Highways England

A1 East of England Strategic Study

Task 1: Review of existing evidence and confirm the strategic case for improved connectivity on the A1

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URBAN, REGIONAL AND TRANSPORT PLANNING

Contents

List of Acronyms

AADT	Annual Average Daily Traffic
AAWT	Annual Average Weekday Traffic
AQMA	Air Quality Management Area
BCR	Benefit to Cost Ratio
BRES	Business Register and Employment Survey
CRF	Congestion Reference Flow
CRRN	Compliance Risk Road Network
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EB	Eastbound
ECML	East Coast Main Line
EEFM	East of England Forecasting Model
FPL	First Priority Location
GCGP	Greater Cambridge and Greater Peterborough
GVA	Gross Value Added
HATRIS	Highways Agency Traffic Information System
HGV	Heavy Goods Vehicle
JTDB	Journey Time Database
KSI	Killed or Seriously Injured
LEP	Local Enterprise Partnership
LGV	Light Goods vehicle
LPA	Local Planning Authority
LSCC	London Stansted Cambridge Consortium
LTB	Local Transport Body
LUTI	Land use/transport interaction [model]
MPH	Miles per hour
$N0^2$	Nitrogen Dioxide
NAQS	National Air Quality Strategy
NB	Northbound
NPPF	National Planning Policy Framework
NTEM	National Trip End Model
OAN	Objectively Assessed Need(s)
OIA	Other Important Areas
PCM	Pollution Climate Mapping
RAG	Red/Amber/Green
RBD	River Basin District
RFC	Flow to Capacity Ratio
RIS	Road Investment Strategy
SAC	Special Area of Conservation
SB	Southbound
SEM	South East Midland
SEP	Strategic Economic Plan
SHMA	Strategic Housing Market Assessment

SRG	Stakeholder Reference Group
SRN	Strategic Road Network
SSSI	Site of Specific Scientific Interest
TEMPRO	Trip End Model Presentation Program
TIEP	Transport Investment and Economic Performance
TRADS	Traffic Flow Data System
USA	Updating and Screening Assessment
WB	Westbound
WFD	Water Framework Directive

0 Executive Summary

0.1 Introduction

0.1.1 This A1 East of England Study is sponsored by the Department for Transport (DfT). The requirements were set out in the first Road Investment Strategy (RIS) published in December 2014, which announced a programme of new Strategic Studies to explore options to address emerging issues and challenges. The DfT has commissioned Highways England to undertake the study on its behalf, who in turn have commissioned Arup, AECOM and David Simmonds Consultancy to consider and produce the strategic outline business case for road improvement and connectivity using existing relevant data and site visits.

0.1.2 This study is concerned with a southerly stretch of around 62 miles of the A1 between Junction 1 (intersecting the M25 on the outskirts of London) and Junction 17 (intersecting the A605 and Fletton Parkway near Peterborough). The A1 study area broadly comprises three distinct sections: the 'northern' A1(M) section from Junctions 14-17 built to a high standard, the 'southern' A1(M) from Junctions 1-10 still at motorway standard but more variable in layout and, in-between, the A1 with numerous unnumbered junctions and of variable layout and quality.

0.1.3 The study area has a diverse socio-economic profile, and an above-average anticipated and planned growth. Overall, this presents a number of future challenges or pressures around or on the A1. Taken overall, the study area is a relatively affluent area with a good level of skills and employment opportunities, however there are some exceptions to this pattern when looking at income and deprivation. The population is expected to rise substantially across all of the districts, matched with a rise in the number of houses delivered and jobs created. Work locations have resulted in high levels of commuter movement across the network and employment sectors vary between education, administration, wholesale and retail, and scientific and technical activities. This means increased pressure in terms of movements and, in combination with capacity, potentially congestion for the study area section of the A1.

0.1.4 As set out in the RIS, this study will look at opportunities to bring consistency to the southern section of the A1, from the junction intersecting with the M25 in the south up to Peterborough in the north. In particular, it will look at the case for improving the non-motorway section linking the two parts of the A1(M) to motorway standard. Options for changes to the alignment of the road will also be considered if they are able to reduce the environmental impact of the existing route whilst also bringing benefits to the local communities.

0.1.5 The study is split into three tasks and this report is concerned with task one - the strategic case for road improvement and investment. The following tasks are concerned with the transport objectives and

options; and sifting and assessment of short-listed options. It is anticipated that severe congestion-related challenges and existing capacity problems will only worsen without extensive intervention, driven by the growth of the surrounding populations and economies. There is a need for investment to support this planned growth without causing undue social and environmental impacts.

0.2 Strategic Context

0.2.1 The Strategic Road Network (SRN) makes up around 3% of the total road length in England, yet carries around a third of road traffic and two thirds of freight traffic. It is the largest asset owned by government, with a value of around £100 billion. The A1 is a crucial route within this network.

0.2.2 A well-functioning network enables growth by reducing business costs, improving access to markets, enabling competition, improving labour mobility, enabling economies of scale and agglomeration, and helping attract inward investment. For the study area, continuation of the status quo is likely to compromise the aspirational growth potential of the study area.

0.2.3 Good road networks also support quality of life for citizens. They allow access to opportunities for work and leisure as well as enabling social networks and interactions[1]. Improving the performance of the SRN, including to the A1 study area, was identified as a critical objective in the Eddington Transport Study.[2]

0.2.4 A well-functioning SRN manages traffic efficiently.. When the SRN underperforms, the impacts are felt by residents and businesses of adjacent areas in terms of rat running, increased congestion, reduced safety and a poorer quality environment.

0.2.5 The A1 is a strategic route between London and the north of the country. The route is a gateway to key international transport hubs including Luton and Stansted airports, Felixstowe and London Gateway deep sea ports. It is a principal road artery for both businesses and communities.

0.2.6 The local authorities served by the A1 in the East of England are amongst the highest performing in the country outside of London in terms of its regional share of total Gross Value Added (GVA)[3] and plays an important role in contributing to national economic performance. There are strong links to the London economy and the

[1] A Cook, 'A fresh start for the Strategic Road Network,' in GOV.UK. November 2011, viewed on 22 January 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/4378/strategic-road-network.pdf.
[2] R Eddington, 'The Eddington Transport Study' in National Archives 2006, viewed on 22 January 2016, http://webarchive.nationalarchives.gov.uk/20090104005813/http://www.dft.gov.uk/162259/187604/206711/executivesummary.pdf.
[3] ONS, NUTS1 regional GVA 2013.

study area forms part of a wider polycentric greater south east economy. Most of the study area falls within the economic hinterland of London and, particularly in the southern section, there is a strong commuter relationship with London. Part of the study area also falls along the Oxford-Milton Keynes-Cambridge arc, three of the most economically successful cities outside of London. The area supports a number of strong and growing economic sectors in both employment and output terms. Realising the economic potential of Hertfordshire, Bedford authorities, Cambridgeshire and Northamptonshire is important in sustaining and improving the economic performance of UK Plc. If the area's road network is underperforming, this may be compromised.

0.3 Existing Alignment and Junctions

0.3.1 The A1 is a key artery for logistics, businesses, and communities, but it is also one of the most inconsistent roads in England. The number of lanes frequently changes whilst the traffic speeds and road quality varies.

0.3.2 Figure 0.1 (page 13) identifies the current road configuration of the A1, showing how the road profile changes along the 62 miles stretch between Junction 1 in the south to Junction 17 in the north.

0.3.3 The route is a mixture of dual two and dual three lane sections between Junction 1 and Junction 10, and dual three- and dual four-lane sections between Alconbury (Junction 14) and Junction 17 (just south of Peterborough), with grade separated junctions.

0.3.4 The all-purpose section of the A1 between Junction 10 at Baldock and Junction 14 at Alconbury has a large number of accesses, at-grade roundabouts and minor side roads, many with central reserve gaps, and frontages very close to the carriageway in places. This severely restricts free flow conditions, and several sections have lower speed limits as a consequence. There are also variations in the speed limits (< 70mph) for the links between Sandy Roundabout (A603) and the A14.

0.4 Methodology

0.4.1 This study provides a review of existing evidence to confirm a strategic case for improved connectivity on the A1. Relevant studies and recent information are presented to assess the planning, economic, transport and environmental considerations and impacts on the study area. Research has been supported by site visits to gain a first-hand understanding of the route. Census data and local planning policy documents for the 14 districts within the study area have been reviewed. In particular, future plans or predictions for population, housing and employment levels were drawn out in order to identify where increased future use may impact upon road capacity and where planned development is proposed to assess how this is likely to impact upon the A1.

0.4.2 Analysis of the A1 case for improvement was continued through a wider transport review which considered use by other modes such as bus and coach routes, walking and cycling provision, competing rail corridors, and planned rail investments. Regional transport policy context was taken into account to recognise existing preferred options and long term transport strategies. A detailed review of junctions and links highlighted inconsistency, specifically lane number changes, varying presence of hard shoulders, hazardous turn offs and/or road speeds, and general road quality including signage, impact on communities and road markings.

0.4.3 An environmental review has been carried out to identify current environmental issues and considerations. Environmental impacts reviewed include noise, air quality and nitrogen dioxide ($N0^2$) levels, as well as analysing the built and natural environment, green belt designations and other landscape character areas. This assessment highlighted any opportunities for environmental improvements.

0.4.4 For each of the above areas of analysis, and for each junction and link, overall conclusions were reached in the form of a traffic light (red, amber, green) assessment. This was then synthesised to indicate stress areas along and around the A1 study area to confirm the strategic case for road improvements. This supported the overall conclusions given in 'A Case for Change' in this report.

0.5 Findings

Planning & Economics

0.5.1 To put the study in a strategic context, the A1 is the spine through a study area (Figure 1.1, page 20) with strong links to the London economy, and wider polycentric greater south east economy as discussed in Paragraph 0.2.1. The A1 is a facilitator of agglomeration economies in the wider South East and a key connector for many growth areas such as the London-Stansted-Peterborough corridor. It provides links to Stansted and Luton airports and links many communities with local employment. The study area is forecast to experience substantial growth over the next 20 years, with an estimated population growth of over 296,000 people over the period to 2037, equivalent to overall growth of 14% on 2014 levels. This will be accompanied by substantial delivery of new housing units and the creation of employment opportunities and anticipated for in the local authorities' growth plans.

0.5.2 A review of the districts' relevant planning policy documents highlighted the local development strategies to accommodate the growth. The A1 is a key route for logistics, businesses, and communities, connecting the north and south and connecting growth areas, and the Government is actively investing within the study area, deploying Local Enterprise Zones for investment in assets and infrastructure in a bid to sustain economic growth. The study area is a key focus of investment in England, both in population and

economies. Infrastructure improvements (such as the A1) will be necessary to ensure continued growth and success in the East of England.

Transport

0.5.3 The A1 study route varies between motorway and all-purpose standard. There are congestion-related challenges, existing capacity problems and low travel speeds on numerous sections of the road which are expected to worsen without intervention.

0.5.4 The section between Junctions 1 and 3 shoulders London and serves both large communities and numerous businesses in the area, as well as connecting to the north. However it is also one of the least reliable stretches on the route with low average speeds in its two lanes in each direction.

0.5.5 The section between Junction 10 at Baldock and Junction 14 at Alconbury has a number of at-grade roundabouts, minor side roads and direct frontage accesses, often very close to the carriageway. This severely restricts free flow and several sections have lower speed limits.

0.5.6 The section from Alconbury to Peterborough operates well; eight miles of this section are dual four lane, whilst the remainder has three lanes in each direction.

0.5.7 Urban areas, particularly Peterborough and Luton, are the origin and destination of much of the weekday traffic. Traffic flows are highest at the northern (Peterborough) and southern (Hertfordshire/M25) ends. Through traffic levels are not fully understood based on current data sources.

0.5.8 Coaches use some of the A1 route and local bus services use the non-motorway sections of the route. There are some East Coast Main Line rail improvements, including new rolling stock and added capacity, which will benefit passengers from Peterborough and Cambridge southwards, and potentially take people off the road network. A new line is being promoted by the East West Rail Consortium. Walking and cycling is not permitted on sections of the route designated as motorway, but is permitted on the non-motorway section; facilities are mostly non-existent or sub-standard.

0.5.9 The A1 is regarded by the counties it runs through as an important strategic route assisting in supporting the regional economies and as a strategic link to London and the North. Local traffic using the route may be reduced by improving rail and bus conditions. However, the proximity to London, large communities and buoyant economies suggest that road demand will continue to be high. The road has variable quality, frequent changes between two, three and four lanes, low speeds as a result of congestion and hazardous slip roads. This highlights the case for targeted road improvements to rationalise and improve the road.

0.5.10 Regional transport policies were reviewed to understand transport policy recommendations. This highlighted widespread concern with the functionality and performance of the A1 as a key strategic route within each authority area. Hertfordshire County Council recognises the A1(M) as a key transport corridor with a north-south focus, but with few east-west routes. Preferred interventions include the use of intelligent transport systems, small scale road improvements, promoting alternatives to the car and corridor strategies for routes such as the A1(M). Similarly, Central Bedfordshire Council recognises the A1 as an important route for traffic, in particular for freight traffic. Cambridgeshire County Council raises issues relating to the roads and junctions intersecting with the A1 and calls for improvement schemes.

Environment

0.5.11 The A1 runs through a number of sensitive receptors such as settlements located within 200m of the current alignment, scattered residential properties and environmental areas designated for conservation or amenity value. Understanding the environmental context of the A1 is critical to ensure suitable opportunities are explored which enhance the surrounding environment whilst also delivering an improved infrastructure network.

0.5.12 There are five First Priority Locations[4] situated along the study area road where the effects of excessive noise are most significant. These sites are largely dense residential areas, housing estates, and retail and commercial areas. There are localised occurrences of poor or reduced air quality, primarily at the northern and southern ends of the study route. These hotspots of poor air quality already exceed EU Air Quality Directives and from a review of traffic data it can be seen that these areas are characterised by high traffic flow, congestion issues and a lack of capacity in the road network.

0.5.13 Due to its length, size and importance, the original construction of the A1 undoubtedly affected numerous heritage assets that the A1 passes through, over, or in close proximity to. The operation of the road also affects the environment in terms of the effect of noise on the integrity of listed buildings and any visitor experience. The impact on heritage assets during ongoing operation of the A1 is minor in comparison to the effects from its original construction.

0.5.14 Four internationally designated sites were identified in the desk-based study, including a Scheduled Ancient Monument at Tempsford Bends. Biodiversity and habitats have the potential to be affected by vehicle strike, prevention of movement by the road, disturbance of species as a result of noise, light, and vibration from vehicles, and contamination through road run-off and vehicle emissions. The A1 also crosses several major and minor watercourses and their associated

[4] 'First Priority Locations' are identified as the locations that should be prioritised for investigation for managing environmental noise.

floodplains, including the River Great Ouse, River Ivel, River Kym and the River Lee/Lea. There are existing flood defences situated in places along the route to protect existing communities and the integrity of existing flood defences must be preserved. Impact of the regulation of soil moisture using land drainage systems, which is critical to the fertility of the farmland, much also be avoided.

0.6 A Case for Change

0.6.1 In transport terms, the A1 is underperforming for much of its length in the East of England. An analysis of traffic conditions indicates noticeable journey time variability along much of the route between Junction 1 and Junction 14, with areas of traffic congestion. Such variations indicate poor journey time reliability. Conditions between Junction 14 and Junction 17 stand out in contrast with much lower levels of variability. Overall, congestion and delay issues are more acute in the southbound direction in the AM peak hour. These issues may partly be explained by the levels of traffic and the reduced capacity on some of the links (decrease in capacity from three lanes per direction at Junctions 3 to 6 down to two lanes per direction at Junctions 6 to 8).

0.6.2 An analysis of the junctions identified problem areas. The southern part, Junction 1 to 10 (Hertfordshire), shows journey time variability and delays in peak periods, especially between Junctions 6 and 7. Overall, Junctions 3, 4 (Hatfield), and 7 (Stevenage) have high traffic flows entering and exiting the junctions during both peak periods. High traffic volumes cause congestion and delay issues. The findings also indicate that Junctions 3 and 4 also serve as a link for the east-west A414. With regards to safety, there is a high number of collisions between Junctions 6 and 7 in both directions. A relatively high proportion of incidents occur where there are severe congestion issues, therefore congestion relief could potentially reduce the number of collisions.

0.6.3 The many at-grade junctions and accesses between Junctions 10 and 14 (the non-motorway section running through Central Bedfordshire and Cambridgeshire) restrict free traffic flow especially during peak periods. This leads to severe speed variability, reduced road capacity and lower speed limits (various speed limits below 70mph). Junctions 14 to 17 (Cambridgeshire) perform well without congestion issues and delays and present little case for change. The motorway has four lanes per direction from Junction 14 to Junction 16 and three lanes between Junctions 16 and 17. This part of the A1 has good capacity, high speeds (close to free flow conditions), limited delays and reliable, less variable journey times.

0.6.4 Improvements to the A1 could result in improvements to the air quality and noise situation at sensitive locations along the route. This could be through lowering traffic volumes along sections of the A1 (e.g. through routing traffic on other routes or new sections of road). With respect to the historic environment, there is the potential to

mitigate negative effects on heritage assets through reducing traffic flows or minor design improvements that would result in less visual or noise disturbance. However, if any major works are proposed, direct adverse effects in heritage assets are likely to outweigh any benefits. In other cases there is the potential for broader environmental enhancements as part of any works to improve the A1. For example, river restoration could improve Water Framework Directive statuses, design measures could improve connectivity between habitats, and improved protection measures could prevent groundwater flooding of the A1.

0.6.5 The report outlines the transport and environmental strategic case for road improvement and investment. Continued population and economic growth is forecast within the study area, and the A1 route is a central spine to supporting and assisting growth. The road has high traffic volumes, congestion, low traffic speeds and an inconsistent profile. Improvements to the A1 will assist free flow, reduce the number of collisions, and manage the severe congestion. Improvements to the road profile could also be expected to stimulate improvements to the local environment by improving aquatic habitats and biodiversity, and provide opportunities to prevent groundwater flooding. There is an evident business case to overcome emerging issues and challenges for road improvement and connectivity.

0.7 Strategic Fit

0.7.1 Addressing the issues described will contribute towards achieving aims and objectives in the Road Investment Strategy (RIS) in the following ways:

Table 0.1: Strategic Fit

1: Providing capacity and connectivity to support national and local economic activity	The study area is one of the most highly performing economic regions of the UK outside London. The A1 is its major strategic artery which provides movement between major centres in the study area, as well as connecting the study area with the London economy which is a crucial economic driver for the study area. Local and national policymakers have strong and credible aspirations for the area as a national level driver of economic growth. This means the route has a crucial role to play in underpinning that growth, enabling the delivery of new jobs and housing. The route is currently underperforming in traffic terms and therefore does not provide the connectivity required to support growth. If this issue is unaddressed it could undermine growth potential.
2: Supporting and improving journey quality, reliability and safety	Parts of the A1 in the East of England are characterised by poor journey quality and reliability. There are sections of road where average speeds are under 40 miles per hour. Delays, tailbacks and disruptions are commonplace, exacerbated by an inconsistent and, in places, incoherent road layout which forces traffic into multiple

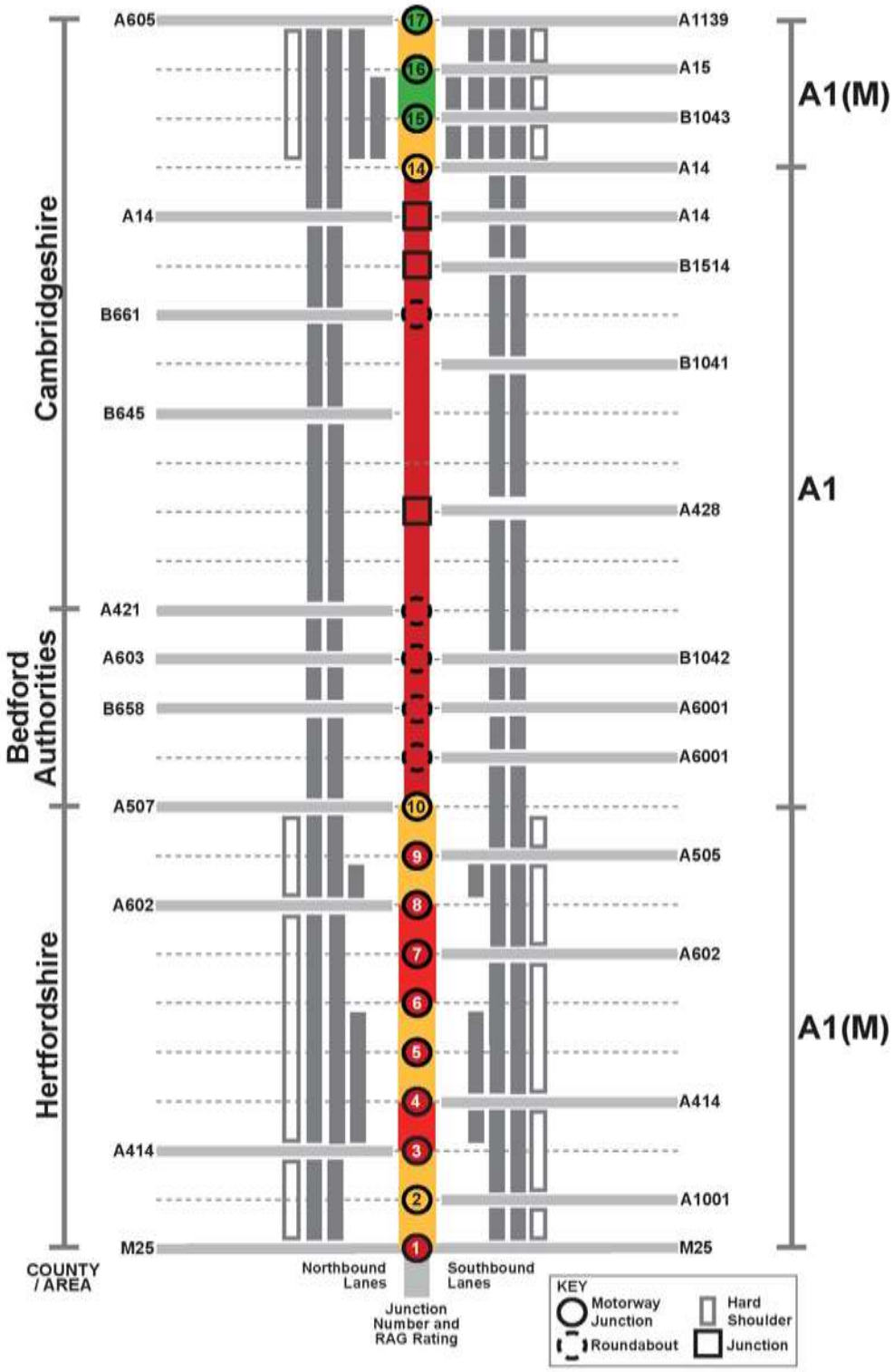
	bottlenecks in both directions. Additionally, there is a high number of collisions along the route and this may be worsening as congestion worsens. Standardising conditions along the length of the route could have substantial impacts on traffic flow and journey time variability. Schemes also have the potential to reduce the number of people killed and seriously injured along the route.
3: Joining our communities and linking effectively to each other	The A1 segregates various communities along its route. This has wide ranging impacts, for example on quality of life, wellbeing, access to jobs and access to services. Well-designed interventions which improve connectivity for local communities could have substantial positive impacts for a range of people including car users, public transport users, walkers, equestrians and cyclists.
4: Supporting delivery of environmental goals and the move to a low carbon economy	Parts of the A1 are located unacceptably close to residential locations, causing unpleasant environmental conditions for local residents, particularly in terms of air quality and noise. Much of the route suffers frequent congestion and disruption which exacerbates the environmental impact of the traffic. Interventions which allow traffic to flow more freely have the potential to substantially improve environmental quality generally across the study area and specifically for those residents living adjacent to the route.

0.8 Summary of the case for change and next steps

0.8.1 Figure 0.1 sets out a combined Red/Amber/Green (RAG) traffic light style assessment of the performance of the A1 East of England. This synthesises findings from an economic, transport and environmental assessment of the route's current performance. The majority of the network is poorly performing with cause for concern.

0.8.2 The route performs poorly, and growth pressures along with underlying travel demand and climate change patterns mean that performance is likely to worsen in the future. This risks damaging the economic growth potential of the study area. Tackling the issues highlighted could make a positive contribution towards Highways England's strategic outcomes. The next stage of this study will begin to identify potential interventions to improve route performance and, beyond that, to carry out sifting and assessment of potential route options.

Figure 0.1: RAG rating of links and junctions



1 Introduction and Strategic Context

1.1 Highways England objectives and Road Investment Strategy

1.1.1 As part of the government's RIS 2014, Highways England is planning to deliver more than £2 billion of government investment to improve the capacity and condition of roads across the East of England. The investment will see improvements and renewals taking place between now and 2021, giving road users simpler, faster and more reliable journeys. It will also boost the area's economy and help to bring the country together. The plans include major improvements on the M11, A5 and M1, A1(M), A12, A14, A47 and A428.

1.1.2 To deliver the Government's vision and investment plan for the Strategic Route Network, Highways England has established the following objectives as set out in the Delivery Plan:

- **Supporting economic growth**: through a modern and reliable network that reduces delays, thereby creating jobs, helping businesses and opening up new areas for development.
- **A safe and serviceable network**: where no one should be harmed when travelling or working.
- **A more free-flowing network:** where routine delays are less frequent and journeys are safer and more reliable.
- **Improved environment:** where its activities ensure a long term and sustainable benefit to the environment.
- **An accessible and integrated network**: where it will work with local authorities and other transport hubs to facilitate other modes of transport and enable safe movement across and alongside our network.

The importance of the Strategic Road Network (SRN)

1.1.3 The SRN makes up around 3% of the total road length in England, yet carries around a third of road traffic and two thirds of freight traffic. It is the largest asset owned by government, with a value of around £100 billion. The A1 is a crucial route within this network.

1.1.4 A well-functioning network enables growth by reducing business costs, improving access to markets, enabling competition, improving labour mobility, enabling economies of scale and agglomeration and helping attract inward investment. For the study area, continuation of the status quo threatens to undermine aspirational growth potential of the study area. Section 2.2 sets out these growth aspirations in more detail.

1.1.5 Good road networks also support quality of life for citizens. They allow access to opportunities for work and leisure as well as enabling

social networks and interactions[5]. Improving the performance of the SRN was identified as a critical objective in both the Eddington (2006)[6] and Cook (2011, *ibid.*) reports.

1.1.6 A well-functioning SRN can assist in channelling traffic away from residential environments and unsuitable roads, increasing the efficiency of the system as a whole. When the SRN underperforms, the impacts are felt by residents and businesses of adjacent areas in terms of rat running, increased congestion, reduced safety and a poorer quality environment.

1.1.7 The districts served by the A1 are amongst the highest performing in the country outside of London in terms of contributing to national economic performance. The East of England regional share accounts for 8.6% of the GVA which represents the third highest regional proportion outside of London, behind South-East and North West England[7]. There are strong links to the London economy, and the study area forms part of a wider polycentric greater south east economy. It is also located along the Oxford-Milton Keynes-Cambridge arc, three of the most economically successful cities outside of London.

1.1.8 The area supports a number of strong and growing economic sectors in both employment and output terms. Realising the economic potential of Hertfordshire, Bedford authorities, Cambridgeshire and Northampton authorities is important in sustaining and improving the economic performance of UK Plc. If the area's road network is underperforming, this may be compromised.

1.2 This Study

1.2.1 The RIS Investment Plan[8] published in December 2014 describes the purpose of this study as follows:

"This study will look at bringing consistency to the southern section of the route, from the junction with the M25 in the south to Peterborough in the north. In particular, it will look at the case for improving the non-motorway section linking the two parts of the A1(M) to motorway standard.

[5] A Cook, 'A fresh start for the Strategic Road Network', in GOV.UK November 2011, viewed on 22 January 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/4378/strategic-road-network.pdf.
[6] R Eddington, 'The Eddington Transport Study' in National Archive December 2006, viewed on 22 January 2016, http://webarchive.nationalarchives.gov.uk/20090104005813/http://www.dft.gov.uk/162259/187604/206711/executivesummary.pdf.
[7] ONS, NUTS1 regional GVA (2013).
[8] DfT, 'Road Investment Strategy: Investment Plan', in GOV.UK December 2014, viewed on 22 January 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/382813/dft-ris-road-investment-strategy.pdf .

Given the age of the road, much of the current route was chosen with little thought to the impact on the nearby environment. This study will examine whether improvements, including changing the alignment of the road, could reduce the environmental impact of the existing route and benefit local communities."

1.2.2 The strategic aim of the **A1 East of England Study** is to identify and provide an initial appraisal of the improvements to the A1. Once options have been refined by using assessment tools to summarise and evidence how options perform and compare, the preparation of strategic outline business cases will be developed to consider future Road Investment Strategies.

Study Objectives

- Assess and form a preliminary strategic case for improving the transport network in the region based on the strategic and economic benefits.
- Define the transport objectives that this ongoing study should seek to identify options for.
- Identify a long-list of options which could meet the transport objectives, and undertake a high level assessment of the potential VfM, benefits and impacts of the different options using the Early Assessment Sifting Tool (EAST).
- Short-list options to be carried forward.
- Prepare a Strategic Outline Business Case for the better option(s) for consideration in the development of future RIS.

Study Stages

Task 1	Review of existing evidence and confirm the strategic case for improved connectivity on the A1.
Task 2	Defining transport objectives that will solve the problem identified and identifying a long-list of options which could meet the transport objectives.
Task 3a	Initial sifting of options.
Task 3b	Work to assess the affordability, value for money and deliverability of short-listed potential options.

1.2.3 Task 1 has sought to provide an initial evidence base to assess the current A1 study area socio-economic profile, and the environmental and transport contexts, issues, and opportunities.

1.3 Overview of the route, its history and previous improvements

1.3.1 The current A1/A1(M) in the study area was constructed to its current alignment and standards in stages. Some sections date back to the late 1950s, whilst others are of more recent construction, having been opened to traffic in the late 1990s.

Previous Studies

A1 motorway upgrade proposals between Baldock and Alconbury

1.3.2 In 1994 the (as named then) Highways Agency released plans to upgrade the A1 to motorway standard between Baldock and Alconbury. It was proposed to construct a new route for the motorway, west of the existing A1.

1.3.3 The motorway alignment was proposed to run close to the existing A1 from Baldock to Biggleswade, before diverging from it to run west of Beeston, Blunham, Roxton, Hail Weston and Buckden. The motorway would re-join the existing A1 alignment south of Brampton. The proposals were for three lanes per direction from Baldock to Biggleswade, and two lanes per direction further north. This scheme was not progressed further. An online scheme was not considered feasible as the road would have to be straightened, widened and a separate route built for non-motorway traffic, which would require extensive demolition of property.

1.3.4 Other alignment options considered included: routeing along the existing A1 road; routeing along the East Coast Main Line railway east of the A1; and routeing east of Sandy. Some options which combined elements of these routes were also considered. These options were rejected due to a combination of environmental and economic issues.

A1 Sandy and Beeston bypass proposals

1.3.5 In 2003 the government announced various road building schemes, one of which was the A1 Sandy and Beeston bypass. However, this scheme was not progressed and no route details were published.

London to South Midlands Multi-Modal Study

1.3.6 The London to South Midlands Multi-Modal Study covered the transport corridors between London and South Midlands which included the A1(M). In July 2003 the then Secretary of State for Transport accepted the study recommendation not to widen the A1(M) between Junctions 6 to 8. However, the Highways Agency was asked to consider how peak hour problems on this section could be addressed through better use of the existing road space. In 2005 the view taken by the region and accepted by the Secretary of State on the prioritisation of regional transport schemes, was that investment on the A1(M) between Welwyn and Stevenage was not in the list of schemes to be prioritised before 2015. No schemes were identified in the regional funding allocations.

A1(M) Congestion relief scheme (Welwyn Garden City to/from Stevenage)

1.3.7 In 2013 the Hertfordshire Local Transport Body (LTB) identified a list of priority transport schemes. A congestion relief scheme for the

A1(M) between Welwyn Garden City and Stevenage is a major transport scheme specified in this list. The updated RIS (DfT 2015) states that the A1(M) junctions 6-8 Smart Motorway scheme is now committed.

Highways England Route Strategies

1.3.8 During 2014 Highways England completed a series of sixteen Route Strategies, as the basis for the investment strategy for the strategic road network. This built on recommendations from the Cook Report, 'A Fresh Start for the Strategic Road Network' (DfT, 2011). The London to Leeds (East) Route Strategy (Highways England, 2014) is one of the route strategies, and relevant to this study.

1.3.9 The London to Leeds (East) Route Strategy states key opportunities and challenges relevant to the study area, including:

- Lack of capacity between Junction 1 and Junction 10.
- Severance affecting vulnerable road users between Knebworth and A1(M) Junction 7.
- Safety concerns with accesses, minor side road junctions and at-grade roundabouts between Baldock and Alconbury.
- Junction capacity issues at the A1/A421 'Black Cat' roundabout pinch point.

Road Investment Strategy

1.3.10 Three improvement schemes and a strategic study within the study area are included in the RIS published in December 2014. These are:

- **A14 Cambridge to Huntingdon** - a major upgrade to the A14 between the A1 and north Cambridge, widening the road to three lanes; providing a new bypass around Huntingdon; creating distributor roads for local traffic; and remodelling key junctions along the route. The scheme includes improving the A1 between the B1514 and south of J14.
- **A1(M) Junctions 6 to 8 Smart Motorway** - upgrading the existing two-lane section of the A1(M) around Stevenage to Smart Motorway to provide a third lane of capacity.
- **A428 A1 to Caxton Gibbet** - improvement of the A428 near St Neots, linking the A421 to Milton Keynes with the existing dual carriageway section of the A428 to Cambridge, creating an Expressway standard link between the two cities via Bedford. The scheme is expected to include substantial improvements to the Black Cat roundabout, where the A1 currently meets the A421.
- **Oxford to Cambridge Expressway strategic study** - this study will examine the case for creating an Expressway to connect the towns and cities of the 'Brain Belt'.

1.4 Study Area

1.4.1 Figure 1.1 on the following page shows both (a) the links and junctions examined in the context of this study, and (b) the local authority study area adopted for the baseline assessment.

1.4.2 The A1(M) is a mixture of dual two and dual three lane sections between Junction 1 (M25) and Junction 10 (Baldock), and dual three and dual four lane sections between Junction 14 (Alconbury) and Junction 17 (just south of Peterborough).

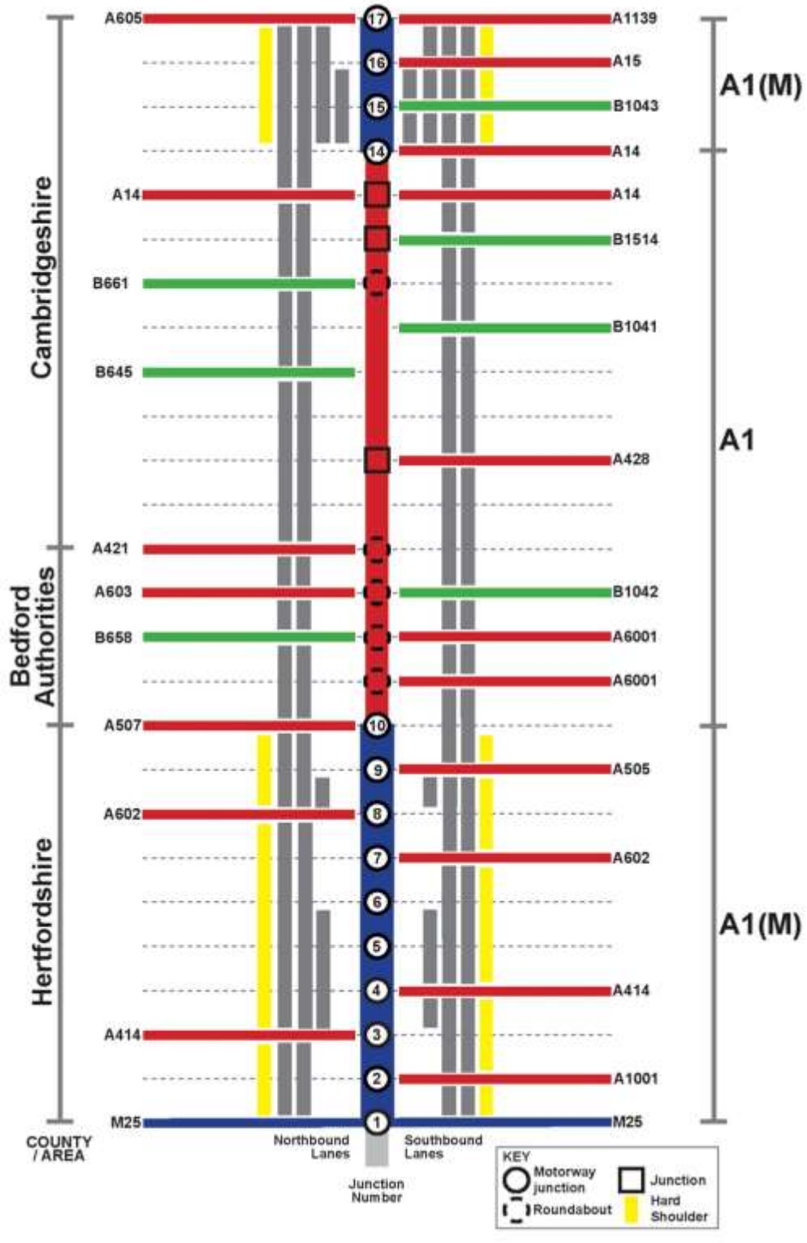
1.4.3 There are many at-grade junctions and accesses on the A1 between Junction 10 at Baldock and Junction 14 at Alconbury. This severely restricts free flow conditions, and several sections have lower speed limits as a consequence. There are also variations in the speed limits (< 70mph) for the links between Sandy Roundabout (A603) and the A14. Where links comprise more than one speed limit, a weighted distance average is used to determine the average speed limit across the link[9].

1.4.4 The study area has been defined based on the functional relationship of the region, capturing local authorities within the A1 'catchment' area but also avoiding straying into neighbouring (M11, M1) catchments. Those local authorities which the A1 runs directly through form the 'core study area', whilst other contiguous districts which have a close functional relationship form the 'wider study area'. These areas are not intended to represent any form of hierarchy and both the core and wider study areas have been included within the baseline assessment. This encompasses 14 local authority areas. Where data are only available on a county basis, the corresponding county has been used. In addition, several centres where population and/or employment changes are planned which potentially stray into other road catchments, have been included as 'policy interest areas'. These areas have been considered in policy terms but have not been included within the baseline assessment.

1.4.5 Although London has not been included in the wider study area, it has a strong influence on the area as a destination for commuters and its economic reach. Movements in and out of London place additional pressure on the A1 infrastructure. Due to its proximity to London and the South-East, the study area is a popular location for businesses locating to the area and this explains the substantial past and anticipated population growth in the area. The study area should be understood in its wider strategic context within the East of England and in terms of its economic links to London, as illustrated within Figure 1.2.

[9] This makes use of HATRIS data which provides information on travel times, speeds, traffic flows and delays.

