit the extent to which the productivity benefits generated through proximity to competitors and collaborators can be achieved.

4.5.4 Conversely, improved transport linkages will expand the pool of labour available to firms along the corridor, and lead to greater benefits through economic agglomeration. Not only will firms within the corridor be able to better match workers with specific skills to employment opportunities, but increased proximity of firms will stimulate greater economic interaction and knowledge spill-over effects. Businesses in the corridor will hence become more competitive at both a national and international level, and the corridor will hence be better able to compete globally for highly mobile investment. Companies such as AstraZeneca, expected to open their global headquarters in Cambridge in 2016, rely almost solely on the strengths of the local labour market, underlining the need for effective transport to connect skilled workers to knowledge-based employment.

4.5.5 Finally, improved transport links are also an important prerequisite to achieving the ambitions set out by the LEPs along the corridor. Each identifies how limited transport connectivity along key arterial routes acts as a barrier to growth, and constrains their ambitions for tens of thousands of new jobs and homes along the corridor. While, as highlighted in Section 2.7, the corridor is home to some of the strongest local economies in the UK, improvements in regional connectivity are vital to ensure that transport does not constrain future economic growth.

4.5.6 In summary interventions in the corridor could address:

- Limited commuting/interaction between Oxford and Cambridge (each has zone of influence) and the urban and rural areas in between;
- Improved connectivity along the Oxford to Cambridge Expressway Corridor is likely to increase the number of people commuting between local areas and may lead to better matching between skills and employment opportunities; and
- Improved connectivity is likely to deliver increased economic interaction (with associated impacts on trade, specialisation, productivity etc.) between the local areas.

4.5.7 In summary, interventions in the corridor could deliver the following benefits:

- Provide strategic east-west links, filling in the missing link in the road and rail network as there are no current strategic connections;
- Address key constraints, such as environmental impact in local communities;
- Promote further investment in the corridor and surrounding area;
- Integrate with planned infrastructure (HS2, East West Rail, other road improvements) and create wider economic opportunities for growth;
- Help facilitate significant planned housing and jobs growth;
- Tackle significant current and future congestion and the network reliability worsening over time;
- Provide interchange access to a number of national strategic roads including the M4, M40, M1, A1, A14 and M11;
- Overcome the restricted access to labour markets and improve business connectivity;
- Providing connections between homes and jobs, seeking to address the lack of affordable housing;
- Overcome the potential negative impact on economic growth (and reduction in contribution to UK economy) from lack of and worsening performance of east-west connections; and
- Seek to cater for some of the local infrastructure challenges, e.g. poor accessibility by all modes into urban centres.

4.6 Outline of Case for Intervention

4.6.1 The outline of the case for intervention within the study area is summarised below:

Key Points

- There is a strategic lack of east – west connections across this part of the UK;
- Sections of the route function as key national and regional freight routes (A34) and provide access to the national SRN network;
- Sections of the route provide important regional and sub-regional functions, linking communities along the route with the main functional economic areas and improving these sections will significantly improve access to labour markets;
- The current performance of the A34 and the non-expressway sections of the A421 and A428 are constraining its use, restricting functional economic area labour catchments, regional connectivity and economic growth;
- Without strategic transport interventions the forecast increase in travel demand and traffic growth will significantly increase delays and congestion on the primary east-west route, constraining economic growth of the communities within the study area and the key growth areas of Oxford, Milton Keynes and Cambridge;
- There is a need for improved connections across the region and into main urban areas and local centres;
- Interventions will have a positive impact on travel reliability, network resilience, regional and local connectivity which is vital to support economic growth and enable the delivery of new jobs and homes;
- This in turn will deliver economic benefits in the form of improved productivity. This will enable the area to contribute significantly to the national economy.

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