Figure 1.1: A1 Corridor: (Junctions 1 to 17 and Links 1 to 16) and the Study Area



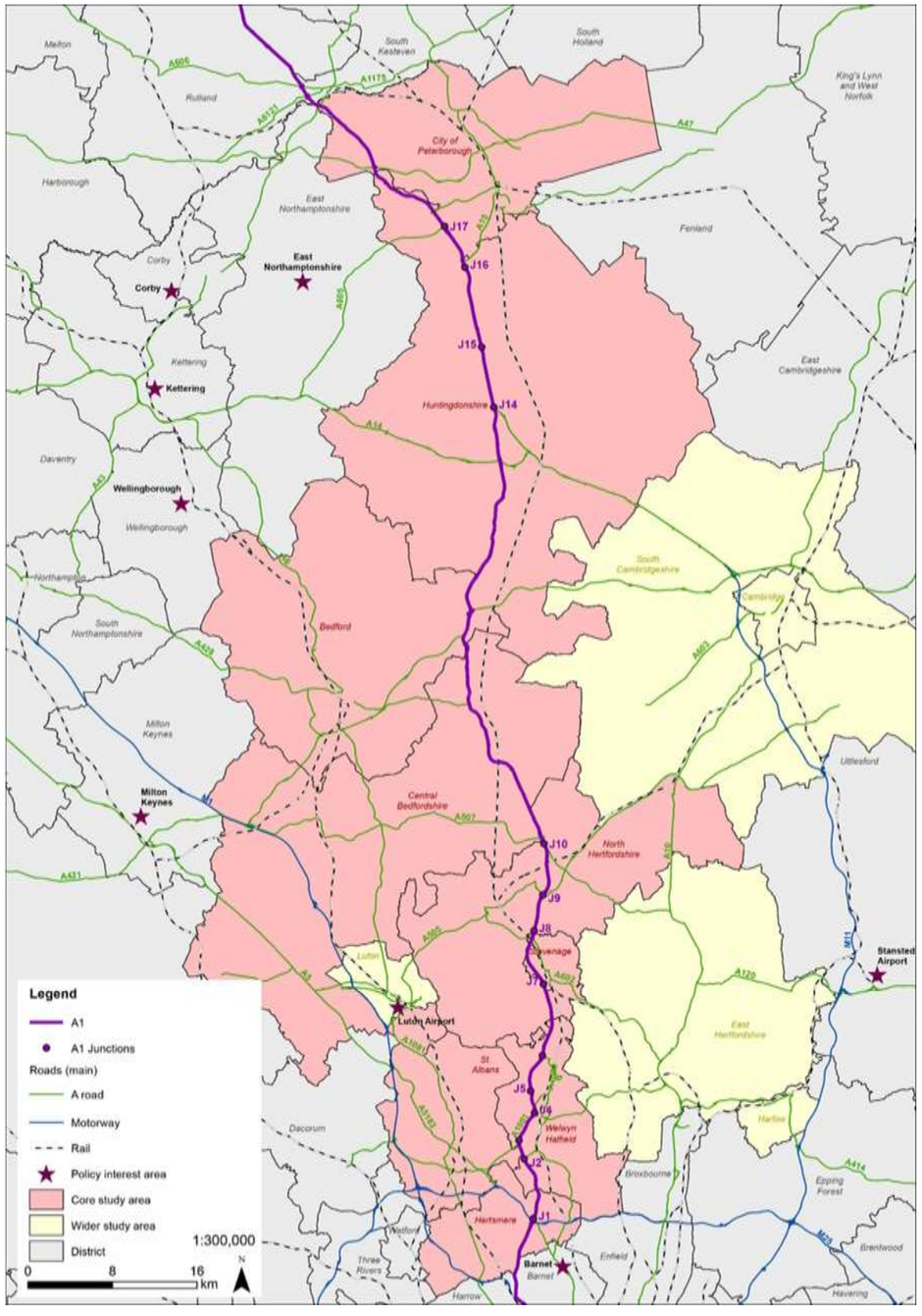
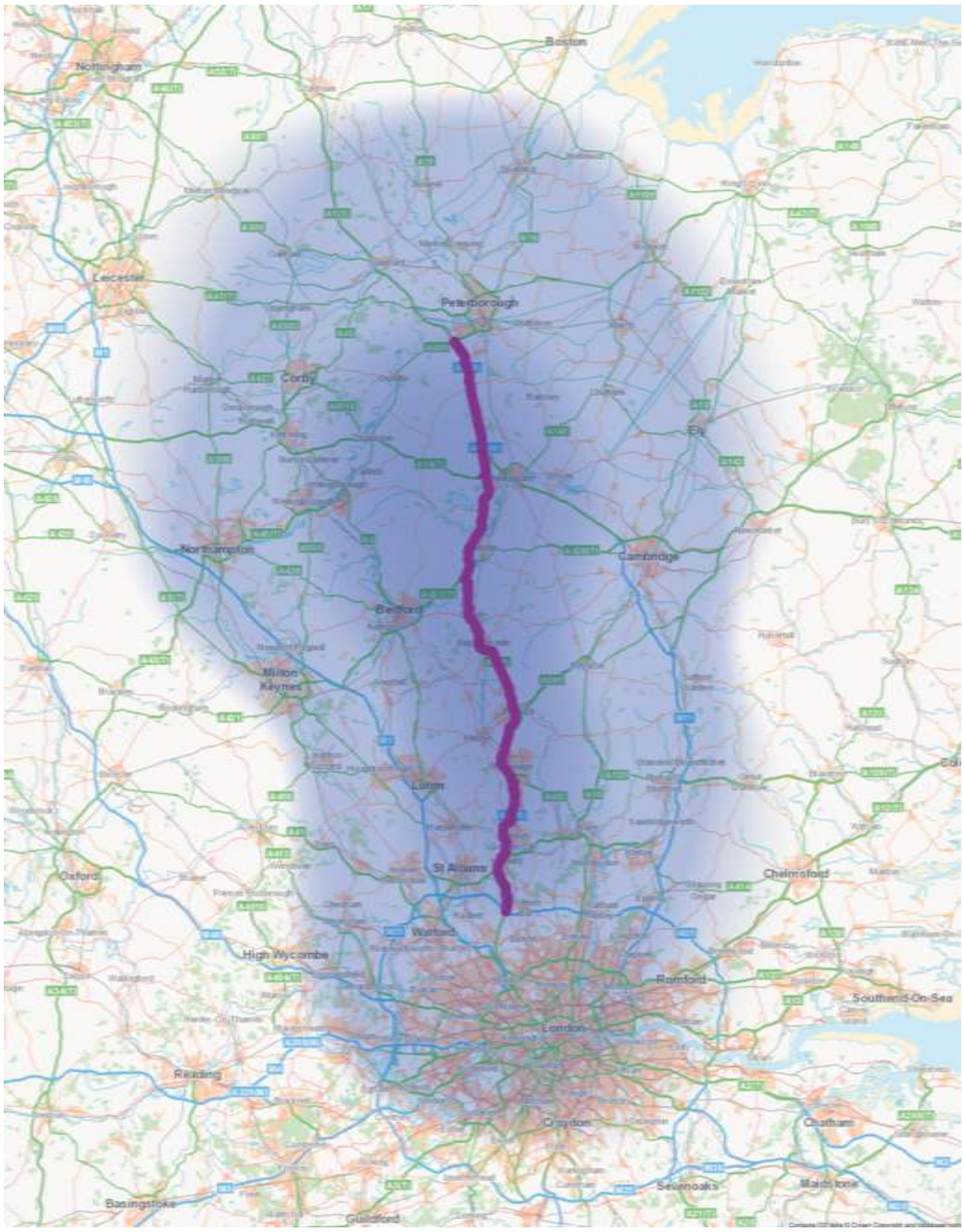


Figure 1.2: Map showing the illustrative wider economic impact area of the A1 study area



1.5 Stakeholder Engagement

Introduction

1.5.1 Stakeholder engagement has helped to provide an understanding of local and regional issues relevant to this study.

Feedback from September 2015 stakeholder reference group (SRG)

1.5.2 A SRG was held on 23 September 2015. Representatives of various stakeholder organisations attended including: Bedford Borough Council, Bedfordshire Association of Local Councils, Cambridgeshire County Council, Campaign to Protect Rural England, Central Bedfordshire Council, Federation of Small Businesses, Hertfordshire Association of Local Councils, Hertfordshire County Council, Historic England, Huntingdonshire District Council, Living Streets, National Farmers Union, Peterborough City Council, Population Matters, Royal Society for the Protection of Birds, St Albans City and District Councils, Welwyn Hatfield Borough Council, Wildlife Trust and Woodland Trust.

1.5.3 The feedback from stakeholders varied in scope; some points related to particular sections of the A1, others related to the whole route and wider area. There was a noticeable concentration of issues relating to the middle (non-motorway) section of the route between Baldock and Alconbury.

1.5.4 The feedback from the SRG was categorised as follows: network reliability – local traffic, network reliability – long-distance traffic, environment, safety, resilience and wider considerations. A summary of issues raised under each topic is set out below.

Network reliability – local traffic

1.5.5 Stakeholders identified the following network reliability issues for local traffic:

- Local traffic is reliant on the A1/A1(M) in some areas. This causes local traffic issues when the route is closed or congested, for example due to a traffic incident. It also highlights the issue of poor journey time reliability.
- Some local routes are unsuitably used as an alternative to the A1/A1(M) by long-distance traffic.

Network reliability – long-distance traffic

1.5.6 Stakeholders identified the following network reliability issues for long-distance traffic:

- Traffic congestion occurs; this partly results from local traffic using the A1/A1(M).
- Local accesses to the A1 between Baldock and Alconbury slow traffic and cause congestion.

Environment

1.5.7 Stakeholders identified the following environmental issues for further consideration:

- Severance of villages caused by the A1/A1(M) between Baldock and Alconbury.

- Close proximity of properties to the A1/A1(M), particularly between Baldock and Alconbury.
- Various sensitive local natural environments within close proximity to the A1/A1(M), for example ancient woodlands, conservation areas and floodplains.
- Various heritage assets within close proximity to the A1/A1(M).
- Air, visual and noise pollution caused by the A1/A1(M).
- The climate change impacts of the A1/A1(M) in the context of national climate change targets.
- Poor quality of townscape around areas of the A1/A1(M), particularly between Baldock and Alconbury.

Safety

1.5.8 Stakeholders identified the following safety issues for further consideration:

- Need for analysis of collision data was identified.
- Ambulances serving Lister Hospital use the A1/A1(M). Possible delay to ambulances perceived as an issue by some stakeholders and purportedly a local concern.
- Several local accesses to the A1 between Baldock and Alconbury perceived as hazardous , for example farm and residential accesses.
- Some roundabouts between Baldock and Alconbury perceived as unsafe, for example the Biggleswade South roundabout where a Heavy Goods Vehicle (HGV) is understood to have overturned due to poor lane alignment.
- Variations in the speed limit, and varying levels of congestion, results in varied vehicle speeds, which is considered a possible safety issue.
- Some slip roads identified as unsuitable and hazardous, for example due to short slip-road length.
- Unsuitability of using or crossing the A1 for vulnerable users, for example pedestrians, cyclists and equestrians.
- Safety issues associated with any loss of hard-shoulder.

Resilience

1.5.9 Stakeholders identified the following resilience issues for consideration:

- Resilience to weather, for example flooding and pot-holes cited as issues.
- Linked to network reliability, collisions and congestion affect both the A1/A1(M) and wider local road network.

- Large events affect the A1/A1(M) and the local road network, for example some Knebworth House events require closure of Junction 7.

Wider considerations

1.5.10 Stakeholders identified the following wider considerations:

- Population growth and development - locations of substantial growth will have implications for the A1/A1(M), and changes to the A1/A1(M) or alternative routes could influence growth.
- The purpose of the A1/A1(M) and the wider road network, including parallel and east-west routes.
- Possibility of enhancing alternative routes, for example east-west routes, to release capacity on the A1/A1(M).
- Alternatives to road capacity increases, for example public transport enhancements.
- Impacts of capacity increases, for example encouraging long-distance commuting.
- How the context of the project is considered in terms of sustainability.
- How technological innovation could change the context or aid in resolving issues, for example use of smart motorways.
- Peterborough is a growing city beyond the northern study boundary.
- Wider freight movements in relation to the A1/A1(M).

Feedback from January 2016 stakeholder reference group:

1.5.11 A second SRG was held on 28 January 2016. Representatives of various stakeholder organisations attended including: Bedford Borough Council, Bedfordshire Association of Local Councils, Bedfordshire Local Nature Partnership, British Horse Society, Cambridgeshire County Council, Cambridgeshire Police, Campaign to Protect Rural England, Campaign for Better Transport, Central Bedfordshire Council, Confederation of Passenger Transport, Cyclists' Touring Club, Environment Agency, Federation of Small Businesses, Freight Transport Association, Hertfordshire Association of Parish and Town Councils, Hertfordshire County Council, Historic England, Huntingdonshire District Council, Living Streets, Luton Borough Council, National Farmers' Union, Natural England, North Hertfordshire District Council, Peterborough City Council, Royal Society for the Protection of Birds, St Albans City and District Council, Stevenage Borough Council, Welwyn Hatfield Borough Council, Wildlife Trust and Woodland Trust.

1.5.12 The meeting objectives included: to inform the reference group about the emerging findings from Task 1 and to seek comments on the emerging findings; and to introduce Task 2 of the study and seek

initial views and to inform the next steps in the process, in particular giving assistance in generating a long list of options.

1.5.13 In summary, stakeholders made the following comments about the emerging findings from Task 1:

- Concerns raised that road building generates more traffic and congestion and does not help the economy.
- Journey time reliability is more important than journey speed/time for freight.
- Weekend traffic flows need to be considered as well as weekday flows.
- Greater clarity sought over how much traffic originates or has destinations in the study area.
- Interventions must be integrated and environmental benefits and improvements need to be aimed at both the natural environment and for road users.
- The A1 creates substantial severance and the importance must be given to achieving benefits for the Public Right of Way network.
- The inclusion of J14-J17 in the study area was queried as this does not seem to have the same degree of issues as the rest of the study area.
- Both designated and non-designated heritage assets need to be taken into consideration.
- Questions over the available funds for the public finances for flood management.
- Discussion around the likely timescale for any works to start on the ground given the RIS 5 year blocks of funding and the interface with the National Infrastructure Commission.
- The study should look beyond 2034 (particularly if works on the ground take place 2020-2025) and should include reference to the area beyond the study area.

2 Context

2.1 Introduction

2.1.1 There are 14 districts within the East of England study area that the A1 passes through or by, from Junction 1 at the M25 to Junction 17 in Peterborough. The A1 study area has experienced economic and demographic growth over the past ten years, and is forecast to continue to expand with Local Planning Authorities (LPAs) producing plans to deliver the infrastructure and homes to support sustainable growth. This is further supported by stakeholders including central government, transport agencies and Local Enterprise Partnerships (LEPs).

2.1.2 To understand the scale and form of change, and to appreciate the study area characteristics, a quantitative socio-economic baseline analysis has been undertaken to show the current profile of the study area and give an oversight of its current population levels and its economic prosperity, principally using Census and Business Rates Employment Survey (BRES) data.

2.1.3 The growing population puts increasing pressures on current infrastructure and housing quantities, suggesting a vital need for investment in transport and provision of new homes. Sector areas identified for growth and investment are largely in education, knowledge and innovation economies and research. A review of recent districts' adopted planning policy, government announcements, and LEPs' Strategic Economic Plans (SEPs) demonstrated a strategic need for commitment and investment in supporting infrastructure, mainly in transport and the road network in particular.

2.1.4 This section of the report then focuses on traffic movements and related data to provide some transport context. This includes an overview of the route, traffic flows, public transport (including rail) and freight. This data is further contextualised with regard to the prevailing transport policy.

2.1.5 Finally, an environmental baseline has been undertaken and is also presented here. This covers a range of aspects of the environment including noise, air quality, built and natural environment designations, the historic environment, biodiversity and the water environment.

2.2 Socio-Economic Context and Seeds for Wider Economic Impacts

Overview

2.2.1 There has been substantial population growth in and around the study area, particularly those of working age and the ageing. This growth is expected to continue. The study area is characterised by high levels of employment, skills attainment and wages compared with national averages. The economy is generally diverse specialising in wholesale and retail, administrative and support services, professional and

technical activities and education. Whilst there is a strong commuting relationship with London, the study area also provides substantial employment locally, with 8 of 14 districts having a higher job density than the UK average. As with all areas, economic strengths and weaknesses are not uniform, and there are neighbourhoods which experience lower levels of employment and skills and higher levels of deprivation. Examples include parts of Hatfield, Stevenage, Luton and Peterborough.

2.2.2 Travel to work flows suggest high levels of commuting, often within the same district but also to other boroughs, likely for neighbouring employment opportunities. Across the study area as a whole there is a high proportion of households with access to a car (although there are pockets of lower rates of access) suggesting frequent use of the road network.

2.2.3 The economic context is explored further below, focussing on population, employment, the labour market, and the anticipated economic growth.

Population

Population Estimates

2.2.4 Mid-2014 population estimates indicate that the population of the study area stood at 2,097,700 people[10], an increase of 11.4% in the 10 years between 2004 and 2014. This compares with average population growth across England and Wales of 8%.

2.2.5 The three most populous districts in the study area are Central Bedfordshire, Luton and Peterborough. Areas which have seen the highest levels of population growth are Welwyn Hatfield (15.4% increase), Luton (14.9% increase) and Cambridge (14.5% increase).

2.2.6 All the districts experienced overall growth from 2004-2014, with some experiencing sharper increases in population than others. Existing urban areas have seen substantial growth, with the greatest population change in Peterborough which has grown 16.5% from 163,500 in 2004 to 190,500 by 2014.

2.2.7 All districts, with the exception of Cambridge, experienced continuous positive growth between 2004 and 2014. The population of Cambridge is estimated to have reduced by 500 between 2006 and 2007, after which the population grew continuously[11] and overall growth was amongst the strongest in the study area. Huntingdonshire, Stevenage and Bedford experienced the lowest levels of population growth across the districts.

2.2.8 This population growth reflects strong employment performance (see below) of the area as well as a long term structural trend of domestic

[10] ONS, Mid-year population estimates (2015).
[11] It is worth also noting that Cambridge is an under-bounded city and population trends should be considered together with South Cambridgeshire (which has experienced continuous population growth) when thinking about trends across the Cambridge functional urban area.

migration out of London to the wider economic hinterland. The East of England region had net domestic in-migration of 6,200 in 2013[12] so is an attractor from other regions, notably London.

Table 2.1: Population change 2004-2014, showing the lowest to highest percentage change by district. (ONS mid-year estimates, 2015).

District	2004	2014	Population Change	% Change
Huntingdonshire	162,700	173,600	10,900	6.7%
Stevenage	80,000	86,000	6,000	7.5%
Bedford	151,300	163,900	12,600	8.3%
Harlow	78,000	84,600	6,600	8.5%
North Hertfordshire	120,100	131,000	10,900	9.1%
Hertsmere	93,800	102,400	8,600	9.2%
East Hertfordshire	130,500	143,000	12,500	9.6%
St Albans	131,300	144,800	13,500	10.3%
Central Bedfordshire	240,400	269,100	28,700	11.9%
South Cambridgeshire	135,600	153,300	17,700	13.1%
Cambridge	112,200	128,500	16,300	14.5%
Luton	183,600	211,000	27,400	14.9%
Welwyn Hatfield	100,500	116,000	15,500	15.4%
Peterborough	163,500	190,500	27,000	16.5%
England & Wales	53,152,000	57,408,700	4,256,000	8.0%
Total	**1,883,500**	**2,097,700**	**214,200**	**11.4%**

Employment and economy

Employment and Job Density

2.2.9 Job density is the number of jobs per resident of working age in a given area. For example, a job density of 1.0 would mean that there is one job for every resident of working age in the population. It is a good general indicator of the economic strength of an area and provides information on its functional economic geography. This in turn suggests what might be expected from travel demand and traffic trends. The South-East of England generally has a higher job density (more jobs per resident) than the North-East of England, for example. The average UK job density is 0.79[13].

2.2.10 Analysis of the job density data using ONS 2013 data shows that the study area is generally a strong employment area. It has high levels of job density, with eight of the 14 districts with job densities equal to or above the UK average. Cambridge and Welwyn Hatfield have more

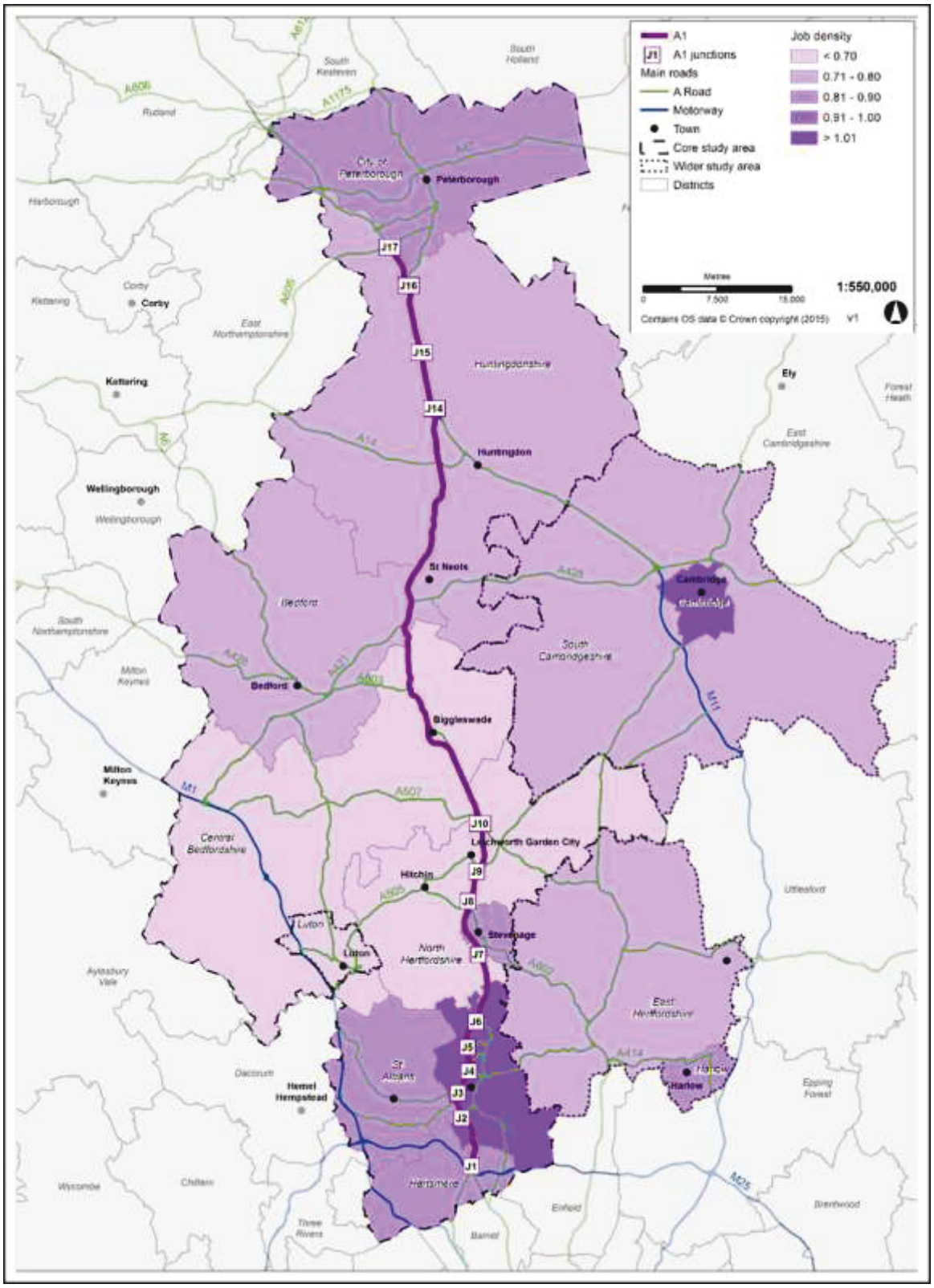
[12] ONS Statistical Bulletin: Internal migration, England & Wales: Year ending June 2014.
[13] ONS, jobs density 2013.

jobs than working age residents and are thus labour-attracting districts. Peterborough, St Albans, Harlow and Hertsmere also have high job densities, ranging between 0.8-0.9 (higher than the average for England). Central Bedfordshire, North Hertfordshire and Luton have fewer jobs than residents, with job densities between 0.65-0.70. Overall, this supports existing travel demand patterns which reflect movements between those labour-supplying areas and the labour-attracting areas (including Greater London).

2.2.11 This strong employment performance may have been a contributing factor in the observed population growth discussed above as people have moved into the study area to take advantage of employment opportunities.

2.2.12 The districts with job density rates near to or above 1.0 are likely to experience high levels of in-commuting, resulting in more movements on the road network as people travel in to areas such as Welwyn Hatfield for work.

Figure 2.1: Job Density[14]



[14] ONS, jobs density, 2013.

Table 2.2: Job density and total workplace-based employment[15]

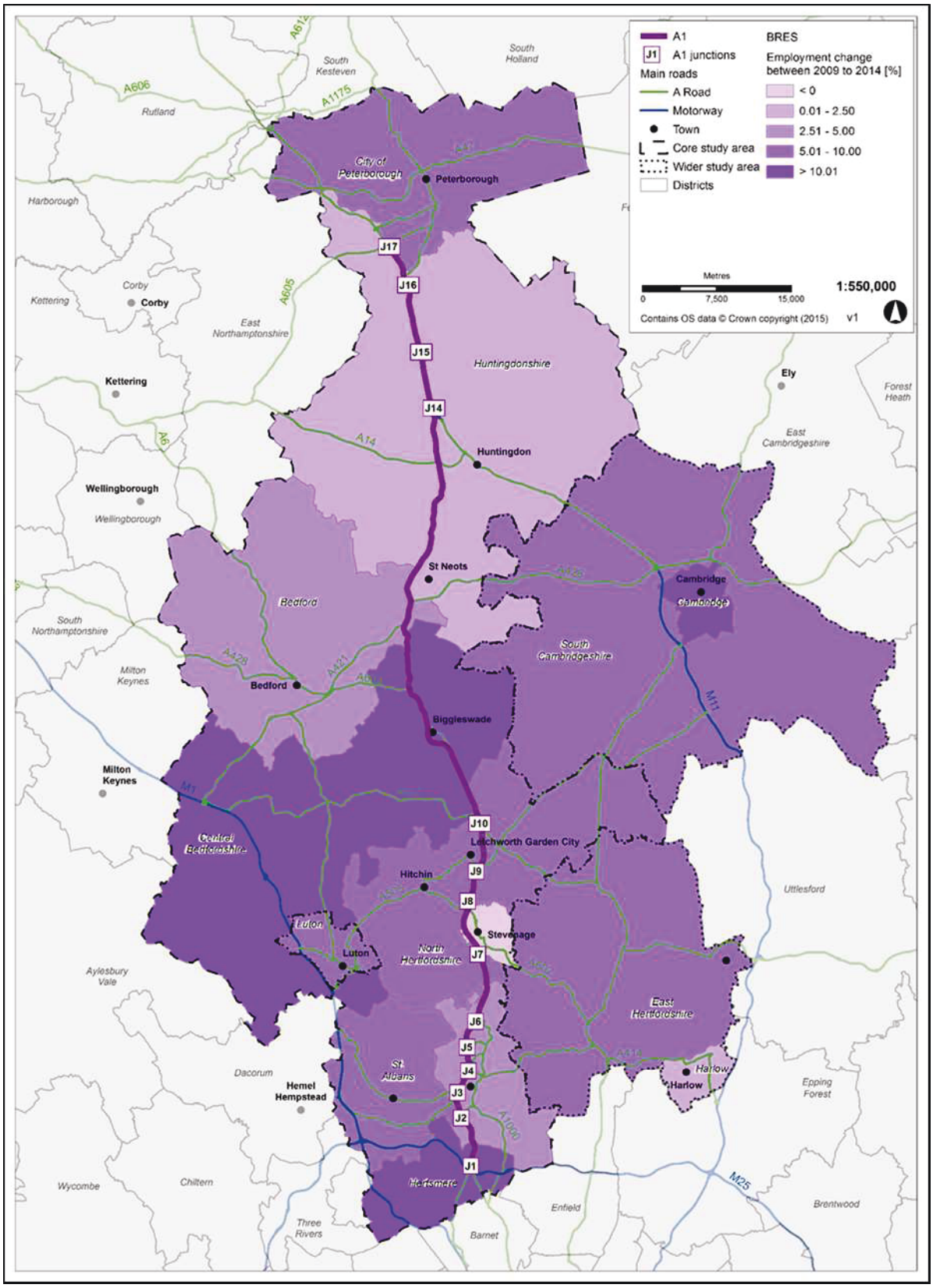
District	Job Density (ONS, 2013)	Employees (BRES, 2014)	Employee increase from 2009-2014 (BRES)	
Bedford	0.78	70,000	1,800	2.6%
Cambridge	1.17	97,900	11,800	13.7%
Central Bedfordshire	0.65	91,800	8,500	10.2%
East Hertfordshire	0.77	61,400	4,500	7.9%
Harlow	0.86	38,300	200	0.4%
Hertsmere	0.84	48,700	6,400	15.2%
Huntingdonshire	0.75	70,600	1,100	1.6%
Luton	0.70	90,500	6,600	7.9%
North Hertfordshire	0.70	48,700	3,000	6.6%
Peterborough	0.90	103,400	7,400	7.7%
South Cambridgeshire	0.80	71,100	4,000	6.0%
St Albans	0.90	70,000	3,900	5.9%
Stevenage	0.81	42,800	-200	-0.4%
Welwyn Hatfield	1.10	75,100	3,000	4.2%
Study Area	0.84 (average)	980,300	62,000	6.8%
Great Britain	0.79 (average)	27,096,300	1,308,300	4.9%

2.2.13 Business Register and Employment Survey (BRES) data shown in the table above and the map overleaf highlight that in 2014 average employment growth across the study area was 6.8%, compared with a 4.9% national average[16]. The district with the highest number of total workplace-based employees was Peterborough with 103,400. Cambridge (97,900), Central Bedfordshire (91,800) and Luton (90,533) districts also have high levels of employment. Each of these high-employment districts also experienced growth in employment above the study area average and the national average.

2.2.14 Other than a very small decline in employees in Stevenage (-200, or 0.4%, between 2009 and 2014), all other districts saw a general increase in employees but employment growth in Bedford (2.6%), Harlow (0.4%) and Welwyn Hatfield (4.2%) was below the national average growth rate.

[15] ONS, jobs density 2013 and BRES, employees 2015. Averages quoted are arithmetic mean figures.
[16] BRES, Employees 2015.

Figure 2.2: Map showing the employment change 2009 to 2014 (%)[17]



[17] BRES, Employment 2014.

Economic Inactivity

2.2.15 Economic inactivity statisticss record people of working age who are not in employment or looking for employment (i.e. are outside the labour force). Between January 2015 and December 2015, 19.7% of working age adults across the study area were classed as economically inactive. This is lower than the national average rate of 22.2%[18]. Of these, around one fifth say that they want a job and the remaining four fifths do not[19]. There are fewer people outside the labour force that want a job in the study area than the national average (19.7% compared with 24.4%). The majority of economically inactive people in the study area are either students (28.3%) or looking after family or home (27.2%), which are both slightly higher than the national average. The proportion of long term sick workers is lower than average (15.2% compared with 21.3%).

2.2.16 Luton, Welwyn Hatfield, Hertsmere and Peterborough had the highest percentages of economically inactive working aged people (27.9%, 24.6%, 22.7% and 20.9%), higher than the reported national economic inactivity rate of 22.2%[20]. All of these districts saw an overall increase in employment over the period 2009-2014. Headline indicators for the East of England[21]for the same time period show that the main reason for economic inactivity is not wanting a job, followed by those not able to work due to looking after family or the home and those currently wanting a job. Retired and being a student were also reasons for economic inactivity in the East of England.

Employment Sectors

2.2.17 An interrogation of BRES (2014) data[22] indicates that the main employment sectors fall into five categories. In 10 of the 14 districts the most important employment sector is wholesale and retail (9 out of 10 of these are in retail). The other main employment types are education (in Cambridge), administrative and support service activities (Luton and St Albans) and professional, scientific and technical activities (South Cambridgeshire).

2.2.18 Human health and social work activities forms the second highest employment sector in four of the districts, with administrative and support service activities forming the second highest employment sector in a further four districts.

2.2.19 A more granular analysis of the employment sectors shown in Table **2.3** below shows the most dominant employment sectors at a lower tier. Education, hospital activities and retail sale in non-

[18] ONS, Annual population survey July 2014 - June 2015.
[19] Note this is not the same as the unemployment rate – economically active people may say they want a job but are not actively seeking one. Those who are unemployed but actively seeking work are classed as economically active.
[20] ONS, Annual population survey July 2014 - June 2015.
[21] ONS, Annual population survey 2016.
[22] BRES, Employment sectors 2009.

specialised stores are all key employment sectors across the study area.

Table 2.3: Highest employment sectors by district[23]

District	Highest Employment Sector
Bedford	Primary education
Cambridge	Higher education
Central Bedfordshire	Retail sale in non-specialised stores
East Hertfordshire	Temporary employment agency activities
Harlow	Hospital activities
Hertsmere	Computer programming, consultancy and related activities
Huntingdon	Retail sale in non-specialised stores
Luton	Hospital activities
North Hertfordshire	Retail sale in non-specialised stores
Peterborough	Temporary employment agency activities
South Cambridgeshire	Research and experimental development on natural sciences and engineering
St Albans	Cleaning activities
Stevenage	Hospital activities
Welwyn Hatfield	Retail sale in non-specialised stores

Labour Market

Skills

2.2.20 The study area as a whole has a high level of qualified residents - 39.7% have NVQ4+ Level qualifications, compared with the national average of 36.6%[24]. NVQ Level 4 is equivalent to an undergraduate degree. However this is quite varied across the study area with some districts having as many as 66.6% (Cambridge) and some as few as 20.9% (Harlow). Other districts with particularly high proportions of highly skilled residents are St Albans (62%) and South Cambridgeshire (51.1%).

2.2.21 The study area as a whole has fewer people with no qualifications (7.1%) than the national average (8.5%) with particular concentrations of unqualified residents in Luton (14.8%), Peterborough and Stevenage (both 9.1%). Most districts have a lower percentage of no qualifications than the English and Welsh average of 8.5% (Annual Population Survey, 2015).

Resident Earnings

2.2.22 The study area in general is relatively affluent with 10 of the 14 districts in the study area having gross average weekly earnings above

[23] BRES, Employment sectors 2009.
[24] ONS, Annual population survey NVQ qualifications January 2014 - December 2014.

that of the UK average of £500, suggesting a reasonable standard of living. There is, however, some substantial variance in earnings across the districts[25]. Data show that the districts with the highest gross weekly pay are St Albans at £801.70 which is £300 more than the UK national average; East Hertfordshire (£633.80 gross weekly pay) and South Cambridgeshire (£618.30 gross weekly pay). This is substantially more than some districts in the study area, the lowest earner being Luton (£439), Harlow (£447.90) and Stevenage (£479.90), all below the UK average. Overall, the study area is a largely affluent area with above UK average earnings and most districts paying the living wage to their employees.

Access to a car

2.2.23 There are generally high levels of car ownership within the study area. In 12 of the 14 study area districts the rate of households with access to a car or van is higher than the English and Welsh average, which stands at 74.4% (whereby the Census[26] identifies 25.6% with no access to a car or van). Access to a car or van is an interesting data point but its implications are not always clear, so it needs to be considered alongside other socio-economic information when considering traffic and policy implications. When an area has a low rate of access to vehicles it can signify one (or both) of two situations. It might signify a relatively low income area, or an indication that there is a well-developed public transport network which has allowed households to function (or choose to function) without a car.

2.2.24 Looking at the data[27], it would appear that both of these typologies are present across the study area. For example, the data shows that Cambridge has a relatively high proportion of households with no access to a car or van – 33.6%, the highest level across the study area. However, Cambridge also has relatively high incomes, high job density and low commuting outflows, suggesting a lesser need for a car as distances to work are shorter and that alternative modes (public and active transport) are easily available.

2.2.25 There are also below-average rates of access to a motor vehicle in Luton (27.4% with no access to a car or van) and Harlow compared with the national average. Peterborough has one of the higher rates of households with no access to a motor vehicle access across the study area at 24.9% (although this is still a slightly lower rate than the national average). In these districts, lower average incomes and employment rates suggests that more households may be unable to afford access to a vehicle which has implications for access to employment and services.

2.2.26 Districts with a very high percentage of households with access to at least one car or van are South Cambridgeshire (89% with one or more car or van), East Hertfordshire (87.3%) and Central Bedfordshire

[25] ONS, Annual survey of hours and earnings – resident analysis 2014.
[26] ONS, Car or van availability 2011.
[27] *ibid.*

(86.8%). All of these are well above the national average of 74.3%. This could suggest people in these areas may be more likely to travel longer distances to work, within and outside of their district, supported by their below average job density which shows that some residents do need to move outside of the district for work.

Travel to work

2.2.27 The A1 provides direct links between some of the East of England's major urban centres and London and, as such, there are significant commuter flows across the area. Census travel to work data suggests that across the study area as a whole, 72% of in-work residents work within the study area. 14% work in London, and 14% work elsewhere outside the study area. Some 113,000 people travel into London from across the study area for work whilst almost 600,000 travel within the study area.

Table 2.4: Study area travel to work patterns, by district[28]

Residents of:	Work within study area	Work in London	Work elsewhere
Bedford	82%	5%	13%
Cambridge	89%	5%	6%
Central Bedfordshire	73%	9%	18%
East Hertfordshire	59%	22%	19%
Harlow	63%	16%	21%
Hertsmere	39%	46%	15%
Huntingdonshire	87%	4%	9%
Luton	80%	9%	11%
North Hertfordshire	79%	14%	6%
Peterborough	82%	2%	16%
South Cambridgeshire	87%	4%	9%
St Albans	57%	29%	14%
Stevenage	83%	11%	6%
Welwyn Hatfield	70%	22%	9%
Study Area	73%	14%	14%

2.2.28 Census travel to work data (2011) show that the most common destination for commuters is within their resident borough, however, there is also substantial out-commuting, with neighbouring districts commonly being the second highest commuter destination. Across the study area as a whole, 73% of in-work residents work within the study area. 14% work in London, and 14% work elsewhere outside the study

[28] ONS, Travel to work 2011.

area. This indicates a greater pressure on the road and rail networks during peak morning and afternoon travel times in particular.

2.2.29 Key commuter flows identified in the Census data are Cambridge to South Cambridgeshire and Huntingdon, East Hertfordshire to Harlow and Stevenage, and between most Hertfordshire Districts and London. Some 113,000 people travel into London from across the study area for work whilst almost 600,000 travel within the study area.

2.2.30 The districts with highest levels of out-commuting to London are Hertsmere (46%), Broxbourne (39%) and St Albans (29%). The districts with the highest level of commuting to other places outside the study area are Broxbourne (40%), Harlow (21%), East Hertfordshire (19%) and Central Bedfordshire (18%)[29].

2.2.31 Cambridge receives the greatest number of commuters travelling into the district for work, with 65,465 employees commuting to Cambridge (including residents of Cambridge). Districts with high number of in-commuters in the study area also include Peterborough (62,910), Luton (60,706), Central Bedfordshire (59,231) and Bedford (52,055), highlighting that there are significant travel to work flows across the whole study area. This work flow pattern is to be expected, given the proximity to several key employment centres within the study area and the good levels of employment opportunities in the locality.

2.2.32 Approximately 45% of travel to work is undertaken by car as shown in Table 2.5 and Figure 2.3 as higher than the national average of 40.4% with the exception of Cambridge which is much lower (20.8%)[30]. Districts with particularly high levels of commuting by car or van are Huntingdonshire (51.9%) and Central Bedfordshire (52.5%) in which more than half of commuters travel to work by car or van.

2.2.33 Levels of commuting to work by public transport are generally low across the study area. Overall, 2.9% of the resident population currently travels to work by bus, compared with 4.7% nationally. The only district with above average levels of bus commuting is Peterborough (5%). Travel to work by rail or light rail is slightly below national average (5.6% compared with 5.8%) although heavy rail commuting alone is higher than national average (5.1% compared to 3.3%), reflecting the relatively good rail commuter links into London. Districts with particularly high levels of rail commuting are St Albans (13.5%), East Hertfordshire (9.6%), North Hertfordshire (8.5%) and Hertsmere (8.4%) reflecting the particularly strong commuter links between Hertfordshire and London.

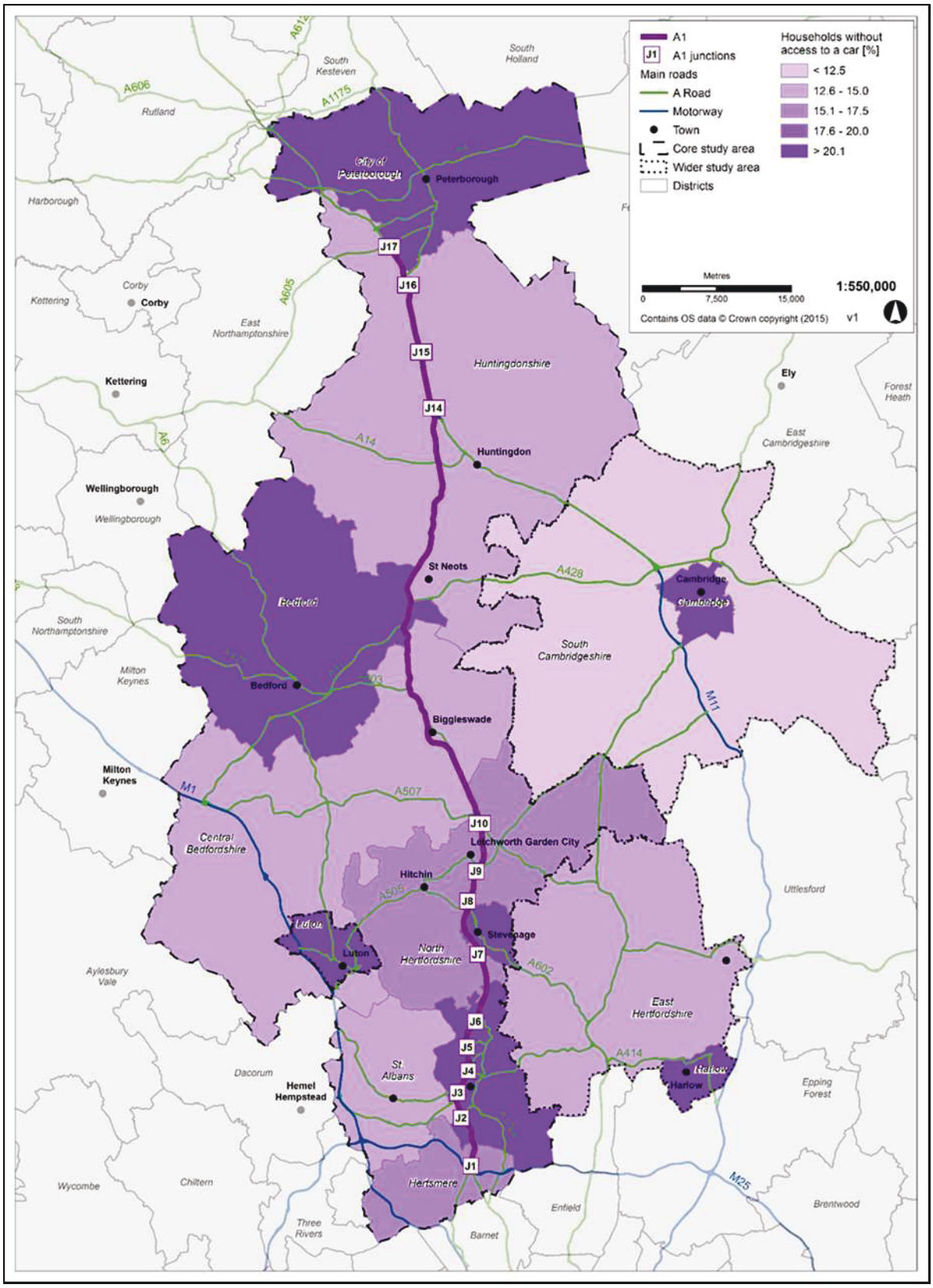
[29] ONS, Location of where people live when working and place of work 2015.
[30] ONS, Method of travel to work 2011.

Table 2.5: Percentage of people who travel to work in a car or a van[31]

District	Percentage of residents who travel to work as the driver of passenger in a car or van	Percentage of residents who travel to work by bus	Percentage of residents who travel to work by train
Bedford	46.2%	2.8%	3.2%
Cambridge	20.8%	3.9%	3.0%
Central Bedfordshire	52.5%	1.4%	4.6%
East Hertfordshire	47.0%	1.3%	9.6%
Harlow	47.6%	3.7%	2.9%
Hertsmere	41.6%	3.2%	8.4%
Huntingdon	51.9%	1.8%	2.6%
Luton	40.7%	4.6%	3.6%
North Hertfordshire	46.9%	1.2%	8.5%
Peterborough	45.9%	5.0%	1.7%
South Cambridgeshire	49.8%	3.2%	2.7%
St Albans	41.6%	1.7%	13.5%
Stevenage	49.1%	4.1%	4.9%
Welwyn Hatfield	41.1%	2.8%	6.6%
Study area total	45.0%	2.9%	5.1%
England & Wales	40.4%	4.7%	3.3%

[31] ONS, Method of travel to work 2011.

Figure 2.3: Households without access to a car[32]



[32] ONS, Car or van availability 2011.

Labour market demand and supply issues

2.2.34 There is some evidence that there is an unsatisfied demand for labour in the study.

2.2.35 The data shows that several districts in the study area simultaneously experience relatively high employment growth, relatively high unemployment rates, and relatively high numbers of unfilled vacancies (particularly Hertsmere and Peterborough). This could be indicative of skills mismatch across the study area. Alongside a pattern of disparities between residence based earnings and workplace based earnings (St Albans, Bedford, East Hertfordshire, Central Bedfordshire), these together provide supporting evidence for strong reliance on commuting both within the study area and outside of it.

Table 2.6: Selected employment statistics, by district

District	Workplace based pay as a ratio of residence-based pay[33]	Employment Growth 2009-2014[34] (%)	Unemployment rate age 16+[35]	Vacancies as a proportion of total jobs[36]
Bedford	0.94	3%	6%	1%
Cambridge	1.03	14%	3%	1%
Central Bedfordshire	0.83	10%	2%	2%
East Hertfordshire	0.86	8%		1%
Harlow	1.10	0%	7%	1%
Hertsmere	1.04	15%	6%	1%
Huntingdonshire	0.91	2%	3%	1%
Luton	1.06	8%	6%	1%
North Hertfordshire	0.91	7%	4%	1%
Peterborough	1.08	8%	5%	3%
South Cambridgeshire	1.00	6%	3%	1%
St Albans	0.74	6%	2%	1%
Stevenage	1.08	0%	3%	2%
Welwyn Hatfield	1.00	4%	4%	2%

Key Findings and Implications

2.2.36 The study area population is growing through both natural increase and in-migration. Key population growth hotspots are Peterborough, Welwyn Hatfield and Luton. These districts also have a high job density, along with Stevenage and St Albans; and high numbers of employees, as do Cambridge and Central Bedfordshire. Travel to work data show that Cambridge, Peterborough and Luton are strong

[33] ONS, Annual Survey of Hours and Earnings 2015.
[34] BRES, 2009 – 2014.
[35] Annual Population Survey, year to December 2015.
[36] Derived from JobCentrePlus vacancy data and BRES data 2014.

attractors for in-commuting and there is a strong relationship with London with 14% of the study area workforce travelling into the capital for work. Some 72% of all study area residents in employment work within the study area.

2.2.37 In general, the study area work force is highly qualified and a large majority of the population is economically active, with a high employment density relative to the national average. The study area is a largely affluent area with above UK average pay. However, there are areas of deprivation in the study area, namely in Peterborough, Luton and Harlow, where there is also a higher proportion of residents with no qualification and of economic inactivity. Wages in these districts are some of the lowest in the study area and there is a much higher percentage of the population without access to a car.

2.2.38 Overall, the study area is experiencing high levels of growth, both in its population and its economic development, but with spatial variation in the distribution of wealth. As highlighted in subsequent sections, local authorities are anticipating the need to deliver a substantial number of new houses to accommodate population, but this will be matched with access to job opportunities and the activation of new business locations.

Planning Context

2.2.39 A full review of relevant planning policy provides a summary of the development plans amongst the districts in the study area, to help understand what additional demand might be placed on the network in the future.

2.2.40 All the local plans reviewed predate the 2012 National Planning Policy Framework (NPPF). Although these plans provide a good indication of development and employment aims, they are likely to contain out-of-date forecasts. Figure 2.4 below shows the progress of the adoption of new local plans throughout England in 2015. The East of England study area is notable for its lack of adopted local plans, indicated by the 'light grey' districts in Figure 2.4). This presents a risk for this study as forecasts for growth and planning projections in older plans will be outdated, and new planning will have come into force. In the preparation of their new local plans, many of the districts have undertaken a Strategic Housing Market Assessment (SHMA) or other population studies which provide the most recent projections for population, employment and housing figures which can be used in this study to provide a profile of level of district development. They do not, however, indicate the locations where new growth and development will be accommodated.

Figure 2.4: Map showing the Local Plan adoption process in October 2015[37]

2.2.41 The planning review presents a summary of each district's relevant plans, highlighting key statistics on the likely population and job growth and the associated housing provision, whilst also giving a good insight in the districts with the most substantial growth.

[37] DCLG, 'Local Plans Progress' in GOV.UK October 2015, viewed on 22nd January2016, https://www.gov.uk/guidance/local-plans#monitoring-local-plans.

Expectation of substantial growth and the need for planning for both population and employment increases is clear across the study area. The main planning issues for each district, which set the context for the Case for Change, are set out in Table 2.7.

Table 2.7: Key relevant planning issues, by district

Bedford	• Three main urban areas for development in Bedford, Kempston and Marston Vale • People moving outside of the District to find work • Housing needs are currently being met • 21,700 new residents from 2012-2037 • 17,367 new dwellings required over the same period • 16,000 new jobs expected over the same period • 1,289 net out commuting in 2011
Cambridge	• Internationally recognised for research, education and tourism • Population growth of 27,000, with a high proportion of younger and older residents over the next 20 years • 14,000 new homes over the same period • 22,000 new jobs over the same period • Diversifying economy
Central Bedfordshire	• Fast rising population, expected to rise to around 306,900 by 2031 • 27,000 new homes needed between 2001-2021 • 20,200 jobs expected within the area up to 2031 • Opportunities for employment with expansion of Stansted Airport • Have to assist in meeting Luton's housing requirements
East Hertfordshire	• High predicted population growth, rising by 20,483 people between 2011 and 2033 • Demand for housing, with an annual increase of 1,745 dwellings needed each year • 34, 980 jobs created by 2031 • Well performing economic base • In-commuters expected to rise
Harlow	• 14,036 population increase between 2011 and 2031 • Approximately 5,000 new dwellings by 2031 • 8,000 new jobs by 2031 • Town centre redevelopment and regeneration is key
Hertsmere	• 80% of district in Green Belt • Population expected to rise by 16,500 people between 2013 and 2027 • 3,990 additional dwellings needed between 2012 and 2027 • 8,335 new jobs to be created by 2026

Huntingdonshire	• Population expected to rise by 12,800 people between 2009 and 2031 • 17,000 new homes needed by 2031 • 15,000 new jobs expected in the same period • Urban extensions planned for at St Neots and Huntingdon
Luton	• Population rise to 236,105 in 2031 • 27,700 new dwellings by 2031 • 17,825 new jobs by 2031 • Strong manufacturing employment base and shopping destination • Attracted in major infrastructure funding • Limited scope for any further development, for new houses in particular • Neighbouring Central Bedfordshire is having to assist in meeting housing needs
North Hertfordshire	• Population increase of 17,500 people from 2013-2023 • 14,200 new dwellings needed between 2011-2031 • 3,600 additional new jobs needed between 2011-2031
Peterborough	• 23.5% population increase between 2001 and 2036 • 1,311 new homes needed per annum • 22,032 new jobs between 2011 and 2036 • Five urban extensions at Hampton, Paston Reserve, Stanground South, Great Haddon and Norwood
South Cambridgeshire	• Population increase of 38,000 people between 2011 and 2031 • 19,000 new dwellings needed in the same time period • 27% increase in jobs by 2036 • High development pressures from the expanding economy • One of the fastest growing districts • New urban extensions and Northstowe New Town planned
St Albans	• Population to rise by 164,700 by 2031 from 138,00 in 2011 • 11,724 new homes between 2011 and 2031 • Struggling to provide enough new affordable homes • Strong employment centre • High out commuting
Stevenage	• Population forecast of 10,000 people between 2011 and 2031 • Substantial ageing population • 5,013 new homes by 2032 • Balanced number of people living and working in the borough • Needs to extend employment offer

Welwyn Hatfield	• High expected population growth of 23,000 people from 2013-2032 • 13,400 new jobs created by between 2014 and 2026 • Additional 10,600 new homes between 2012 and 2032 • High in-commuting • Strong employment growth in professional jobs

Strategic Economic Plans (SEPs)

2.2.42 In 2013 the Government asked LEPs to set out their proposals to drive growth in their area, expressed as an offer to government in the form of a SEP. In response, SEPs covering the study area have been compiled by Greater Cambridge and Greater Peterborough (GCGP) LEP, Hertfordshire LEP, South East Midlands (SEM) LEP and Northamptonshire LEP.

2.2.43 In addition to the plans for growth set out in the local plans and summarised above, the SEPs help set the context for expectations of growth across the study area that the road network can help to facilitate, as well as the consequent pressures on the network. Key points of the SEPs are summarised by LEP area in Table **2.8** below.

2.2.44 More generally, key points to note are:

- All of the LEPs are 'going for growth' in terms of population, employment and Gross Value Added (GVA). The area is judged to be successful and the LEPs are looking to the Strategic Road Network as a means to help to support and increase economic success.
- The study area hosts globally important business clusters, research centres with links to universities and is strategically located for two major airports and London.
- SEP evidence presented suggests a skilled workforce and offering a high quality of life. In combination with other data this presents the areas as an attractive commuter location. The area is also a strong attractor for both headquarters and back office functions.
- Key sectors are: agri-tech; food processing; advanced engineering; science; biotech; digital technology; film; financial services; and logistics & distribution.
- All of the LEPs stress the importance of delivering new homes, including affordable homes, to underpin economic growth objectives.

Table 2.8: Summary of key relevant points from the Strategic Economic Plans, by LEP area

Greater Cambridge and Greater Peterborough LEP	• 700,000 jobs, 60,000 enterprises, generates £30 billon per annum • Awarded £60 million from government • Targeting 15,500 new jobs and 10,000 new homes. By 2021 • Identified critical need for new homes, including affordable, to support growth ambitions • Alconbury Weald Enterprise Campus, largest brownfield site in the south of England in single ownership, is a priority location for many of the interventions and recently designated Enterprise Zone
Hertfordshire LEP	• Secured £222 million from government • Focus on three growth areas including new towns • By 2030 there will be an additional 16,600 new homes, 38,600 new jobs, £3bn additional uplift to GVA, and a leverage of £590 million in private sector funding. • Four priorities: grow existing science and tech cluster; reinvest in the new towns; capitalise on relationship with London; address deprivation and economic underperformance • The LEP has established an A1(M) Forum tasked with planning for future growth, with priorities to stimulating growth, investing in employment and skills, and developing necessary infrastructure
Northamptonshire LEP	• By 2021: 80,000 new jobs; 70,000 new homes; £4 billion additional GVA • One of the fastest growing populations in the country • Objectives are centred around growing the businesses and innovation sectors creating new skills and jobs
South East Midlands LEP	• Population of 1.7 million; GVA of £38.6bn • By 2021: 86,700 new homes; 151,400 additional population; 111,200 new jobs; GVA to increase by £10.8bn • Strategic objectives include stimulating enterprise and enhancing the competitiveness of SME's, and strengthening innovation and knowledge assets • Enterprise Zone at Northampton Waterside

Other relevant context/information

The East of England Forecasting Model

2.2.45 The East of England Forecasting Model (EEFM) was developed by Oxford Economics to project economic, demographic and housing trends. A review of the EEFM 2014 baseline forecasts shows a perhaps more accurate projection of population and economic growth across the study area than the local planning policy documents. The forecasts suggest substantial growth in populations, total employment and in the number households. Some of these figures were used for

population projections in the analysis for this study where relevant and up to date information was unavailable.

Government Announcements

Long term economic plan for the East of England (February 2015)

2.2.46 In February 2015, the Government announced a long term plan for the East of England[38]. This was a six-point long term economic plan, looking at what has been achieved, what is underway and what can be done in the future with a timetable for delivery.

- Adding £12bn to the East of England economy by 2030.
- Creating 250,000 extra jobs by 2020.
- To support such growth, £4.2bn of investment in transport is planned in the East of England to improve road and rail connections.
- Building on the existing assets, the focus will be on growing the science and technology base by supporting the universities and high technology industries, as well as maximising the East's role in defence.
- The rural economy will also be boosted, including the energy sector for renewables and gas exploration and agri-tech.
- Finally the construction of 15,000 new homes and 90,000 new school places are planned to support the new growth.

2.2.47 Following the government elections in May 2015 these may be out of date as specific Government priorities or targets. However, as set out above the four established SEPs in the study area generally accord with the announced priorities.

West Anglia Task Force

2.2.48 In February 2015, the Government also announced a long term economic plan for London[39]. One of the proposals was to establish a West Anglia Task Force to assess opportunities to improve connections to Stansted and Cambridge from Liverpool Street. The announcement has been welcomed by the London Stansted Cambridge Consortium (LSCC) as it is hoped that this will: (a) result in earlier delivery of infrastructure, and (b) will provide faster and more frequent mainline services to Cambridge, Hertfordshire, Essex and Stansted, and higher frequency trains into London[40].

[38] https://www.gov.uk/government/news/prime-minister-announces-long-term-economic-plan-for-the-east-of-england viewed on 22 January 2016.
[39] https://www.gov.uk/government/news/long-term-economic-plan-for-london-announced-by-chancellor-and-mayor-of-london viewed on 22 January 2016.
[40] http://lscc.co/lscc-welcomes-west-anglia-task-force/, viewed on 22nd January 2016.

2.2.49 LSCC sees infrastructure and rail improvements as important in supporting the substantial population growth expected in the area and improving access to Stansted Airport. This supporting infrastructure will enable a growing population and workforce in the A1 study area to access employment opportunities and will enable the connectivity of new homes.

Cambridge Compass

2.2.50 The GCGP LEP has also successfully won a bid for a new Enterprise Zone at Cambridge Compass, announced by DCLG in November 2015, which is designed to encourage economic growth. The Cambridge Compass will benefit from discounted business rates and will be able to retain business rate growth within the zone for the next 25 years. The sites included in the enterprise zone are Cambridge Research Park, Water beach; Haverhill Research Park to the south-east of Cambridge; Lancaster Way, Ely; Cambourne Business Park to the west of Cambridge; and Northstowe Phase 1.

Luton Enterprise Zone

2.2.51 Luton was granted an Enterprise Zone in November 2015. The Luton Airport Enterprise Zone will link three sites around the airport - Stirling Park, Century Park and Airport Business Park. It is set to create 7,200 direct jobs, supported by the planned expansion of Luton airport, the areas innovation and technology sectors and established partnerships.

Key Findings and Implications: planning context

2.2.52 None of the districts within the study area have adopted their new local plan post the 2012 NPPF and some significantly pre-date this, which poses a risk that the future change and development identified in plans may not be up-to-date. There are however, supporting studies, namely the SHMAs and other population and employment studies that provide an evidenced based forecast of future population, housing and employment change. Although this provides an overall profile of change within the districts in terms of population and employment change, without a detailed plan, there will be no specific recognition of which parts of the borough are identified for housing or employment sites or where urban extension (for example) will be designated.

2.2.53 However, what is clear in the policy review is that all the districts are planning for substantial growth, all forecasting substantial population growth. Housing delivery will need to align with the rate of the growth of the population, ensuring that the right quantity, tenure, and affordability of housing is delivered. Similarly, districts have identified a need to sustain their local economies, either by diversifying their economies; enhancing their existing economic base; or building on their strategic links to neighbouring districts, London, or other growth arcs.

2.2.54 Town centre regeneration, urban extensions and a new town have been the identified ways to accommodate the growing population and the provision of new houses. These tend to be located on the urban fringes and cross over district boundaries. For example, urban development is expected around the fringes of Cambridge as well as developing a new town at Northstowe; urban extensions to the north of Luton; and investing in Bedford town centre. In rural areas such as East Hertfordshire and parts of Central Bedfordshire, there is a drive to maintain a healthy rural economy, however most employment growth across the study area is centred on the existing high-technology, knowledge-based, education, and research industries that are already well-established in the area.

2.2.55 In addition to the SEPs, Central Government has invested in new Enterprise Zones at Cambridge Compass and Luton. Future plans build on the strategic locations of the LEP areas in the SCCC; road and rail networks to London, and to south-north and east-west growth corridors. Plans also reflect the need to maintain and enhance existing industries.

2.2.56 Across all reviewed plans, the effective delivery of households and employment to support the growing population is a key priority. This is clearly a challenge in the study area, and is reflected in the local authorities' struggles to update planning policies against the speed of change that is occurring. Investment in road networks will help to support sustained economic growth by facilitating commuting, logistic, and business access.

2.3 Transport Context

2.3.1 The A1 is one of England's oldest trunk roads and also one of the least consistent. With more than fifty years of local upgrades, the road today is a patchwork of different standards, ranging from four-lane motorway to elderly dual carriageway – often within the same ten-mile stretch.

2.3.2 The road has severe congestion-related challenges and existing capacity problems and low travel speeds on numerous sections of the road are expected to continue or worsen without extensive intervention. Commissioned schemes may alleviate some pressure but will not address fundamental problems with other sections of the route.

2.3.3 The A1 currently varies between motorway and all-purpose standard within the study scope area. In the area close to or adjoining the M25, the A1(M) serves large communities and the business areas adjacent to them and is a major artery for communities further north. However, the section between Junction 1 (M25) and Junction 3 (Hatfield) is one of the least reliable sections of the A1. Further north, existing capacity issues on the A1(M) around Stevenage and Welwyn Garden City cause average speeds to drop below 40mph in peak periods and they are expected to continue to drop without more extensive intervention.

2.3.4 The section between Junction 10 at Baldock and Junction 14 at Alconbury has a number of at-grade roundabouts, minor side roads and direct frontage accesses, often very close to the carriageway. This severely restricts free flow and several sections have lower speed limits.

2.3.5 The section from Alconbury to Peterborough was opened in 1998 and operates well. This stretch is designed to a higher standard, with eight miles of either dual four lane or dual three lane for the remainder of the section.

Traffic flows

2.3.6 The A1 serves both strategic and local traffic. It carries relatively substantial volumes, although this varies along its length by both time period and direction. Traffic volumes are also partly determined by the capacity of the section of the route, as well as local trip generators and attractors.

2.3.7 Table 2.7 and Table **2.8** show the annual average weekday traffic (AAWT) levels along its route in both the southbound (SB) and northbound (NB) directions, compared to the estimated congestion reference flow (CRF) which is broadly the flow at which a carriageway is likely to be congested in the peak periods on an average day. The highest flows are at the southern (Hertfordshire/ M25) and northern (Peterborough) ends. Flows are most likely to exceed the CRF at the southern end. Flows in the middle section, although substantially lower than the rest of the route, are also close to or greater than the CRF, reflecting the lower capacity and standard of road in this section. More detailed analysis is set out in Chapter 3.

Figure 2.5: Average Weekday Traffic and Congestion Reference Flow March 2015 southbound (based on Highways England's TRADS database)[41]

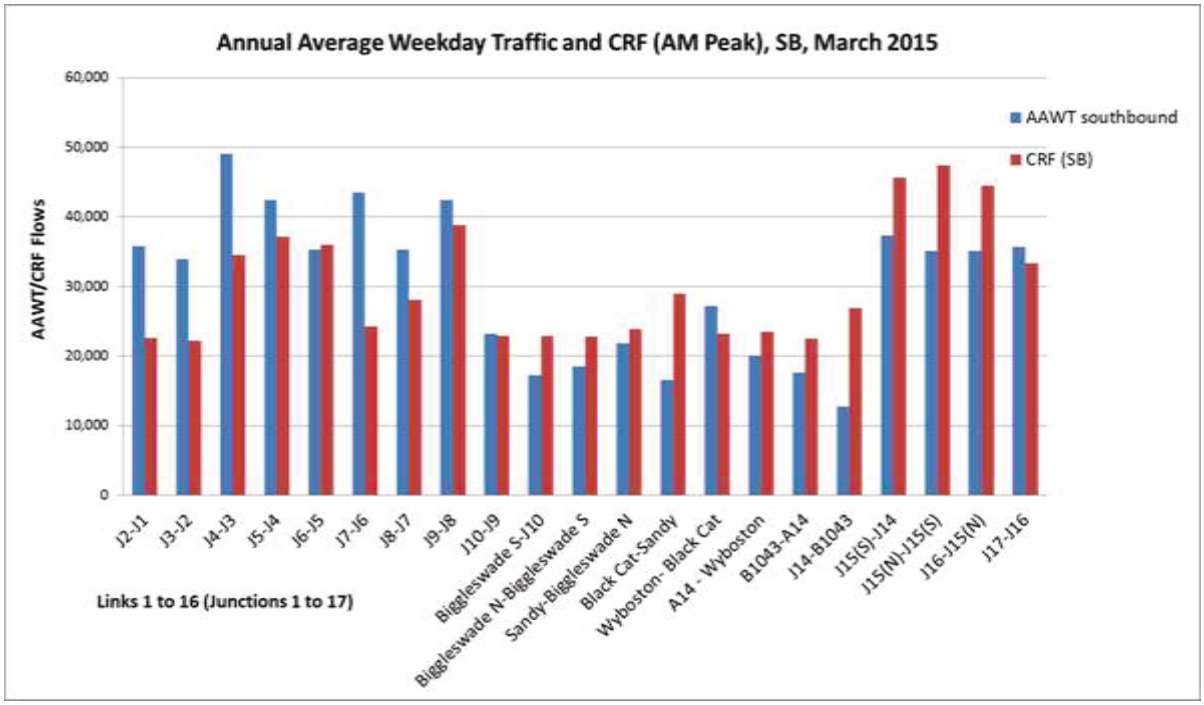
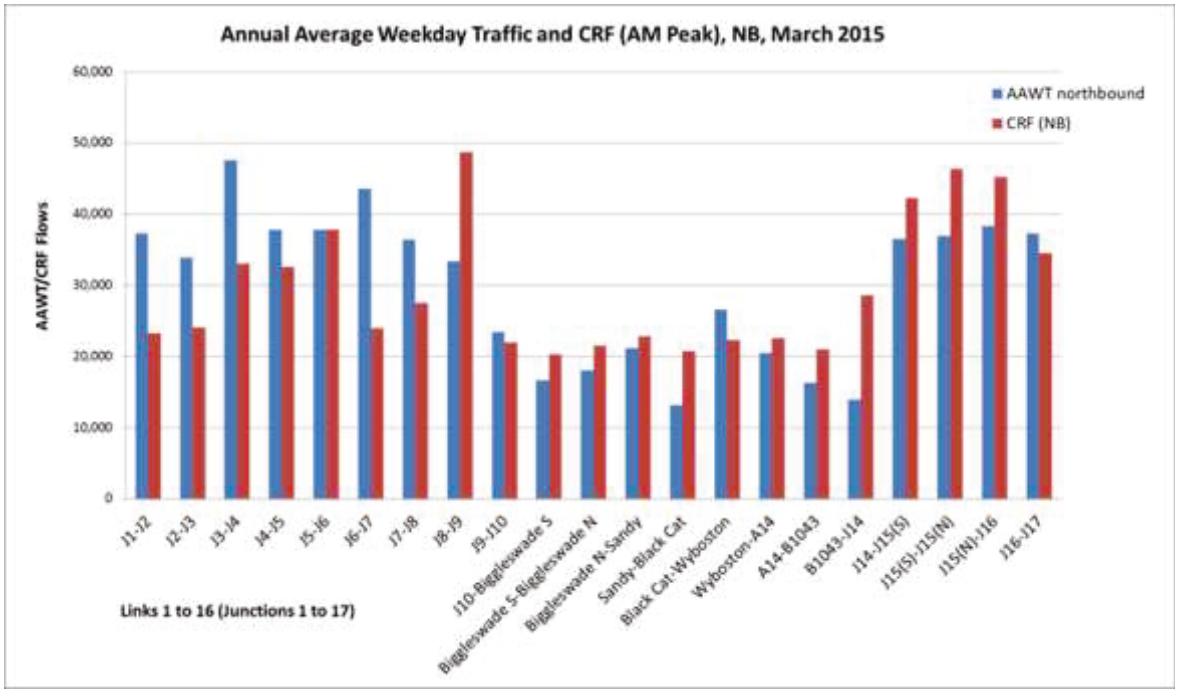


Figure 2.6: Average Weekday Traffic and Congestion Reference Flow March 2015 northbound (based on Highways England's TRADS database)

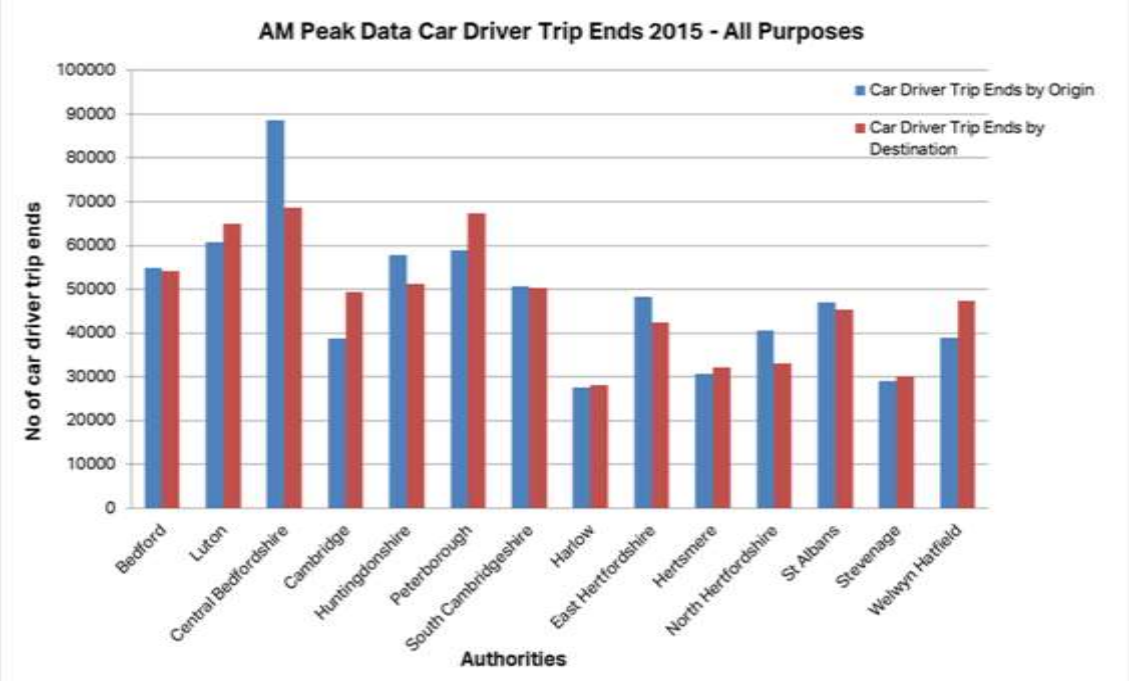


[41] See section 3.3 for information on data sources.

Origins and destinations of traffic

2.3.8 Future stages of work will look to make use of strategic modelling tools to provide a better understanding of trip origins and destinations in the corridor and likely use of the A1. Within the study area, National Trip End Model (NTEM) data are available estimating trip origins and destinations by user class and purpose. Taking car driver trips in the morning peak as an example, Figure 2.7 shows the relative importance of urban areas such as Peterborough and Luton. However, it should be noted that Stevenage and Welwyn Hatfield are almost contiguous urban areas and directly connected to the A1.

Figure 2.7: AM Peak Data Car Driver Trips All Purposes 2015 (NTEM)



Bus and coach routes using the A1

2.3.9 A review of National Express coach services indicates that some routes use the A1/A1(M). National Express coach stops within close proximity of the A1/A1(M) study area include: Hatfield, Welwyn Garden City, Knebworth (during events such as music festivals), Stevenage, Hitchin, Letchworth Garden City, Baldock, St Neots, Huntingdon and Peterborough. Green Line also offers coach services within the A1/A1(M) study area, with a service operating between Hatfield and London.

2.3.10 Local bus services operate in the vicinity of the A1/A1(M) study area. It is unlikely that local services use motorway sections of the route, as local bus services usually have frequent stopping points which use of the A1(M) would not facilitate. Local bus services use sections of the route which are not motorway standard.

Freight

2.3.11 The A1 forms part of the European TEN-T network and is designated as a comprehensive status route in addition to its designation as forming part of the SRN. The route provides connectivity on the London – Leeds corridor to a number of key international freight gateways including Stansted, Luton, Heathrow and Gatwick for air; and Felixstowe and London Gateway for deep sea and the Haven Ports/Dover for the short sea routes to continental Europe.

2.3.12 In developing interventions for road freight, it is critical to consider HGV intensity along the route as this is instructive in understanding and bringing forward appropriate interventions for freight users as part of this study. As part of subsequent stages of the study a more detailed breakdown of HGV movements may reveal whether there are particular time related issues as part of the assessment of proposed transport interventions.

2.3.13 The A1 between Junctions 14 and 17 has both the highest volume of HGVs and the highest proportion of HGV movements (19%), reflecting the additional freight from the A14 which carries substantial volumes from the Ports of Felixstowe and Dover. The A1 between Junction 9 (Letchworth Garden City) and the A14 has a lower proportion of HGVs (13%) and the lowest total number of HGVs. The southern section between the M25 and Junction 9 experiences a higher number of HGVs relative to the A1 between Junction 9 and the A14 (with the existence of a number of warehouse facilities, logistics hubs and depots serving Greater London and the South East), although HGVs make up a smaller proportion (9%) of total vehicle movements.

2.3.14 In considering the role of freight in the economic context of the study area it is important to note that the A1 is close to the M1 and M11, particularly at the southern end, where these routes radiate out from London. As such, these provide viable alternatives in times of network disruption and poor traffic conditions for longer distance traffic. The East Coast Main Line (which runs parallel to the A1) is capacity constrained, particularly close to London, and therefore currently has limited capacity to provide an alternative to facilitate freight modal shift.

The Local Road Network

The Major Road Network

2.3.15 The A1 and A1(M) form part of the major road network (motorways, trunk roads and principal roads). DfT traffic count data (2015)[42] shows that Hertfordshire, Cambridgeshire, Central Bedfordshire and Bedford have all seen increases in the volume of traffic using the major road network within each area. Between 2009 and 2015 the overall number of vehicle miles using the major road network has increased by 1.0% in Bedford, 7.2% in Cambridgeshire, 10.0% in Central Bedfordshire

[42] http://www.dft.gov.uk/traffic-counts/, viewed on 14th June 2016.

and 10.9% in Hertfordshire. This highlights increasing traffic pressure on the major road network within the study area.

Network of A-Roads

2.3.16 The A1 and A1(M) link to a wider network of A-roads. The total length of the A-road network for each transport authority area is:

- Hertfordshire: 312 miles.
- Cambridgeshire: 349 miles.
- Central Bedfordshire: 113 miles.
- Bedford: 67 miles.

2.3.17 The average speed achieved on locally managed A-roads in England, based on 2015 DfT traffic count data[43], was 24.2 mph between October 2013 and September 2015 during the morning peak period, defined as 07:00 to 10:00. Average speeds achieved on locally managed A-roads within the study area, comparable to the above, were above the average for England, namely:

- Hertfordshire: 27.1 mph.
- Cambridgeshire: 29.9 mph.
- Central Bedfordshire: 32.4 mph.
- Bedford: 26.1 mph.

2.3.18 The average journey time for the locally managed A-road network in England , based on 2015 DfT traffic count data[44], was 2.5 minutes per mile (mpm), between October 2013 and September 2015 during the morning peak period, defined as 07:00 to 10:00. Average journey time achieved on locally managed A-roads within in the study area, comparable to the above, were below the average for England, namely:

- Hertfordshire: 2.2 mpm.
- Cambridgeshire: 2.0 mpm.
- Central Bedfordshire: 1.9 mpm.
- Bedford: 2.3 mpm.

2.3.19 The locally managed A-road network in Hertfordshire, Cambridgeshire, Central Bedfordshire and Bedford appears to perform better than average when compared with data for the locally managed A-road network in England. This is based on below average journey times per mile and above average speeds achieved.

[43] *ibid.*
[44] *ibid.*

Rail Corridors and Planned Rail Investments

East Coast Main Line

2.3.20 The ECML runs between London Kings Cross and Edinburgh Waverley. The rail route runs parallel to and within close proximity of the A1/A1(M) through the study area, therefore, the route is relevant to consider as a competing travel corridor.

2.3.21 Great Northern and Virgin Trains East Coast currently operate rail services on the ECML within the study area. Great Northern operate local services with station stops within close proximity to the A1 and within the study area including: Potters Bar, Brookmans Park, Welham Green, Hatfield, Welwyn Garden City, Welwyn North, Knebworth, Arlesey, Biggleswade, Sandy, St Neots and Huntingdon. Virgin Trains East Coast operates long-distance services; some services stop at Stevenage and others at Peterborough. This highlights Stevenage and Peterborough stations as key rail interchanges within the study area.

2.3.22 Planned improvements, starting in the 2014-2019 period, are specified in the Hendy Report on re-planning Network Rail's Investment Programme[45] (Network Rail 2015). The improvements will result in the following benefits for the ECML:

- New Super Express Trains replacing the current long distance fleets.
- New trains providing more seats for growing passenger numbers.
- The opportunity for faster journeys by allowing slow trains to get out of the way of faster services more easily.

2.3.23 Schemes to deliver planned improvements starting in the 2014-2019 period include:

- The Intercity Express Programme – East Coast Capability.
- The Intercity Express Programme – East Coast Power Supply Upgrade.
- The Gordon Hill Turnback.

2.3.24 The Thameslink programme, due to be completed in 2018, will provide additional connections to Peterborough and Cambridge. The programme will see new rolling stock and additional capacity provided alongside greater cross-London connectivity with new destinations south of the Thames directly accessible from the ECML.

East West Rail

2.3.25 East West Rail aims to establish a strategic railway connecting East Anglia with Central, Southern and Western England. The project consists of three sections, an eastern, western and central section, and

[45] Network Rail, 'Hendy Review' November 2015, viewed on 4 April 2016, https://www.networkrail.co.uk/Hendy-review/.

is being promoted by the East West Rail Consortium, a group of local authorities and businesses. Cambridgeshire County Council, Central Bedfordshire Council and Hertfordshire County Council are all members of the Consortium.

2.3.26 The Western Section is a committed and funded scheme which will link Bedford, Oxford, Milton Keynes and Aylesbury. The scheme will see the re-introduction of passenger and freight services through upgrading and reconstructing sections of rail track, delivered by Network Rail. The Hendy Report on re-planning Network Rail's Investment Programme (Network Rail 2015) confirms that this scheme will go ahead.

2.3.27 The Central Section, which would connect Bedford and Cambridge, is not currently committed or funded. The Consortium is currently working with Network Rail in considering two route options - Bedford to Cambridge via Hitchin, and Bedford to Cambridge via Sandy. This Central section of the route is considered the most difficult and costly to reinstate as the former railway was dismantled and land ownership was not retained.

2.3.28 The Eastern Section, which would connect Cambridge to Norwich and Ipswich, is currently under review by Network Rail. A study is underway to explore the options for the Eastern section of the line and consider the possibility of a new station south of Cambridge at the new Addenbrookes campus.

Walk and Cycle

2.3.29 Walking and cycling is not permitted on sections of the A1 which are designated as motorway. The motorway causes severance, however, this is mitigated in some areas through the provision of bridges and tunnels which provide access either over or under the motorway.

2.3.30 Walking and cycling provision and the quality of the environment along the A1 varies, with provision considered poor for much of this section. Key issues relating to the non-motorway section are:

- No footway or cycleway provision – this is the case along much of the non-motorway section, particularly outside of towns and villages.
- No pedestrian crossing facilities – this was observed along much of this section and is a particular issue where there is a need for a crossing to connect areas of residential and commercial land uses segregated by the A1.
- Substandard footway provision – in areas where a footway is available, it was frequently observed as being substandard. Issues included: poor maintenance; limited footway width, making it unsuitable for a pushchair or wheelchair; and close proximity to fast moving traffic, making use of the footway unpleasant and potentially a safety hazard.

- Substandard crossing provision – in areas where crossings were provided or designated some were observed as unsuitable for various reasons. Some informal crossings are provided; these comprise a gap in the central reservation and signs warning road users of pedestrians crossing. Crossing using these informal crossings is unsafe due to fast-moving traffic. Formal crossings such as pedestrian bridges are provided in some areas, although use of these requires substantial deviation from desire lines and some effort is required to reach the height of the crossing. These are particularly unsuitable for some elderly and disabled people.

2.3.31 National Cycle Route 12 runs between Enfield Lock in north London to Spalding via Stevenage, St Neots and Peterborough. The route comprises both traffic-free and on-road stretches. Some sections of this route, for example around Sandy, are broken and under development.

2.3.32 Levels of cycling to work within the wider study area, based on 2011 Census data[46], are as follows:

- In Bedford, 2,912 people cycle to work out of 71,581 people making journeys to work, this equates to 4.1% of journeys to work made by bicycle.
- In Central Bedfordshire 2,125 people cycle to work out of 124,123 people making journeys to work, this equates to 1.7% of journeys to work made by bicycle.
- In Cambridgeshire 30,513 out of 295,160 people making journeys cycle to work, equating to 10.3% of journeys to work made by bicycle.
- In Hertfordshire 9,399 out of 530,265 people cycle to work, equating to 1.8% of journeys to work made by bicycle.

2.3.33 Levels of walking to work within the wider study area, based on 2011 Census data[47], are as follows:

- In Bedford, 8,018 people walk to work out of 71,581 people making journeys to work, this equates to 11.2% of journeys to work made on foot.
- In Central Bedfordshire of 124,123 people making journeys to work, 10,762 people walk, equating to 8.7% of journeys to work made on foot.
- In Cambridgeshire 30,310 out of 295,160 people making journeys walk to work, equating to 10.3% of journeys to work made on foot.
- In Hertfordshire 9,399 out of 530,265 people walk to work, equating to 9.9% of journeys to work made on foot.

[46] ONS, Travel to work 2011.
[47] *ibid*.

2.3.34 The 2011 census data show that levels of walking and cycling to work in Cambridgeshire are substantially higher than in Central Bedfordshire and Hertfordshire. There is the potential to increase the mode share of people walking and cycling in all areas, particularly for short journeys. Improvements to the walking and cycling networks alongside behavioural change initiatives could help to achieve this.

Regional Transport Policy Context

2.3.35 Transport policy documents from Hertfordshire County Council, Bedford authorities and Cambridgeshire County Council have been reviewed. These are presented below and any recommendations from this study will consider the regional transport policies.

Hertfordshire County Council transport policy

2.3.36 Hertfordshire County Council transport policy includes:

- Local Transport Plan 2011-2031 – Volume 1 Strategy Document (Hertfordshire County Council 2011).
- Local Transport Plan 3 – Volume 2 Transport Policy Document (Hertfordshire County Council 2011).

2.3.37 Hertfordshire County Council policy recognises the A1(M) as a key transport corridor. It considers that the road and rail network in Hertfordshire has a north-south focus with limited east-west routes. The preferred approach to achieving their stated goals and challenges includes the use of intelligent transport systems; small scale road network improvements; promoting alternatives to the car; and corridor strategies for routes such as the A1(M).

Bedford Authorities transport policy

2.3.38 The Bedford authorities transport policies include:

- Local Transport Plan 3 – The Central Bedfordshire Council Transport Strategy April 2011 to March 2026 (Central Bedfordshire Council 2011).

2.3.39 Central Bedfordshire Council policy recognises the A1 as a significant route in terms of annual average daily traffic. It also recognises the A1 as a key route for freight traffic.

2.3.40 The *Freight Issues and Routing in Sandy Study Report* (Central Bedfordshire Council 2012) examines HGV routes and volumes through the town, and the suitability of existing junctions to support HGV traffic manoeuvers. Recommendations, such as amending signage on the A1 approaches to Sandy, aim to address local issues.

Cambridgeshire County Council transport policy

2.3.41 Key Cambridgeshire County Council transport policy includes:

- Cambridgeshire Local Transport Plan 2011-2031 – Policy and Strategy (Cambridgeshire County Council 2015)

- Cambridgeshire Local Transport Plan 2011-2031 – Long Term Transport Strategy (Cambridgeshire County Council November 2014)

2.3.42 Cambridgeshire County Council transport policy recognises various issues relating to the A1/A1(M) and roads which intersect the A1/A1(M), in particular, on local roads between Cambridge and Huntingdon. Issues include high levels of traffic and vehicle emissions along the route. Various road and junction improvement schemes are referenced; in determining study recommendations, these schemes will be considered.

2.3.43 The policy documents reference regulations regarding noise, in particular, the EU directive 2002/49/EC, Environmental Noise (England) Regulations 2006. Cambridgeshire County Council is considered a 'noisemaking authority' due to roads above a journey threshold (six million journeys per year), such as the A1/A1(M). Cambridgeshire County Council is responsible for informing the Department for Environment, Food and Rural Affairs' (Defra) of 'Noise Action Plans' to reduce noise.

2.4 Environmental Context

2.4.1 A review has been carried out to appraise the existing environmental conditions between Junction 1 and Junction 17 of the A1 (the study route), and to identify current environmental issues and considerations which should be taken into account during the design of any new scheme.

2.4.2 Between Junction 1 and Junction 17, the A1 runs through a number of sensitive receptors such as settlements located within 200m of the current alignment; scattered residential properties; and areas designated for conservation or amenity value. As such, understanding the environmental context of the A1 is critical to ensure suitable opportunities are explored which enhance the surrounding environment whilst delivering an improved infrastructure network.

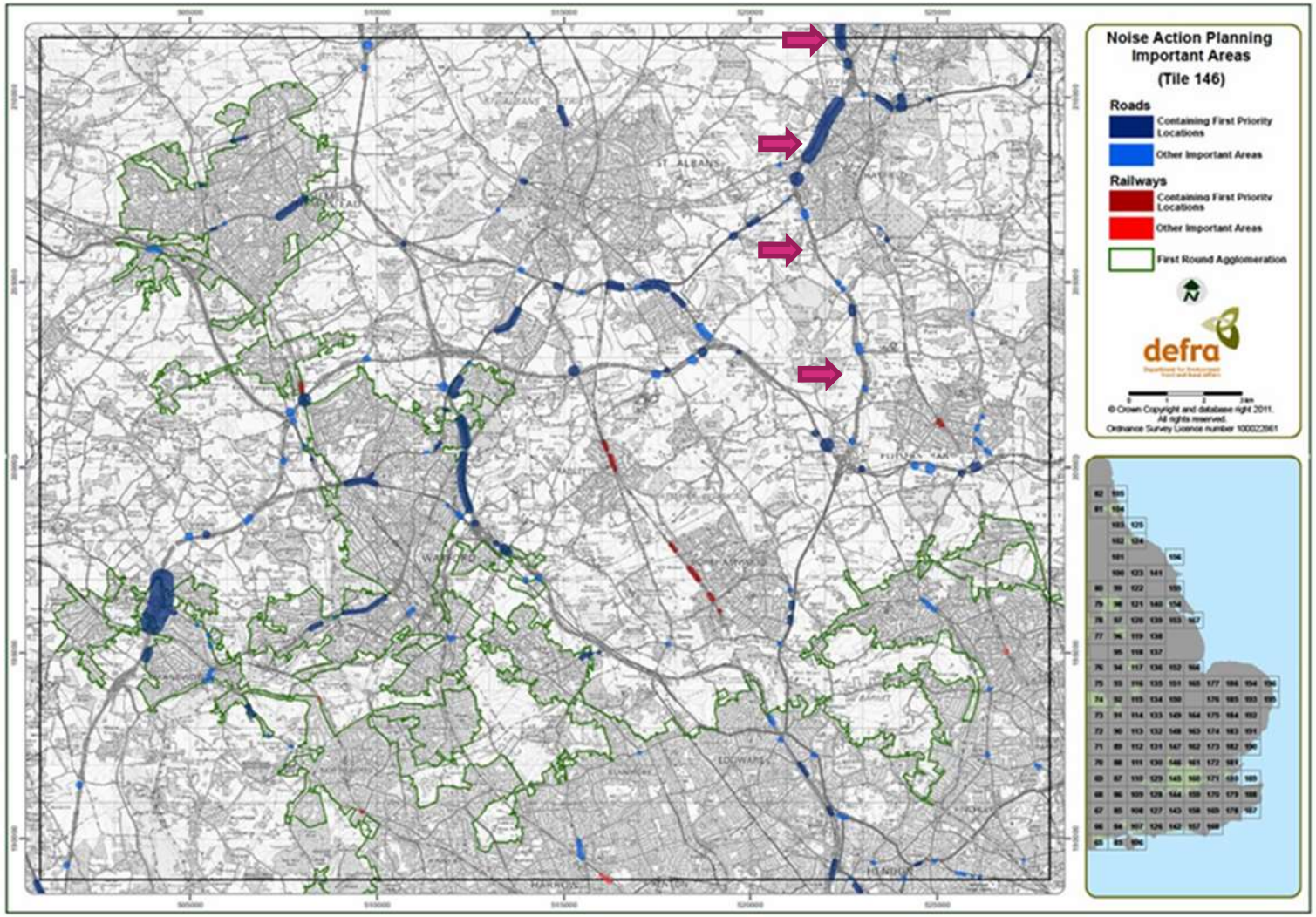
Noise

2.4.3 The noise review has focussed on Defra's 2006 Noise Action Plans for the A1 in order to identify sensitive areas and the status of noise mitigation along the A1.

2.4.4 There are currently 72 identified 'Important Areas'[48] between Junction 1 and Junction 17 of the A1/A1(M); 51 were identified as 'First Priority Locations' (FPLs) and 21 identified as 'Other Important Areas' (OIAs). An example of mapped FPLs and OIAs is illustrated in Figure 2.8 below. For the purposes of this report, the IAs with the greatest environmental impacts have been selected and discussed as these are where the greatest opportunities lie.

[48] 'Important Areas' are where the 1% of the population that are affected by the highest noise levels from major roads are located according to the results of Defra's strategic noise maps.

Figure 2.8: Example tile: Noise First Priority Locations and Other Important Areas *(arrow annotations indicate the A1/A1(M) alignment)*



2.4.5 The most significant residential areas lie within the following locations, and these are therefore where the effects of excessive noise would be most substantially felt:

- FPL 8 and 9 – Hatfield. Dense residential areas in close proximity to both sides of A1 corridor.
- FPL 10 – Welwyn Garden City. Mainly residential areas in close proximity to both sides of the A1 corridor, along with Welwyn Garden City Golf Course to either side.
- FPL 17 – large housing estates within Oaklands, north of Welwyn Garden City. Residential, retail and commercial areas close to the A1 corridor on both sides in this area.
- FPL 25 – Baldock. Mainly residential areas along both sides, with a large industrial estate to west of the A1 corridor.
- FPL 37 – Girtford. Large residential area immediately to the east, with commercial and industrial areas immediately to the west of the A1 corridor. Note: the extremely close proximity of many residential properties facing directly onto the existing A1 road would not permit noise barriers as a form of mitigation to address and reduce noise exposure for these properties. Standard low noise road surfacing is also not considered sufficient to provide the level of noise reduction for the most exposed properties in these areas.
- FPL 44 – Wyboston and Chawston. Scattered residential properties in very close proximity to the A1 roadside i.e. 5m. Note: extreme close proximity of many residential properties facing directly onto the existing A1 road would not permit noise barriers as a form of mitigation to address and reduce noise exposure for these properties. Standard low noise road surfacing is also not considered sufficient to provide the level of noise reduction for the most exposed properties in these areas.

Air Quality

2.4.6 The review of air quality for the A1 has taken into consideration local authorities' review and assessment of air quality and the Pollution Climate Mapping (PCM) model managed by Defra. This has allowed the identification of areas along or close to the A1 where air quality is a sensitive issue in relation to compliance with the EU Air Quality Directive.

2.4.7 As required under the Environment Act 1995, local authorities review and assess air quality with respect to the objectives for seven pollutants specified in the Government's National Air Quality Strategy (NAQS). Local authorities are required to carry out an Updating and Screening Assessment (USA) of their area every three years. If the USA identifies potential areas likely to exceed air quality objectives, then a detailed assessment of those areas is required. Where objectives are not expected to be met, local authorities must declare the area as an Air Quality Management Area (AQMA).

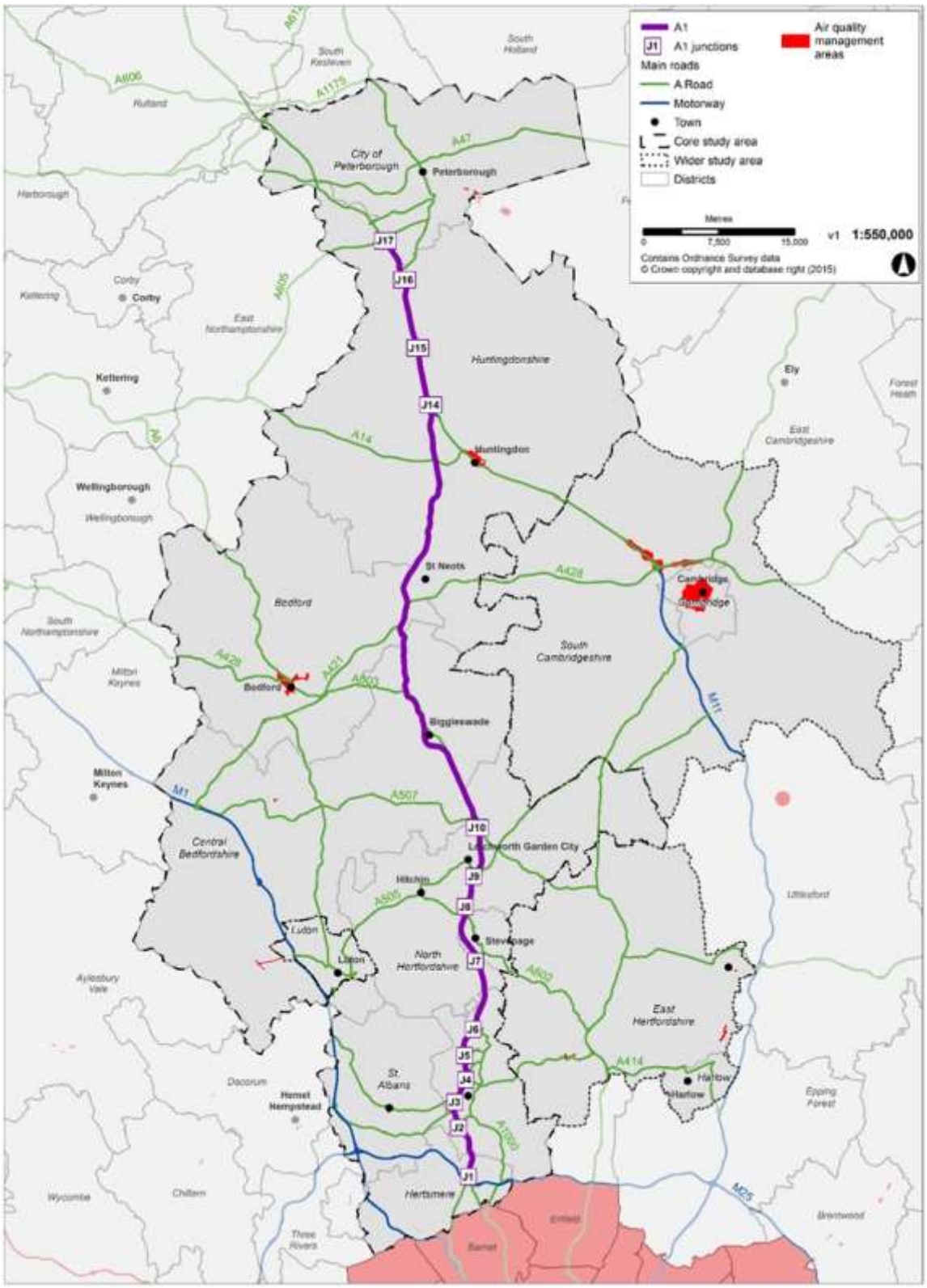
2.4.8 AQMAs within the core study area have been reviewed and one AQMA has been identified on the route of the A1, to the northern portion of Central Bedfordshire (see Figure 2.9 below). This designation is for the likely exceedance of the annual mean NO_2 objective[49] ($40\mu g/m^3$).

2.4.9 Air Quality Monitoring is undertaken throughout the administrative area of all local authorities within the core study area, using both continuous and passive monitoring methods. There are 36 monitoring locations within 200m of the A1 in the study area. The latest air quality progress reports have been requested from all relevant local authorities. The most recent monitoring results that were available at the time of assessment have been reviewed for the specified monitoring locations.

2.4.10 Two monitored exceedances have been identified. One of these is a small zone situated at a kerbside location on the urban fridge of Sandy, approximately 11m from the alignment of the A1. This exceedance is covered by the AQMA designated by the Bedford authorities mentioned above. The other exceedance is recorded at a roadside location near the village of Chawston (between the A428 and A421) in the jurisdiction of Bedford Borough Council approximately 10m from the alignment of the A1.

[49] Annual mean objective for Nitrogen Dioxide (NO^2) is $40\mu g/m^3$. Source: Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air.

Figure 2.9: Air Quality Management Areas



2.4.11 Highways England Interim Advice Note 175/13 states that in addition to an environmental impact assessment, a compliance risk assessment should be carried out to assess the impacts of road schemes on compliance with the EU Air Quality Directive. This does not need to

be carried out at a strategic level but will be required for future environmental assessment of preferred design options. The road links that should be included in a compliance risk assessment are referred to as the Compliance Risk Road Network (CRRN) and are identified on the PCM model managed by Defra.

2.4.12 The Defra PCM has been reviewed for the area within a 200m radius of the study route. There are three CRRN along the study route; two located in Welwyn Garden City (between Junctions 4 and 6) and one in Sandy. In addition, there is a number of CRRN within 200m of the study route, concentrated around Hatfield (Junctions 2 and 3); Welwyn Garden City (Junction 4); Welwyn (Junction 6) and Biggleswade. The details of the identified CRRN are shown in Table 2.9 below.

Table 2.9: Compliance Risk Road Network within 200m of the study route[50]

Associated A1 Junction	On or adjacent to study route	Road name	Roadside annual mean NO2 in 2014 (µg/m3)
J2	Within 200m of study route	A1001 South Way	24.64
	Within 200m of study route	A1001 Roehyde Way	31.29
J3	**Within 200m of study route**	**A1001 Comet Way**	**41.52**
	Within 200m of study route	A1057 St Albans Road West	37.24
J4	Within 200m of study route	A1001 Comet Way	36.45
	Within 200m of study route	A414 Great North Road	38.94
	Within 200m of study route	A6129	36.65
	On study route	**A1(M)**	**40.56**
J6	On study route	A1(M)	29.40
	Within 200m of study route	A1000 Hertford Road	32.82
	Within 200m of study route	A1000 Welwyn Bypass Road	36.04
J10 to Biggleswade	Within 200m of study route	A6001 Langford Road	20.15
Sandy	On study route	A1 (T)	35.65

2.4.13 Table 2.9 above shows that exceedances of the annual mean NO_2 objective have been recorded at two identified links near Hatfield (Junction 3) and Welwyn Garden City (Junction 4) and, as a result, air quality is a particularly sensitive issue in these areas.

[50] Bold text indicates exceedances of the annual mean NO^2 objective.

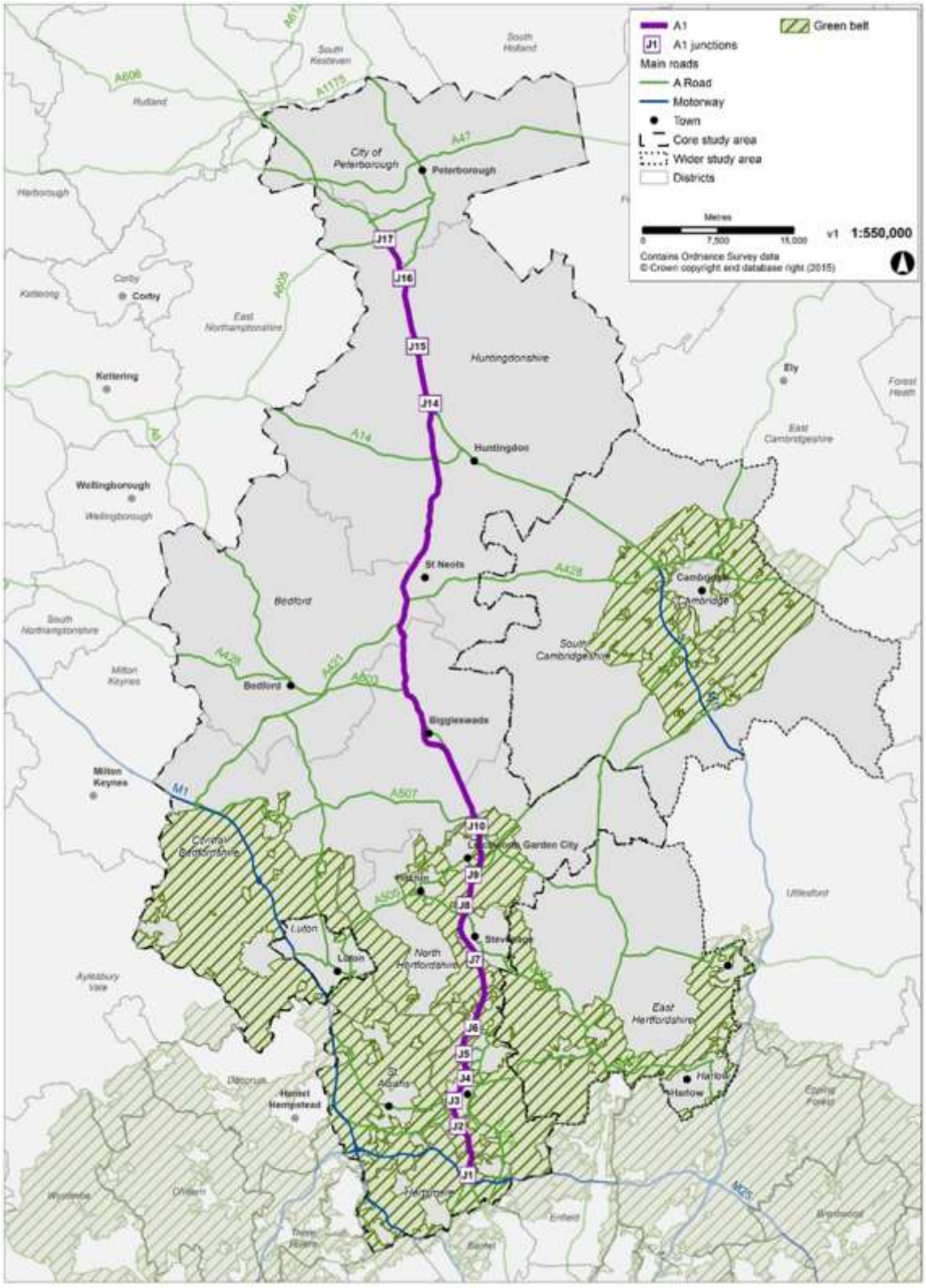
2.4.14 This review has indicated that there are localised occurrences of poor or reduced air quality, including non-compliance with the EU Air Quality Directive, primarily at the northern and southern ends of the study route. These hotspots of poor air quality already exceed air quality objectives and, from the review of traffic data, it can be seen that these areas are associated with stretches of high traffic flows, congestion issues and a lack of capacity in the road network.

Built and Natural Environment

2.4.15 The landscape and townscape review has identified landscape designations in the vicinity of the A1. In addition, landscape character has been identified for the study area. Both of these will have significance for the development of route options as the A1 currently has the potential to affect the various landscape typologies present around the A1 due to disturbance of the landscape setting through noise, light and vibrations from vehicle usage and maintenance of the road corridor. The physical presence of the road and associated infrastructure such as lighting columns, gantries and signage also have the potential to affect the landscape.

2.4.16 The A1 between Junction 1 and Junction 17 intersects a number of green belt areas which surround key conurbations such as Letchworth Garden City, Stevenage, Welwyn Garden City, Biggleswade, St Neots, Huntingdon and Hatfield (see Figure 2.10 below). These landscapes are designated to predominantly keep this land permanently open or largely undeveloped.

Figure 2.10: Green belt designations



Historic Environment

2.4.17 The historic environment review has focussed on identifying heritage assets within 1km of the A1. How the road affects and has previously

affected these assets has been considered. Work is ongoing to identify undesignated heritage assets in the study area to further inform the study.

2.4.18 There are 15 Grade I and 43 Grade II* listed buildings within a 1km buffer of this section of the A1. The A1 is adjacent to three registered 'Parks and Gardens' of historic interest, which all fall within the area south of Stevenage and north of Hatfield, at the southern end of the route.

2.4.19 The route is also within 1km of 30 scheduled monuments. These scheduled monuments range from spatially smaller items such as barrows and earth works, through to bridges and roman villas, and unique sites such as 'South Mimms motte and bailey castle' and a Napoleonic Prisoners of War Camp site. Notably, Tempsford Bridge, which forms part of the Northbound A1 carriageway, is both a Grade II listed structure and a scheduled ancient monument.

2.4.20 In addition, there are 26 conservation areas that lie within 1km of the A1. Conservation areas are not a national level designation.

2.4.21 The main areas of impact from the A1 occurred during its construction. This relates to the disturbance of archaeological materials through ground work and the construction of the current infrastructure which compromises the setting (and therefore the integrity) of certain built heritage assets, including numerous listed buildings and scheduled monuments. Due to its length, size and importance, the original construction of the A1 undoubtedly affected heritage including the numerous assets it passes through over, or in close proximity to.

2.4.22 The operation of the road also affects the historic environment. These mostly relate to the effect of noise on the integrity of listed buildings and any visitation experience. However, the impacts on heritage assets during ongoing operation of the A1 is minor in comparison to the effects from its original construction.

Biodiversity

2.4.23 The biodiversity review has focussed on identifying designated ecological sites in the vicinity of the A1. The significance of these sites has been discussed in order to inform the development of options.

2.4.24 The A1 currently has the potential to affect habitats and species as a result of:

- Mortality of individuals of a number of species from vehicle strike.
- Prevention of movement of species between habitats severed by the road corridor (barrier effects).
- Disturbance of species as a result of noise, light and vibration from vehicle usage, signage and maintenance of the road corridor (including land directly adjacent to it).

- Contamination of aquatic and terrestrial systems through road run-off and particulates from vehicle emissions (habitat degradation).

2.4.25 Four internationally designated sites were identified in the desk study (see overleaf). These include one Special Area of Conservation (SAC) within 1km of the A1 and a further two SACs and one Ramsar site within 5km of the road. These sites are listed with the justification for their designation; and their orientation and approximate distance from the A1 in Table 2.10 below and presented spatially in Figure 2.11 and Figure 2.12.

Table 2.10: Internationally designated sites within 5km of the A1

Site Name and Designation	Justification for Designation	Orientation and approximate distance from the A1
Woodwalton Fen (Ramsar)	This site comprises a range of wetlands that include several types of open fen and swamp communities and supports an appreciable assemblage of wetland plants and invertebrates, including the nationally rare fen violet *Viola persicifolia* and fen wood rush *Luzula pallescens* in addition to 20 nationally rare invertebrate species.	4.7km east
Fenland (SAC)	This site also comprises Woodwalton Fen Ramsar site. Annex I Habitats that are a primary reason for selection of the site comprise: • Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) • Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* • Annex II species that are primary reason for site selection: • Spined loach *Cobitis taenia* • Great crested newt *Triturus cristatus*	4.7km east
Portholme (SAC & SSSI)	Annex I Habitats that are a primary reason for selection of the site comprise: • Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) • There are no Annex II species classified as the primary reason or a qualify feature for the site selection, however, habitats support a small population of fritillary *Fritillaria meleagris*.	3.2km east
Orton Pit (SAC & SSSI)	Annex I habitats that are a primary reason for selection of the site comprise: • Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. • Annex II species that are primary reason for site selection comprise: • Great crested newt *Triturus cristatus*.	0.8km east

Figure 2.11: Special Areas of Conservation

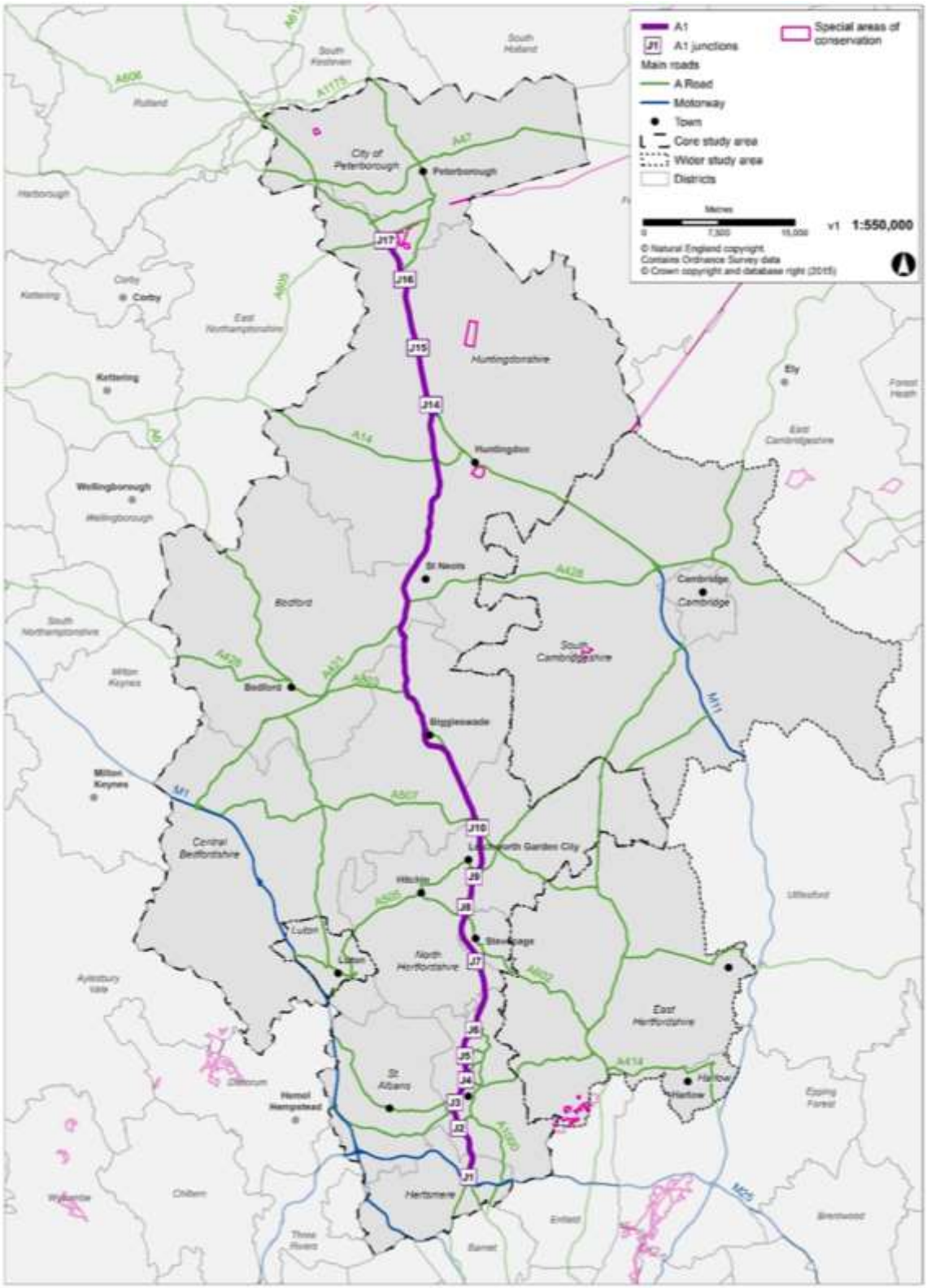
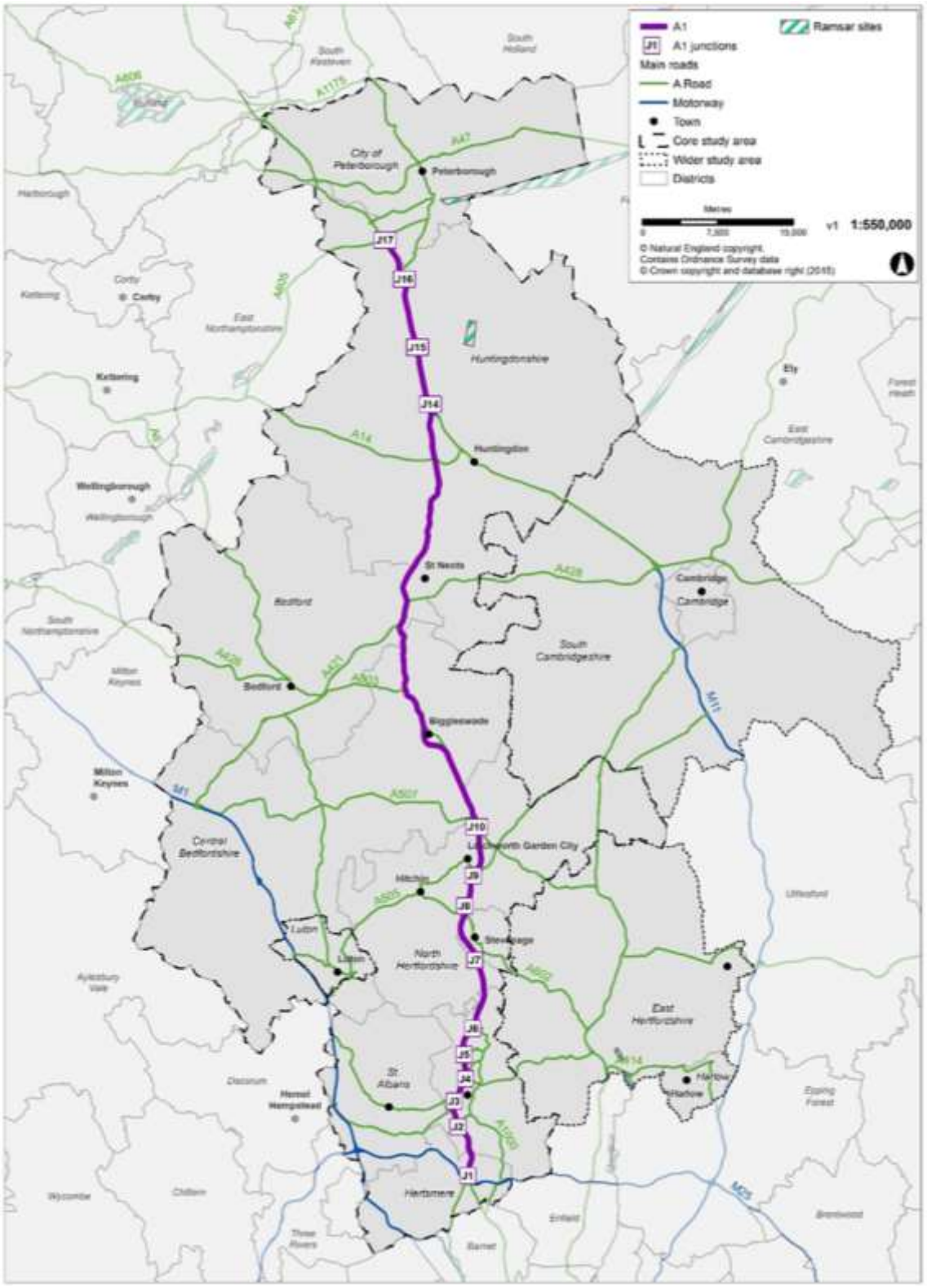


Figure 2.12: Ramsar Sites



Water Environment

2.4.26 The current alignment of the A1 has the potential to adversely affect:

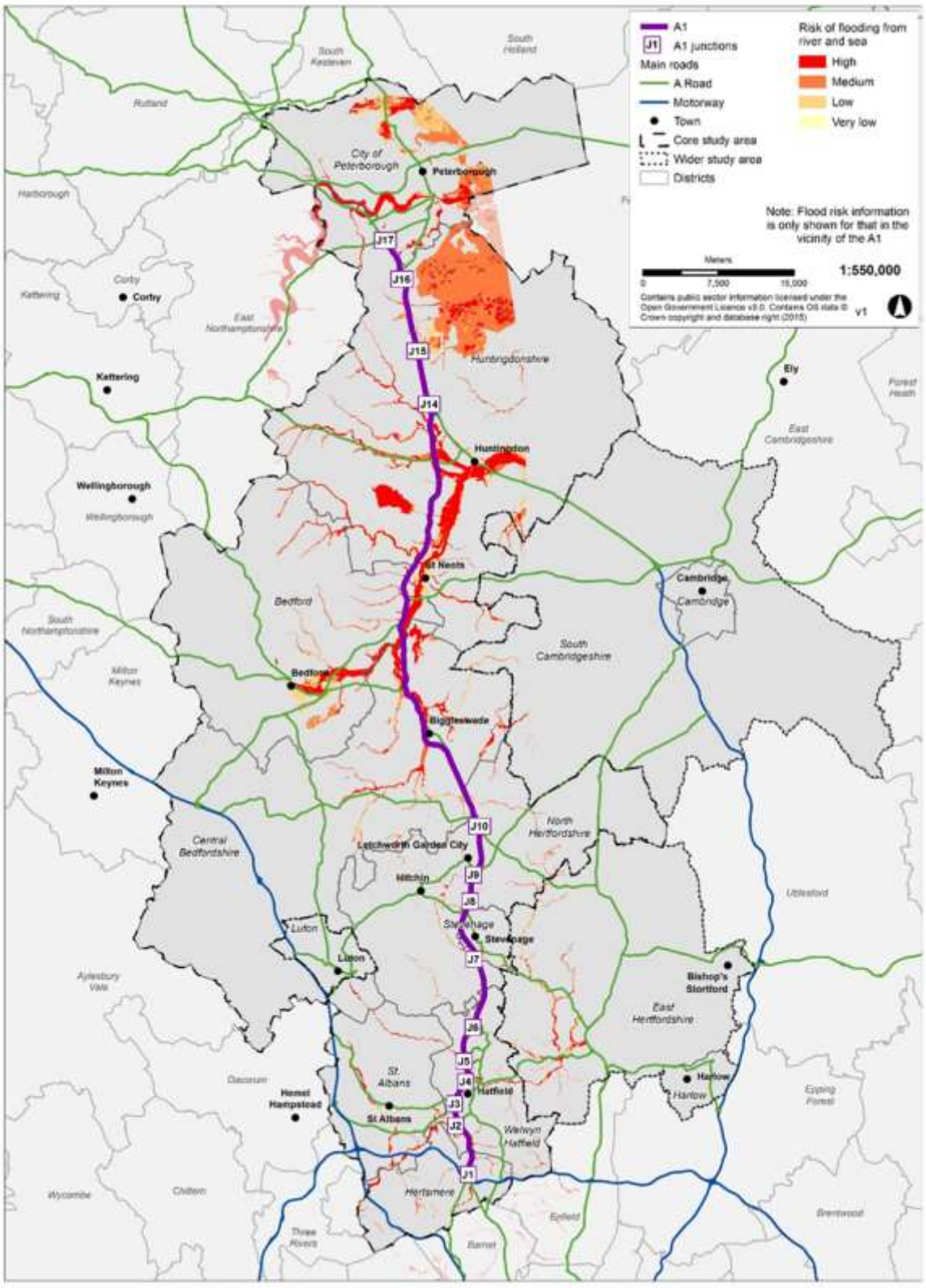
- Flood risk and land drainage.

- Water Framework Directive (WFD) status (chemical, biological, hydro-morphological and quantitative).
- Surface water and groundwater dependent wetland habitats.
- Abstractions from surface and ground waters.
- Aquifer sensitivity.
- Groundwater users in close proximity.

2.4.27 The water environment review has sought to gather information on all of the above issues in order to inform the development of options.

2.4.28 The existing alignment crosses several surface water features, the majority of which are located in the Upper and Bedford Ouse catchment in the Anglian River Basin District (RBD). The remainder are located in either the Old Bedford including the Middle Level in the Anglian RBD, or the Lee or Colne catchments in the Thames RBD. These are shown in Figure 2.13.

Figure 2.13: Risk of flooding from river and sea (2km buffer from the A1 study area)



3 Summary of the Case for Change

3.1 Introduction

3.1.1 This chapter investigates the current operation, safety and performance of the corridor. Beyond the previous baseline data and analysis, this chapter develops the case for change through investigating how well the current configuration is functioning and identifying problematic locations along the corridor.

3.1.2 This chapter summarises the analysis of: current traffic conditions at link and junction level, safety along the corridor and environmental issues, thereby setting out the case for change. It also considers forecast traffic growth, forecast demographic and economic growth, and sets out: why these problems are strategic; what is likely to happen if not addressed; and how addressing these problems contributes to Highways England's strategic outcomes. For completeness, analysis is accompanied by a methodological outline where appropriate.

3.2 Summary of The Case for Change

Overall: Current traffic conditions, road safety, environmental impacts and the socio-economic drivers of growth highlight a case for change to rectify and mitigate against the effects of the current A1 road operation.

Traffic conditions: There is journey time variability along much of the route, including delays and congestion between Wyboston Junction and Black Cat Roundabout, and between Junction 8 and Junction 6 SB. There is a notable decrease in average speed between Junctions 6 and 7 NB. The A1 between Junctions 5 and 9 is in the top ten busiest sections of the entire London to Leeds (East) route strategy route. Traffic entering the A1(M) at Junction 7 causes speed to drop below 50mph. Off-slips experience high flows during peak times. There are a number of at-grade junctions on the A1, including roundabouts and minor side roads. There are properties and frontages in close proximity to the carriageway. These factors restrict free traffic flow, reduce capacity and lower speed limits. Some sections of the A1 which do operate within capacity without substantial congestion or delay.

Road safety: Safety issues along the route include collisions and casualties, especially along the most congested sections. Safety is poorest between Junctions 6-8, and between Wyboston Junction and Black Cat Roundabout.

Environmental Impacts: Poor air quality and noise have been identified as key environmental issues. These affect both the biodiversity in the area and the historic environment, with the impact likely to intensify without intervention. Opportunities for environmental enhancements also arise from road improvements, including river restoration, improved aquatic habitats and measures to improve habitat connectivity.

Socio-economic drivers: The study area is forecast to experience substantial growth over the next 20 years which the local areas must

accommodate in both housing and job creation. Population increase puts upward pressure on demand for infrastructure services like energy, water and transport. Investment in infrastructure is key to sustaining economic growth. A majority of economic studies report that infrastructure has a significant positive effect on output, productivity, and growth rates, and is a key driver of jobs throughout the economy.

Investment in the road network is key to unlocking growth. Failure to invest in an efficient road network could compromise the sustainability of local economies, disinvestment from businesses, poor quality places to live, and cause further harm to the environment.

3.3 Traffic conditions

Introduction

3.3.1 This analysis considers traffic flow, journey time, delay and speed variability. The data are used to identify congestion and capacity issues along the route.

3.3.2 The link data analysis utilises observed data obtained from Highways England's Traffic Information System (HATRIS), both the Journey Time Database (JTDB) and the Traffic Flow Data System (TRADS) for March 2015. HATRIS data provide information on travel times, speeds, traffic flows and delays:

- Data available from 07:00 to 19:00 in 15 minute intervals and as average weekday (Tuesday to Thursday, March 2015) for each link of the A1.
- The analysis identified the maximum and the average hourly flow during each peak period for each link (AM peak period 07:00 to 10:00 and PM peak period 16:00 to 19:00).
- For the journey time and delay analysis, the study identified the worst peak hour per period.
- The average speed, speed variability and congestion reference flows were calculated based on average peak period conditions.

3.3.3 The analysis undertaken in this section focuses on the AM and PM peak periods. The following data were also available for the study area (Junction 1 to Junction 17):

- Turning count data (observed survey data or data extracted from paramics traffic models) for the AM and PM peak periods for Junction 3 (Hatfield South), Junction 4 (Hatfield North) and Junction 7 (Stevenage South).
- Turning counts, flow to capacity ratios (RFC), queue lengths and delay data for the Biggleswade North, Sandy and Buckden roundabouts, derived from junction modelling (ARCADY 8 or VISSIM) undertaken as part of a separate commission for Highways England.

- Qualitative junction analysis for Junctions 5 to 9 and options assessment as part of the A1(M) Junction 5 to Junction 9 route strategy study, undertaken for Highways England in 2014.
- Overview of the main issues and challenges on the A1 Corridor included in Highways England's 2015 'London to Leeds (East) Route Strategy Assessment'.

Links Analysis – mainline conditions

3.3.4 The key outputs from the analysis are:

- Cumulative travel times (minutes) along the corridor by direction (northbound/ southbound) in the AM and PM peak hours compared to free flow travel times (for this analysis these were based on the prevailing speed limit).
- Actual delays (in seconds) by link and direction in the AM and PM peak hours.
- Delays compared to free flow travel times – each link delay expressed as a percentage of the respective free flow travel time on that link to indicate the magnitude of the delay.
- Traffic flows, capacity and average speed by link, direction and peak period. Capacity has been calculated as the maximum sustainable hourly lane throughput assuming a layout compliant with current road standards and adjusted based on the percentage of HGVs, the number of lanes and the width of the road.
- AAWT and CRF by link, direction and peak period.
- Speed variability by link, direction and peak period compared to the respective average speed and the speed limit.

3.3.5 Figure 3.1 and Figure 3.2 below compare free flow travel times with journey times during the AM and PM peak hours with the highest traffic flows for each link by direction. The comparison highlights where on the route journey times differ most compared to free flow conditions.

3.3.6 In the northbound direction there are delays between Junction 6 and Junction 7 and between Sandy and Black Cat roundabout, specifically in the evening peak hour. In the southbound direction there are delays between Wyboston and Black Cat roundabout and between Junction 8 and Junction 6, specifically in the morning peak hour.

Figure 3.1: Cumulative Travel Time Comparison (AM/PM Peak Hour vs Free Flow) – SB Direction[51]

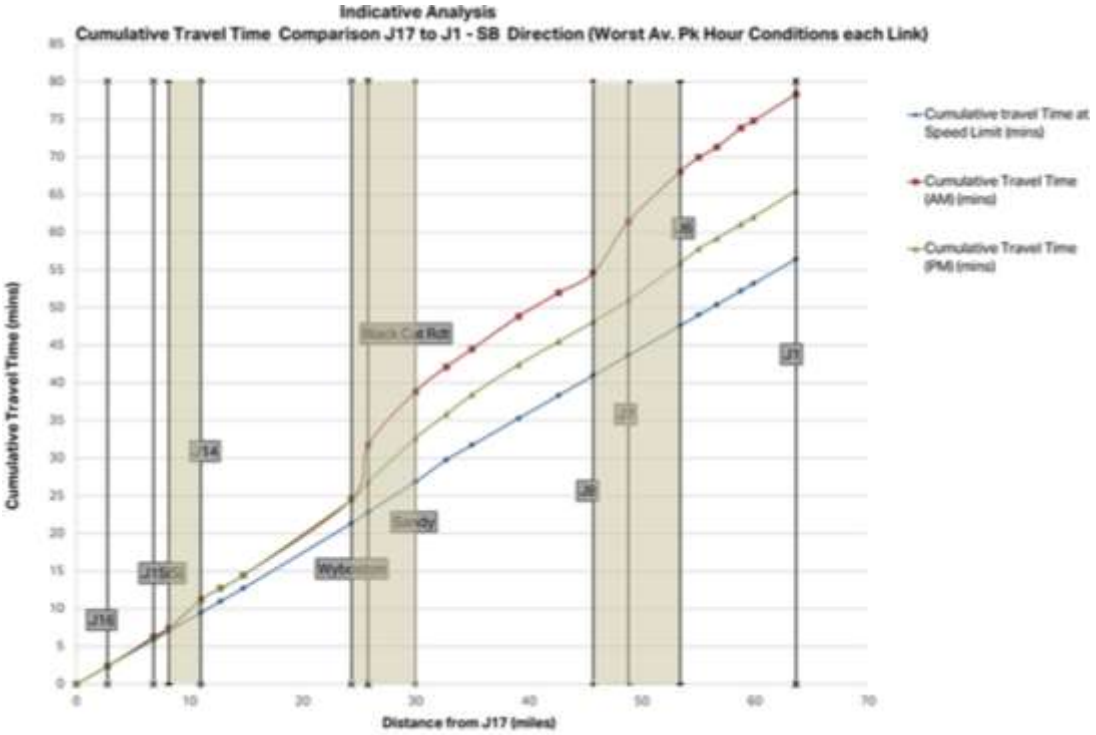
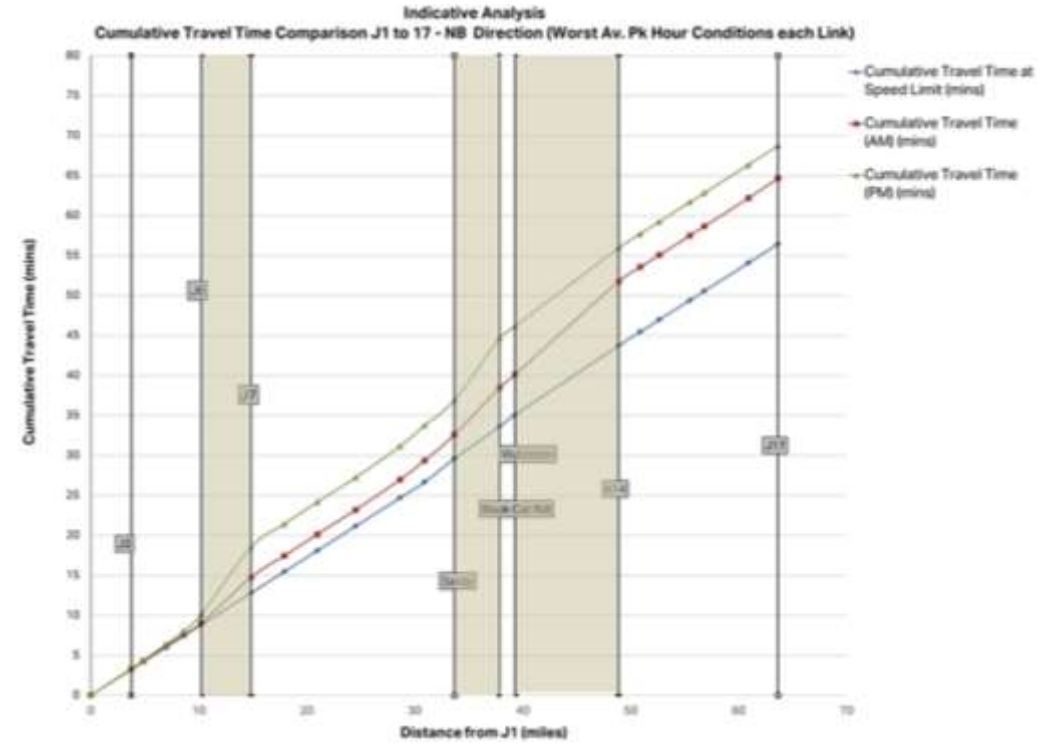


Figure 3.2: Cumulative Travel Time Comparison (AM/PM Peak Hour vs Free Flow) - NB Direction[52]



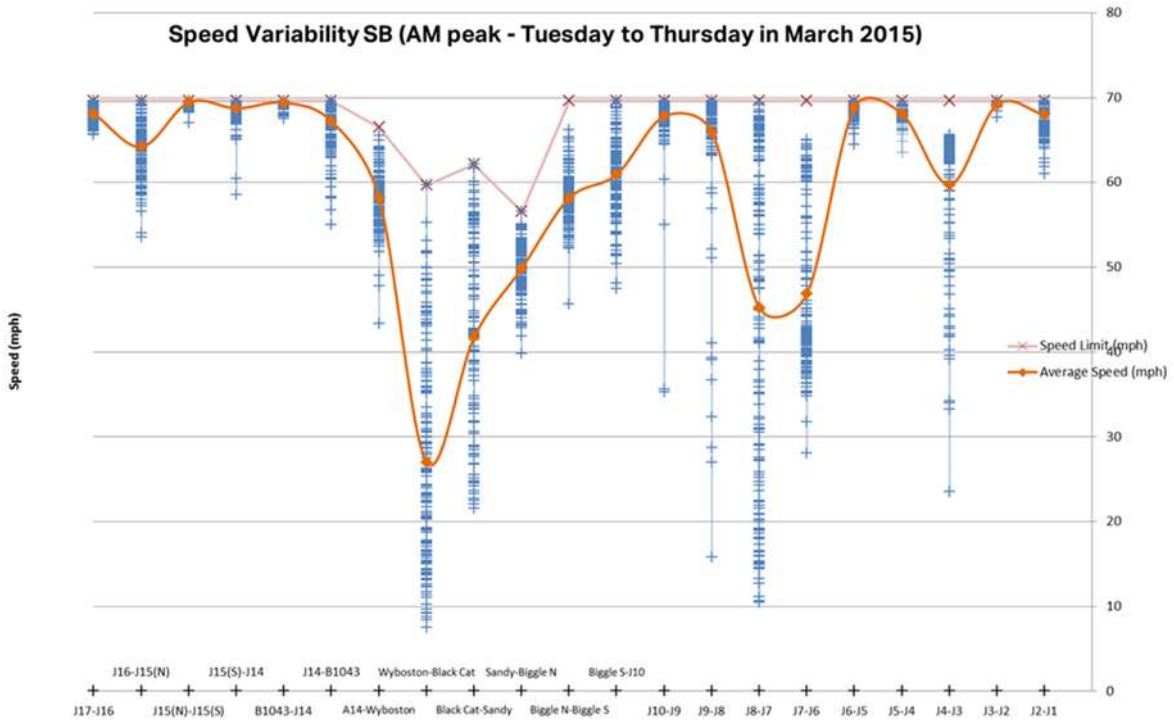
3.3.7 As such, issues relating to PM peak northbound traffic and AM peak southbound traffic were investigated further. Figure 3.3 and Figure 3.4

[51] HATRIS, March 2015.
[52] i*bid.*

show speed levels (in mph) and their variability during the entire peak period by direction (AM Peak 07:00 to 10:00 southbound and PM Peak 16:00 to 19:00 northbound respectively), along with the average speed by peak period and the respective speed limits for each link.

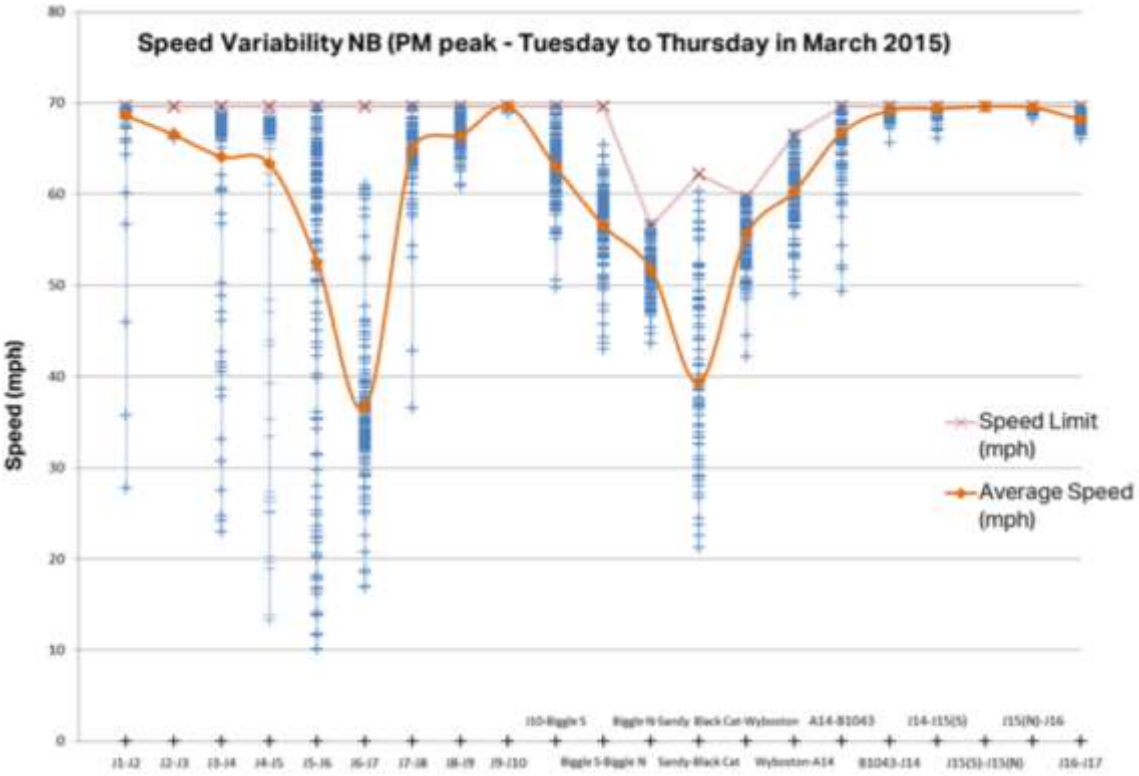
3.3.8 The charts indicate substantial journey time variability along much of the route between Junction 1 and Junction 14 (particularly those links identified in Figure 3.3 and Figure 3.4 as having the greatest departure from free flow conditions). Such variations indicate poor journey time reliability. There are much lower levels of variability between Junction 14 and Junction 17.

Figure 3.3: Speed Variability by Link - Southbound Direction AM Peak Period[53]



[53] *ibid.*

Figure 3.4: Speed Variability by Link - Northbound Direction PM Peak Period[54]



3.3.9 The figures below present weekday annual average daily traffic flow levels, congestion reference flows and average speeds by link, peak period and direction. The charts provide a comparison between the average daily traffic flows and the respective congestion reference flow (the flow at which a carriageway is likely to be congested in the peak periods on an average day).

3.3.10 The results and charts indicate that some sections of the A1 corridor (Junction 1 to Junction 17) operate within capacity and without substantial congestion or delay. The exceptions to this are consistent with the locations identified in the speed variability analysis above. This indicates that there may not be as strong a case for change along the entirety of the study area route.

[54] i*bid.*

Figure 3.5: Annual Average Weekday Traffic (AAWT) vs Congestion Reference Flow (CRF) and Average Speed-SB Direction AM Peak Period[55]

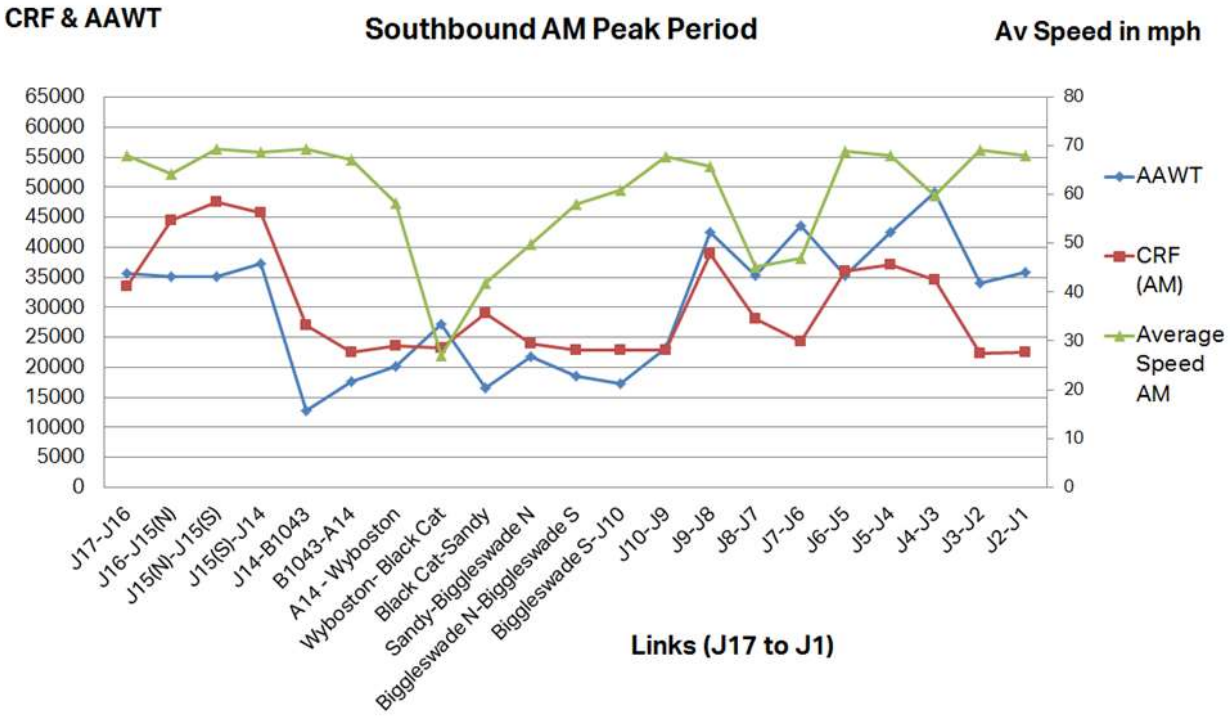
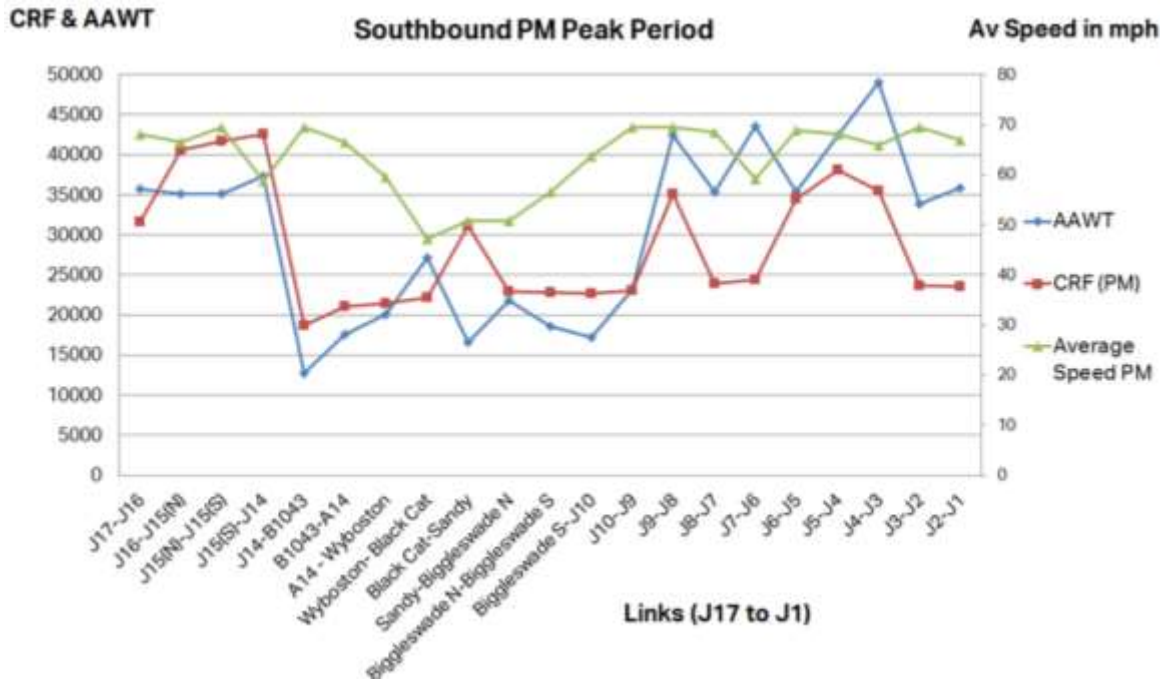


Figure 3.6: Annual Average Weekday Traffic (AAWT) vs Congestion Reference Flow (CRF) and Average Speed-SB Direction PM Peak Period[56]



[55] *ibid.*
[56] *ibid.*

Figure 3.7: Annual Average Weekday Traffic (AAWT) vs Congestion Reference Flow (CRF) and Average Speed-NB Direction AM Peak Period[57]

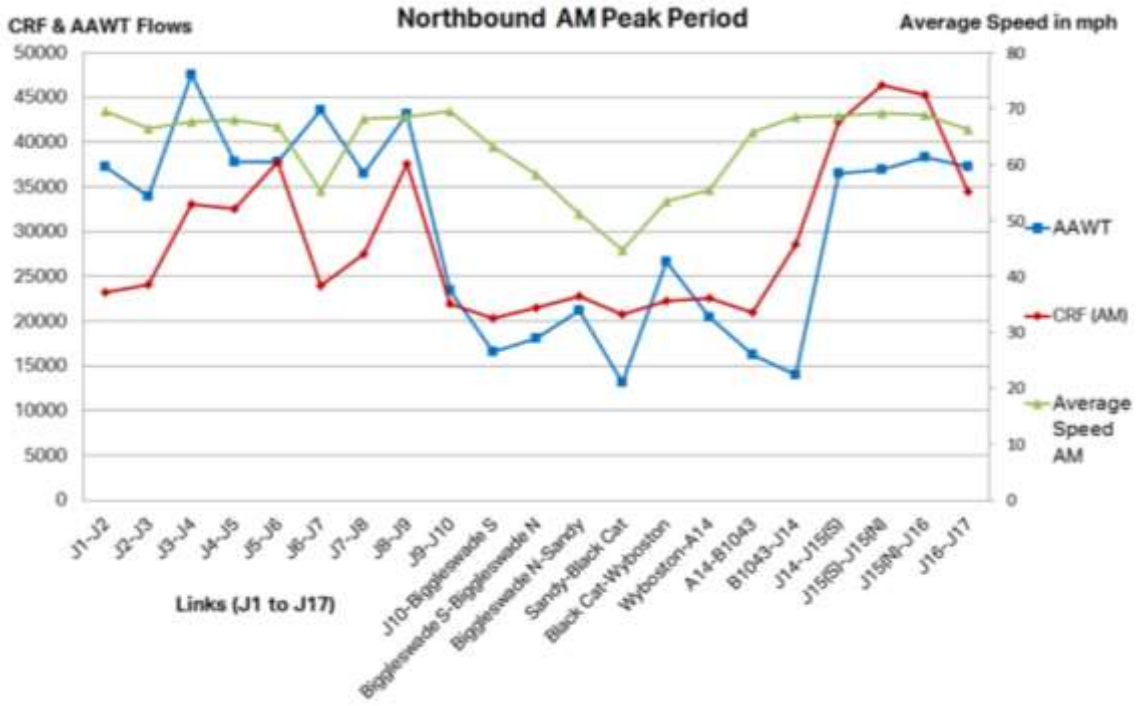
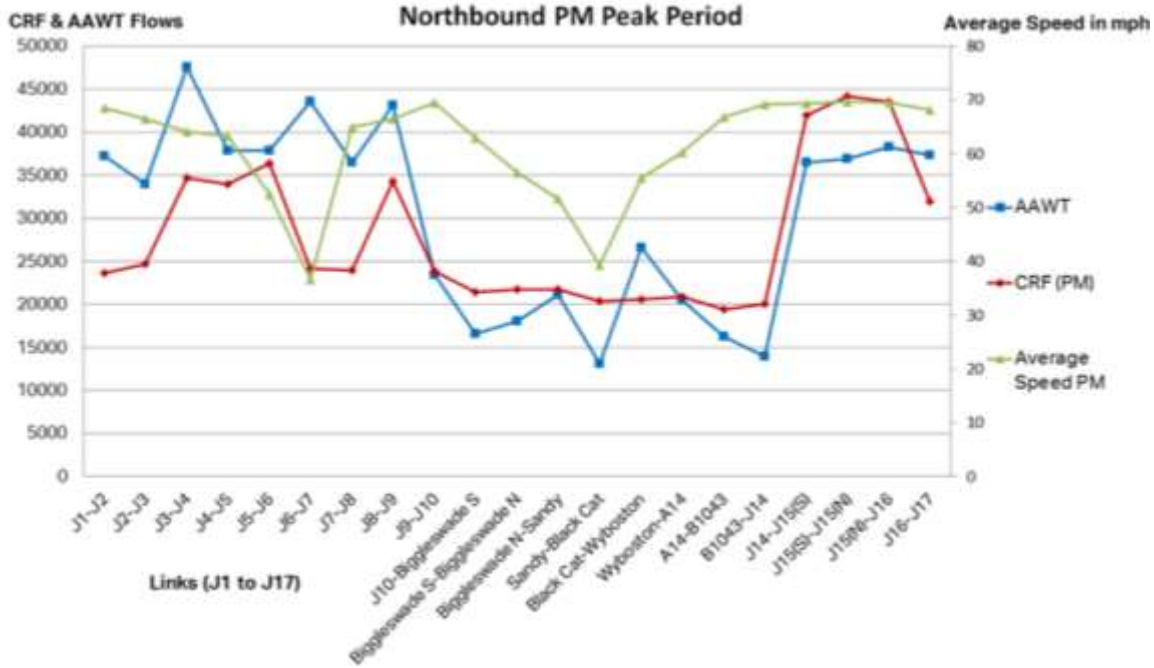


Figure 3.8: Annual Average Weekday Traffic (AAWT) vs Congestion Reference Flow (CRF) and Average Speed-NB Direction PM Peak Period[58]



[57] i*bid.*
[58] *ibid.*

3.3.11 The key issues in the AM peak southbound are:

- Substantial delays, congestion issues, increased and unreliable travel times are observed on the A1 from Wyboston Junction (A428) to Black Cat Roundabout (A421); and from A1(M) Junction 8 to Junction 7.
- The decrease in speed between Wyboston and Black Cat roundabouts could primarily relate to delays at the Black Cat Roundabout. The analysis is based on data obtained prior to or during recent improvements. It is possible that the presence of ongoing road works at this location could have had a substantial impact on the journey times recorded and therefore the results of the analysis should be updated in due course. Anecdotal observations suggests that queues and delays have reduced following the opening of the recent Black Cat Improvement scheme; however queues still form, particularly for the offside lane of the A1 southbound approach.
- The links between Junction 8 and Junction 6 experience high daily traffic flows that are above the CRF.

3.3.12 The key issues in the PM peak southbound are:

- Delays occur in the same areas as in the AM peak but are less substantial.
- The PM peak has substantially higher speeds and lower speed variability than in the AM peak.

3.3.13 The key issues in the AM peak northbound are:

- There are slight delays between Junctions 6 and 7 and between Sandy and Black Cat.

3.3.14 The key issues in the PM peak northbound are:

- Delays occur in the same areas as in the AM peak but are more substantial and the travel times less reliable.
- The main issues identified are from Junction 6 to Junction 7 and from Sandy (A603) to Black Cat Roundabout (A421).
- The section between Junctions 6 and 7 experiences high daily traffic flows that are above the CRF.
- A substantial decrease in average speed is observed from Junction 6 to 7 and from Junction 10 to Black Cat Roundabout (A421). These sections of the A1 have only 2 lanes per direction at both locations with relatively high flows.

3.3.15 Overall, congestion and delay issues are most acute southbound during the AM peak. These issues may partly be explained by the substantial levels of traffic and the reduced capacity on some sections of the route where the number of lanes is limited to two running lanes in each direction, a reduction from three running lanes in each direction in other sections.

Junctions Analysis

3.3.16 The analysis of junctions has been based on existing published information or work in which the study team has been directly involved.

Junctions 1 to 10 (Hertfordshire):

3.3.17 According to the 2015 *London to Leeds (East) Route Strategy* (HE):

- The main congestion issues on this part of the A1(M) are identified at Junctions 3, 4 (Hatfield), 7 and 8 (Stevenage).

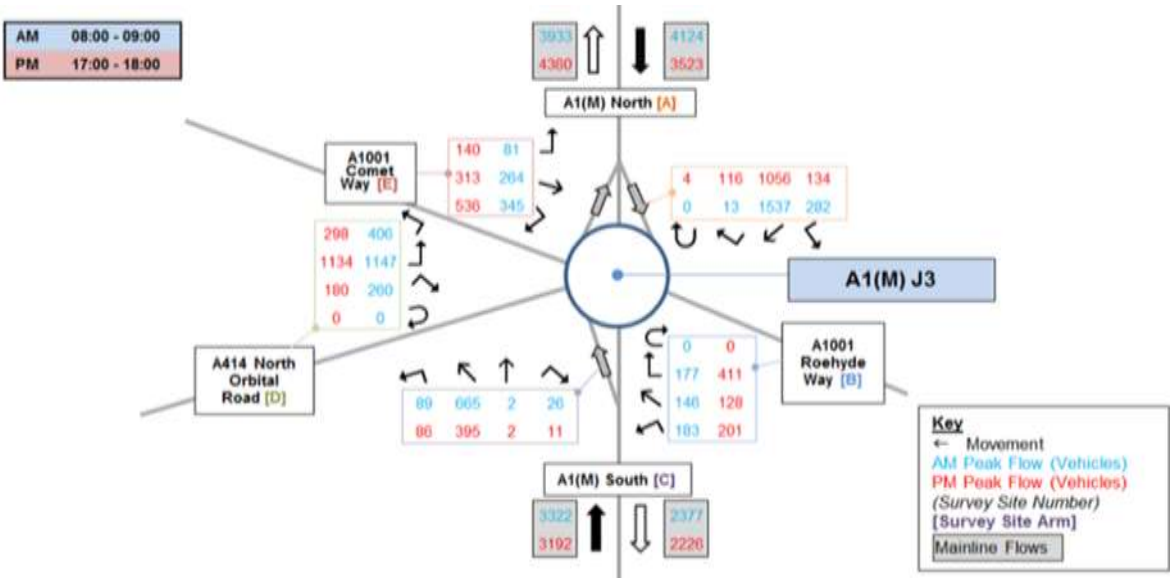
3.3.18 According to the *A1(M) Junction 5 to Junction 9 Options Assessment Report for HE* (AECOM, 2014):

- Substantial delays occur between Junctions 6 and 7 northbound during the PM peak and between Junctions 8 and 7 southbound during the AM peak.
- Delays and capacity constraints are experienced between Junctions 6 and 8 in both directions.
- Poor visibility and potential unequal lane usage result in queuing and inefficient give-way movements on the northbound off-slip at Junction 9.
- The substantial volumes of traffic entering the A1(M) at Junction 7 causes speed levels to drop below 50mph at a number of locations including A1(M) southbound between Letchworth and Stevenage.

3.3.19 The A414 is an east-west route located north of the M25 which uses the A1(M) between Junctions 3 and 4. Based on modelled information (for 2015) obtained from a Highways England-Hertfordshire County Council study:

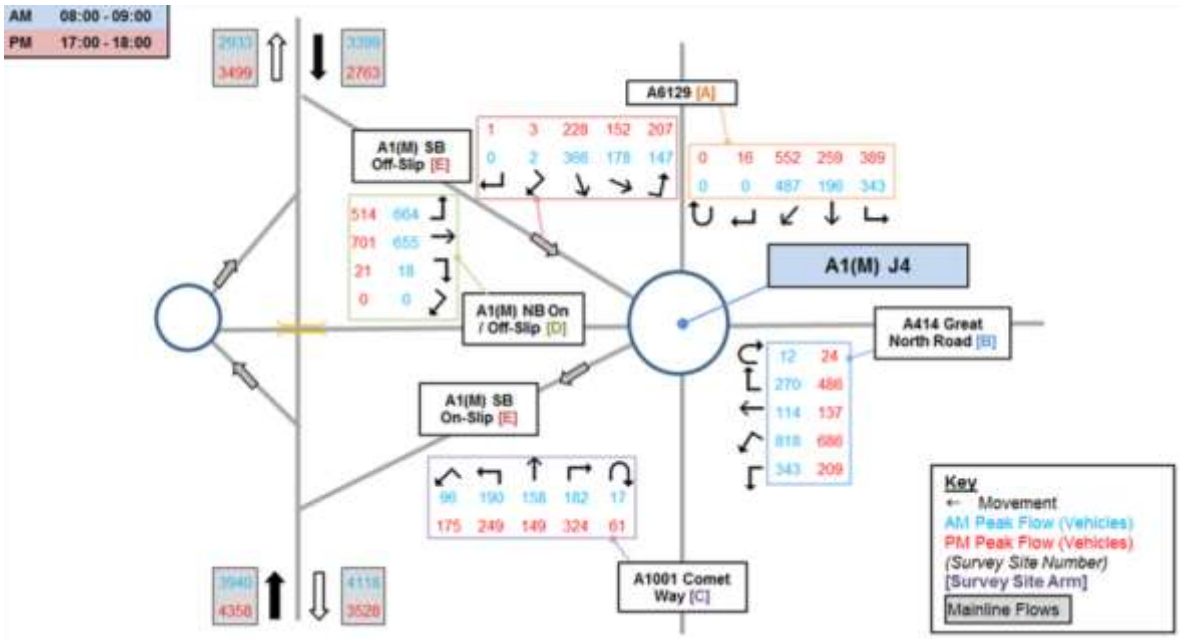
- At Junction 3 (Figure 3.9), the highest traffic flows using the signalised gyratory are from the A1(M) northern offslip (SB direction) to the A414 North Orbital Road and from the A414 to the A1(M) north onslip (NB direction) during both the AM and PM peaks.

Figure 3.9: Schematic Flow A1(M) Junction 3



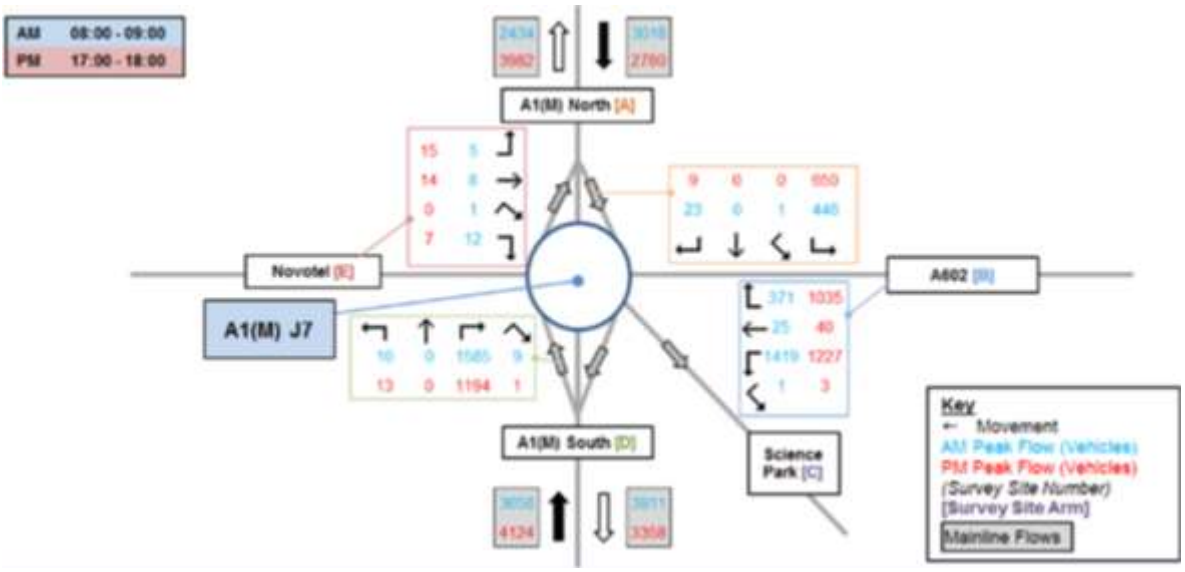
- At Junction 4 (Figure 3.10), the main vehicle movements are between the A1(M) southbound onslip and offslip, the A414 Great North Road to the east and the A6129 to the north. A substantial number of vehicles exit the junction via the A1(M) SB onslip to join the mainline carriageway in both peak periods.

Figure 3.10: Schematic Flow A1(M) Junction 4



- At Junction 7 (Figure 3.11) the most substantial movements during both the AM and PM peak hours are to/from the A1(M) south. The southbound onslip and the northbound offslip experience the highest flows in both the morning and evening peaks. There are slightly lower traffic volumes in the PM peak compared to the AM peak.

Figure 3.11: Schematic Flow A1(M) Junction 7



3.3.20 Overall, Junctions 3, 4 and 7 have high traffic flows entering and exiting the junctions during both peak periods. The high traffic volumes cause congestion and delay issues.

3.3.21 The findings are consistent with the link analysis findings which suggest substantial journey time variability and delays in the peaks northbound between Junctions 6 and 7 and southbound between Junctions 8 and 6.

3.3.22 The findings also indicate issues at Junctions 3 and 4 where the A1(M) also serves as a link for the east-west A414.

Junctions 10 to 14 (Bedford authorities and Cambridgeshire):

3.3.23 The section of the A1 between Junction 10 at Baldock and Junction 14 at Alconbury is constrained by a large number of at-grade junctions and accesses. These consist of roundabouts (Biggleswade South, Biggleswade North, Sandy, Black Cat, Buckden), minor side roads and direct frontage access to individual properties, plus a number of central reserve gaps. Some sections of this part of the route have relatively tight turns (radii) and/or relatively steep running (gradients), providing additional constraints to the network in these locations.

3.3.24 All the aforementioned factors restrict free traffic flow especially during peak periods leading to severe speed variability, reduced road capacity and lower speed limits (various speed limits below 70mph).

3.3.25 The 2015 London to Leeds (East) Route Strategy points out particular capacity concerns for the A421 Black Cat Roundabout, as it is considered to be a congestion pinch point. A Pinch Point scheme was delivered in March 2015 (consisting of an enlargement of the roundabout, widening of approaches and installation of traffic signals) to alleviate capacity issues at the junction in the short to medium term. However in the longer term additional improvements are likely to be required to the A1/A421/A428 corridors to ensure the network in this

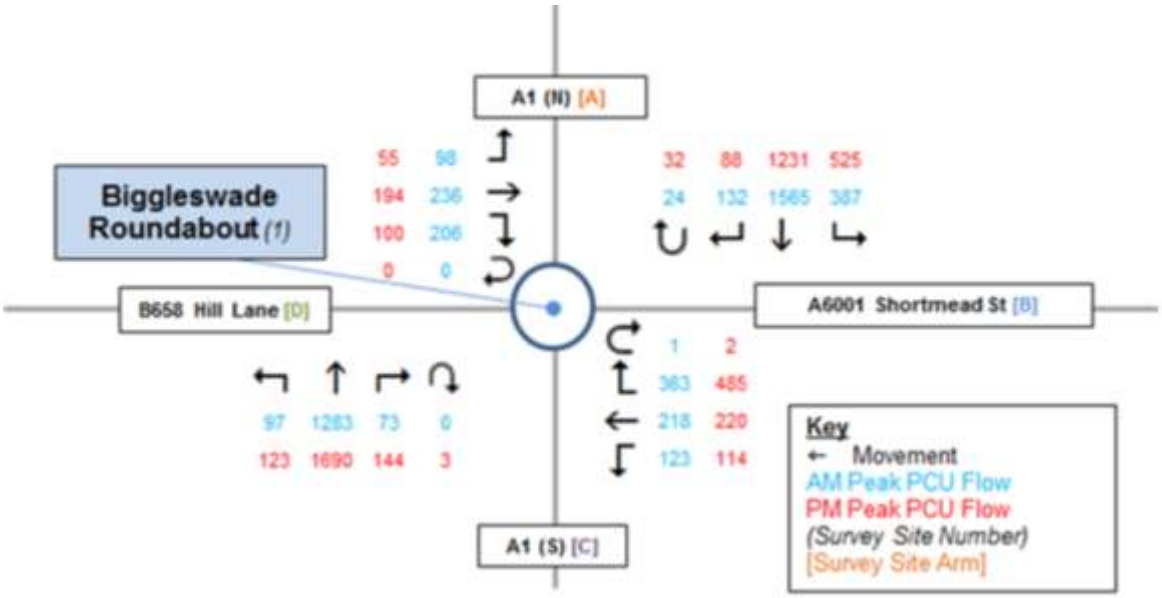
location can operate efficiently with increases in demand resulting from growth[59]. The Black Cat Roundabout is also expected to be grade separated as part of the A428 Black Cat to Caxton Gibbet scheme[60].

3.3.26 The results from the junction modelling undertaken for Biggleswade North, Sandy and Buckden roundabouts show that the junctions are very close to capacity with some of them exceeding capacity in both directions in the peak periods. These are discussed in terms of RFC values. RFC is a measure of the volume of traffic (flow) relative to the theoretical maximum flow (i.e. the capacity). The higher the ratio, the greater the congestion or 'stress' levels that will be experienced on the link. Typically there is no congestion if the ratio is less than 0.8; moderate congestion if it is between 0.8 - 0.9; and severe congestion if it is above 0.9.

3.3.27 Biggleswade North Roundabout is a 4-arm un-signalised at-grade roundabout (Figure 3.12). The modelling has shown that:

- The northern A1 (southbound) approach has a high RFC value in the AM peak, whilst the southern A1 (northbound) approach has a substantial RFC value in the PM peak. This reflects the direction of the peak flows on the A1, which are predominantly southbound in the AM peak and northbound in the PM peak.
- There are substantial queues on the B658 and modest queues on the A1 north and south adjoining link sections.

Figure 3.12: Schematic Flow A1 Biggleswade North Roundabout (2015)

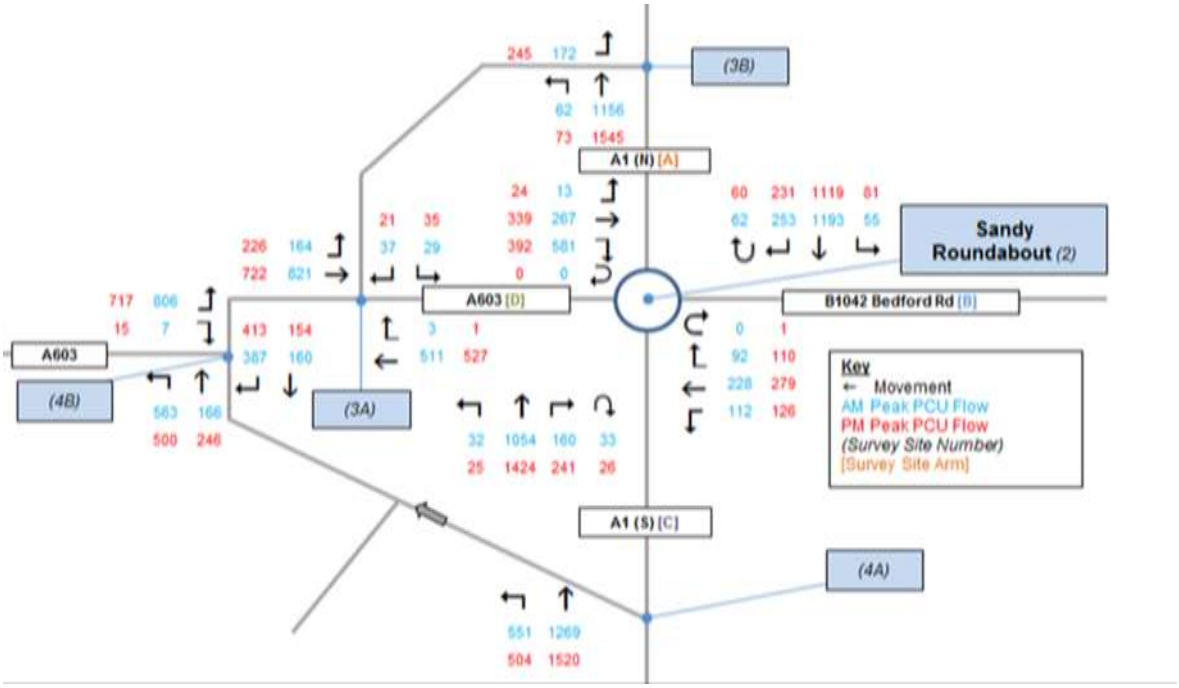


[59] Highways Agency 'London to Leeds (East) Route Strategy Evidence Report', April 2014.
[60] DfT, 'Major roads investment in the east of England' in GOV.UK December 2014, viewed on 3 June 2016, https://www.gov.uk/government/news/major-roads-investment-in-the-east-of-england.

3.3.28 Sandy Roundabout is a 4-arm un-signalised at-grade roundabout (Figure 3.13). The modelling has shown that:

- The roundabout experiences acute capacity issues, particularly on the northern A1 (southbound) approach with queue lengths of up to 0.75km. On the A603 there is extensive queuing and considerable delays are observed and modelled.
- There are substantial delays during the AM peak on both westbound and southbound approaches; and less substantial delays also occur on the eastbound approach. In the PM peak, similar congestion trends exist but to a lesser extent. The northbound approach functions relatively well in both peak hours.

Figure 3.13: Schematic Flow A1 Sandy Roundabout – 2015

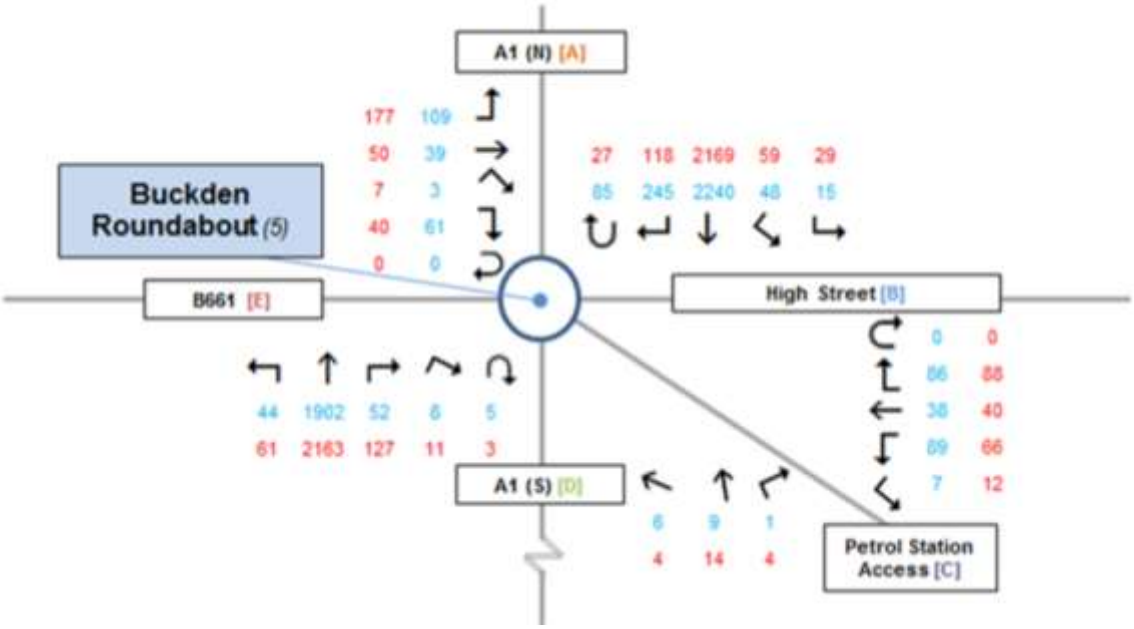


3.3.29 Buckden Roundabout is a 5 arm un-signalised roundabout (Figure 3.14). The modelling has shown that:

- The junction is operating at capacity in both peak periods.
- In the AM peak there are high flow to capacity ratios (>0.77) for all arms with an RFC greater than 0.97 for both the A1 northbound and southbound approaches.
- In the PM peak there are high flow to capacity ratios (>0.70) for all arms with an RFC greater than 0.90 for the A1 northbound and southbound approaches and an RFC greater than 1 for the B661 approach, indicating severe capacity issues.
- The northbound A1 experiences a high RFC in both peak periods and substantial queues. Observations suggest this is due to the

geometry of the junction in combination with the heavy traffic flows experienced.

Figure 3.14: Schematic Flow A1 (Buckden Roundabout)



Junctions 14 to 17 (Cambridgeshire):

3.3.30 The section of the A1(M) from Junction 14 (Alconbury) to Junction 17 (South of Peterborough) performs well without congestion issues and delays. The motorway in this section consists of four lanes in each direction between Junctions 14 and 16 and three lanes between Junctions 16 and 17.

3.3.31 According to the link analysis results, traffic flows on this part of the A1 are generally within the capacity of the road, and travel speeds are close to free flow (speed limit) conditions with limited day to day variability.

3.3.32 No additional data were available to assess junction performance issues.

3.4 Safety

3.4.1 Highways England provided STATS19 data from 2012 to 2014 for the A1 corridor (Junctions 1 to 17). For each collision record, information was provided detailing the date, time, location (link), number of casualties and their severity (fatal, serious, and slight), number of vehicles involved, weather and road surface conditions.

3.4.2 Separate analysis was conducted for collision and casualty records to estimate by direction and in total: collision and casualty rates; casualties by severity type; and annual actual and percentage change in collision and casualty rates 2012-2014 (Table 3.1 and Table 3.2). The analysis also identified locations where the majority of incidents and casualties occurred (Table 3.3).

3.4.3 In addition, the profile of collision and casualty rates along the A1 corridor has been compared against national averages for the equivalent road types in order to provide context and identify potential hotspots.

Table 3.1: Collisions and Casualties Summary Statistics (2012-2014)[61]

Collisions/ Casualties Statistics 2012-2014 (J1 to J17)	NB Direction*	SB Direction*	Total (NB & SB Direction)**
Total Number of Casualties	391	283	686
Total Number of Collisions	238	177	426
KSI (*Killed or Seriously Injured)* Casualties	51	29	83
Fatal Casualties	6	9	15
Serious Casualties	45	20	68
Slight Casualties	340	254	603
KSI Casualties/ Total Number of Casualties (%)	13%	10%	12%
Fatal Casualties/ KSI Casualties (%)	12%	31%	18%
Serious Casualties/ KSI Casualties (%)	88%	69%	82%
Slight Casualties/ Total Number of Casualties (%)	87%	90%	88%

**Excluding the link between Biggleswade South and Biggleswade North.*
***Including the link between Biggleswade South and Biggleswade North.*

Table 3.2: Annual Actual and Percentage Change (%) in Collision and Casualty Rates (2012-2014)[62]

Collisions/ Casualties (*In total & by severity type*)	Actual Difference		% Change	
	2012-2013	2013-2014	2012-2013	2013-2014
Total Number of Casualties	+88	-69	+46%	-25%
KSI Casualties	+16	-21	+67%	-53%
Slight Casualties	+72	-48	+43%	-20%
Fatal Casualties	+7	-5	+350%	-56%
Serious Casualties	+9	-16	+41%	-52%
Total Number of Collisions	+28	-20	+22%	-13%

[61] https://data.gov.uk/dataset/road-accidents-safety-data
[62] *ibid.*

Table 3.3: Collision and Casualty Hotspots by Type[63]

Collisions/ Casualties Statistics 2012-2014 (J1 to J17)	Links with the highest number of collisions and casualties by severity type	
	NB Direction	**SB Direction**
Total Number of Casualties *(Number of People Injured)*	J6-J7 (*58 people*), and Wyboston Junction to A14 (*81 people*)	J7-J6 (*42 people*), J8-J7 (*31 people*), J9-J8 (*30 people*), and Wyboston Junction to Black Cat Roundabout (*27 people*)
Total Number of Collisions *(Number of Incidents)*	J6-J7 (*40 incidents*), and Wyboston Junction to A14 (*23 incidents*)	J7-J6 (*23 incidents*), J8-J7 (*22 incidents*), and A14 to Wyboston Junction (*19 incidents*)
Slight Casualties *(Number of people slightly injured)*	J6-J7 (*54 people*), and Wyboston Junction to A14 (*67 people*)	J7-J6 (*41 people*), J9-J8 (*30 people*), and Wyboston Junction to Black Cat Roundabout (*27 people*)
KSI Casualties *(Number of people fatally or seriously injured)*	J7 to J8 (*6 people*), and Wyboston Junction to A14 (*14 people*)	J8 to J7 (*5 people*), and A14 to Wyboston Junction (*9 people*)

3.4.4 Figure 3.15 and Figure 3.16 show the total number of casualties (by severity type and in total) for each link and direction. It should be noted that, on the link between the Biggleswade South and the Biggleswade North roundabouts (link 10.1), the direction (northbound or southbound) of traffic where the reported casualties and collisions occurred was not identified and the data have been included in both directions in Figures 3.15 to 3.18.

[63] *ibid.*

Figure 3.15: No of Casualties (2012-2014) by type and link – Northbound Direction[64]

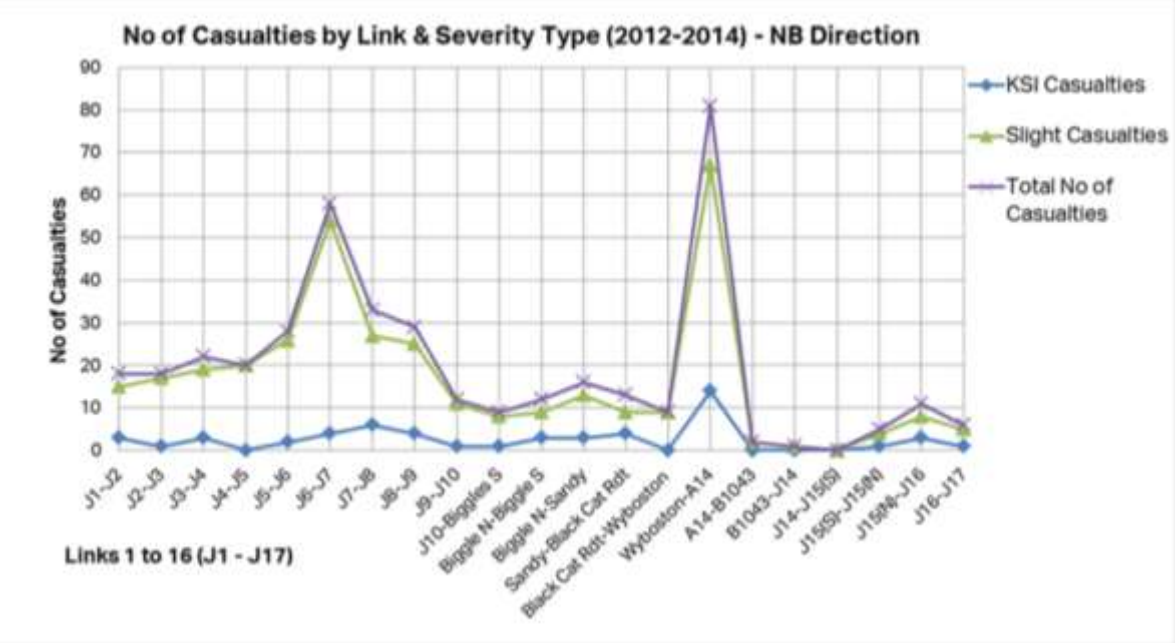
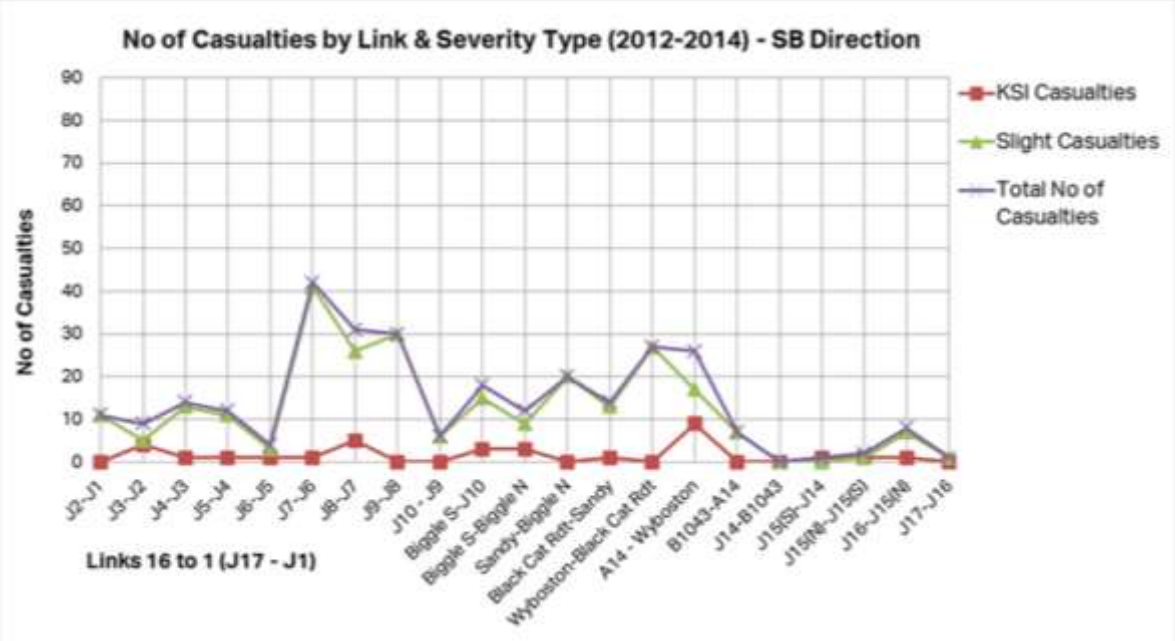


Figure 3.16: Number of Casualties (2012-2014) by type and link - Southbound Direction[65]



3.4.5 Figure 3.17 and Figure 3.18 show the total number of collisions by link and direction for the years 2012 to 2014.

[64] *ibid.*
[65] *ibid.*

Figure 3.17: Total No of Collisions (2012-2014) by Link in the Northbound direction[66]

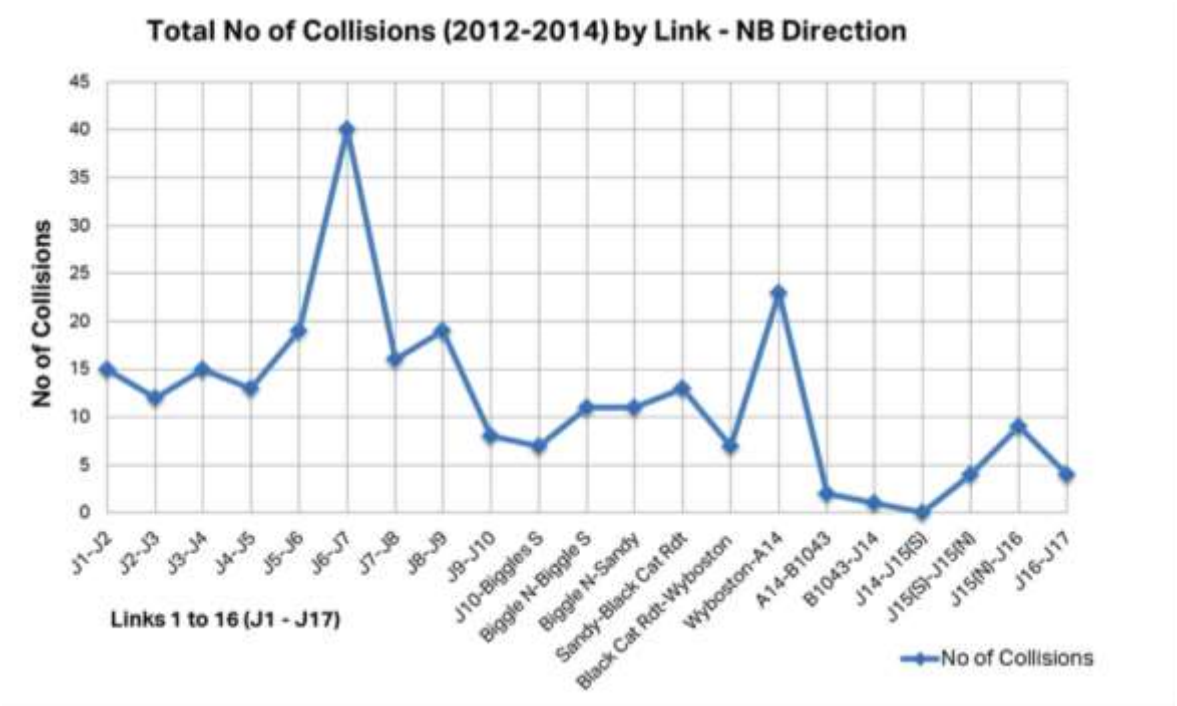
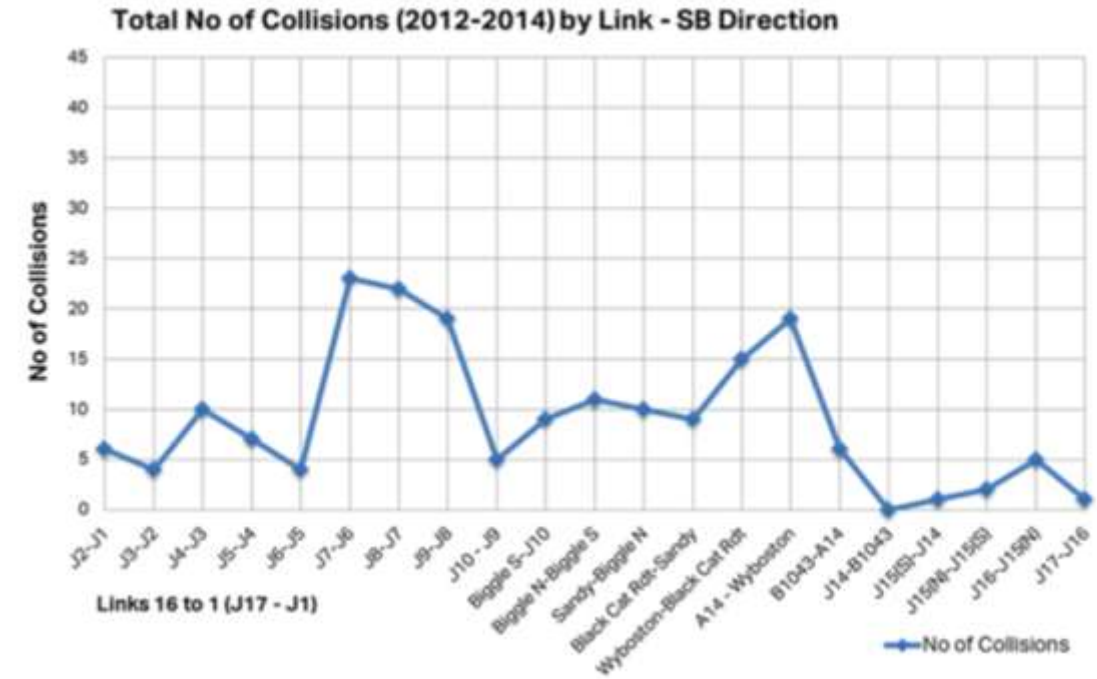


Figure 3.18: Total No of Collisions (2012-2014) by Link in the Southbound direction[67]



[66] *ibid.*
[67] *ibid.*

3.4.6 Overall, there are a higher number of collisions and casualties in the northbound direction compared to the southbound direction.

3.4.7 Both directions have a similar proportion of slight and Killed or Seriously Injured (KSI) casualties compared to the total number of collisions.

3.4.8 There was a relatively high number of collisions between Junctions 6 and 7 in both directions; and between Wyboston and the A14 in both directions compared to the rest of the route.

3.4.9 It should also be noted that a relatively high proportion of collisions and casualties occur where there are severe congestion issues. Congestion relief could potentially reduce the number of incidents and improve road safety on those parts of the network.

3.4.10 The preceding analysis does not take into account link length or total traffic flow, which would allow a comparison of accident rates along the route and with national averages published by the DfT for the relevant road types. The following charts present accident rates (collisions, casualties, KSI) per billion vehicle miles. An average rate has also been calculated for each of Junction 1 to 10, 10 to 14, and 14 to 17. A separate assessment examining pedestrian casualties has also been provided later in this section.

3.4.11 Rates are compared against the mean national average accident rates for motorways and rural A roads[68]. The A1(M) between Junctions 1 and 10 and between Junctions 14 and 17 (including the section between the B1043 and Junction 14) has been compared to the national average for a motorway, whilst the A1 between Junctions 10 and 14 (excluding the section between the B1043 and Junction 14) has been compared to the national average for a rural A road.

3.4.12 Figure 3.19 and Figure 3.20 show collision rates along the corridor compared to the national average in the northbound and southbound directions respectively.

[68] https://www.gov.uk/government/publications/reported-road-casualties-great-britain-annual-report-2014, Reported Road Casualties Great Britain: Annual Report 2014, DfT, 2015 and Table RAS30018 from DfT's 'Road Accident Statistics'. Table RAS30018 - Reported casualty and accident rates by urban and rural roads, road class, road user type, severity and pedestrian involvement, Great Britain (DfT 2012-2014). This data is combined with the STATS19 data for subsequent analysis.

Figure 3.19: Collision Rate (per billion vehicle miles) 2012-2014 by Link (northbound)[69]

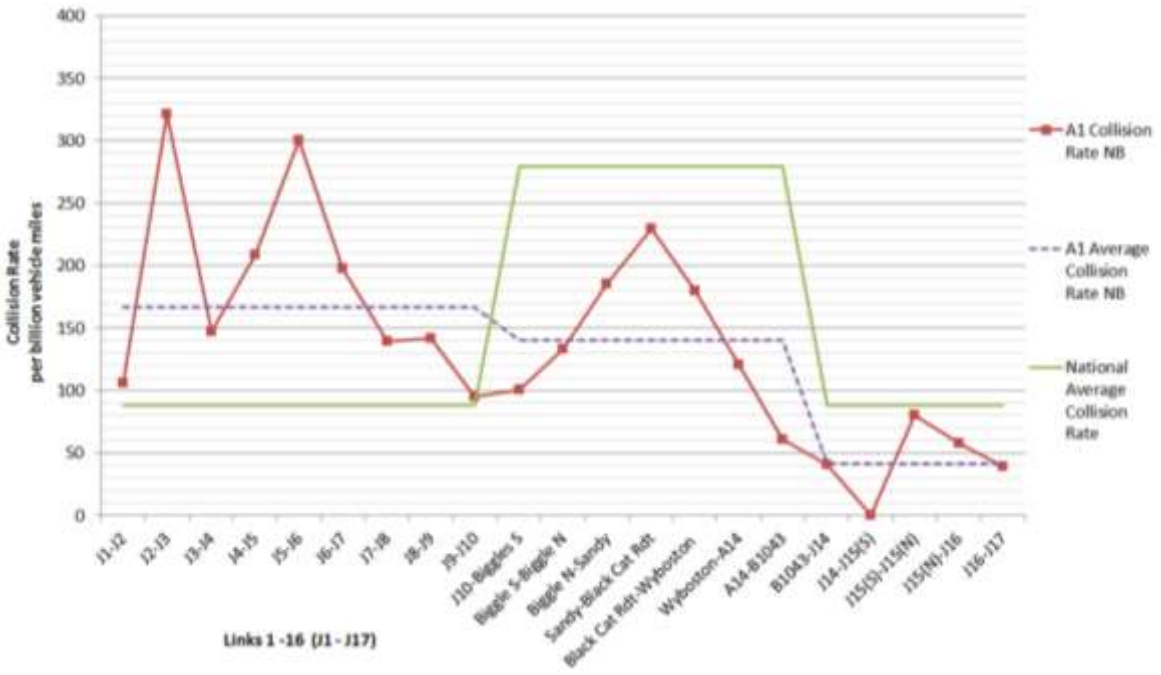
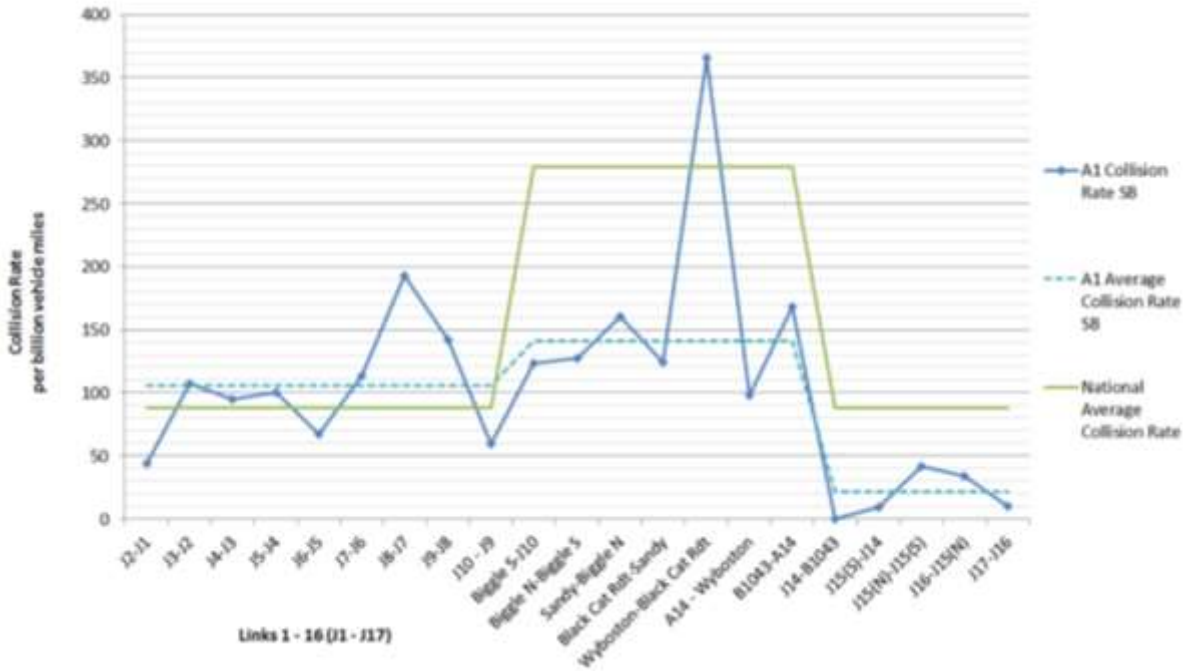


Figure 3.20: Collision Rate (per billion vehicle miles) 2012-2014 by Link (southbound)[70]



3.4.13 Considering the collision rates on the A1(M) northbound between Junctions 1 and 10, the rate is particularly high between Junctions 2

[69] *ibid.*
[70] *ibid.*

and 3 (321 casualties per billion vehicle miles) and between Junctions 5 and 6 (301 casualties per billion vehicle miles). The overall collision rate between Junctions 1 and 10 (167 casualties per billion vehicle miles) is higher than the national average (88 casualties per billion vehicle miles), and the highest along the corridor in either direction.

3.4.14 The overall northbound collision rate decreases north of Junction 10 on the A1, although the collision rate appears noticeably higher between Biggleswade North and Wyboston (180 – 230 casualties per billion vehicle miles). This is however lower than the national average for a rural A road (279 casualties per billion vehicle miles), although higher than for a motorway. The northbound collision rate on the A1(M) north of Junction 14 remains below the national average for a motorway.

3.4.15 In the southbound direction, the collision rate between Junctions 10 and 1 is generally close to the national average although is noticeably higher between Junctions 9 and 7 (142 to 193 casualties per billion vehicle miles).

3.4.16 The southbound collision rate is highest between Junctions 14 and 10 (141 casualties per billion vehicle miles), particularly between Wyboston and Black Cat (366 casualties per billion vehicle miles), although only the latter is higher than the national average for a rural A road (279 casualties per billion vehicle miles).

3.4.17 Between Junctions 17 and 14, the southbound collision rate is lower than the national average, and the lowest along the corridor in either direction.

3.4.18 Figure 3.21 and Figure 3.22 show casualty rates along the corridor compared to the national average in the northbound and southbound directions respectively.

Figure 3.21: Casualty Rate (per billion vehicle miles) 2012-2014 by Link (northbound)[71]

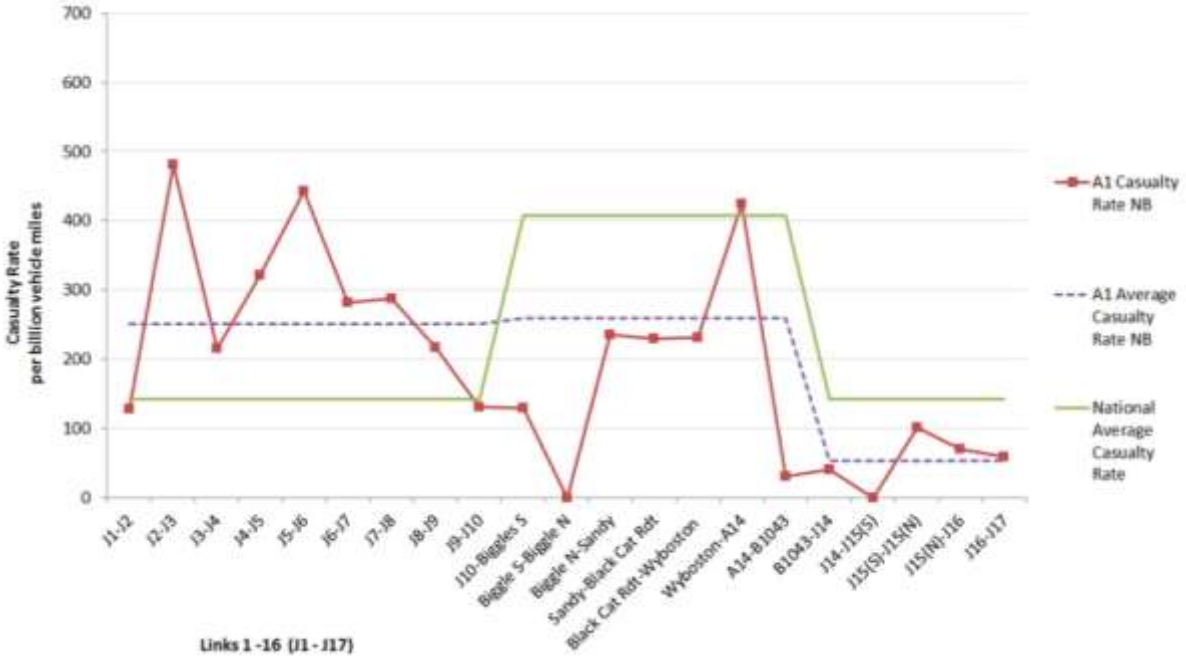
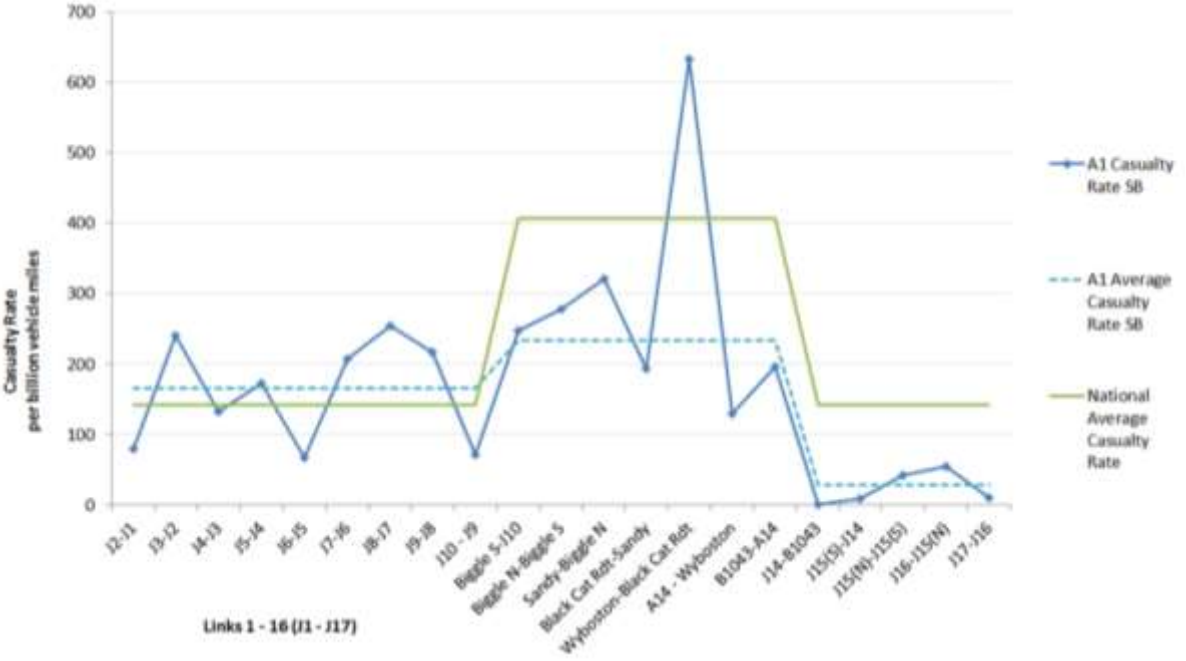


Figure 3.22: Casualty Rate (per billion vehicle miles) 2012-2014 by Link (southbound)[72]



3.4.19 In the northbound direction the casualty rate follows a similar trend to the collision rate, with the highest rates between Junctions 2 and 3 and

[71] *ibid.*
[72] *ibid.*

between Junctions 5 and 6 (482 and 443 casualties per billion vehicle miles respectively). The overall casualty rate (251 casualties per billion vehicle miles) is higher than the national average (142 casualties per billion vehicle miles) between Junctions 1 and 10.

3.4.20 The overall northbound casualty rate between Junctions 10 and 14 (259 casualties per billion vehicle miles) is similar to that between Junctions 1 and 10, although the former is lower than the national average for a rural A road (408 per billion vehicle miles). The casualty rate is highest between Wyboston and the A14 (425 casualties per billion vehicle miles), the only location along this section where it is higher than the national average.

3.4.21 The northbound casualty rate is lowest between Junctions 14 and 17, where it remains below the national average.

3.4.22 In the southbound direction, the overall casualty rate between Junctions 10 and 1 (165 casualties per billion vehicle miles) is lower than in the northbound direction and is similar to but slightly higher than the national average, but with higher rates between Junctions 3 and 2 (241 per billion vehicle miles) and between Junctions 9 and 6 (207-255 per billion vehicle miles).

3.4.23 Between Junctions 14 and 10 the overall casualty rate (234 casualties per billion vehicle miles) is much lower than the national average (408 casualties per billion vehicle miles) and slightly lower than in the northbound direction. However, there is a noticeably higher casualty rate between Wyboston and Back Cat (634 casualties per billion vehicle miles).

3.4.24 Between Junctions 17 and 14, the southbound collision rate is lower than the national average, and the lowest along the corridor in either direction.

3.4.25 Figure 3.23 and Figure 3.24 show KSI rates along the corridor compared to the national average in the northbound and southbound directions respectively.

Figure 3.23: KSI Rate (per billion vehicle miles) 2012-2014 by Link (northbound)[73]

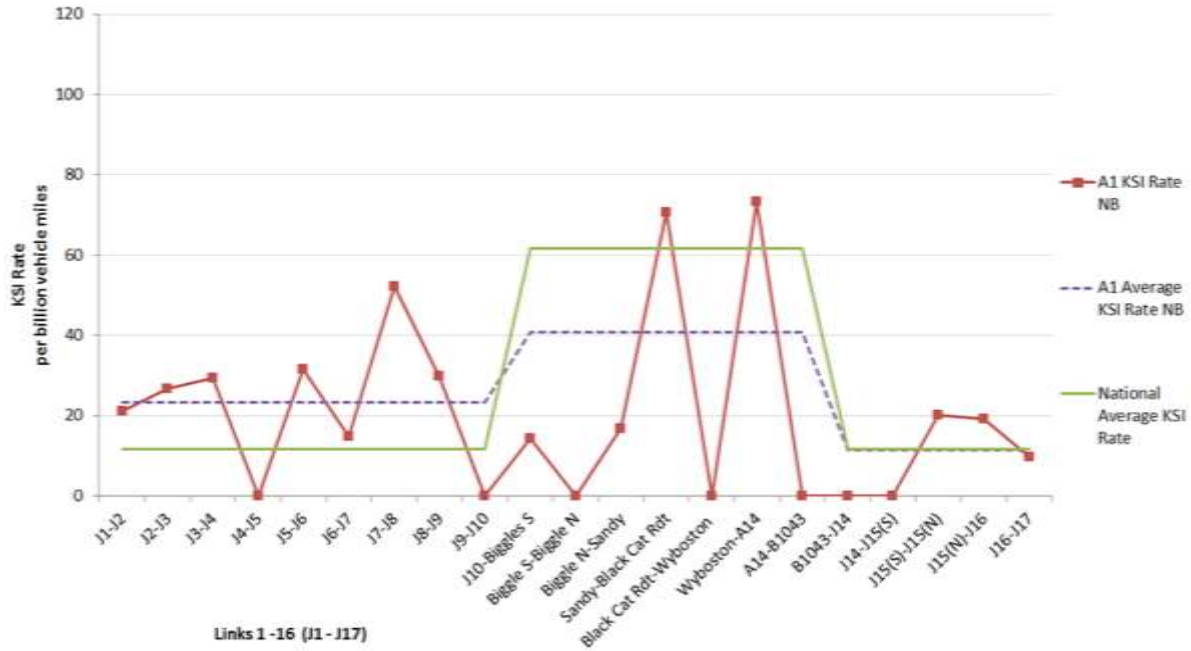
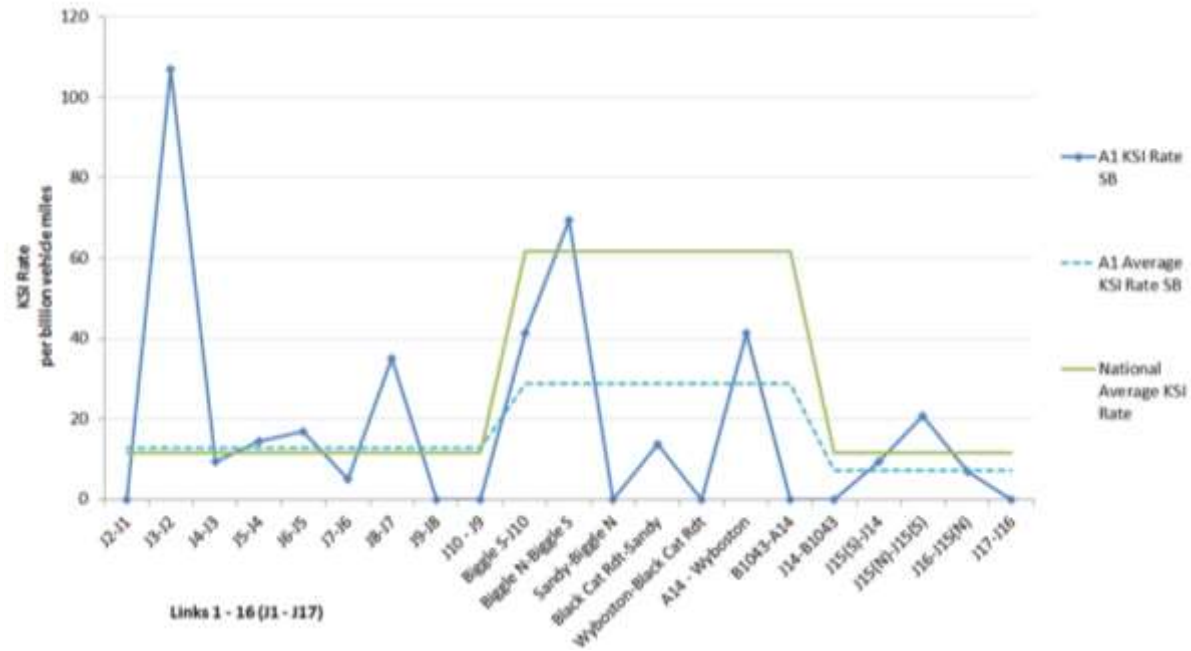


Figure 3.24: KSI Rate (per billion vehicle miles) 2012-2014 by Link (southbound)[74]



3.4.26 KSI rates show much greater variability along the route in both directions. Rates are more likely to be influenced by particular incidents. With the exception of Junctions 1 to 10 (northbound) KSI rates are similar to or lower than the relevant national averages.

[73] *ibid.*
[74] *ibid.*

3.4.27 In the northbound direction the KSI rate between Junctions 1 and 10 (23 casualties per billion vehicle miles) is higher than the national average (12 casualties per billion vehicle miles) and noticeably higher between Junctions 7 and 8 (52 casualties per billion vehicle miles).

3.4.28 The KSI rate increases to 41 per billion vehicle miles between Junctions 10 and 14, although overall this is lower than the national average rate for a rural A road (62 casualties per billion vehicle miles), but with particular peaks at Sandy to Black Cat (71 casualties per billion vehicle miles) and Wyboston to the A14 (73 casualties per billion vehicle miles).

3.4.29 The northbound KSI rate between Junctions 14 and 17 broadly matches the national average rate, although is higher between Junctions 15 and 16 (19-20 casualties per billion vehicle miles).

3.4.30 In the southbound direction the overall KSI rates are similar to the national average along the motorway sections and noticeably lower than the national average along the A road section (although this is still higher than the motorway sections). Between Junctions 1 and 10 there is a noticeably higher rate between Junctions 3 and 2 (107 casualties per billion vehicle miles, the highest along the route) and between Junctions 8 and 7 (35 casualties per billion vehicle miles).

3.4.31 Between Junctions 14 and 10 the KSI rate (29 casualties per billion vehicle miles) is lower than the national average (62 casualties per billion vehicle miles), although does reach 69 casualties per billion vehicle miles between Biggleswade North and Biggleswade South.

3.4.32 The KSI rate is lower than the national average between Junctions 17 and 14, although higher at Junction 15(N) to Junction 15(S) (21 per billion vehicle miles compared to the national average of 12 per billion vehicle miles).

3.4.33 A separate assessment has been undertaken of pedestrian casualties. There were ten pedestrian casualties in the period 2012 to 2014 (of which six were in 2013 and only one in 2014), and only two during daylight hours, as summarised in Table 3.4.

Table 3.4: Pedestrian Casualties[75]

Year	Casualty severity	Link location	Location description	Light conditions	Weather	Road surface
2012	Serious	J9-J10	In carriageway, not crossing	Darkness - no lighting	Fine no high winds	Wet or damp
2012	Fatal	A14 - Wyboston	In carriageway, crossing elsewhere	Darkness - lighting unknown	Fine no high winds	Dry
2012	Serious	Biggleswade North - Sandy	In carriageway, crossing elsewhere	Darkness - lights lit	Fine no high winds	Dry
2013	Slight	J9-J8	In carriageway, not crossing	Darkness - lights lit	Fine no high winds	Wet or damp
2013	Fatal	J8-J7	In carriageway, crossing elsewhere	Darkness - no lighting	Fine no high winds	Dry
2013	Slight	Wyboston - Black Cat Rdt	In carriageway, crossing elsewhere	Darkness - lights lit	Fine no high winds	Dry
2013	Fatal	Biggleswade North - Sandy	On refuge, central island or central reservation	Daylight	Fine no high winds	Dry
2013	Fatal	J6-J7	In carriageway, crossing elsewhere	Darkness - no lighting	Fine no high winds	Dry
2013	Slight	A14-B1043	In carriageway, not crossing	Darkness - no lighting	Raining no high winds	Wet or damp
2014	Slight	J8-J7	In centre or carriageway - not on refuge, island or central reservation	Daylight	Fine no high winds	Dry

3.4.34 In both directions, half the casualties were between Junctions 6 and 10 and the other half between Biggleswade North and the B1043. There were no pedestrian casualties between Junctions 14 and 17.

3.4.35 Pedestrian casualty rates tend to be very low on motorways (0.9 casualties per billion vehicle miles), and the equivalent rates on the A1(M) links are 4.9 (between Junctions 6 and 7 northbound), 11.9 (between Junctions 9 and 10 northbound), 7.5 (between Junctions 9 and 8 southbound), and 17.6 (between Junctions 8 and 7 southbound). There needs to be caution in interpreting the data, given the year to year variability and low numbers involved.

[75] *ibid.*

3.5 Environmental

3.5.1 Improvements to the A1 could result in improvements to the air quality and noise situation at sensitive locations along the route. This could be achieved through lowering traffic volumes along these sections of the A1 (e.g. through routeing traffic on other routes or a new sections of road), or by improving traffic flow. However, any benefits to the sensitive receptors along the A1 would need to be balanced against any potential adverse effects to sensitive receptors elsewhere through, for example, increased traffic flows as a result of re-routeing.

3.5.2 With respect to the historic environment, there is the potential to improve the setting of heritage assets through reducing traffic flows or minor design improvements that would result in less visual or noise disturbance. However, if any major works are proposed, direct adverse effects in heritage assets, such as damage caused by land excavation, are likely to outweigh any benefits if they cause permanent or longer-term damage.

3.5.3 In other cases there is the potential for broader environmental enhancements as part of any works to improve the A1. For example, river restoration opportunities along relevant water bodies could be realised to improve aquatic habitat, with the overall aim of improving WFD statuses; implementing design measures to improve connectivity between habitats; and improving protection measures to prevent the groundwater flooding of the A1.

3.6 Drivers of Growth

Demographic change and population forecast

3.6.1 The study area is forecast to experience substantial growth over the next 20 years. Although it is unclear where this growth is planned (as many of the plans are currently under development), data available suggests population growth across the study area of approximately 1% per annum over the period to 2037, with all districts experiencing increases in their resident populations.

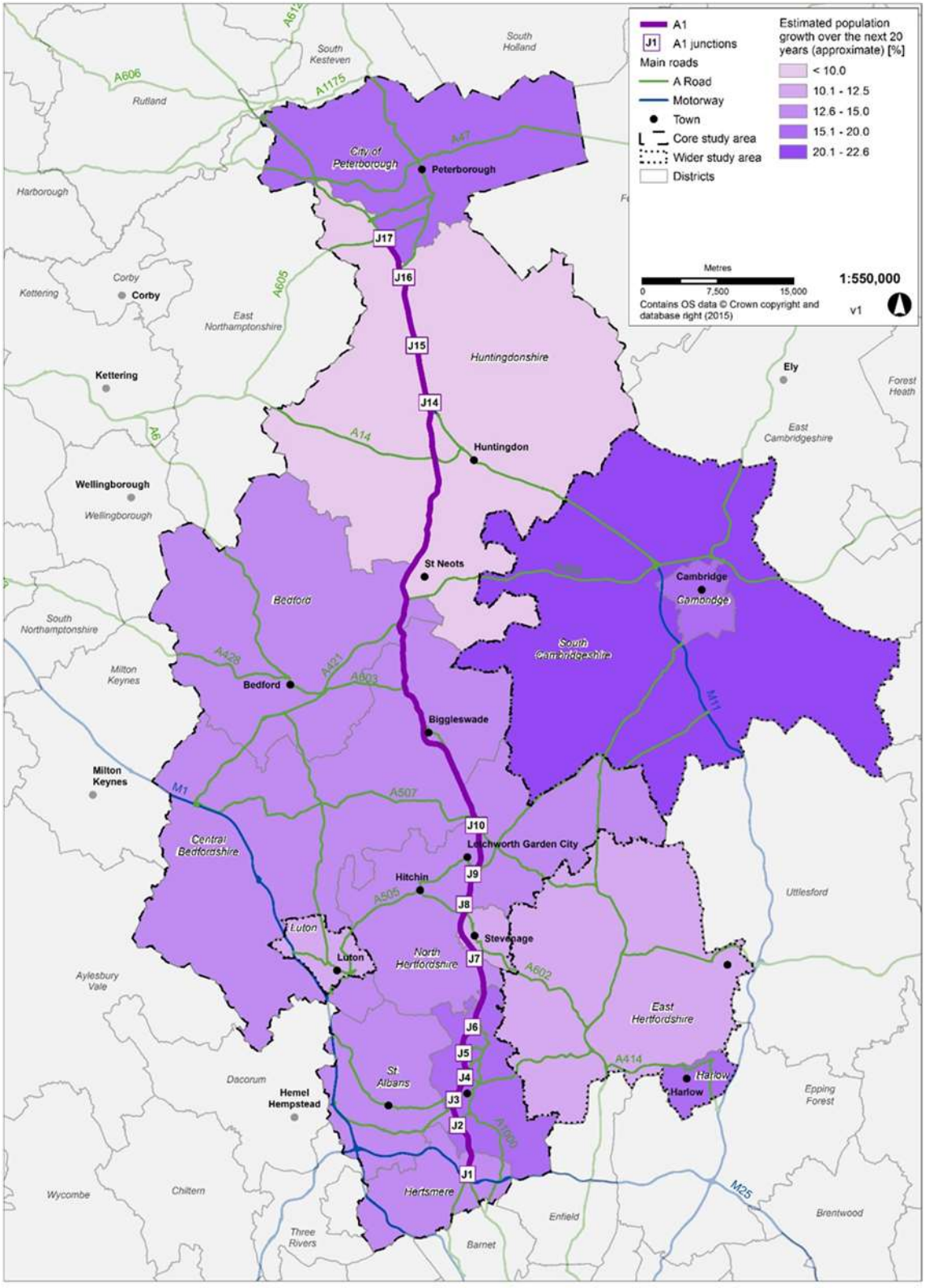
Table 3.5: Current and forecast population numbers across the study area[76]

District	Population			
	Current (2014)	Forecast (year)	Increase	Implied Annualised Percentage Increase
Bedford	163,900	185,600 (2037)	+21,700	0.6%
Cambridge	128,500	151,000 (2031)	+22,500	1.0%
Central Bedfordshire	269,100	306,900 (2031)	+37,800	0.8%
East Hertfordshire	143,000	158638 (2033)	+15,638	0.6%
Harlow	82,200	96,236 (2031)	+14,036	1.0%
Hertsmere	102,400	116,500 (2028)	+14,100	1.0%
Huntingdonshire	173,600	176,800 (2031)	+3,200	0.1%
Luton	211,000	236,105 (2031)	+25,105	0.7%
North Hertfordshire	131,000	148,000 (2023)	+17,000	1.4%
Peterborough	190,500	227,890 (2036)	+37,390	0.9%
South Cambridgeshire	153,300	188,000 (2031)	+34,700	1.3%
St Albans	144,800	164,700 (2031)	+19,900	0.8%
Stevenage	86,000	96,000 (2031)	+10,000	0.7%
Welwyn Hatfield	116,000	139,000 (2032)	+23,000	1.1%

3.6.2 In absolute terms, population growth hotspots within the study area are South Cambridgeshire, Central Bedfordshire, Peterborough and Welwyn Hatfield. When taking account of the relative annualised percentage increase, North Hertfordshire also has high projected population growth. Figure 3.25 shows this forecast population growth.

[76] Compiled from analysis of various local plans and evidence base documents.

Figure 3.25: Map showing the approximate percentage increase in growth from 2014 up to 2037[77]



[77] As the underlying data uses different plan end dates in their plans for the population increases, this is only an indicative scale of growth.

3.6.3 There is a rising ageing population throughout the study area, particularly in Peterborough and Stevenage. This growth in the over 65s population is a common pattern across England, reflecting fewer births in the 1970s and the reduced number of deaths in older people due to better housing and healthcare. This may affect the number of people who are likely to be economically active in the study area, the types of houses that will need to be delivered (i.e. sheltered accommodation and family houses). This may result in proportionately higher levels of car use as people over 65 are currently more likely to use a car than public transport.

3.6.4 The number of working age people is also set to increase across the whole study area, as a result of natural change and in-migration. The study area has a highly skilled population with a good number of qualifications and people in high-earning roles. However, Harlow, Peterborough and Luton are identified as more deprived areas, with a greater presence of industrial (Peterborough), manufacturing (Luton) and service and retail economies. Other districts plan to build on their existing thriving economies, for example research and high-technology in Cambridge and South Cambridgeshire, distribution and film (East Hertfordshire), and development and engineering (Central Bedfordshire).

3.6.5 Although many of the residents live and work within the same district, there are high levels of commuting. London is a key destination for workers, who make use of the good rail links. However a substantial number of workers commute to neighbouring districts for work, suggesting frequent use of the road network that will increasingly become more pressurised with the emerging populations seeking work in and around the study area.

Forecast economic and employment growth

3.6.6 Businesses and government have highlighted the study area as a specific area of investment, with the new Luton Enterprise Zone and Cambridge Compass Enterprise Zone. Both Enterprise Zones capitalise on enhancing their existing business sectors including education and technology sectors and centring on their strategic locations near airports and aspirations for greater connectivity with the international market. The designation of the four LEPs which cover the study area and their Strategic Economic Plans for the area all suggest investment in assets and infrastructure is central to sustaining economic growth, whilst ensuring an equal distribution of wealth too. The LEPs focus investment on job generation and the delivery of new homes to support the new communities.

Table 3.6: Current and forecast employment growth in the study area[78]

District	Employment			
	Current (2014)	Forecast	Growth (year)	Implied Annualised Percentage Increase
Bedford	69,965	85,965	+16,000 (2021)	3.3%
Cambridge	97,947	119,947	+22,000 (2031)	1.3%
Central Bedfordshire	91,770	111,970	+20,200 (2031)	1.3%
East Hertfordshire	61,370	96,350	+34,980 (2031)	3.4%
Harlow	43,000	51,000	+8,000 (2033)	1.0%
Hertsmere	48,671	57,006	+8,335 (2026)	1.4%
Huntingdonshire	70,550	85,550	+15,000 (2031)	1.3%
Luton	96,350	114,175	+17,825 (2031)	1.1%
North Hertfordshire	48,843	52,443	+3,600 (2031)	0.4%
Peterborough	103,425	132,992	+29,567 (2036)	1.3%
South Cambridgeshire	71,133	104,000	+32,867 (2036)	2.1%
St Albans	69,954	no data	no data	no data
Stevenage	42,823	53,547	+10,724 (2031)	1.5%
Welwyn Hatfield	75,122	88,522	+13,400 (2026)	1.5%

Planned development

Evidence from LDPs and Employment Land Reviews on housing

3.6.7 New housing is paramount to supporting the new communities, especially as all districts forecast increasing populations. Luton suggests that they will struggle to meet the demands of new housing and will therefore need Central Bedfordshire to assist in their delivery. There are similar arrangements between East Hertfordshire and Harlow to build a series of new villages between the two district boundaries. Development is planned for within existing urban areas, in urban extensions, and in new towns such as in Northstowe in Cambridgeshire. Urban extensions tend to be on the fringes of districts for example in Cambridge, or near existing built areas such as Kempston and Marston Vale south of Bedford. Sufficient infrastructure will be necessary to support the success of these new communities, along with local employment opportunities and services, and improvements to the A1 could ensure safe and efficient transit through the study area.

[78] Compiled from analysis of various local plans and evidence base documents.

Table 3.7: Current and forecast new housing provision in the study area[79]

District	Housing Units			
	Current (2011)	Forecast	Growth (year)	Implied Annualised Percentage Increase
Bedford	63,812	81,179	+17,367 (2032)	1.3%
Cambridge	48,100	62,100	+14,000 (2031)	1.5%
Central Bedfordshire	104,399	131,399	+27,000 (2021)	2.6%
East Hertfordshire	56,577	94,967	+38,390 (2033)	3.1%
Harlow	35,835	40,745	+4,910 (2033)	0.9%
Hertsmere	41,054 (2013)	45,044	+3,990 (2027)	0.5%
Huntingdonshire	71,800	88,800	+ 17,000 (2031)	1.2%
Luton	74,293	101,993	+27,700 (2031)	1.9%
North Hertfordshire	53,426	67,626	+14,200 (2031)	1.3%
Peterborough	77,000	99,825	+22,825 (2036)	1.2%
South Cambridgeshire	61,200	80,200	+19,000 (2031)	1.6%
St Albans	56,140	67,864	+11,724 (2031)	1.0%
Stevenage	34,898	39,911	+5013 (2031)	0.7%
Welwyn Hatfield	43,613	57,046	+13,433 (2032)	1.5 %

3.6.8 The A1 is the spine through the study area, and is the key connector for many growth areas such as the London-Stansted-Peterborough corridor, links to Stansted and Luton airports, and a variety of other economies. Substantial growth is forecast in the study area, with districts needing to respond to the demands. With much government and business interest[80] in the area, and its attractiveness as a place many people are choosing to live, improvements to the A1 will be necessary to ensure continued growth and success in the East of England.

Planned Transport Investments

Highways

Commissioned improvements

3.6.9 As part of the government's Road Investment Strategy, Highways England is planning to deliver more than £2 billion of government investment to improve the capacity and condition of roads across the East of England. The investment will see improvements and repairs taking place between now and 2021, giving road users simpler, faster and more reliable journeys. It will also boost the area's economy and

[79] *ibid.*
[80] https://www.gov.uk/government/news/prime-minister-announces-long-term-economic-plan-for-the-east-of-england

help to bring the country closer together. The plans include major improvements on the M11, A5 and M1, A1(M), A12, A14, A47 and A428.

3.6.10 There are committed road improvement schemes for the A428, the A1(M) between Junctions 6 and 8 and the A14 between Cambridge and Huntingdon. These schemes will be considered in the analysis and any recommendations from this study will need to be compatible with such proposals.

3.6.11 **A14 Cambridge to Huntingdon** – a major upgrade to the A14 between the A1 and A14 Junction 33, widening the road to three lanes, providing a new bypass around Huntingdon, creating distributor roads for local traffic and remodelling key junctions along the route. The scheme includes improving the A1 between the B1514 (Buckden Road) and south of J14 (Alconbury).

3.6.12 **A1(M) Junctions 6 to 8 Smart Motorway** - upgrading the existing two-lane section of the A1(M) around Stevenage to Smart Motorway to provide a third lane of capacity in each direction.

3.6.13 **A428 A1 to Caxton Gibbet** - improvement of the A428 near St Neots, connecting the A421 to Milton Keynes with the existing dual carriageway section of the A428 to Cambridge, creating an Expressway standard link between the two cities via Bedford. The scheme is expected to include substantial improvements to the Black Cat roundabout, where the A1 currently meets the A421.

3.6.14 **Oxford to Cambridge Expressway strategic study** – this study will examine the case for creating an Expressway to connect the towns and cities of the 'Brain Belt'.

3.7 Forecast Traffic Growth and Impacts

3.7.1 This section of the report provides a brief overview of possible future traffic conditions and potential issues.

3.7.2 The analysis here has simply looked at growth forecasts based on the available data. Future stages of work will require more detailed analysis and use of strategic models to forecast traffic levels to help refine this assessment.

3.7.3 TEMPRO (Trip End Model Presentation Program) data on trip ends are only available by geographical area/ local authority and by TEMPRO zone. No information, from other sources, on particular links and junctions was available in the timescales of this report, thus limiting the assessment.

3.7.4 Based on local plan growth aspirations, a substantial increase in dwellings and jobs is forecast within the study area. Taking the existing issues (section 3.3) into account, together with the growth forecasts (set out in the preceding section of this chapter) and the future increase in demand, there is a high likelihood that congestion will be a constraint on future growth.

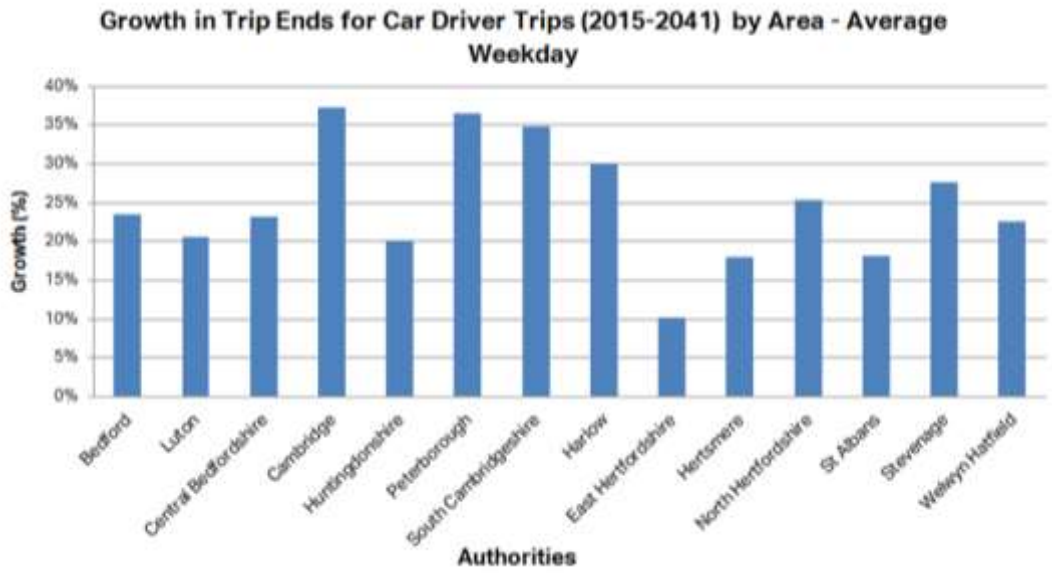
3.7.5 Considering that many of the junctions already operate close to capacity with some above capacity, even relatively low increases in annual traffic levels will place increasing pressure on existing infrastructure where it is already experiencing substantial congestion with the potential for uncongested parts of the network to reach capacity.

3.7.6 In addition, the propensity to travel is forecast to increase. Figure 3.26 below shows the forecast percentage growth in trip ends (by origin) by district between 2015 and 2041. Substantial growth is forecast for almost all the local authorities in the study area.

3.7.7 The average percentage growth (2015-2041) for the study area as a whole is forecast to be about 24% (for all day all trip purposes). Growth in car trips in the peak periods may be substantially more.

3.7.8 The areas with the highest forecast growth are Cambridge and Peterborough (at about 35%), followed by South Cambridgeshire, Luton and Harlow. Relatively high growth is also forecast in Stevenage and North Hertfordshire (at about 25%). All lane running between Junctions 6 and 8, due to be implemented by 2021, will increase capacity and may also result in induced demand. However, this could potentially cause issues to the main junctions or feeder routes to the A1(M) as a result of it becoming a more attractive (higher capacity) route.

Figure 3.26: Growth in Trip Ends (2015-2041)[81]



3.7.9 The growth forecast in major urban centres such as Cambridge, Peterborough, Bedford, Stevenage, Welwyn and Hatfield, is anticipated to induce additional demand in the A1 Corridor.

3.7.10 The substantial increase in trip numbers for Cambridgeshire as a whole, Peterborough, Bedford and Central Bedfordshire is anticipated

[81] TEMPRO, 2013.

to put additional pressure on the A1 between Junction 10 and Junction 14.

3.7.11 According to the junction modelling results summarised in section 3 of this report, the Biggleswade North, Biggleswade South and Sandy Roundabouts are already operating very close to or in excess of capacity, experiencing long queues, blocking back and large delays in both directions in the peak periods. The Black Cat Roundabout is also considered to be a congestion pinch point with a longer term scheme needed to address growth[82]. Additionally, substantial journey time variability and delays are experienced on the section between Sandy and Black Cat Roundabout, as well as between Wyboston and Black Cat Roundabout during the peak hours. A substantial decrease in average speed is also observed from Junction 10 to Black Cat Roundabout (A421) due to high traffic flows and reduced road capacity (2 lanes per direction).

3.7.12 The growth in Hertfordshire will also generate extra demand for the A1 between Junctions 1 and 10. These junctions are close to existing urban areas and in some cases, major planned housing sites.

3.7.13 A substantial increase in dwellings and jobs is planned within Welwyn-Hatfield, Stevenage and Hitchin by 2031 based on local plan aspirations, which will add to the pressures at the junctions on the A1, in particular Junctions 3, 4 and 7.

Safety

3.7.14 In terms of accident rates and comparison to national average accident rates, the A1 can be split into three sections: the two motorway sections between Junctions 1 and 10 and between 14 and 17, and the middle section of rural A road between Junctions 10 and 14. The motorway section between Junctions 1 and 10 has noticeably higher accident rates than between Junctions 14 and 17, particularly in the northbound direction, with rates higher than the equivalent national average collision, casualty and KSI rates.

3.7.15 On the non-motorway section between Junctions 10 and 14 collision, casualty and KSI rates are all lower than the national average for a rural A road (but in all cases higher than for a motorway). With the exception of the northbound collision rate, the collision, casualty and KSI rates are similar to or higher than elsewhere on the route.

3.7.16 Congestion, capacity and safety are complex and do not directly correlate. For example, increased congestion has typically thought to equate to an increase in the number of collisions, but a decrease in the average severity. There is little conclusive research but some econometric assessments have been undertaken[83]. All other things remaining equal, an increase in the number of vehicle miles along

[82] Highways Agency, 'London to Leeds (East) Route Strategy Evidence Report', April 2014.
[83] For example: C Wang, 'The relationship between traffic congestion and road accidents: an econometric approach using GIS' PhD Thesis in Loughborough University Institutional Repository, February 2010.

with A1 and surrounding road network (see Figure 3.26) will have a negative impact on overall safety along both the motorway and non-motorway section of the route.

Environmental

3.7.17 Traffic models indicate that there is already severe congestion and inefficient traffic flow on some sections of the A1, with this expected to worsen with the forecasted growth in traffic. As discussed above (Section 2.4), air quality and noise conditions are poor on a number of sections of the A1. Increases in congestion and inefficient traffic flow would exacerbate this situation.

3.8 The Problems that need to be addressed

3.8.1 Following from the detailed issues previously presented, key issues relating to the northern (Junctions 14-17), middle (Junctions (10-14) and southern (Junctions 1-10) sections of the route are summarised.

North

3.8.2 The northern part of the study area, between Junction 14 and Junction 17, comprises 11 miles of A1(M) motorway. This section varies between dual three and dual four lane carriageway plus a hard shoulder in each direction. Currently, this section of the route operates without traffic issues. Future development and improvements to roads which intersect the A1(M) such as the A14 Cambridge to Huntingdon road improvement scheme may affect this and other sections of the route.

3.8.3 The A1(M) serves Peterborough and Huntingdon, both significant settlements in the northern section of the study area. Peterborough is expected to have one of the highest percentage increases in population between 2014 and 2036, and also has a high proportion of people commuting into the district. Huntingdon is also expected to experience a sharp population increase. Peterborough has a large ageing population, but this is a trend that is seen across the whole study area, which will affect the types of houses that need to be delivered and influence the way in which people move around the districts. Peterborough and Huntingdon have economic inactivity levels of 20.9% and 14.7% respectively (lower than the English and Welsh average of 22.2%) and have a lower number of employees working in professional roles in comparison with other districts. Key sectors include public administration and manufacturing. Peterborough aspires to shift towards a knowledge based economy, which is thriving in nearby districts. There is some investment in the area from the Greater Cambridge and Greater Peterborough LEP which has a particular focus on improving the transport network to assist in growing the area's economy, however Peterborough still is one of the most deprived districts in the study area.

3.8.4 Environmental issues identified in the northern part of the study area relate to severance and flooding primarily. This includes the barrier

effect created by the lack of habitat connectivity across the A1, fragmenting species populations and flooding issues, particularly the stretch between Junction 10 and Junction 15 which has >75% risk of shallow groundwater flooding.

Middle

3.8.5 The middle part of the study area is a 26 mile non-motorway section of the A1 between Baldock and Alconbury. The route has two lanes in each direction through this section, with no hard shoulder, and speed limits varying between 50mph and 70mph. There are five roundabouts and numerous accesses both to roads and individual buildings. Key issues include: poor provision for pedestrians and cyclists; restrictions to traffic flows such as direct accesses and at-grade junctions; a poor-quality environment for those living within close proximity of the road; and severance affecting towns and villages.

3.8.6 Districts within this part of the study area are also set to see substantial population and employment growth. South Cambridgeshire has a high level of employment opportunities, with low deprivation and high earnings, as such, continued population increase is expected. The area also has a strategic location, in the middle of both the London-Stansted-Peterborough growth corridor and the Oxford-Cambridge arc; Luton and Stansted airports are nearby and there is an established east to west road network. Many residents commute to destinations outside of their own district, and there is also out-commuting into London. There are substantial professional occupations in the area, which leads in high-technology, research and development and education, and future growth is being planned around these sectors. There are established urban areas, for example, Bedford and Cambridge where growth will be focussed, however all districts in this area are essential to accommodating growth and new housing to support economic development.

3.8.7 Environmental issues identified in the middle part of the study area relate to air quality, noise, severance and flooding primarily. There are overarching problems of poor air quality with, in some instances, exceedances of the legal, health-based objectives; high levels of noise, particularly at some sensitive receptors such as houses; and the barrier effect created by the lack of habitat connectivity across the A1, fragmenting species populations; and flooding issues, particularly the stretch between Junction 10 and Junction 15 which has >75% risk of shallow groundwater flooding.

South

3.8.8 The southern part of the study area between Junction 1 and Junction 10 comprises a 25 mile stretch of the A1(M) motorway. This section varies between dual two and dual three carriageway plus a hard shoulder in each direction. Traffic congestion is a key issue on this section of the A1. Congestion issues between Junctions 6 and 8 form a

pinch point, which the A1(M) junctions 6 – 8 road improvement scheme aims to address.

3.8.9 Districts within this area are keen to maintain rural economies where they exist, including Central Bedfordshire and East Hertfordshire. More dynamic sectors such as finance, high-technology manufacturing and computing are well represented here, as well as established film and television industry. This part of the study area is very well connected, with strong commuter connections to London for higher paid professional jobs; access to sectors such as education and research which dominate the districts in the middle of the study area and both Stansted and Luton airports are in close proximity. Parts of St Albans and East Hertfordshire are particularly affluent. However there are areas of deprivation in Luton and Harlow where skill levels and economic diversification will need to be targeted. In addition to responding to the forecast growth and the number of new homes that will need to be delivered in these southern districts, there is the pressure of accommodating London's outward growth.

3.8.10 Noise and severance are the primary environmental issues which have been identified in the southern part of the study area. There are high levels of noise, particularly at some sensitive receptors such as houses and the barrier effect created by the lack of habitat connectivity across the A1, fragmenting species populations.

3.9 Why these problems are strategic

3.9.1 The districts served by the A1 are amongst the highest performing in the country outside of London in terms of contributing to national economic performance. The area supports a number of strong and growing economic sectors in both employment and output terms. Realising the economic potential of Hertfordshire, Bedford authorities and Cambridgeshire is particularly important in sustaining and improving the economic performance of UK Plc.

3.9.2 Substantial population growth is forecast across the study area. This growth will increase pressure on both local and strategic transport networks.

3.9.3 The A1 is a crucial link in the SRN. The route is used for both long-distance and local journeys and is therefore integral to both the local and wider transport networks. A range of issues result in traffic congestion and poor journey time reliability. Planned population and employment growth within the study area will likely exacerbate these issues.

3.9.4 Roads support quality of life for citizens. They allow access to opportunities for work and leisure as well as enabling social networks and interactions[84]. Environmental issues, poor journey time reliability

[84] A Cook, 'A fresh start for the Strategic Road Network,' in GOV.UK. November 2011, viewed on 22nd January 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/4378/strategic-road-network.pdf.

and rat-running resulting from the A1 are just some of the issues impacting on the quality of life for people living nearby.

3.9.5 Environmental issues identified through the study area mainly relate to air quality, noise, severance and flooding. The severity and frequency of these issues, some of which are concentrated in particular locations, show the scale of environmental issues along the route. Localised interventions may aid in addressing some of the environmental issues, but changes over a wider area would be required to comprehensively address some of the issues.

3.10 The case for change

3.10.1 Without improvements existing problems will and have implications on the spatial distribution of planned socio-economic growth, on transport and traffic, and on the environment.

3.10.2 Based on local plan growth aspirations, a substantial increase in dwellings and jobs is forecast within the study area. In addition, the propensity to travel is expected to increase. The route will play a crucial role in underpinning this growth, to enable access to homes and assist in the stimulation of job creation.

3.10.3 Taking into account the existing issues (Section 3.3) together with the growth forecasts (set out earlier in this chapter) and the future increase in demand, there is a high likelihood that congestion will be a constraint on economic growth as the route is already underperforming in traffic terms. It is likely that the pressure from additional road users living, working and commuting through the area will further exacerbate these problems.

3.10.4 Parts of the A1 in the East of England are amongst the worst performing along its entirety. There are sections of road where average speeds are below 40 miles per hour. Delays, tailbacks and disruptions are commonplace, exacerbated by an inconsistent and, in places, incoherent road layout which forces traffic into multiple bottlenecks in both directions. These issues are likely to worsen as a result of projected population and employment growth.

3.10.5 There are a high number of collisions along the route and this may increase as congestion worsens. Without intervention the number of collisions could potentially increase due to increases in traffic levels and congestion.

3.10.6 Many of the junctions already operate close to capacity with some exceeding capacity. Even relatively low increases in annual traffic levels will place increasing pressure on existing infrastructure where it is already experiencing substantial congestion with the potential for uncongested parts of the network to reach capacity.

3.10.7 At present the route does not operate well for public transport users, walkers or cyclists. Continued poor provision will discourage travel by these modes, which are more sustainable than travel by private car. Other impacts of this poor provision include segregation of

communities and social exclusion of certain groups, for example people that do not have a car.

3.10.8 Parts of the A1 are located unacceptably close to residential locations, causing unpleasant environmental conditions for local residents, particularly in terms of air quality and noise.

3.10.9 Much of the route suffers frequent congestion and disruption which exacerbates the environmental impact of the traffic. Upgrades to allow traffic to flow more freely have the potential to substantially improve environmental quality generally across the study area and specifically for those residents living adjacent to the route. As flooding incidents become more common due to changing climate it should be expected that flooding will be an even greater challenge. The severance caused by the A1 will also affect biodiversity, where changes to the alignment could assist in improvements.

3.11 Strategic Fit

3.11.1 This report has set out the context and background to the A1 Strategic Study and made a case for change. It has provided supporting data and commentary which describes current performance and how this is expected to deteriorate. Addressing the issues described will contribute towards achieving aims and objectives in the Road Investment Strategy (RIS) in the following ways:

Table 3.8: Strategic Fit

1: Providing capacity and connectivity to support national and local economic activity	The study area is one of the most highly performing economic regions of the UK outside London. The A1 is its major strategic artery which provides movement between major centres in the study area, as well as connecting the study area with the London economy which is a crucial economic driver for the study area. Local and national policymakers have strong and credible aspirations for the area as a national level driver of economic growth. This means the route has a crucial role to play in underpinning that growth, enabling the delivery of new jobs and housing. The route is currently underperforming in traffic terms and therefore does not provide the connectivity required to support growth. If this issue is unaddressed it could undermine growth potential.

2: Supporting and improving journey quality, reliability and safety	Parts of the A1 in the East of England are characterised by poor journey quality and reliability. There are sections of road where average speeds are under 40 miles per hour. Delays, tailbacks and disruptions are commonplace, exacerbated by an inconsistent and, in places, incoherent road layout which forces traffic into multiple bottlenecks in both directions. Additionally, there is a high number of collisions along the route and this may be worsening as congestion worsens. Standardising conditions along the length of the route could have substantial impacts on traffic flow and journey time variability. Schemes also have the potential to reduce the number of people killed and seriously injured along the route.
3: Joining our communities and linking effectively to each other	The A1 segregates various communities along its route. This has wide ranging impacts, for example on quality of life, wellbeing, access to jobs and access to services. Well-designed interventions which improve connectivity for local communities could have substantial positive impacts for a range of people including car users, public transport users, walkers, equestrians and cyclists.
4: Supporting delivery of environmental goals and the move to a low carbon economy	Parts of the A1 are located unacceptably close to residential locations, causing unpleasant environmental conditions for local residents, particularly in terms of air quality and noise. Much of the route suffers frequent congestion and disruption which exacerbates the environmental impact of the traffic. Interventions which allow traffic to flow more freely have the potential to substantially improve environmental quality generally across the study area and specifically for those residents living adjacent to the route.

3.12 Summary of the case for change and next steps

3.12.1 The table and schematic overleaf (Table 3.10 and Figure 3.27) set out a combined 'RAG' (Red/Amber/Green) traffic light-style assessment of the performance of the A1 in the East of England. This synthesises findings from an economic, transport and environmental assessment of the route's current performance. It shows that the majority of the route performs poorly with cause for concern. A full breakdown of the RAG assessment by criteria is attached to this document.

3.12.2 Growth pressures along with underlying travel demand and climate change patterns mean that performance, already poor, is likely to deteriorate in the future. This risks damaging the economic growth potential of the study area. Tackling the issues highlighted could make a positive contribution towards Highways England's strategic outcomes. The next stage of this study will begin to identify potential interventions to improve route performance and, beyond that, to carry out sifting and assessment of potential route options.

Table 3.9: RAG Assessment Criteria

Assessment Criteria	Assessment Criteria Considerations
Congestion	Use of two measures: 1) Worst Peak Hour Flow/ Design Capacity. 2) Link Stress = AAWT (Annual Average Weekday Traffic) divided by CRF(Congestion Reference Flow).
Journey time reliability	Use of speed variability graphs.
Collisions	Calculation of three measures per link: 1) Collision Rate compared with the National Average Collision Rate for Motorways 2012-2014 (DfT), 2) Casualties Rate compared with the National Average Casualties Rate for Motorways 2012-2014 (DfT) and 3) KSI Casualties Rate compared with the National Average KSI Casualties Rate for Motorways 2012-2014 (DfT).
Journey quality	The standard of the journey including the extent to which the journey is affected by congestion, the suitability of the road and the quality of interchanges.
Severance	The extent to which residents are separated from facilities and services they use within their community.
Studies/Schemes	Issues identified in other studies and schemes.
Environmental conditions	Red: environmental conditions are very poor and intervention should be sought to improve the situation. Amber: environmental conditions are poor; improvements would help the situation and worsening of the situation should be avoided. Green: environmental conditions are acceptable.
Population & housing	Extent to which population and housing growth is forecast near link/junction or along adjoining routes.
Employment & business	Extent to which employment and business growth is forecast near link/junction or along adjoining routes.
Stakeholder Feedback	The overall extent of stakeholder concerns raised.

Table 3.10: RAG assessment of junctions and links by topic

A1 EoE Task 1 Link / Junction RAG Assessment

Junction	Link	Description	Transport Modelling/Data			Transport Planning/Policy			Environment						Economics and Planning		Stakeholder Engagement	OVERALL RATING
			Congestion	Journey time reliability	Accidents	Journey quality	Severance	Studies / Schemes	Air Quality	Cultural Heritage	Ecology	Landscape	Noise	Water	Population & housing	Employment & business		
17		Junction with A605	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
	16	Link between A15 and A605	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	AMBER	GREEN	AMBER	GREEN	GREEN	AMBER	GREEN	AMBER
16		Junction with A15	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
	15.2	Link between B1043 and A15	AMBER	AMBER	AMBER	GREEN	GREEN	GREEN	GREEN	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
	15.1	Link between B1043 and A15	AMBER	GREEN	AMBER	GREEN	GREEN	GREEN	GREEN	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
15		Junction with B1043	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	AMBER	GREEN	GREEN	GREEN	GREEN
	14	Link between beginning of 4 lanes and B1043	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	AMBER	AMBER	AMBER	GREEN	AMBER
14		Junction between A14 and B1043	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	RED	GREEN	GREEN	GREEN	GREEN	AMBER	GREEN	GREEN	GREEN	AMBER
	10.7	B1043 to A1 Junction 14	GREEN	GREEN	GREEN	RED	RED	GREEN	RED	GREEN	GREEN	GREEN	GREEN	AMBER	GREEN	GREEN	RED	RED
	10.6	A14 Junction 21 to B1043	GREEN	GREEN	RED	RED	RED	GREEN	RED	GREEN	GREEN	GREEN	GREEN	AMBER	GREEN	GREEN	RED	RED
A14		Junction with A14	GREEN	AMBER	AMBER	RED	RED	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	AMBER	AMBER	AMBER	RED	RED
	10.5.3	B1514 to A14	AMBER	AMBER	RED	RED	RED	RED	GREEN	GREEN	GREEN	GREEN	GREEN	RED	GREEN	GREEN	RED	RED
B1514		Brampton	AMBER	AMBER	AMBER	RED	RED	RED	GREEN	GREEN	GREEN	GREEN	GREEN	RED	GREEN	GREEN	RED	RED
	10.5.2	B661 to B1534	AMBER	AMBER	RED	RED	RED	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	RED	GREEN	GREEN	RED	RED
B661		Buckden	RED	AMBER	AMBER	RED	RED	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	AMBER	AMBER	RED	RED
	10.5.1	A428 to B661	AMBER	AMBER	RED	RED	RED	AMBER	GREEN	GREEN	AMBER	GREEN	AMBER	GREEN	GREEN	GREEN	RED	RED
A428		Wyboston Junction	AMBER	AMBER	AMBER	RED	RED	RED	GREEN	GREEN	GREEN	GREEN	AMBER	GREEN	RED	RED	RED	RED
	10.4	Link between Black Cat Roundabout and Wyboston Junction	RED	RED	RED	RED	RED	RED	GREEN	AMBER	GREEN	GREEN	RED	AMBER	RED	RED	RED	RED
A421		Black Cat Roundabout	AMBER	AMBER	AMBER	RED	RED	RED	GREEN	GREEN	GREEN	GREEN	GREEN	AMBER	RED	RED	RED	RED
	10.3	Link between Sandy Roundabout and Black Cat Roundabout	RED	RED	RED	RED	RED	AMBER	RED	AMBER	GREEN	GREEN	RED	AMBER	AMBER	AMBER	RED	RED
A603/B1042		Sandy Roundabout	RED	RED	AMBER	RED	RED	AMBER	AMBER	GREEN	GREEN	GREEN	GREEN	AMBER	AMBER	AMBER	RED	RED
	10.2	Link between Biggleswade Nth Rdbt and Sandy Rdbt	RED	AMBER	RED	RED	RED	AMBER	AMBER	AMBER	GREEN	GREEN	AMBER	RED	AMBER	AMBER	RED	RED
B658/A6001		Biggleswade North Roundabout	AMBER	AMBER	AMBER	RED	RED	GREEN	AMBER	GREEN	GREEN	GREEN	AMBER	RED	RED	RED	RED	RED
	10.1	Link between Biggleswade Sth Rdbt and Biggleswade Nth Rdbt	AMBER	AMBER	RED	RED	RED	GREEN	AMBER	GREEN	GREEN	GREEN	AMBER	RED	AMBER	AMBER	RED	RED
London Rd		Biggleswade South Roundabout	AMBER	AMBER	AMBER	RED	RED	GREEN	AMBER	GREEN	GREEN	GREEN	GREEN	RED	AMBER	AMBER	RED	RED
	10	Link between A507 and Biggleswade South Roundabout	AMBER	AMBER	RED	RED	RED	GREEN	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	AMBER	AMBER	RED	RED
10		Junction with A507	GREEN	GREEN	GREEN	AMBER	GREEN	GREEN	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	AMBER	AMBER	GREEN	AMBER
	9	Link between A505 and A507	RED	GREEN	RED	AMBER	GREEN	GREEN	GREEN	AMBER	GREEN	GREEN	RED	GREEN	AMBER	AMBER	GREEN	AMBER
9		Junction with A505	RED	RED	GREEN	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	AMBER	AMBER	GREEN	RED
	8	Link between A602 and A505	RED	AMBER	RED	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	AMBER	AMBER	GREEN	AMBER
8		Junction with A602	RED	RED	RED	RED	GREEN	RED	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	AMBER	AMBER	RED	RED
	7	Link between A602 and A602	RED	RED	RED	RED	GREEN	RED	GREEN	GREEN	AMBER	GREEN	GREEN	GREEN	AMBER	AMBER	RED	RED
7		Junction with A602	RED	RED	AMBER	RED	GREEN	RED	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	RED	RED	RED	RED
	6	Link between B197 and A602	RED	RED	RED	RED	GREEN	RED	GREEN	GREEN	AMBER	AMBER	RED	GREEN	AMBER	AMBER	RED	RED
6		Junction with B197	RED	RED	AMBER	AMBER	GREEN	RED	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	RED	RED	AMBER	RED
	5	Second Link between A414 and B197	RED	RED	RED	AMBER	GREEN	GREEN	AMBER	AMBER	RED	AMBER	GREEN	GREEN	AMBER	AMBER	AMBER	AMBER
5		Junction between A414 and B197	AMBER	AMBER	AMBER	AMBER	GREEN	GREEN	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	RED	RED	AMBER	RED
	4	First Link between A414 and B197	RED	AMBER	RED	AMBER	GREEN	GREEN	RED	AMBER	GREEN	AMBER	RED	GREEN	AMBER	AMBER	AMBER	AMBER
4		Junction with A414	RED	RED	GREEN	AMBER	GREEN	GREEN	RED	GREEN	GREEN	GREEN	GREEN	GREEN	RED	RED	AMBER	RED
	3	Link between A414 and A414	RED	RED	RED	AMBER	GREEN	GREEN	RED	GREEN	GREEN	GREEN	RED	GREEN	AMBER	AMBER	AMBER	RED
3		Junction with A414	RED	RED	GREEN	AMBER	GREEN	GREEN	RED	GREEN	GREEN	GREEN	GREEN	GREEN	RED	RED	AMBER	RED
	2	Link between A1001 and A414	RED	GREEN	RED	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	AMBER	AMBER	AMBER	AMBER
2		Junction with A1001	AMBER	AMBER	GREEN	AMBER	GREEN	GREEN	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	AMBER	AMBER	AMBER	AMBER
	1	Link between M25 and A1001	RED	GREEN	RED	AMBER	GREEN	GREEN	GREEN	AMBER	GREEN	AMBER	GREEN	GREEN	AMBER	AMBER	AMBER	AMBER
1		Junction with M25	AMBER	AMBER	GREEN	AMBER	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	RED	RED	AMBER	RED

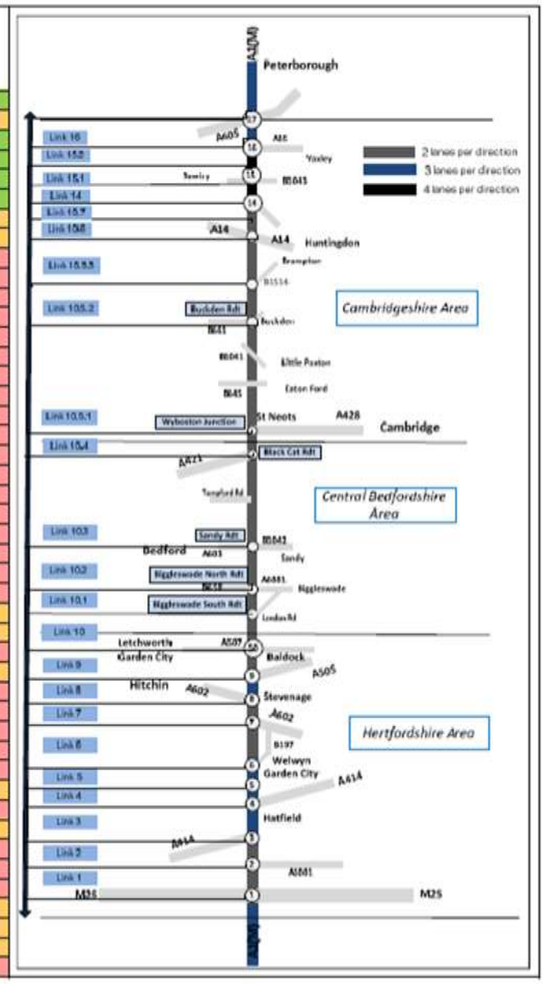
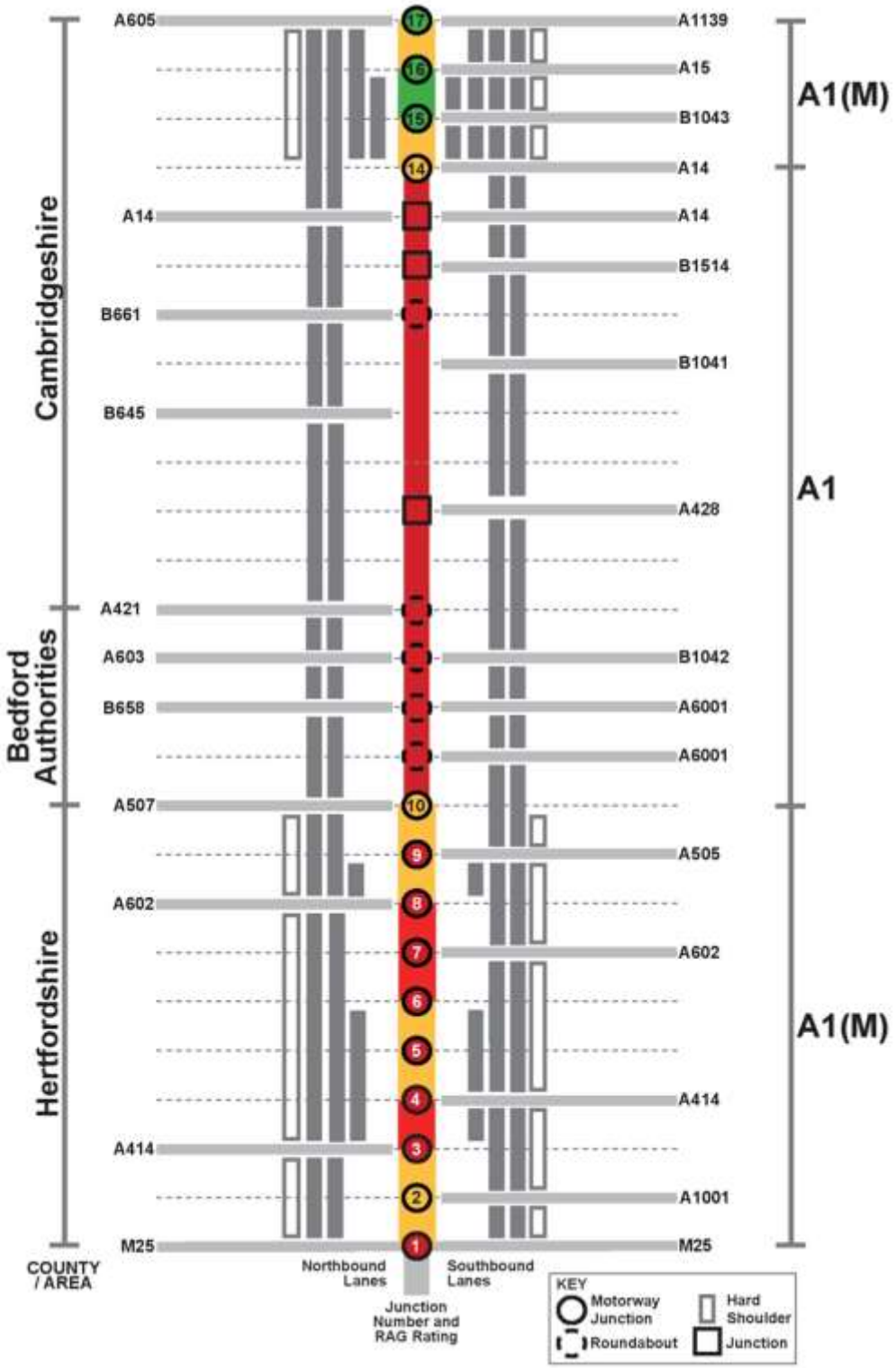


Figure 3.27: Overall RAG assessment of junctions and links



4 Wider Economic Impact: Strategic Narrative

4.1 Introduction

4.1.1 The recent Transport Investment and Economic Performance (TIEP) report has helped to inform a new approach to appraising the Wider Economic Benefits of transport infrastructure investment in WebTAG. TIEP identifies three main ways in which transport improvements improve economic performance:

- User Benefits (assessed through the standard cost-benefit assessment).
- Productivity effects.
- Investment and employment.

4.1.2 DfT has consequently identified the following potential Wider Economic Impacts of transport infrastructure investment:

- Economic impacts, at a UK and regional level are an important part of the strategic case for investment in the Strategic Road Network. This is particularly so where they address regional imbalances or local regeneration issues. In many contexts, wider economic benefits contribute to the welfare benefits of transport improvements and therefore are relevant to the economic case for investment. When appraising potential infrastructure investments it is important to consider – based on the relevant context – how the proposed scheme will deliver wider economic benefits and the extent to which these need to be considered in the economic case for the scheme.

4.2 Objectives

4.2.1 The evidence and analysis of identified problems and issues has been used to develop a set of transport objectives for the A1 between Junctions 1 and 17. The development of objectives is fundamental to the identification and assessment of potential investment options. The objectives are:

- Consistency (to bring consistency to the route)
- Environment (to deliver better environmental outcomes)
- Connectivity (to improve connectivity)
- Growth (to encourage growth)
- Network performance (to improve the operation of the road network)

4.2.2 Additionally, safety is a cross-cutting objective relating to both road operation and local communities.

4.3 Potential for wider economic impacts

4.3.1 The following section qualitatively assesses the potential of A1 upgrades to deliver wider economic benefits according to the mechanisms identified above.

Agglomeration effects (static clustering)

4.3.2 The study area collectively provides a large number of jobs for people inside and outside the study area. The study area is densely populated, with employment densities above the national average in eight of fourteen districts, and more jobs than working age residents in Cambridge and Welwyn Hatfield. The majority of the study area is classed as either a core or hinterland part of a Functional Urban Region (FUR) in the relevant WebTAG workbook.

4.3.3 The A1 is one of the key radial routes from London, serving key urban centres and employment hotspots of Peterborough, Stevenage, Hatfield and Welwyn Garden City. It supports east-west movements between Oxford, Milton Keynes, Bedford, Luton and Cambridge which are some of the fastest growing cities outside of London.

4.3.4 The study area has a relatively high presence in sectors which are known to be highly agglomerated, with a proportion of jobs above the national average in architectural and engineering consultancy, technical testing & analysis, natural sciences and engineering research. Drilling down below aggregated study area data reveals clusters of activity above the national average in financial services (Peterborough, Hertsmere), architectural and engineering activities (Cambridgeshire, Bedfordshire and St Albans), creative industries (Hertfordshire) and scientific (across the study area but particularly Cambridgeshire).

4.3.5 The A1 links these sectors to London providing for labour market agglomeration effects and the move to more productive jobs both within the study area and externally with London.

Investment effects

4.3.6 Assessing the likely impacts of route improvements in terms of supporting planned development in the study area is challenging, given the paucity of local plan coverage in the study area. Nevertheless, it is clear that this region has seen strong population and employment growth in recent decades, and various evidence base documents have been reviewed (see section 2.2 for more detail). There is therefore good evidence that the levels of growth being planned for are substantial.

4.3.7 The study area is forecast to experience substantial growth over the next 20 years. Although it is unclear where this growth is planned (as many of the plans are currently under development), data available suggests population growth across the study area of approximately 1%

per annum over the period to 2037, with all districts experiencing increases in their resident populations. This will be accompanied by a substantial number of housing units delivered and employment opportunities created.

Table 4.1: Current and forecast population numbers across the study area[85]

Local Authority	Population			
	Current (2014)	Forecast	Increase	Implied Annualised Percentage Increase
Bedford	163,900	185,600 (2037)	+21,700	0.6%
Cambridge	128,500	151,000 (2031)	+22,500	1.0%
Central Bedfordshire	269,100	306,900 (2031)	+37,800	0.8%
East Hertfordshire	143,000	158638 (2033)	+15,638	0.6%
Harlow	82,200	96,236 (2031)	+14,036	1.0%
Hertsmere	102,400	116,500 (2028)	+14,100	1.0%
Huntingdonshire	173,600	176,800 (2031)	+3,200	0.1%
Luton	211,000	236,105 (2031)	+25,105	0.7%
North Hertfordshire	131,000	148,000 (2023)	+17,000	1.4%
Peterborough	190,500	227,890 (2036)	+37,390	0.9%
South Cambridgeshire	153,300	188,000 (2031)	+34,700	1.3%
St Albans	144,800	164,700 (2031)	+19,900	0.8%
Stevenage	86,000	96,000 (2031)	+10,000	0.7%
Welwyn Hatfield	116,000	139,000 (2032)	+23,000	1.1%

[85] Compiled from analysis of various local plans and evidence base documents.

Table 4.2: Current and forecast employment growth in the study area[86]

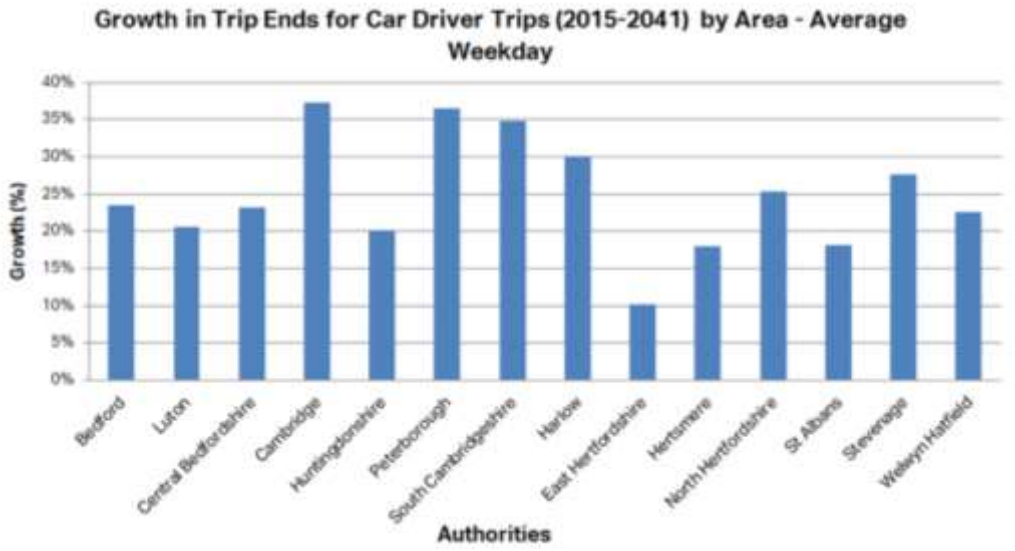
Local Authority	Employment			
	Current (2014)	Forecast	Growth	Implied Annualised Percentage Increase
Bedford	69,965	85,965	+16,000 (2021)	3.3%
Cambridge	97,947	119,947	+22,000 (2031)	1.3%
Central Bedfordshire	91,770	111,970	+20,200 (2031)	1.3%
East Hertfordshire	61,370	96,350	+34,980 (2031)	3.4%
Harlow	43,000	51,000	+8,000 (2033)	1.0%
Hertsmere	48,671	57,006	+8,335 (2026)	1.4%
Huntingdonshire	70,550	85,550	+15,000 (2031)	1.3%
Luton	96,350	114,175	+17,825 (2031)	1.1%
North Hertfordshire	48,843	52,443	+3,600 (2031)	0.4%
Peterborough	103,425	132,992	+29,567 (2036)	1.3%
South Cambridgeshire	71,133	104,000	+32,867 (2036)	2.1%
St Albans	69,954	no data	no data	no data
Stevenage	42,823	53,547	+10,724 (2031)	1.5%
Welwyn Hatfield	75,122	88,522	+13,400 (2026)	1.5%

4.3.8 The levels of growth outlined above will inevitably place greater demands on the A1 specifically and the SRN generally. Considering that many of the junctions already operate close to capacity with some above capacity, even relatively low increases in annual traffic levels will place increasing pressure on existing infrastructure where it is already experiencing significant congestion with the potential for uncongested parts of the network to reach capacity.

4.3.9 Examining the study area as a whole, the average percentage trip growth (2015-2041) is forecast to be about 24%. It should be noted this is all day all trip purpose information. Growth in car trips in the peak periods may be significantly more. The areas with the highest forecast traffic growth are Cambridge and Peterborough (at about 35%), followed by South Cambridgeshire, South Bedfordshire (Luton) and Harlow.

[86] *ibid.*

Figure 4.1: Growth in Trip Ends (2015-2041)[87]



4.3.10 In areas where the network is particularly congested one would expect that individual developments will find it increasingly difficult to gain planning permissions as it becomes harder to demonstrate that the existing transport infrastructure can cope with the increased demands the development will place on it.

4.3.11 Relatively high growth is also forecast in Stevenage and North Hertfordshire (at about 25%). All lane running between Junctions 6 and 8, due to be implemented by 2021, may also result in induced demand, as the link capacity issues are addressed, but potentially causing issues to the main junctions or feeder routes to the A1(M).

4.3.12 The growth forecast in major urban centres in Cambridgeshire, Bedfordshire and Hertfordshire, is anticipated to induce additional demand in the A1 Corridor as it is a strategic route that serves significant north-south movements, but is also co-incident with some east-west routes and crossing movements.

4.3.13 There is a number of reasons that growth might be difficult to deliver in the absence of additional capacity on the A1 route in the East of England:

- Congestion and journey time variability may be a barrier to firms and businesses investing or relocating into the area. Conversely, improved transport infrastructure may attract investment and stimulate growth. Findings from the Eddington Review and the SACTRA review before it suggest that transport infrastructure investment works best to drive growth where it is releasing existing constraints to growth (for example, by unlocking new sites in an overheating market).

[87] TEMPRO, 2013.

- Without transport network upgrade, the local housing market may not be able to accommodate the additional workers implied by economic growth forecasts. This could lead to still greater traffic pressures if people are forced to commute longer distances within or into the study area.
- Based on the desk review, it is not expected that there is a strong case for considering output change under imperfect competition, given the generally well connected nature of the area, although the study will investigate this through the LUTI modelling (see Section 4.4.3 below).

Employment effects

4.3.14 Beyond the benefits of agglomeration impacts accruing to businesses (knowledge spillovers, greater access to supplier and consumer markets etc.) there is the potential for transport infrastructure improvements to contribute to growth not just through getting unemployed people into work, but through those already employed being enabled to access more productive jobs.

4.3.15 Numerous commuters use the A1 daily. It provides direct links between some of the East of England's major urban centres and London. There are significant commuter flows across the area. Census travel to work data suggests that across the study area as a whole, 72% of in-work residents work within the study area. 14% work in London, and 14% work elsewhere outside the study area. Some 113,000 people travel into London from across the study area for work whilst almost 600,000 travel within the study area.

4.3.16 There is some evidence (Table 4.3) that there is an unsatisfied demand for labour in the study area suggesting that any transport upgrade which improved both employers' access to workers and residents' access to jobs could improve employment levels and rates across the study area. However it is unlikely that the improvements themselves would affect generalised journey cost to the extent that the number of people attracted into work changes significantly. It is therefore not proposed to calculate labour supply impacts.

4.3.17 The other element of employment effects is the move towards more productive jobs. Here, the data suggests that several districts in the study area simultaneously experience relatively high employment growth, relatively high unemployment rates and relatively high numbers of unfilled vacancies (particularly Hertsmere and Peterborough). This could be indicative of skills mismatch across the study area. Alongside a pattern of disparities between residence-based earnings and workplace-based earnings (St Albans, Bedford, East Hertfordshire, Central Bedfordshire) provides supporting evidence for strong reliance on commuting both within the study area and outside of it. Allowing better access to a range of jobs could enable workers already in employment to move to more productive jobs either within

or outside of the study area. This will be tested through the LUTI modelling in Task 3b.

Table 4.3: Selected employment statistics, by district

District	Workplace based pay as a ratio of residence-based pay[88]	Employment Growth 2009-2014[89] (%)	Unemployment rate age 16+[90]	Vacancies as a proportion of total jobs[91]
Bedford	0.94	3%	6%	1%
Cambridge	1.03	14%	3%	1%
Central Bedfordshire	0.83	10%	2%	2%
East Hertfordshire	0.86	8%	3%	1%
Harlow	1.10	0%	7%	1%
Hertsmere	1.04	15%	6%	1%
Huntingdonshire	0.91	2%	3%	1%
Luton	1.06	8%	6%	1%
North Hertfordshire	0.91	7%	4%	1%
Peterborough	1.08	8%	5%	3%
South Cambridgeshire	1.00	6%	3%	1%
St Albans	0.74	6%	2%	1%
Stevenage	1.08	0%	3%	2%
Welwyn Hatfield	1.00	4%	4%	2%

Impact mechanisms: summary

The A1 is congested and performs poorly with long/unreliable journey times. As well as providing greater consistency, improvements to the transport infrastructure along the A1 corridor would result in faster journey times, improved reliability, improved safety, better connectivity, and potentially lower environmental impacts.

Based on the economic context and the evidence set out in TIEP, the following primary economic impact mechanisms have been identified:

- Lower transport costs for businesses
    - Route heavily used for business travel
    - Highly congested with unreliable journeys which impose costs on businesses and reduce productivity

[88] ONS, Annual Survey of Hours and Earnings 2015.
[89] BRES, 2009 – 2014.
[90] Annual Population Survey, year to December 2015.
[91] Derived from JobCentrePlus vacancy data and BRES data.

- Agglomeration benefits (static clustering)
    - Links important urban centres of Hertfordshire with London in the south and Peterborough and beyond in the North. Facilitates key east-west movements in Hertfordshire and along the Oxford-Cambridge arc.
    - Presence of highly agglomerated sectors suggests relatively high economic benefits from transport upgrades.
    - Important role in Cambridgeshire/Bedfordshire/London labour market
    - Potential for growth at the newly designated Alconbury Enterprise Zone.
- Dynamic Clustering effects and the Move to More Productive Jobs
    - Prospects for growth in housing and jobs across the study area and particularly in Hertfordshire
    - A1 improvements needed to enable growth
    - A1 improvement will reduce journey times and make area more attractive for investment
    - Impacts on productivity will be complex and difficult to predict:
        - On the one hand growth in Bedfordshire/Cambridgeshire may result in some shift in employment away from London – i.e. from more to less productive areas.
        - On the other hand improvements may result in increased concentration of jobs in London and shift from less to more productive areas.

4.4 Assessment Methodology

4.4.1 The above indicates that the study needs an approach which captures user benefits and agglomeration effects, but particularly land use.

4.4.2 The TIEP report recommends a closer connection between the strategic and economic cases in the appraisal of transport schemes, and more attention to the "narrative" of the logic by which transport schemes may have economic impacts. In the present case, the "narrative" hinges on the likelihood that at least some of the options will involve significant improvements (reductions in generalised costs) over the section of road from the M25 to Peterborough (or at least to Alconbury), with associated but not necessarily simply proportional changes for places along the route (bearing in mind that the route itself may change). There are also possibilities for change on

competing and complementary routes and modes. All of these could contribute to different changes in different kinds of accessibility [where accessibility is taken as a general term including connectivity, access to economic mass, employment density, etc.] affecting places north of Peterborough as well as places along the route and (to a lesser extent) London and other places reached via the M25. These changes in accessibility could have effects both on land-use (the location of development and the distribution of residents and jobs, including changes in the occupancy of pre-existing development) and on productivity, all of these potentially having further feedback effects.

4.4.3 The plan for the appraisal of the shortlisted options is therefore to carry out a systematic comparison of the different effects by using a formal LUTI-type model which will:

- Take account of changes in generalised costs of travel both within and beyond the Peterborough-M25 corridor (including changes on complementary modes and routes).
- Consider both the more detailed effects within the corridor and possible effects further afield.
- Consistently consider both:
  - The "physical" land-use effects (where development occurs (subject to planning policy controls), where people live and firms locate jobs).
  - The "economic" effects (changes in productivity), taking account of feedbacks between the different types of effect (e.g. that improved accessibility may contribute to bringing about additional development (housing and commercial) which itself will have some further impact on measures of agglomeration).

4.4.4 The modelling will have the facility to build agglomeration and move-to-more-productive-location effects into the forecasting itself, rather than treating them as post-modelling appraisal questions, and hence will be able to consider their further consequences including multiplier effects. (It will also be possible to turn these wider economic effects off in order to distinguish their consequences from the rest of the model responses.)

4.4.5 The modelling approach has been adopted on the basis that:

- At a more theoretical level, the study is proceeding on that basis that it is not self-evident in advance of option generation which particular economic effects need to be considered and which can safely be excluded as being neither significantly positive nor significantly negative.
- At a practical level, the modelling of land-use and economic effects needs to be implemented so that it is ready to use once the options have been generated and a preliminary sifting carried out.

4.4.6 The approach is summarised below:

Table 4.4: Summary approach to Wider Economic Impacts

Impact type	WebTAG based approach	Supplementary economic model
Lower transport costs	Transport User Benefits Assessment (TUBA)	LUTI Model
Agglomeration effects	As per A2.1 guidance (WI1) – either WITA modelling or a bespoke spreadsheet-based approach	
Dynamic Clustering Effects and M2MPJ	N/A	

4.4.7 Benefit to Cost Ratios (BCRs) for the scheme will be based on TUBA with sensitivity analysis including productivity benefits from LUTI model. A key constraint associated with the economic assessment relates to the early stage of design of potential options that would be available at PCF Stage 0, as well as the limited timescales available for option development, modelling and appraisal. This necessarily results in a margin for error in the traffic assessment and in the assessment of scheme costs. Therefore, whilst BCRs will be produced for each of the shortlisted options, the focus of the overall assessment of value for money will be on the value for money category within which the option is expected to lie (i.e. poor, low, medium, high or very high) rather than the precise value of the BCR.

4.4.8 The outputs from the LUTI model include, for each year of each forecasts:

- Households (at least 12 categories) and population (4 person types) by zone.
- Jobs by industry, and workers by industry, workplace and socio-economic level, by zone.
- GVA by zone (workplace based).
- Stocks, vacancy rates and rents for housing and main commercial floorspace types.
- Rents for housing and main commercial floorspace types.

4.4.9 It is suggested that the LUTI contributions to appraisal will consist of:

- Analysis of the spatial impacts of the scheme (on development, employment and population) in relation to statutory and other plans, under the traditional “integration” heading.
- A stand-alone assessment of the “real economy” impacts at local, regional and national scales that arise from the agglomeration, more productive location and multiplier effects that are incorporated within the model (identifying these separately and in total).

- Discussion of how the productivity-related impacts assessed in the LUTI model compare with the standard assessment of Wider Impacts.
- Suggestions and contributions on how these "real economy" impacts should be used to modify or extend the conventional WebTAG welfare-based evaluation.

4.4.10 It is proposed that the average daily generalised cost for business and commuting travel for each origin/destination journey pair be based on the same zonal structure as used in the LUTI modelling, to allow results to be triangulated between the LUTI model and the standalone static analysis of agglomeration (static clustering). This will be calculated for base and future years in line with LUTI modelling.

4.4.11 This change in generalised cost with be used to calculate changes in effective density and then summed to give total productivity impacts across the study area in line with the guidance in A2.1 and Appendix D of WebTAG. These inputs will be calculated using WebTAG datasets and outputs from the transport modelling described above.